Appendix H: Design Guidelines and Standards

The SGV Greenway Network Plan Design Guidelines and Standards is a companion document that provides greenway project requirements and guidance. Following the guidelines will enable project proponents to customize their initiatives to match the community's needs and the District requirements. The overall goal is to build smart projects that provide a secure and uniform visual identity and user experience across the SGV Greenway Network. The purpose of the Design Guidelines and Standards is to describe the types of greenway projects and subcomponents to be considered, and to provide a framework for good and consistent project development.

Design priorities documented in the Design Guidelines and Standards intentionally incorporate community values and priorities identified through the community engagement process. Based on the feedback received from the public, the following design considerations are priorities: safety, vector control, comfort, welcoming and inclusive, community engagement, connectivity, and environmental benefits.

The Design Guidelines and Standards are organized by design topics and associated standards. Each section compiles applicable requirements and guidance for bikeways and multi-use greenways, subcomponents, and beneficial elements from local, state, and federal sources. They also draw from similar plans and best practices developed locally, including the LA River Master Plan and LA County Public Works Green Streets Design Standards, and examples from around the country. All of the resources were used to develop the required SGV Greenway Network standards, community character opportunities for customization, and design precedents.

SAN GABRIEL VALLEY GREENWAY NETWORK

STRATEGIC IMPLEMENTATION PLAN

APPENDIX H: DESIGN GUIDELINES AND STANDARDS

January 2025

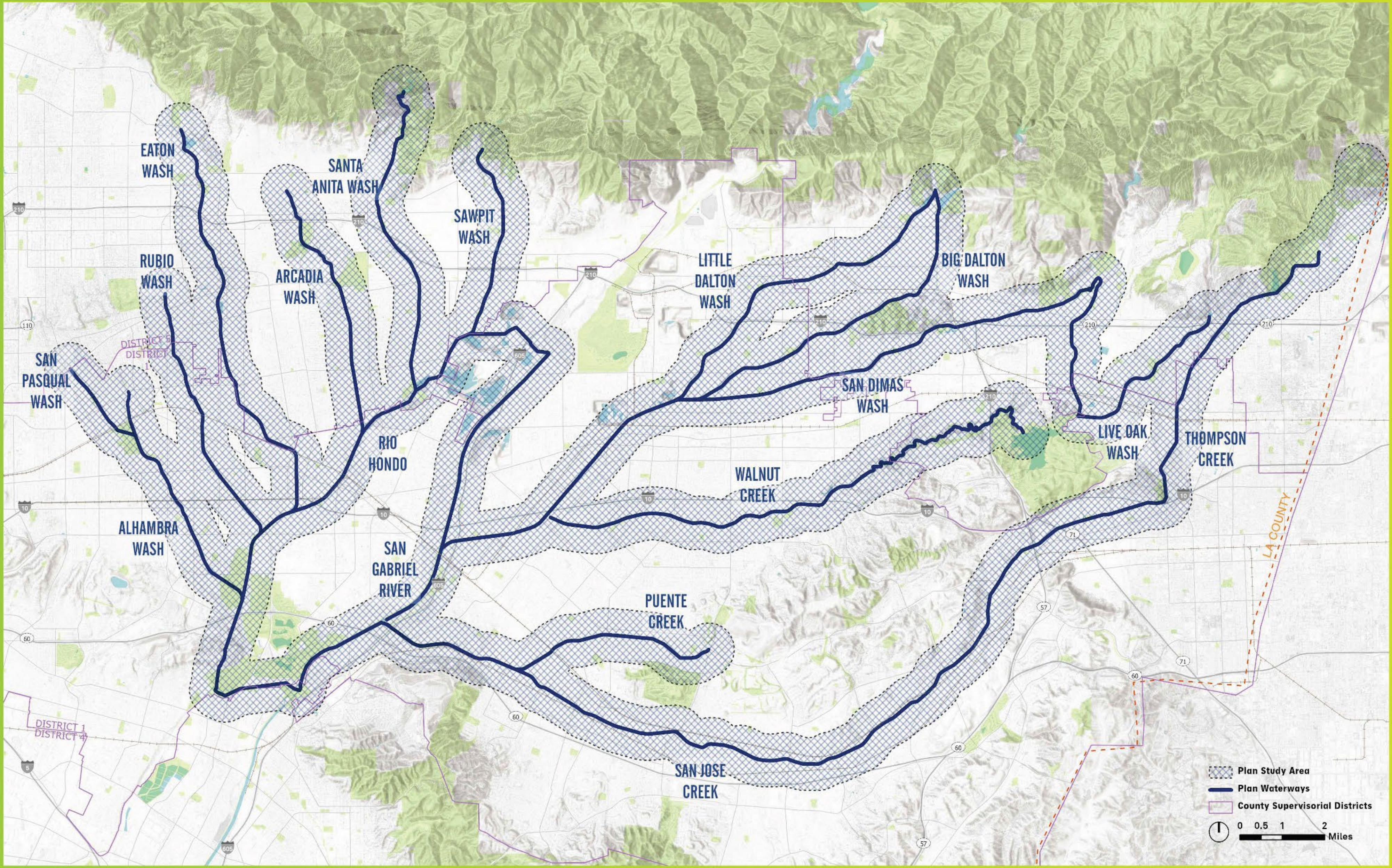
PREPARED FOR:
LOS ANGELES COUNTY AND LOS ANGELES COUNTY PUBLIC WORKS

THIS BOOK IS APPENDIX H FOR THE SAN GABRIEL VALLEY GREENWAY NETWORK STRATEGIC IMPLEMENTATION PLAN

These guidelines represent the Flood Control District permit requirements. Project proponents are responsible for implementing these guidelines in accordance with prevailing codes, LA County policies, and other authorities having jurisdiction.

While these guidelines are specific to the San Gabriel Valley Watersheds, certain approaches and techniques may be applicable to other river and tributaries in LA County.

PREPARED BY:
Brown AND Caldwell
STUDIO-MLA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SANTA ANITA WASH
SAWPIT WASH
RUBIO WASH
ARCADIA WASH
LITTLE DALTON WASH
BIG DALTON WASH
SAN PASQUAL WASH
DISTRICT 5
DISTRICT 1
RIO HONDO
SAN DIMAS WASH
LIVE OAK WASH
THOMPSON CREEK
WALNUT CREEK
ALHAMBRA WASH
SAN GABRIEL RIVER
PUENTE CREEK
LA COUNTY
DISTRICT 1
DISTRICT 4
SAN JOSE CREEK
Plan Study Area
Plan Waterways
County Supervisorial Districts
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Section 1

Introduction

The San Gabriel Valley Greenway Network Strategic Implementation Plan (SGV Greenway Network Plan) is a multi-objective effort by Los Angeles County (LA County) to transform the existing right-of-way (ROW) at the top bank of rivers, channels, washes, and creeks in the San Gabriel Valley (SGV) into a world-class greenway network.

The flood control channels present a unique opportunity to create a countywide network of interconnected, multiuse community greenways with pocket parks and greenspaces, amenities, safe crossings, and integrated stormwater management. An example channel opportunity is shown on Figure 1-1.

The Design Guidelines and Standards were prepared to support the development of specific design and technical solutions for future greenway projects to be implemented under the SGV Greenway Network Plan. Flexibility is embedded to allow communities to reflect their diverse priorities, art, and culture while maintaining a safe user experience and flood conveyance; preserving a unified, cohesive identity along the open space corridor; and promoting best practices and resiliency.

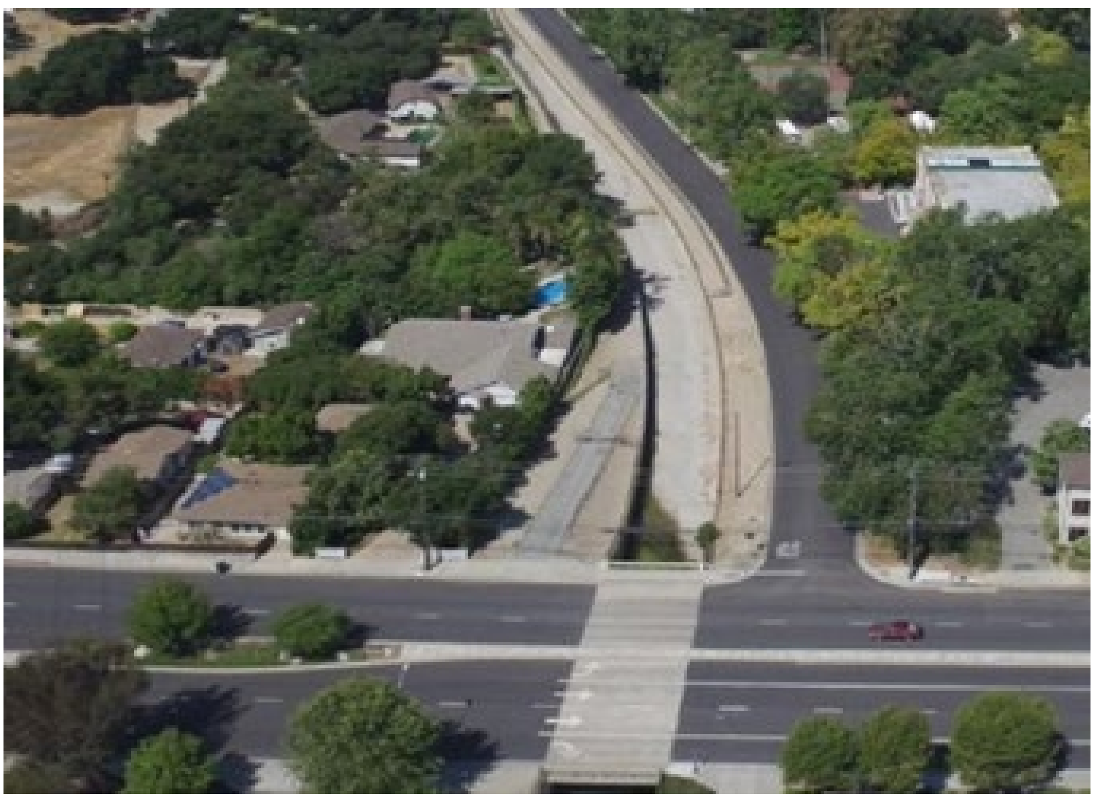

Figure 1-1. Aerial view of the Live Oak Wash channel and ROW near Foothill Drive

All photo credits are located in Section 13.

1.1 Role of Los Angeles County Public Works

Los Angeles County Public Works (LA County Public Works) is responsible for the planning and operational activities of the Los Angeles County Flood Control District (District), and coordinates with regional and local agencies to effectively use open spaces to create greenways throughout the SGV. The District was established to provide flood risk reduction, water conservation, recreation, and aesthetic enhancement for cities and unincorporated areas within LA County, excluding most of the Antelope Valley. The guidance contained in this document applies to areas of the SGV maintained, operated, or owned by LA County and all projects permitted by LA County Public Works along District and United States Army Corps of Engineers (USACE) right-of-way (ROW).

1.2 About the Greenway Design Guidelines

The SGV Greenway Network Plan Design Guidelines and Standards provides greenway project requirements and guidance. Following the guidelines enable project proponents to customize their greenway project to match the community's needs while satisfying LA County requirements. The overall goal is to build smart projects that provide a secure and uniform visual identity and user experience across the SGV Greenway Network. The purpose of the Design Guidelines and Standards is to describe the types of greenway projects and subcomponents to be considered, and to provide a framework for good and consistent project development. Most project proponents will require for a Flood Permit from the District and following the Design Guidelines and Standards will help streamline and simplify the Flood Permit process.

Design priorities documented in the Design Guidelines and Standards intentionally incorporate community values and priorities identified through the community engagement process described in the SGV Greenway Network Plan, Section 3. Based on the feedback received from the public, design priorities are safety, vector control, comfort, welcoming and inclusive, community engagement, connectivity, and environmental benefits.

The Design Guidelines and Standards are organized by design topics and associated standards. Each section compiles applicable requirements and guidance for bikeways and multi-use greenways, subcomponents, and beneficial elements from local, state, and federal sources. They also draw from similar plans and best practices developed locally, including the LA River Master Plan and LA County Public Works Green Streets Design Standards, and examples from around the country. All the resources were used to develop the required SGV Greenway Network standards, community character opportunities for customization, and design precedents. This document also includes precedent photos to illustrate design concepts; these photos are *for reference only*. They are often from different jurisdictions and do not always reflect all the standards and guidelines set forth by this document.

The following provides a summary of the topics addressed in the Design Guidelines and Standards:

- **Section 1, Introduction:** This section describes the document sections and content and an overview of the SGV greenway project permitting process including the District Flood Permit.
- **Section 2, Greenway Uses and Project Design:** This section summarizes the design priorities for the SGV Greenway Network, technical resources, and project success factors.
- **Section 3, Potential Users:** This section documents design considerations for potential users of greenways, including pedestrians, different types of bicyclists, equestrians, and maintenance/emergency vehicles, and considerations for greenway design based on users, continuity, destinations, and traffic.

- **Section 4, Class I Bikeway and Multi-Use Greenway Design Criteria:** This section includes design criteria for Class I bikeways and multi-use greenways, including horizontal and vertical clearance, surface types, drainage and slopes, and alignment characteristics. It provides examples of greenway configurations in narrow (13 to 19 feet [ft]), medium (19 to 24 ft), and wide (greater than 24 ft) ROW areas. It also includes guidance for greenway grade-separated overpasses and underpasses, railroad crossings, and cantilever sections.
- **Section 5, Class II Bikeway Design Criteria:** For off-channel segments, this section summarizes the design criteria for Class II bikeways, which create dedicated space for bicyclists on roadways with a marked separation between motor vehicle and bicycle traffic.
- **Section 6, Class III Bikeway Design Criteria:** For off-channel segments, this section summarizes the design criteria for Class III bikeways, in which bicyclists and motor vehicles share the street or roadway with no striping or physical barrier for separation.
- **Section 7, Class IV Bikeway Design Criteria:** For off-channel segments, this section summarizes the design criteria for Class IV bikeways, also referred to as separated bikeways or cycle tracks, which include a physical barrier between bicyclists and motor vehicles.
- **Section 8, Bikeway Signage and Markings:** This section includes guidelines for informational graphics and text displays in the SGV Greenway Network, including guidance for color, branding, symbology, and language. There are six categories of signage graphics: Informational, Regulatory, Confirmation, Interpretive, Directional, and Pavement Markings. It also addresses the types of pavement markings that should be present.
- **Section 9, Safe Crossing Design:** This section describes the recommended treatments where a greenway or bike path intersects a street or highway, including uncontrolled mid-block crossing, crossing an uncontrolled approach at an intersection, and crossing at a signalized intersection.
- **Section 10, Architectural and Safety Elements:** This section presents details on key architectural and safety elements, including fencing, guardrails, privacy screens, gates, lighting, seating, bicycle parking, equestrian amenities, landscaping, irrigation, and gateways.
- **Section 11, Stormwater Management:** This section describes stormwater management requirements for treatment of the greenway project impervious surfaces, desire and opportunities to treat runoff from off-site areas, best management practice (BMP) design criteria and standards, subsurface requirements and setbacks, and necessary regulatory coordination.
- **Section 12, Operation & Maintenance:** This section documents operation and maintenance (O&M) responsibilities, including litter control, landscaping, hardscape elements, greenway features, restriping, and stormwater BMP maintenance.

Project proponents should review the Design Guidelines and Standards prior to project planning and incorporate them throughout implementation to ensure the project aligns with applicable requirements and guidelines. LA County will use the Design Guidelines and Standards during the permit review process to confirm compliance.

A summary of the Design Guidelines and Standards sections organized by applicable project phase is provided on Figure 1-2. Additional valuable information related to project implementation, including project phases and tasks, extensive available resources, advancing partnerships and community engagement, and funding sources is provided in Section 6 of the SGV Greenway Network Plan.

Project implementation is divided into five primary phases: planning, design and permitting, bidding, construction, and operation and maintenance. All implementation phases must be thoughtfully completed to implement a successful greenway project. It is important to note that while many projects will require public bidding to select a contractor for project construction, some may not depending on local and state requirements and project size and construction cost.

PLANNING, DESIGN, & PERMITTING

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- 2.3 Design Guidelines and Technical Resources
- 2.4 Project Success Factors

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- 3.3 Bicyclists
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- 3.5 Access for Emergency and Maintenance Vehicles
- 3.6 Proposed Greenway Usage

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- 4.3 Multi-Use Greenways
- 4.4 Potential Greenway Configurations
- 4.5 Bikeway Characteristics
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Section 5: Class II Bikeway Design Criteria
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- 5.6 Intersections

Section 6: Class III Bikeway Design Criteria
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Section 7: Class IV Bikeway Design Criteria
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- 8.2 Standard Design Features
- 8.3 Informational Signage
- 8.4 Confirmation Signage
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- 8.9 Installation & Maintenance

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- 9.2 Uncontrolled Mid-Block Crossing
- 9.3 Crossing of an Uncontrolled Approach Adjacent to an Intersection
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- 10.3 Guardrails/Railings/Barriers
- 10.4 Privacy Screens
- 10.5 Gates
- 10.6 Lighting
- 10.7 Seating
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Section 11: Stormwater Management
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OPERATIONS & MAINTENANCE

Section 12: Operations & Maintenance
- 12.2 Operations & Maintenance Responsibilities
- 12.3 Landscape Improvements
- 12.4 Fencing & Gates
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- 12.6 Graffiti
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Figure 1-2. SGV Greenway Network Plan Design Guidelines and Standards sections organized by applicable project phase

1.3 Permitting Process

Greenway projects will have different local, state, and federal permitting and approval requirements based on their location, scope, project limits, and existing physical and environmental conditions throughout the project site. Depending on the project type, location, and site-specific conditions, there are certain permit requirements that must be met to plan and implement a project in or along District or USACE ROW.

Project teams should review the latest information available from each agency during project planning to confirm the applicable requirements. Meeting with agencies early in the planning process is essential to discuss permitting and application requirements and schedule. Projects that require discretionary approval, meaning that the approval requires the exercise of judgment or deliberation by the reviewing public agency or agencies prior to project approval or disapproval, require some level of environmental review pursuant to the California Environmental Quality Act (CEQA). Projects that also impact a federal facility, such as the USACE ROW, are also subject to the National Environmental Policy Act (NEPA).

Proponents of greenway projects should also consider and plan for as needed:

- Site and construction/maintenance access through acquisition or easement.
- Municipal permits such as Building and Safety and/or permits for work within the public ROWs.
- Coordination with rail corridors/crossings (Southern California Regional Rail Authority, Metropolitan Transportation Authority, Union Pacific Railroad, etc.).
- Utilities, including connections/hook ups, crossings, relocations.
- Site remediation, including cleanup of contaminated soils, may require coordination with the United States Environmental Protection Agency (EPA), California Environmental Protection Agency, or California Department of Toxic Substances Control.
- Pest/vector control minimization measures including project elements and O&M.

Projects within the District ROW, excluding projects completed by the District, including fee property and easements, will require a Flood Permit issued by the District. See Section 1.3.3 for details on this. Project planners should consider if the following permit types or consultation needs are applicable to their project based on the project location and scope:

- District Flood Control Permits: See Section 1.3.3
- LA County Public Works
- LA County Department of Parks and Recreation
- LA County or City Building and Safety
- USACE permits:
  - Clean Water Act Section 404 permit
  - Clean Water Act Section 408 permit
- US Fish and Wildlife Service and/or National Marine Fisheries Service Endangered Species Act Section 7 or 10 Consultation
- California Department of Fish and Wildlife (CDFW)
  - California Endangered Species Act, Section 2080 Permit
- California Fish and Game Code Section 1602 Streambed Alteration Agreement
- California Public Utilities Commission authorizations for railroad crossings
  - General Order 88-B for modification of an existing railroad crossing

  - Formal Application for a new public railroad crossing
- California Department of Transportation (Caltrans) Encroachment Permit for construction within state highway ROW
- LA Regional Water Quality Board (LARWQCB)
  - Section 401 Clean Water Act Water Quality Certification
  - Porter-Cologne Water Quality Control Act, Waste Discharge Requirements)
  - Section 402 permit (National Pollutant Discharge Elimination System Construction Stormwater Permit)
- Local city Planning, Building, and Public Works Department permits (e.g., Grading Permits, Utility Permits, Roadway Permits, Community Compatibility Approvals, CEQA)
- Individual cities in the SGV
- LA County Public Works (including District) and DPR should be engaged on all projects.

The project proponent must work with a number of entities to receive the necessary permits and approvals. Early consultation with these groups will help ensure the project team properly plans the time and effort to meet all applicable requirements within the proposed scope, schedule, and budget. Ongoing coordination can also ensure that the project stays on track for successful implementation and that the resources and interagency agreements are in place to maintain the greenway after construction is complete. Project proponents should coordinate with their counterparts throughout project planning and implementation.

If any portion of the proposed greenway project is located near or crosses jurisdictional boundaries, project proponents are strongly encouraged to engage the neighboring community to review potential connectivity with existing or planned projects in the adjacent jurisdiction, as well as potential destinations that may appeal to greenway users.

1.3.1 Project Initiation

LA County Public Works should be engaged by the project proponent from project inception. LA County Department of Parks and Recreation (DPR) has a parallel engagement and review process for SGV greenway projects during implementation. Prior to applying for grant funding and planning, an initial meeting should be scheduled with the LA County Implementation Team (LA County Public Works and DPR). This can be done by contacting LA County Public Works. During this meeting, the greenway project idea will be discussed (location, extents, greenway type, users and section, project subcomponents, project proponent(s), etc.) along with adjacent existing and planned greenways, trails, and other project components. Potential sources of funding should also be discussed along with possible schedule. The meeting may result in questions, additional coordination, or investigation that is needed prior to the next step, greenway project concept submittal by submitting a Flood Permit request at https://pw.lacounty.gov.

During Implementation Team engagement, DPR will be part of the initial coordination meeting and will advise the project proponent on specific coordination, submittal, and review requirements to be completed during the implementation process.

1.3.2 Approval of ROW Use

One of the primary considerations with a greenway project is the owner of the channel ROW being used for the greenway. In some cases, the ROW is owned by the District by fee property. In other cases, the District has an easement on the ROW, but the ROW is owned by another entity or individual. In all cases, formal approval for use of the ROW must be obtained directly from the by the project proponent from the ROW owner. District approval will be done via a Flood Permit.

If there are proposed greenway project subcomponents on property beyond the channel ROW, approval must also be obtained from those owners, whether a LA County, a city, or private entity or individual. Because a greenway project can only proceed with formal approval to use the ROW (e.g., through Use Agreement), confirming the ability to use should be done early in the project implementation process.

Project proponents must also determine if the proposed greenway is adjacent to a channel owned and maintained by the District or USACE. Figure 1-3 shows the approximate extent of the District and USACE ROWs. Project teams should verify the ownership entity early in the project planning process. With the exception of limited segments of channel ROW on Alhambra Wash, San Pasqual Wash, Rio Hondo River, San Gabriel River, and San Jose Creek, SGV channel ROW has District ownership or easement.

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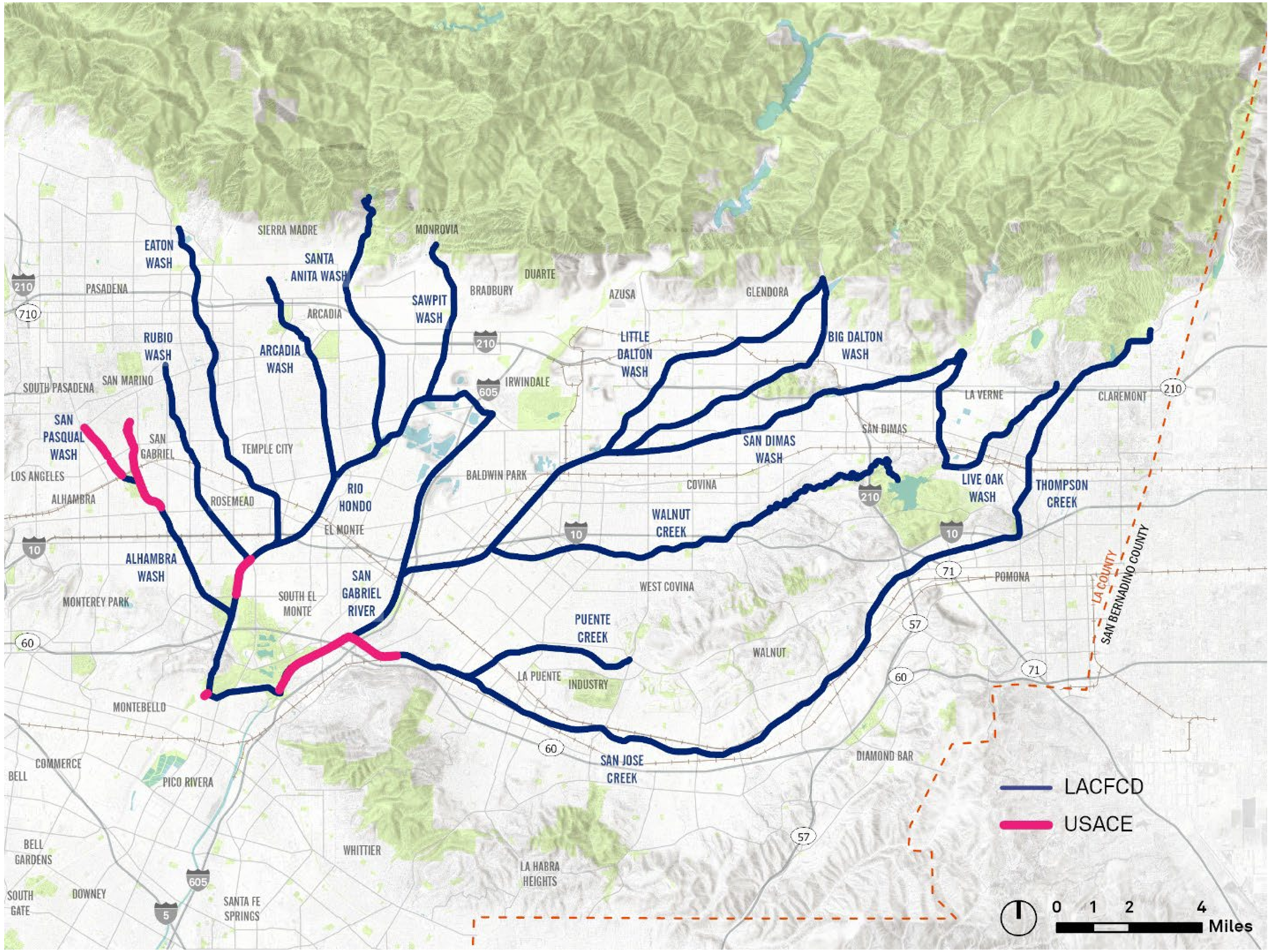

Figure 1-3. District or USACE channel jurisdiction in the SGV Greenway Network.

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1.3.3 Flood Permit Process

Projects within the District ROW including fee property and easements, but excluding projects completed by the District, will require a Flood Permit issued by the District. This is accomplished by coordinating with and submitting information and permit application electronically to LA County Public Works. Greenway project plans are required to be submitted for permitting and concept review using the LA County Public Works Permit Center at https://pw.lacounty.gov/ldd/lddservices/floodpermits.shtml. From there plans are distributed to all required reviewers, including operations and maintenance divisions, which review all elements of the project.

The Flood Permit process typically starts with a concept review to assess primary project elements such as footprint, planned improvements, channel ROW ownership. Following review, comments are provided to applicant. Once the concept is approved more developed engineering plans are submitted for review and approval. This takes multiple months depending on how much additional info needed and number of permit iterations. Permit iterations are reduced when the project applicant address comments to the expectation of the District. Greenway project maintenance responsibilities are formalized in a Use Agreement developed during the Flood Permit process.

The project proponent is typically responsible for all greenway project maintenance. In cases with multiple proponents including LA County and one or more other project partners, O&M responsibilities will be discussed and decided upon during Planning or Design and Permitting. With the exception of greenway projects completed by LA County Public Works, maintenance responsibilities are formalized in a Use Agreement developed during the Flood Permit process by the District.

If the greenway project is along a channel in USACE ROW, then the project is submitted first to LA County Public Works as described above, and then after initial review LA County Public Works submits to USACE. USACE has their own application and approval process which can take substantial time to complete depending on complexity and public notice. https://www.spl.usace.army.mil/Missions/Section-408-Permits/ The 408 permit is issued to the District. A published public notice is required, and the project proponent must also sign a Third-Party Agreement.

Some of the more common types of Flood Control permits are:

Access Permit: required for temporary use of District right-of-way. Examples include community or educational events, volunteer trash cleanup events, or filming.

Connection Permit: required when a private citizen, developer, or agency proposes to connect a drainage system to an existing District facility. Examples include connecting a small pipe to the rear of a catch basin or a new storm drain connecting to a larger storm drain or channel.

Temporary Discharge Permit: required for the temporary discharge of non-stormwater such as water well start up, construction dewatering, municipal water supply system flushing, swimming pool discharge etc.

Construction Permit: required for encroachment onto and/or alteration of District right-of-way for new construction. A few examples of permitted activities are storm drain realignment, landscape improvements, parks, bikeway construction, or installation of structural BMP devices.

Requirements for permit reviews are provided in the following District Permitting Checklist. In addition, the SGV Greenway Network Plan Design Guidelines and Standards must be followed for a project seeking these types of permits. Additional information related to permitting through LA

County Public Works, including the Flood Permit and Use Agreement, can be found at eDevServ (lacounty.gov).

Detailed Checklist for LA County Flood Control District (District)

Background Review

- Determine location of project and list on all documents associated with the project.
- Review the SGV Greenway Network Plan to identify local and site-specific opportunities and understand the approach, resources, and funding available for implementation.
- Review the SGV Greenway Network Plan Design Guidelines (this document) for applicable requirements and guidance.
- Meet with LA County Implementation Team (LA County Public Works and DPR staff) and local municipality staff (as required per site location). Contact LA County Public Works to schedule.
- Review other relevant documents, such as adjacent LA County and city plans.
- Meet with sponsoring groups (as required).
- Begin community engagement process.
- Hire a professional design team (may include landscape architect, engineer, architect, ecologist, artist, botanist, and others depending on project type). (Best Practice: Early integration of all disciplines, particularly designers and artists).

Evaluate Site for Opportunities and Constraints

- Determine maintenance jurisdiction.
- Determine all land ownerships and easements/rights-of-way.
- Contact all agencies involved and owners for concept approval.
- Identify water source (point of connection) if required and funding responsibility.
- Conduct site analysis:
  - Assess topographic, hydrologic, and microclimate conditions.
  - Conduct agronomic and biological activity soil test.
  - Determine existing utilities (gas lines, water lines, electric lines, others).
  - Review applicable codes, which may include, but is not limited to CA Title 24 Building Energy Efficiency Standards, LA County Public Works and/or American Public Works Association (APWA) Standard Plans, District code, Municipal codes, USACE Policy, LID ordinance and Manual, LA County Parks and Rec Guidelines.
- Research adjacent arts and cultural assets determine if project should have an art component.

Conceptual Design Stage

- Develop a site-specific program (include multi-benefit opportunities as outlined in the SGV Greenway Network Plan)
- Develop preliminary plant palettes per the Design Guidelines.
- Develop conceptual planting and grading.
- Develop conceptual public art program (as required).
- Prepare section-view illustrations, including topography, planting, and architectural features.
- Identify irrigation basis of design
- Submit to LA County Public Works for review.

- Discuss applicability of plant nursery contract growing for the project.
- Review O&M requirements for project success and begin to plan for how O&M will be accomplished.

Schematic Design Stage

- Prepare design and irrigation plans with preliminary details.
- Consult LA County LID manual and municipality requirements regarding irrigation equipment.
- Prepare comprehensive plant palettes including species types, quantities, sizes, and installation details.
- Begin contract growing process (as required).
- Prepare preliminary cost estimate and project specifications.
- Complete preliminary site engineering analyses as required for project including stormwater calculations, hydraulic analyses, and site structures.
- Prepare public art proposal (as required).

Monitoring and Maintenance Program

- Prepare irrigation schedule.
- Prepare a 12-month maintenance program for planting.
- Prepare a 3-year monitoring and maintenance program, including all planting and improvements (pavilions, site furnishings, etc.).
- Submit budget for maintenance and include a written statement of intention to perform and fund maintenance.
- List agencies responsible for maintaining the project.
- Prepare O&M for public art proposal (as required).

Technical Drawings and Specifications

- Coordinate technical drawings with public art (as required).
- Submit technical drawings and specifications to LA County Public Works for review and approval. Landscape plans, irrigation plans, and specifications to be prepared by a registered landscape architect licensed to practice in California. Engineering plans, calculations, and specifications to be prepared by a California registered engineer. For structural amenities not shown in LA County Public Works or APWA standard plans, the designer should provide detailed drawings and design calculations, prepared, signed, and stamped by a California registered civil or structural Engineer.
- Submit maintenance and monitoring programs for both 12-month and 3-years as part of the technical specifications required for project approval.
- Require underground service alert (Sponsored by the underground Service Alert of Southern California, a non-profit mutual-benefit organization dedicated to ensuring public safety and that of workers of underground utility lines: www.digalert.org).

As-Built Drawings

- Submit an updated planting plan, irrigation schematics, site engineering plans, and other applicable as-built record drawings to LA County Public Works. (As built drawings should be prepared by the installing contractor).

1.3.4 CEQA Requirements

CEQA requires a lead agency (public agency that has the primary responsibility for carrying out or approving a project, State CEQA Guidelines Section 15367) to disclose significant environmental effects of proposed actions to decisionmakers and the public. Project proponents are responsible for addressing and complying with all CEQA requirements and other local, state, and Federal requirements CEQA compliance is a requirement for issuance of a District Flood Permit.

A Program Environmental Impact Report (PEIR) has been prepared in compliance with CEQA requirements to describe any significant environmental effects, identify possible mitigation measures to mitigate those effects, and describe reasonable alternatives for the SGV Greenway Network Plan. The PEIR is available to be utilized by the project proponent as the first-tier analysis for future projects proposed from the SGV Greenway Network Plan and located within the SGV Greenway Network Plan area.

Section 2

Greenway Uses and Project Design


Figure 2-1. A segment of the San Gabriel bikeway

The entirety of the proposed San Gabriel Valley Greenway Network (SGV Greenway Network), like the bikeway shown on Figure 2-1, should reflect a consistent set of design priorities identified by community members, LA County Public Works, District, and other partners. This section outlines design priorities for greenway segments in the SGV Greenway Network Plan and a description of the design guidelines and standards included in this document.

2.1 What's in This Section

This section describes the design criteria for Class I bikeways, multi-use greenways, and greenway components to be used in the District and USACE ROW, including safe crossings.

Greenway Uses and Project Design

2.2 Design Priorities

During the development of the SGV Greenway Network, LA County Public Works conducted a series of community workshops to collect information about citizens' priorities, potential concerns, and preferences for the proposed SGV Greenway Network. Based on the feedback received from the public, the following design considerations are priorities:

- **Safety.** Of paramount importance is that all SGV Greenway Network projects are safe for all users and that the feeling of safety is noticeable. This includes the personal safety of visitors of the commons, as well as protecting life and property throughout the entire greenway network. SGV greenways shall be designed, constructed, and maintained in such a way that provides a safe and accessible user experience. Safety must be addressed with each greenway component. Emergency and maintenance vehicle access, fall protection fencing/barriers, proper lighting, safety call boxes, vegetation and structure placement with clear lines of sight, posting guidance on avoiding flood and storm hazards, and proper operation and long-term maintenance are some of the essential elements. Rest stations with shading and water on or immediately adjacent to the greenway should be provided at least every half mile.

  In the interest of user safety, the SGV Greenway Network should also be designed to highly resist vandalism and deter crime through environmental design and material selection. Designers should incorporate natural surveillance along greenways through the use of lighting and open, visible spaces, control access to the SGV Greenway Network and greenway amenities through defined points of entry, and locate signs and amenities in highly visible areas. Regular maintenance may also discourage vandalism and tampering along the greenways. Specific recommendations for design and maintenance are incorporated in the later sections of this document. For additional information on Crime Prevention Through Environmental Design (CPTED) refer to ICA home page (cpted.net).

- **Vector Control.** It is critical to review minimization measures with the vector control district of the jurisdiction early in the design process. The project should be designed to facilitate necessary surveillance as well as physical and chemical mosquito control efforts by the vector control agency. Minimization measures include implementing a comprehensive O&M plan with vegetation management.
- **Comfort.** The SGV Greenway Network should be a welcoming and inclusive space for all residents and visitors. Amenities such as shading, seating, water stations, restrooms, kiosks, and other services enhance the usability and comfort of the SGV Greenway Network.
- **Community Engagement.** As specific greenway projects are conceptualized and developed, the project proponent should actively engage the community to obtain input on preferences and creativity to be incorporated into project design and implementation. Amenities should reflect community character and enhance aesthetics.
- **Connectivity.** Greenways should provide connectivity within and among the communities in the SGV. Key elements include connectivity to parks, schools, other destinations, adjacent greenways, DPR trails, and various forms of transportation (e.g., vehicle parking and connection to transit).
- **Connection to the Environment.** Greenways should incorporate and demonstrate responsible stormwater management for new impervious surfaces, and off-site runoff whenever possible. Additional amenity greenspace, vegetation, and habitat should be provided for the benefit of wildlife, in addition to the greenway network's human users.

2.3 Design Guidelines and Technical Resources

The requirements and recommendations included in this document are consistent with or complement those of the Los Angeles River Master Plan (LA River Master Plan) and the Emerald Necklace Implementation Plan for dedicated greenways. Therefore, these planning documents are an additional resource.

For project areas outside of District ROW, additional requirements and standards may apply based on the project location and type. For example, bicycle facilities off channel and adjacent to a roadway (referred to as Class II, III, and IV bikeway) should be designed based on Caltrans design criteria and local jurisdiction requirements. The remaining guidelines and standards are derived from a compilation of other local, state, and federal references.

The Design Guidelines and Standards are not a 'cookbook' for the design process; rather, they are the framework for good project development and include details related to the greenway project component, subcomponents, and beneficial elements. In addition, the knowledge and experience of planners, landscape architects, engineers, architects, botanists, ecologists, and artists engaged in project implementation are invaluable in creating safe spaces that enhance life in communities along the SGV channels. SGV Greenway Network Plan Design Guidelines and Standards are a tool for project proponents and these professionals and reflect the baseline of values for promoting smart design along the SGV channels.

Substantial additional resources that are beneficial in locating, defining the extents, developing a greenway section, adding subcomponents and beneficial elements, and implementing a greenway project are provided in the SGV Greenway Network Plan, as summarized in Section 6. Resources include channel ROW figures, opportunities and constraints figures, tributary narratives, example conceptual designs, and project element diagrams and renderings, and more.

2.4 Project Success Factors

In addition to the design priorities described in Section 2.1, including pest/vector control, members of the community and stakeholders identified other factors that may affect the success of the SGV Greenway Network, including persons experiencing homelessness and engagement between communities. Greenway maintenance, which is also a key element of ongoing project success, is described in Section 12.

2.4.1 Persons Experiencing Homelessness

Unhoused individuals or persons experiencing homelessness sometimes use public spaces, including greenways, for shelter and respite. These individuals are legitimate greenway users. However, homeless encampments can create health and safety hazards for unsheltered individuals and other users of the SGV Greenway Network. They may also impede the activity of maintenance staff and become a source of stormwater pollution to the adjacent channel. The Design Guidelines and Standards including the operations and maintenance guidance are intended to discourage encampments while treating all users, including persons experiencing homelessness, with respect and dignity.

The greenway and subcomponents should have sufficient sight distance and lighting, so all users can observe their surroundings. The greenway should include facilities, such as water stations, restrooms, and trash cans, or be located near public facilities where users can dispose of trash and address personal and hygiene needs. These amenities must be designed to resist vandalism and/or tampering. Some may express concern that these facilities can attract unhoused individuals, but they are intended to prevent the accumulation of trash and debris, encourage cleanliness, and prevent conditions that may deter use of the greenway.

In addition, routine maintenance of greenways, subcomponents, and amenities, such as removal of graffiti and brush clearing, creates a welcoming destination and encourages equal care by greenway users. Events, art exhibits, and other programming that encourage frequent use of the greenway can build users' comfort within the SGV Greenway Network and create a sense of visibility, awareness, and safety.

It is important to recognize that homelessness has many complex causes that cannot be addressed or solved by the Design Guidelines and Standards. While design elements can be included to create a more welcoming environment and discourage encampments, a robust engagement and multifaceted strategy involving different municipal, and LA County Public Works agencies and organizations should be utilized to identify and seek to address the stressors in each community and provide the types of services and policies appropriate to the identified causes.

LA County policy will be followed on greenway projects to address homeless encampments within the District ROW. This includes the District's commitment to 1) ensuring services are offered, notice is provided, and personal possessions are handled appropriately; and 2) assisting the Department of Public Health in installing Public Hygiene Facilities where deemed necessary (District, 2018).

2.4.2 Coordination Between Communities

The SGV Greenway Network will weave through communities and neighborhoods in the SGV. While each segment should reflect each neighborhood's unique character and priorities, each segment must also be part of a cohesive network. The guidelines and standards in this document are intended to achieve a balance between each community's customized approach and the shared design framework needed to provide a safe and consistent experience for users across the SGV Greenway Network. Another success factor, particularly for segments that cross or are located near community boundaries, is coordination between communities. and adjacent greenway projects. Adjacent communities should be a stakeholder in the planning and design of proposed segments. Depending on whether the proposed segment will connect to an existing or future segment, there should be consideration of the greenway users, greenway section, dimensions, surface material, lighting, signage, artwork, and graphics of the complementary segment.

After construction is complete, ongoing community coordination remains important to address safety or maintenance issues that arise over time, to highlight new nearby amenities and destinations, and to maintain the condition of the greenway.

2.4.3 Pest/Vector Control

Mosquitos threaten public health through transmission of disease. To limit the hazards of mosquitos to users of the SGV Greenway and avoid potentially costly corrective actions after construction, vector control should be considered during project design. The local vector control district should be consulted early in implementation to ensure mosquito minimization measures are incorporated in the greenway project.

Minimization measures can include natural predation by species that prey on mosquitoes or their larvae, mosquito exclusion through elimination of breeding and habitat areas, and a comprehensive O&M plan including vegetation management. The California Department of Public Health "Checklist for Minimizing Vector Production in Stormwater Management Structures" (https://www.cdph.ca.gov/) is useful for project designers to discourage mosquitos in stormwater BMPs.

Section 3

Potential Users

The SGV Greenway Network should support pedestrian, bicycle, and equestrian users, depending on the available ROW and the preference of the local community. At a minimum, greenway segments along channels should provide continuous access for pedestrians and bicyclists. This section details considerations for each of the intended users.

3.1 What's in This Section

This section describes the design criteria for Class I bikeways, multi-use greenways, and greenway components to be used in the District and USACE ROW, including safe crossings.

Potential Users

3.2 Pedestrians

Pedestrians are the slowest and, therefore, the most vulnerable type of greenway user. To make the SGV Greenway Network a safer and accessible place for pedestrians, dedicated paths for only pedestrian use as part of a wider multi-use greenway section, should be a minimum of 4 ft wide; 5 ft is preferred.

The Design Guidelines and Standards are intended to protect pedestrians and all users, promote their enjoyment, and provide accessibility to all prospective users.

3.3 Bicyclists

Bikeways in the SGV Greenway Network should be open to all levels of bicyclists from casual recreationalists to regular commuters or athletes.

Key considerations for the design of dedicated bikeways and shared use greenways are accessibility, continuity, safety, and limited conflict between bicyclists, especially those at higher speeds, and other users. An example greenway in LA County is shown on Figure 3-1.

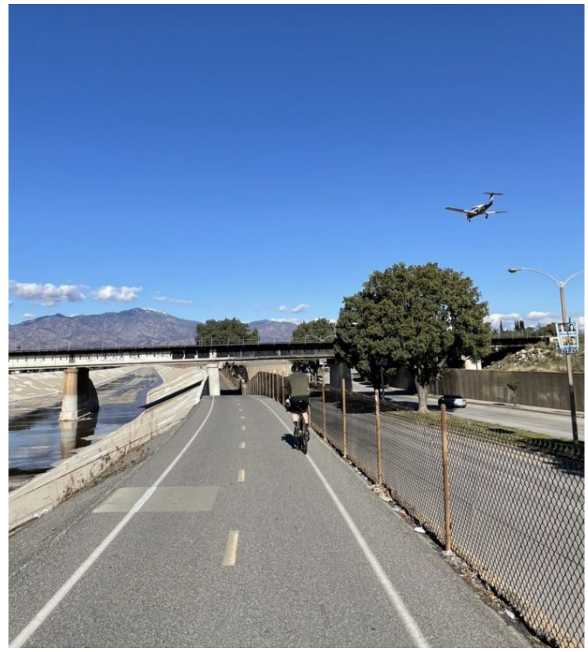

Figure 3-1. Bicyclist uses a greenway along the Rio Hondo

3.3.1 Types of Cyclists

Bicyclists will have a range of experience and level of comfort around other greenway users. Characteristics that may affect their use of the greenway are age, experience, confidence, and trip purpose (e.g., recreation, exercise, utilitarian). The bikeways shall safely accommodate users along the entire spectrum of experience.

3.3.2 Typical Bicycle Dimensions

According to the American Association of State Highway and Transportation Officials (AASHTO), the typical upright adult bicyclist is assumed to occupy 30 inches (2.5 ft) of horizontal space (AASHTO, 2012). Therefore, for each direction of traffic, a minimum width of 4 ft of horizontal space should be provided. The bikeway shown on Figure 3-1 along the Rio Hondo includes a 4-foot marked path (paved) for each direction of bicycle traffic in addition to an appropriate shoulder.

For the typical upright adult bicyclist, eye level is assumed to be 60 inches (or 5 ft). The user's eye level will affect both their visibility to other users and their ability to see ahead on the bikeway (sight distance), which will in turn affect the bikeway design.

These dimensions may vary based on the type of bicycle used. Figure 3-2 illustrates the typical dimensions for common types.

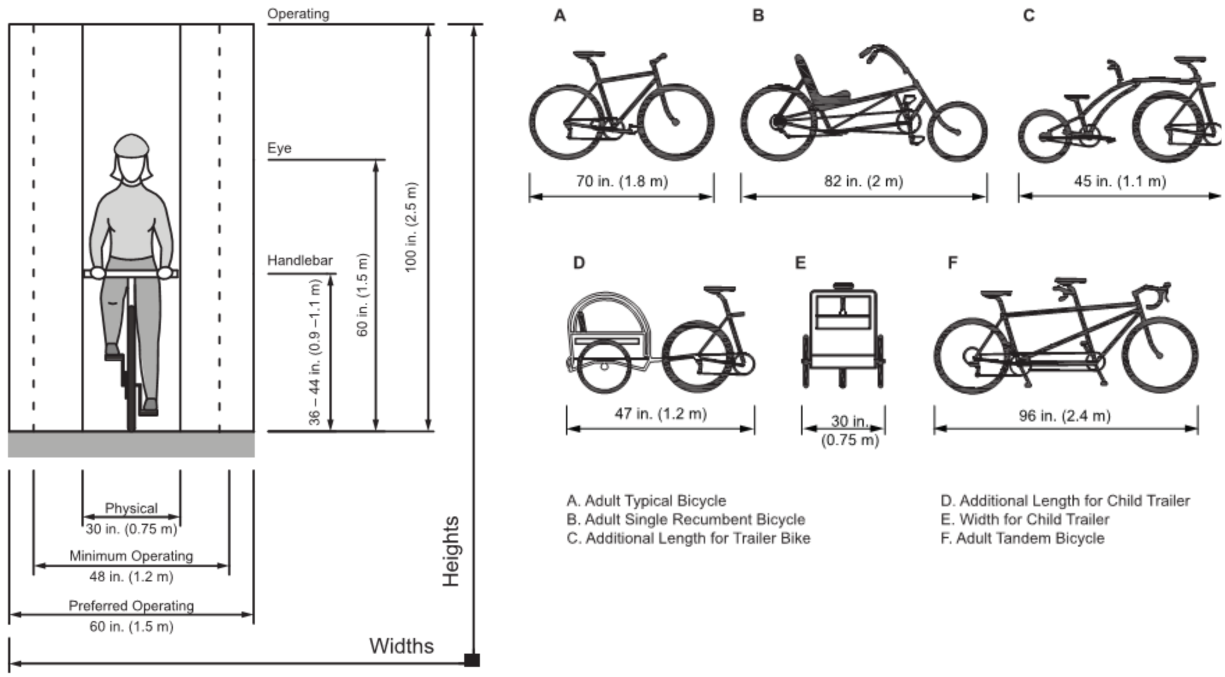

Figure 3-2. Typical dimensions for bicycle types and bicyclist operating space

(AASHTO, 2012)

3.3.3 Design Speed

A bicyclist's preferred speed will differ based on their age, experience, confidence, and trip purpose. For example, an experienced bicyclist using the greenway for athletic training or to commute will have a different ideal speed than a family of bicyclists using the greenway for leisure.

Environmental factors, such as greenway traffic, bicycle design, light conditions, weather, wind, and terrain, can also influence a bicyclist's preferred speed. An average adult will typically ride between 8 and 15 miles per hour (mph); children ride more slowly. Experienced riders may reach up to 30 mph or more (AASHTO, 2012).

A bikeway's design speed refers to the selected speed that is used to inform various elements of the bikeway design, such as horizontal and vertical curve radii and sight distance (AASHTO, 2012). The design speed is different from a speed limit, which may be set based on observed travel speeds, traffic and infrastructure conditions, and the desired level of safety for all users. Caltrans' Highway Design Manual (HDM) Chapter 1000 specifies that the minimum design speed for a dedicated bike path (Class I bikeway) is 20 mph. On long downgrades (more than 4 percent grade over 500 ft or more), the HDM's minimum design speed is increased to 30 mph (Caltrans, 2020).

Where the greenway is designed such that bicyclists share a path with pedestrian and/or equestrian users, traffic control measures should be included to slow bicyclists and provide a safer overall experience.

3.4 Equestrians

Figure 3-3. Equestrian facilities (right side) should be separated from pedestrian paths and bikeways

Facilities dedicated to equestrian users are important in SGV Greenway Network projects. The inclusion of an equestrian trail will be dictated by available ROW, anticipated equestrian users, and potential destinations and connections for equestrians. The safety and comfort of the horse, rider, and other users of the greenway are important design considerations.

A minimum width of 4 ft shall be provided for low equestrian only use trails which can range up to 12 ft wide in high-use areas with two-way traffic (County of Los Angeles, 2021b). Because horses may be startled by passing bicyclists and pets, equestrian facilities should be separated from pedestrian paths and bikeways. An example is shown on Figure 3-3. Additional space should be provided in shared use segments or where additional ROW is available.

Please refer to the Adopted County Trails Manual as a guiding document for multi-use trail standards in the County. The guidelines provided in this Trails Manual are intended to be used by County departments engaged in the planning, design, construction, and maintenance of hiking, equestrian, and mountain biking recreational trails within the County of Los Angeles.

The Trails Manual sets guidelines for all trails under the jurisdiction of LA County DPR. Trails within the jurisdiction of LA County DPR include unpaved trails, also known as soft trails; however, small portions of such trails may be paved (pavement can extend up to approximately 100 feet on a soft trail). Fully paved trails, also known as hard trails, are under the jurisdiction of LA County Department of Public Works.

3.5 Access for Emergency and Maintenance Vehicles

The greenway must be accessible to authorized vehicles, including emergency responders and vehicles used to maintain the greenway.

Therefore, all greenway segments must include a minimum of 12 ft of unobstructed drivable width to allow access by emergency and maintenance vehicles. An overall minimum 13-ft ROW width accommodates the minimum 12 ft of unobstructed width for the path and its shoulders, plus the width necessary (1 foot) to accommodate channel wall fencing and signposts or other auxiliary features outside of the shoulders. Additionally, a vertical clearance of at least 10 ft is required to the bottom of overhead structures including lighting. Note that the Stormwater Maintenance District clears access roads, including greenways adjacent to channels used for maintenance access, of vegetation to a height of at least 13 ft, and may clear to a height of 15 ft.

3.6 Proposed Greenway Usage

Greenway designs may accommodate different combinations of these intended users based on the available ROW, community preferences, and other factors. However, at a minimum, except in unique cases where no recourse is available and for limited lengths, greenway segments shall allow for use by bicyclists and pedestrians and must allow access by emergency and maintenance vehicles (County of Los Angeles, 2021b).

According to California Vehicle Code Section 21966, “No pedestrian shall proceed along a bicycle path or lane where there is an adjacent adequate pedestrian facility.” Conversely, where there is no adjacent adequate pedestrian facility, pedestrians are allowed to proceed along a bicycle path or lane. Therefore, segments with ROW widths insufficient to separate pedestrians from bicyclists shall be designed to safely accommodate both types of users.

If there are segments of the greenway that do not have varying ROW available, and where the ROW narrows to a minimum width, consider the context of the larger network, and if there are opportunities to connect users to the larger trail network, determine how to include those users in the proposed project In general, the following factors should be evaluated during design:

- **Continuity.** Will the greenway segment provide continuity in the SGV Greenway Network with adjacent existing or proposed facilities? Can each type of facility (pedestrian, bicycle, equestrian, as applicable) be connected to adjacent segments?
- **Destinations.** Will the greenway segment connect users with desirable destinations? Are appropriate amenities (such as gates, entry points, and bicycle parking) available at the destination to facilitate stops?
- **Traffic.** Are the facility types and widths appropriate for the anticipated traffic and destinations available along the greenway segment (or connected segments)?

Whenever possible, the greenway should leverage existing facilities to create a continuous network, the ultimate objective of the SGV Greenway Network Plan. In addition to ROW width, the configuration of upstream and downstream greenway segments should be considered in the design of the new greenway segment. To promote use, greenways should be located to provide safe access to potential destinations, such as parks, schools, and shopping, and other forms of transportation, such as transit and vehicle parking options. At those destinations, adequate facilities should be included to provide safe and convenient access for greenway users. Finally, communities should consider the most appropriate greenway users to accommodate based on demand, types of nearby destinations, and community input/needs.

Section 4 discusses requirements for Class I bikeways and multi-use greenways. Class I bikeways and multi-use greenways are facilities dedicated to bicycle, pedestrian, and equestrian use. For the SGV Greenway Network, these are typically in available tributary channel ROW.

Sections 5, 6, and 7 discuss requirements for Class II, III, and IV bikeways. Class II, III, and IV bikeways are different configurations for only bicycles traveling on streets/roads with vehicles. These are typically used to connect Class I bikeway or multi-use greenways when a Class I segment is not possible. For example, when insufficient ROW is available adjacent to the tributary channel.

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Section 4

Class I Bikeway and Multi-Use Greenway Design Criteria

A Class I bikeway (i.e., bike path) or multi-use greenway (with sufficient ROW) is the preferred design for segments of the SGV Greenway Network. In District or USACE channel ROWs, a Class I bikeway is the default bikeway design.

4.1 What's in This Section

This section describes the design criteria for Class I bikeways, multi-use greenways, and greenway components to be used in the District and USACE ROW, including safe crossings.

Class I Bikeway and Multi-Use Greenway Design Criteria

4.2 Class I Bikeways

Class I bikeways are bike paths (paved) with exclusive ROW for bicyclists and minimized cross flow with vehicles. Pedestrians may also use a Class I bikeway unless an adjacent pedestrian facility is provided. With dual use, signage is required for safety and to alert one user of the potential to encounter another user type. Motor vehicle access, except for emergency and maintenance vehicles, are prohibited from dedicated bike paths (Caltrans, 2020). A Class I bikeway in the SGV Greenway Network shall include a minimum 12 ft of unobstructed drivable width. The minimum total ROW width of 13 ft includes 1 foot for fencing at the channel wall. Figure 4-1 includes an example of a Class I bikeway.

Bikeways that are combined with facilities for other types of users (pedestrian and/or equestrian) are considered multi-use greenways. Motor vehicles, except for emergency and maintenance vehicle access, are prohibited from multi-use greenways in the SGV Greenway Network.

Figure 4-1. Rio Hondo bicycle path by the City of Rosemead in the San Gabriel Valley

An example of a Class I bikeway (2-way bicycle traffic with shoulder)

4.3 Multi-Use Greenways

Pedestrian and equestrian facilities may be combined with a Class I bikeway (and the associated requirements) as part of a multi-use greenway. As described in the Caltrans Highway Design Manual, a “trail” refers to an unpaved facility suitable for recreational use by hikers, pedestrians, equestrians, and/or off-road bicyclists. In addition, the phrase “bike path” refers specifically to a Class I bikeway that conforms to Caltrans design standards (Caltrans, 2020). For the purposes of the SGV Greenway Network, a “bikeway”, “bike path”, or “path” generally refers to a paved surface, which may be for pedestrians and/or bicyclists, or equestrians in unique dual use cases. A “greenway” may refer to a path, trail, or any combination of paths and trails. These are not regulatory definitions but are provided for clear and consistent interpretation of the guidelines and standards in this document.

Please refer to the Adopted County Trails Manual as a guiding document for multi-use trail standards in the County. The guidelines provided in this Trails Manual are intended to be used by County departments engaged in the planning, design, construction, and maintenance of hiking, equestrian, and mountain biking recreational trails within the County of Los Angeles.

The Trails Manual sets guidelines for all trails under the jurisdiction of LA County DPR. Trails within the jurisdiction of LA County DPR include unpaved trails, also known as soft trails; however, small portions of such trails may be paved (pavement can extend up to approximately 100 feet on a soft trail). Fully paved trails, also known as hard trails, are under the jurisdiction of LA County Department of Public Works.

When planning a trail where sufficient ROW is available, a multi-use trail inclusive of all three users (off-road bicyclist, pedestrian, equestrian) should be implemented. Where space is not available to accommodate all three users consider a multi-use trail that is inclusive of equestrians and pedestrians. Barriers are considered optional but provide a higher level of safety. Here are some examples of commonly used barriers, 2 feet or greater vegetation/low shrubs, posts, railing, or PVC or wood fencing. Please note chain link fencing is strongly discouraged for separation and has been removed on some previously completed projects.

Where further ROW constraints are present, and dependent on the needs and expected greenway users, a shared use path for pedestrians, bicyclists, and equestrians may be necessary. In this case of adjacent users with no buffer, clear pavement markings and signage are needed to designate the greenway area dedicated to each use. With dual use (cyclists with pedestrians and/or equestrians), signage is required for safety and to alert one user of the potential to encounter another user type. Traffic control measures should also be included to slow bicyclists and provide a safer overall experience.

4.4 Potential Greenway Configurations

The preferred multi-use greenway configuration in a particular reach will be determined by the ROW width, the community goals and objectives for the greenway, destinations, adjacent existing or planned greenways, the presence and location of utilities in the ROW, and other requirements specified by the District/ROW owner.

In general, three categories of ROW widths have been defined in the SGV Greenway Network for multi-use greenways:

- Narrow: 13-19 ft
- Medium: 19-24 ft
- Wide: >24 ft

Example configurations for each of the three ROW width categories follows. Note that additional bikeway/greenway sections and example conceptual designs are provided in Section 5 of the SGV Greenway Network Plan.

4.4.1 Narrow (13-19 ft)

In a narrow ROW segment, the following combinations of facility types may be accommodated:

- Class I bikeway
- Shared pedestrian and bike path (equestrians can also be accommodated with appropriate path width (12 ft.) and surface selection, brushed concrete)
- Shared pedestrian and bike path and adjacent multi-use trail
- Shared pedestrian and bike path and separated equestrian or multi-use trail (with buffer/barrier)

Table 4-1 describes potential configurations of narrow ROW multi-use greenway combinations including minimum sections.

Table 4-1. Potential Narrow ROW Multi-Use Greenway Configurations in SGV Greenway Network

Configuration	Width, ft	Cross Section Description
Minimum Class I bikeway, minimum shared pedestrian and bike path	13	• 2-foot shoulder • 8-foot bikeway or shared path (4 ft in each direction of travel) • 2-foot shoulder • 1-foot width channel fence/signage
Shared pedestrian and bike path, minimum shared pedestrian, equestrian, and bike path	17	• 2-foot shoulder • 12-foot shared path (6 ft in each direction of travel) • 2-foot shoulder • 1-foot width for channel fence/signage
Minimum Class I bikeway or minimum shared pedestrian and bike path with adjacent minimum multi-use trail	17	• 4-foot multi-use trail (equestrian and pedestrian, for low use) • 2-foot shoulder • 8-foot bikeway or shared path (4 ft in each direction of travel) • 2-foot shoulder • 1-foot width for channel fence/signage
Minimum Class I bikeway or minimum shared pedestrian and bike path with adjacent multi-use trail and planting	19	• 5-foot multi-use trail (equestrian, pedestrian, and bike, for low use) • 1-foot barrier/fence • 2-foot shoulder • 8-foot bikeway (4 ft in each direction of travel) • 2-foot shoulder • 1-foot width for channel fence/signage
Minimum Class I bikeway or minimum shared pedestrian and bike path with adjacent multi-use trail and planting	19	• 1-foot planting • 5-foot multi-use trail (equestrian, pedestrian, and bike, for low use) • 2-foot shoulder • 8-foot bikeway (4 ft in each direction of travel) • 2-foot shoulder • 1-foot width for channel fence/signage
Shared pedestrian and bike path and separated equestrian trail (with buffer)	19	• 6-foot multi-use trail (equestrian, pedestrian, and bike, for moderate use) • 2-foot shoulder • 8-foot shared path (4 ft in each direction of travel) • 2-foot shoulder • 1-foot width for channel fence/signage
Minimum Class I bikeway or minimum shared pedestrian and bike path with adjacent pedestrian path and planting	19	• 3-foot planting • 3-foot pedestrian path • 2-foot shoulder • 8-foot bikeway (4 ft in each direction of travel) • 2-foot shoulder • 1-foot width for channel fence/signage

In many locations with limited ROW, a minimum Class I bikeway/minimum shared use greenway (bike and pedestrian) will be the best configuration. A section of a minimum-width Class I bikeway/shared use greenway in a 13-ft. ROW is included on Figure 4-2.

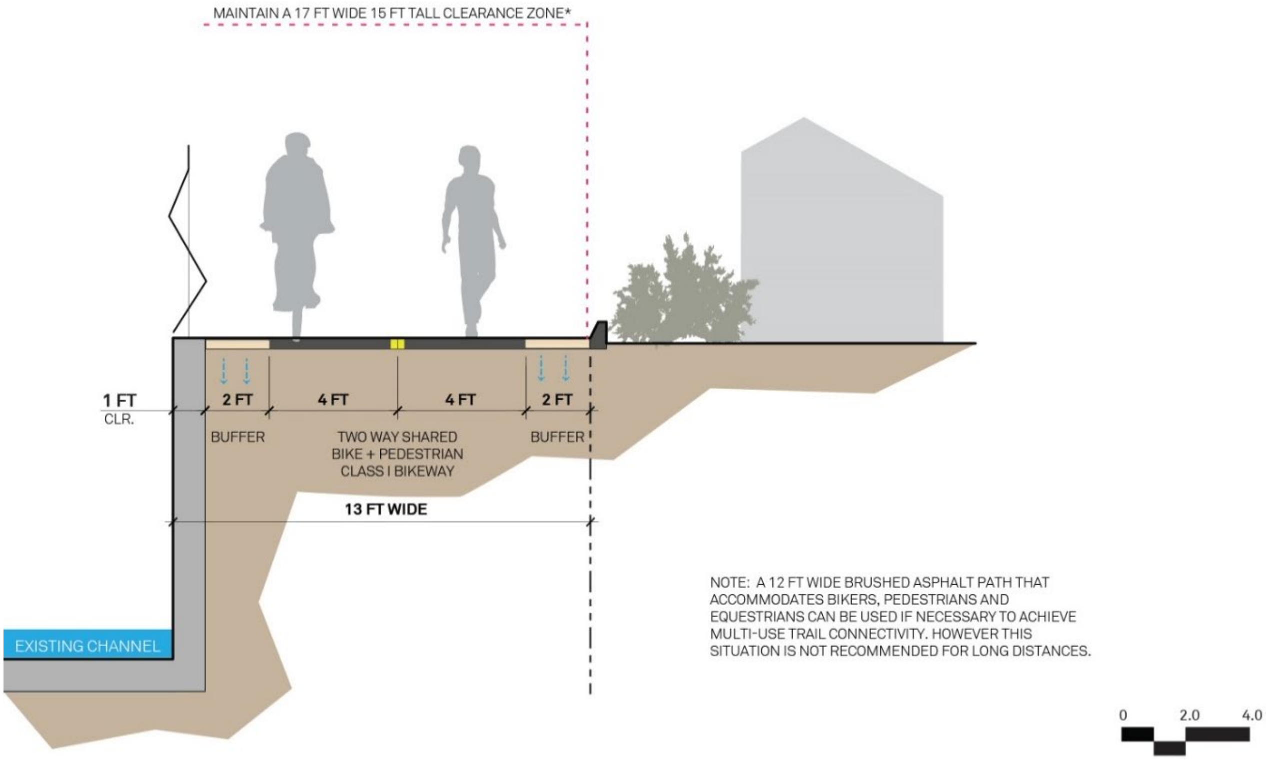

Figure 4-2. Minimum Class I bikeway/shared use greenway (bike + pedestrian path) in a narrow ROW (13 ft.)

Pedestrians may use a Class I bikeway if no pedestrian facility is available (Caltrans HDM 1003.1); therefore, Class I bikeway must conform to Americans with Disabilities Act (ADA) standards. Additional configurations are possible depending on the segment conditions/ROW and may be used if they are consistent with the individual guidelines and standards documented in this document.

An example shared-use greenway for pedestrians, cyclists, and equestrians on a brushed concrete path in a 17 ft. ROW is shown on Figure 4-3.

An example shared use bike + pedestrian path with adjacent multi-use trail in 17-19 ft. ROW is shown on Figure 4-4. Another potential section for a narrow ROW including plantings, pedestrian path, and bikeway/shared-use greenway is shown on Figure 4-5.

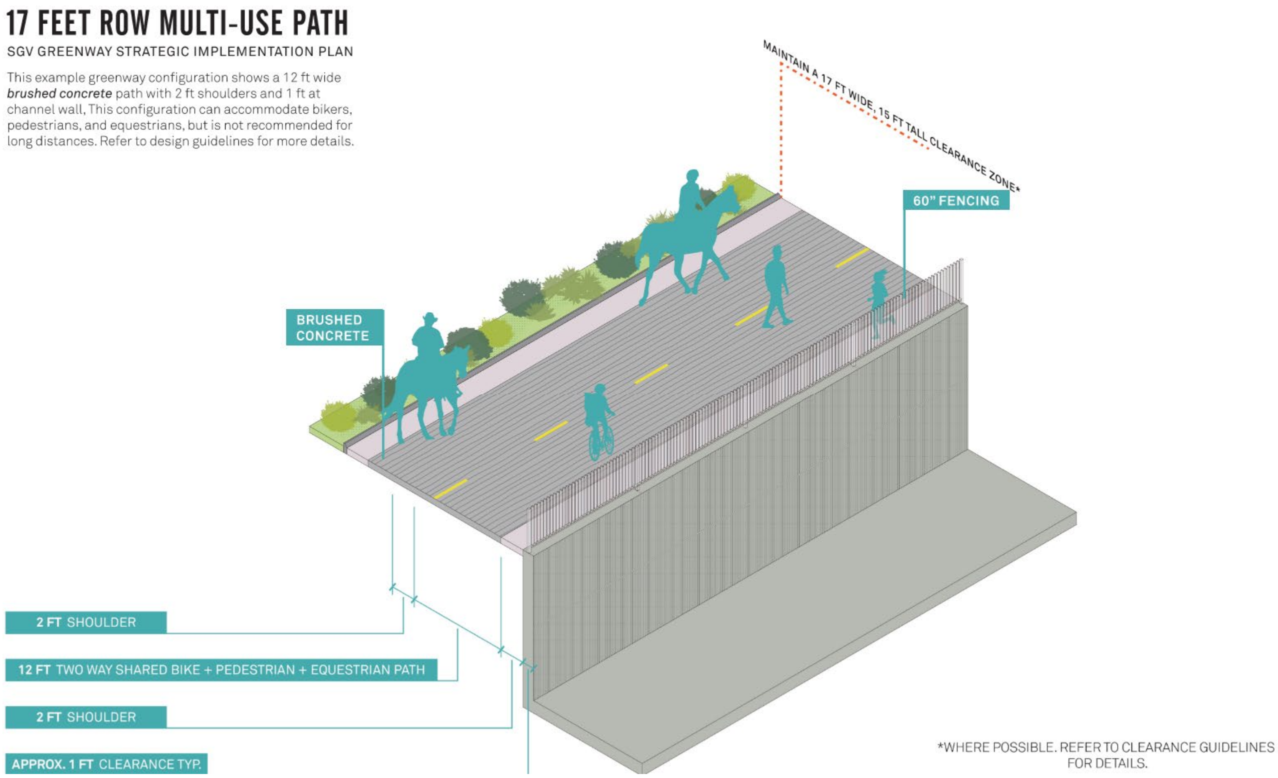

Figure 4-3. Shared use greenway (bike, pedestrian, equestrian) brushed concrete path in narrow ROW (17 ft.)

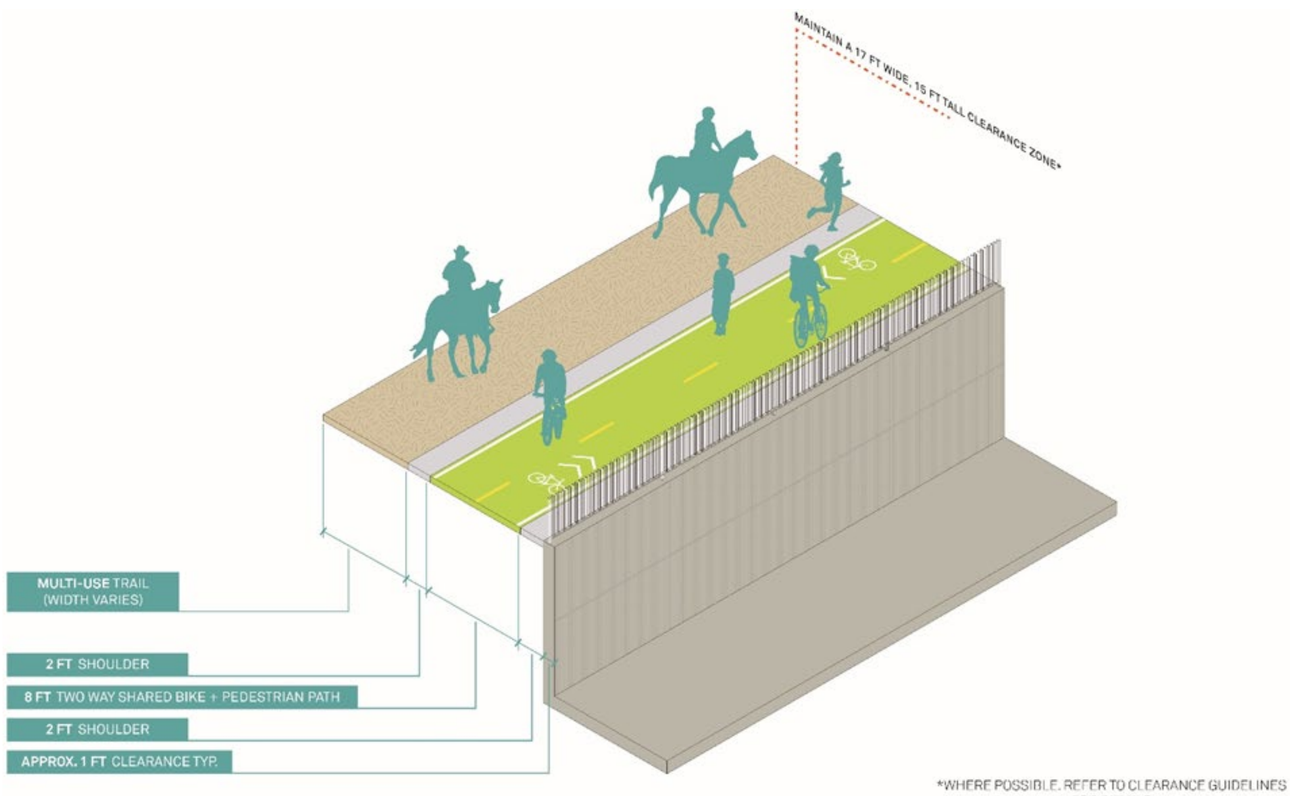

Figure 4-4. Shared use greenway (bike + pedestrian path and multi-use trail) in 17-19 ft. ROW (4 ft. multi-use trail in 17 ft. ROW, 6 ft. multi-use trail in 19 ft. ROW)

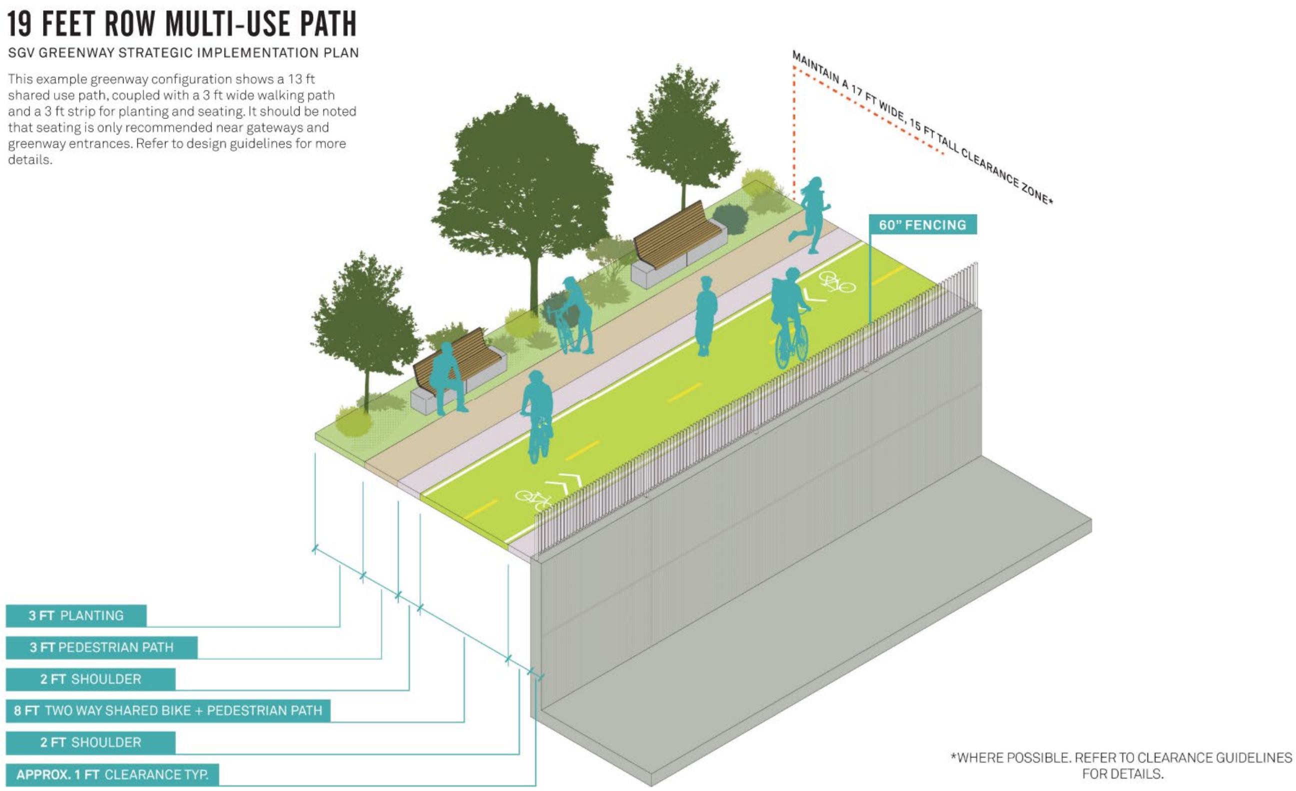

Figure 4-5. Minimum Class I bikeway/shared use greenway (bike + pedestrian path) with pedestrian path and planting in a narrow ROW (19 ft.)

4.4.2 Medium (19-24 ft)

In a medium ROW segment, the following combinations of facility types may be accommodated:

- Adjacent pedestrian path, Class I bikeway, and equestrian trail (with buffer/barrier)
- Separated multi-use trail and Class I bikeway (with buffer)
- Wider Class I bikeway, or shared pedestrian and bike path, and equestrian trail (with buffer/barrier)
- “Narrow” ROW configurations with added greenspace or amenities

Table 4-2 describes potential configurations of medium ROW multi-use greenways. In a medium ROW segment, all three uses (equestrian, pedestrian, and bicycle) may be accommodated with separate facilities. In a medium ROW it is also possible, depending on expected number of users and community preference, to have a dual use trail (pedestrian and equestrian) with a separate bikeway and buffer between. Sufficient dual use trail width is needed to accommodate both users and directions of travel.

Additional combinations may be possible based on the segment conditions and can be used if they are consistent with the individual guidelines and standards provided in this document. For example, a portion of a medium ROW segment may be devoted to a stormwater management BMP, landscaped area, or another amenity, such as bicycle racks, vegetation, or seating area (see Sections 10 and 11 for more information).

Table 4-2. Potential Medium ROW Multi-Use Greenway Configurations in SGV Greenway Network		
Configuration	**Width, ft**	**Cross Section Description**
Adjacent pedestrian path, Class I bikeway, and equestrian trail (with buffer)	24	• 5-foot equestrian trail • 1-foot buffer/barrier • 5-foot pedestrian path (or trail) • 2-foot buffer/shoulder • 8-foot bikeway (4 ft in each direction of travel) • 2-foot shoulder • 1-foot width channel fence
Wider Class I bikeway, or shared pedestrian and bike path, and equestrian trail (with buffer)	21	• 4-foot equestrian trail • 2-foot buffer/barrier • 2-foot shoulder • 10-foot bikeway or shared path (5 ft in each direction of travel) • 2-foot shoulder • 1-foot width channel fence
Separated pedestrian path and Class I bikeway (with buffer)	24	• 2-foot shoulder • 8-foot bikeway (4 ft in each direction of travel) • 2-foot shoulder • 3-foot buffer (vegetation, seating) • 2-foot shoulder • 4-foot pedestrian path (or trail) • 2-foot shoulder • 1-foot width for channel fence

An example multi-use greenway with equestrian trail, pedestrian path, and bike path in a 24 ft. ROW is illustrated on Figure 4-6. Some pedestrians prefer a path (paved) while others prefer a trail (non-paved) for recreation and exercise. An alternative section with a multi-use trail and a shared use greenway path separated by a planting buffer is shown on Figure 4-7. The planting buffer could also be used for installation of seating, a bioretention swale to treat greenway stormwater runoff, or other amenities.

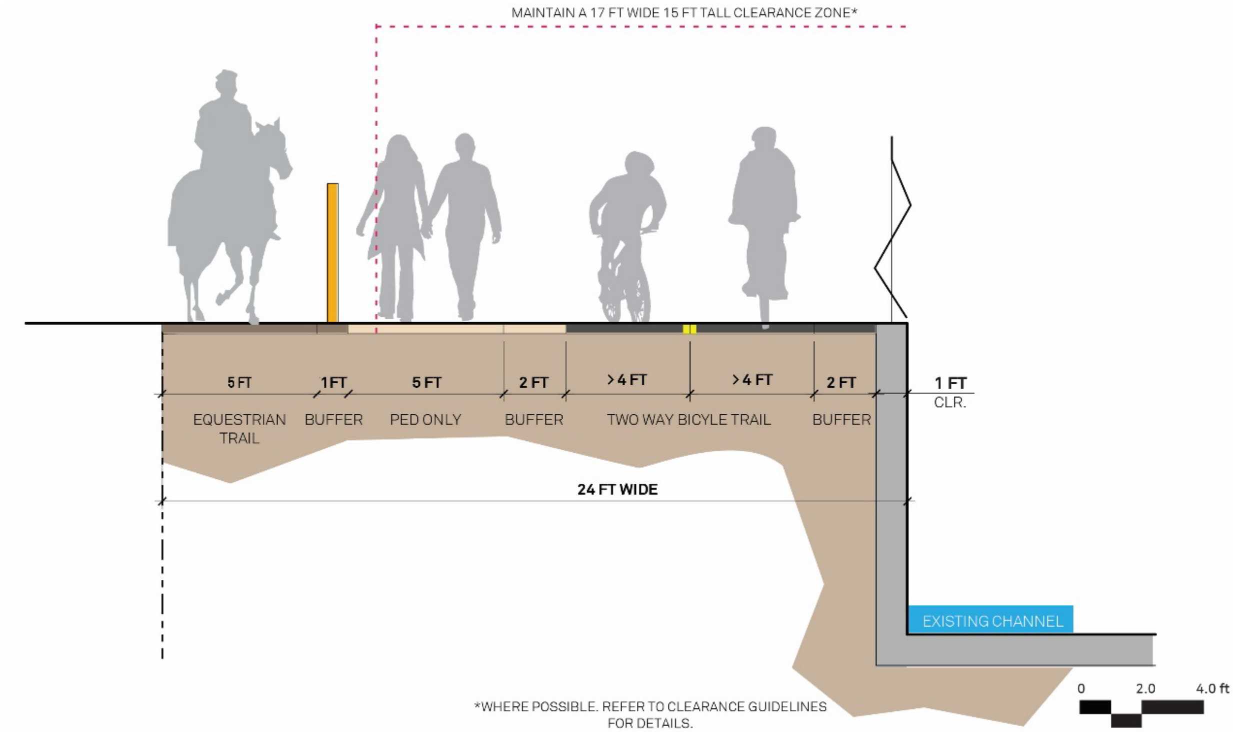

Figure 4-6. Multi-use greenway (equestrian trail, pedestrian path or trail, and bikeway) in 24 ft. ROW

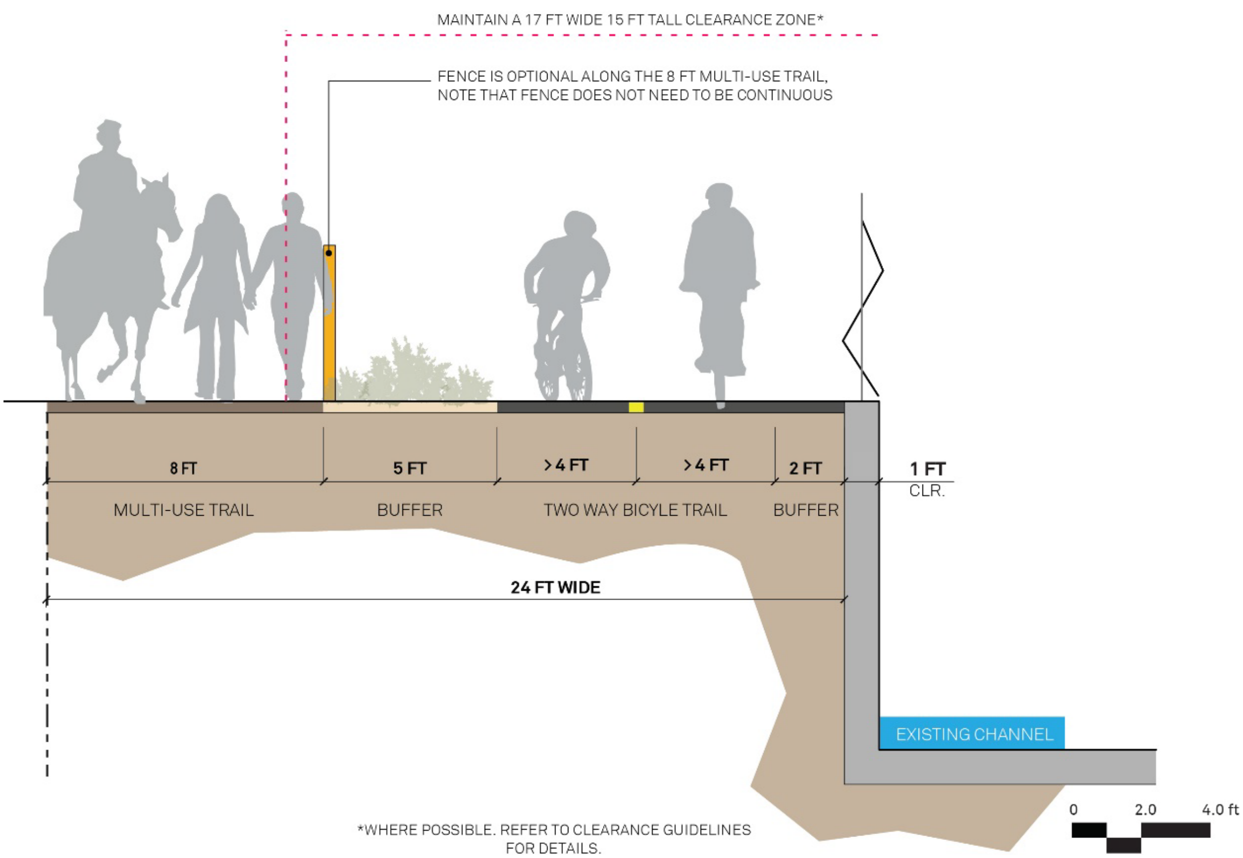

Figure 4-7. Multi-use greenway (multi-use trail and bikeway) with planting buffer in 24 ft. ROW

4.4.3 Wide (>24 ft)

In a wide ROW segment, there are numerous opportunities and combinations of facility types that may be accommodated including:

- Separated pedestrian, Class I bikeway, and equestrian facilities (with buffers)
- "Narrow" and "Medium" ROW configurations with pocket parks, greenspace, and/or amenities
- Shared use paths and trails with stormwater management

Additional combinations may be possible depending on the segment conditions and may be used if they are consistent with the individual guidelines and standards provided in this document. For example, a portion of a wide ROW segment may be devoted to a stormwater BMP, landscaped area, or another amenity, such as bicycle racks or seating area (see Sections 10 and 11 for more information). Where significant ROW is available, designers may also consider a larger stormwater BMP retrofit (for off-site drainage), pocket park, gateway, shade structure, or other desired beneficial element(s). An example multi-use greenway configuration in a wide ROW with bikeway path, multi-use trail, and green infrastructure stormwater treatment area is shown on Figure 4-8. Figure 4-9 provides an alternative greenway section in a wide ROW with paths and trail for multiple users.

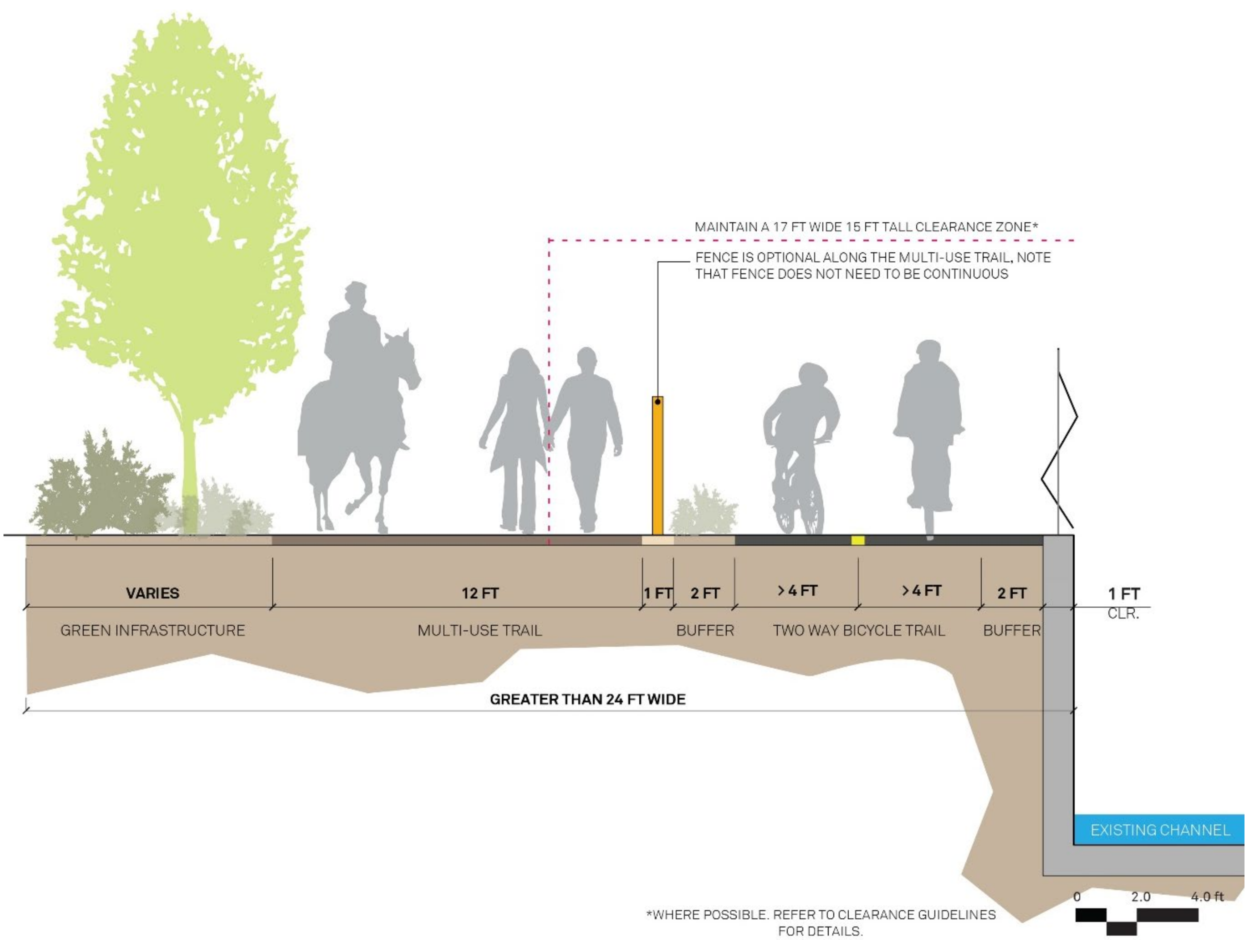

Figure 4-8. Multi-use greenway (multi-use trail, bikeway, and green infrastructure stormwater management) in wide ROW

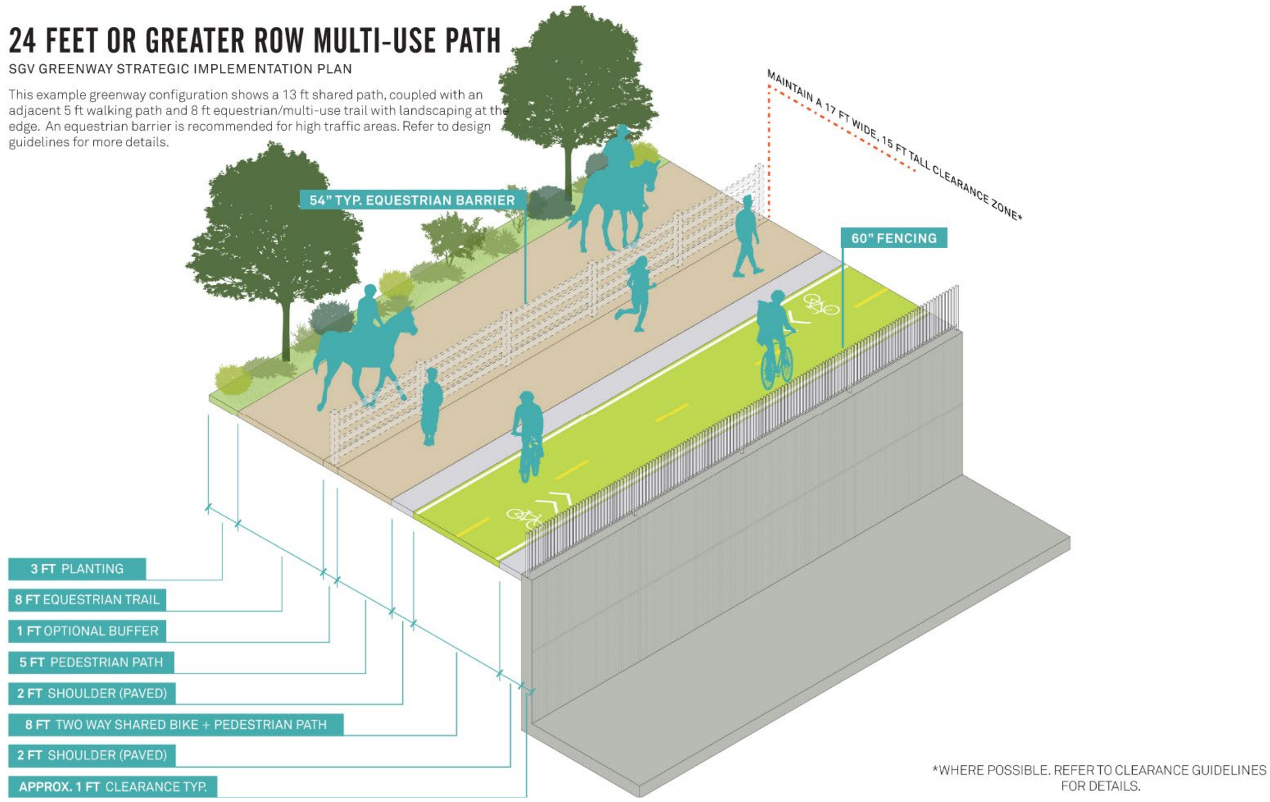

Figure 4-9. Multi-use greenway (equestrian trail/barrier, pedestrian path or trail, bikeway, and planting) in wide ROW

4.5 Bikeway Characteristics

The bikeway portion of the greenway must meet Caltrans standards for a Class I bikeway.

4.5.1 Horizontal Clearance

A Class I bikeway must have a minimum 4 ft paved width in each direction of travel. Therefore, the minimum paved width of a two-way bike path travel lane is 8 ft (Caltrans, 2020). Class I bikeways must also have a shoulder with a minimum vertical clearance of 2 ft on each side of the bike path to provide 12-ft of unobstructed drivable width. The shoulder should be composed of the same paved material as the bike path, or an all-weather drivable surface material that is free of vegetation. Paved shoulders are recommended due to their uniform surface with the paved path, durability, and lower maintenance requirements. The shoulder area is not considered part of the bike path travel way. Obstructions such as signposts must lie outside of the shoulder area (Caltrans, 2020) to provide the minimum 12-ft width.

Where a fence, wall, or other type of structure is located adjacent to the bikeway, a minimum 2-foot horizontal clearance must be provided between the paved edge of a bike path and the obstruction. Three ft of horizontal clearance is preferred. The purpose of the added distance is to prevent collisions with nearby structures and provide additional space to prevent conflicts between bicyclists and pedestrians in shared travel lanes (Caltrans, 2020).

The District Maintenance Standards establish a “Limited Landscape Management Zone” within up to 17 ft of the channel wall. Structures and trees are not permitted within this zone. Low shrubs (3-5 ft. maximum height), ground cover, and grasses are permitted in planting areas within the Limited

Management Landscape Zone and against the channel walls, except directly behind an expansion joint. The edge of the planting area must be at least 5 ft from the expansion joint.

4.5.2 Vertical Clearance

A vertical clearance of 10 ft from the highest point on the greenway surface to the lowest point of an overhead structure or feature is required to accommodate emergency and maintenance vehicles (County of Los Angeles, 2021b). This applies across the minimum unobstructed drivable width of 12 ft.

When planning vegetation along greenways note that within the up to 17 ft. wide Limited Landscape Management Zone the Stormwater Maintenance District clears access roads, including greenways adjacent to channels used for maintenance access, of vegetation to a height of at least 13 ft, and may clear to a height of 15 ft. Cantilever shade structures must be located outside the up to 17 ft. width, and above the 15 ft. height from the greenway surface.

4.5.3 Drainage and Slopes

The greenway path should slope away from the channel at a grade of 2 percent (County of Los Angeles, 2021b; Caltrans, 2017). Where feasible, bike paths should slope into a vegetated area designed to provide stormwater treatment. See Section 11 for design standards for stormwater BMPs. The bike path shoulder may slope away from the bike path at a grade between 2 and 5 percent to reduce ponding and keep debris away from the bike path (Caltrans, 2020). Drainage infrastructure and pavement slope shall be provided for the greenway, so stormwater runoff drains immediately from the surface and does not pond. See Section 11 for additional requirements and information related to stormwater management.

Along the travel path, the maximum recommended longitudinal slope is 5 percent. If site conditions do not permit a slope of 5 percent, the slope should not exceed 8.33 percent (Caltrans, 2020; Caltrans, 2017). Landings should be provided as needed per Americans with Disabilities Act (ADA) standards (ADA, 2010, Chapter 405).

4.5.4 Surface Types

The bike path material for the travel lane and shoulders shall be a smooth, well drained, and all-weather riding surface with skid resistant qualities and free of vegetation (Caltrans, 2020). The recommended surface types for Class I bikeways and shoulders are concrete, asphalt, permeable concrete, and permeable asphalt. See additional information under multi-use greenway in this section and Section 11 for permeable pavement standards. When asphalt surfacing is specified, only use low volatile organic carbons (VOC), warm mix asphalt to reduce the urban heat island effect. Designers can also use light-colored or high albedo surfaces, which reflect rather than absorb solar energy. Note that there is evidence coming out that while high-albedo surfaces keep pavement temperatures cooler, they increase the air temperature for users due to the light/heat being reflected back off the ground.

All pavement structural sections (full drivable width, 12 ft. minimum) shall be designed consistent with the guidelines outlined in the Caltrans and AASHTO design manuals. Design should be based upon a reasonable Traffic Index provided by a traffic/transportation engineer considering use by emergency and maintenance vehicles. A geotechnical consultant and licensed CA civil engineer shall be used to provide recommendations for the structural design of the travel lane sections. If permeable pavement is proposed, any impacts to the structural integrity of an adjacent channel wall or other structures due to infiltration or other permeable pavement characteristics shall be evaluated and addressed in the design.

4.5.5 Alignment Characteristics

Because bicycles are powered by the rider's physical movements, stops can be inconvenient or, in some cases, dangerous. However, it is also important that greenway segments are designed so bicyclists can identify potential hazards with sufficient space to slow or stop. Accordingly, the following alignment characteristics should be incorporated into the greenway design:

- **Stop distance.** Stop distance refers to the distance required for a bicyclist to safely come to a full controlled stop. Stop distance is a function of the bicyclist's awareness and reaction time, travel speed, friction between the tires and ground surface, and the bike's braking ability (Caltrans, 2020).
- **Sight distance.** Sight distance refers to the distance along the bike path that is visible to a user. Sufficient sight distance should be provided to allow a bicyclist to come to a complete stop in response to an observed obstruction or hazard or crossing/intersection. For a bicycle traveling at 20 mph (the typical design speed for a Class I bikeway), the minimum stopping sight distance is 125 ft (Caltrans, 2020). Longer distances are required at higher speeds. Sight distance shall be evaluated at the potential speeds with the path horizontal radius of curvature, crossings/intersections, and placement of vegetation and any other above ground features along or adjacent to the bikeway/greenway.
- **Turn radius.** For a design speed of 20 mph, the minimum horizontal radius of curvature should be 90 ft. On downslopes, where bicyclists' speeds may increase to 30 mph, the minimum radius of curvature should increase to 320 ft. If the curve radius is less than those given, standard curve warning and reduce speed signs, and supplemental pavement markings, shall be used to warn greenway users (Caltrans, 2020).
- **Traffic calming elements.** Safe traffic calming elements should be used to slow traffic and bicycle speeds. These are especially important to install when the sight stopping distance is less than the minimum and when approaching crossings/intersections. However, obstacle posts or gates must not be used to force bicyclists to slow down, stop, or dismount, but may be considered when other measures have failed to stop unauthorized motor vehicle entry onto the greenway (Caltrans, 2020). Common traffic calming practices include rumble strips (see Figure 4-10), paver section, creating a curved or narrower traffic pattern, and posting reduced speed signage.

Figure 4-10. Rumble strips on an LA River Class I bikeway

4.6 Multi-Use Greenway Characteristics

In cases where separated pedestrian paths, equestrian trails, or multi-use trails will be adjacent to a Class I bikeway, additional criteria apply. The location, width, surface type, and design for each additional path or trail should be carefully considered, in conjunction with the Class I bikeway, as presented below.

Although there are challenges to activating both sides of a channel, various possibilities may be explored when planning and designing. In some unique cases where the channel ROW is significantly limited to less than 13-ft, and the other side of the channel has an acceptable 12-ft. wide bikeway or greenway, a single-use equestrian trail, pedestrian path or trail, or multi-use trail may be implemented in lieu of a bikeway. An example is shown on Figure 4-11. This requires approval by LA County Public Works and other regulatory entities. Without 12-ft of paved unobstructed width, access by emergency and maintenance vehicles is not expected substantially reducing the safety and maintenance of the path or trail.

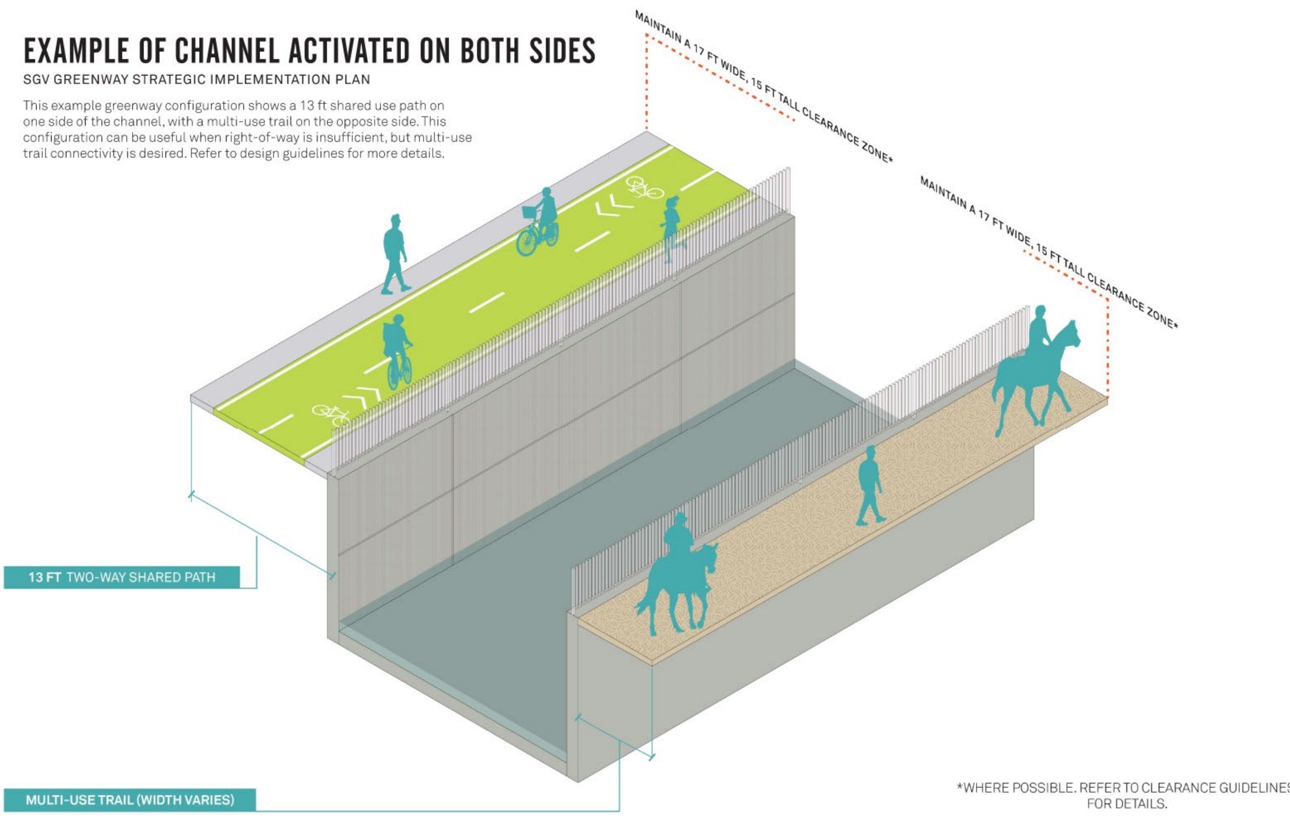

Figure 4-11. Example with greenway on one side of channel and separate trail with less than 13 ft of ROW on opposite side

4.6.1 Horizontal Clearance

A pedestrian path or trail may be 4 to 12 ft wide. A minimum 5-foot width is recommended. Regardless of the path width, 2-foot-wide shoulders should be provided on each side. An equestrian-trail can be 4 to 12 ft wide based on anticipated usage (County of Los Angeles, 2021b). A minimum 5-foot width is recommended with 2-foot-wide shoulders on each side of the trail. When planning an equestrian trail, local equestrians/community should be consulted to determine the expected number of users and appropriate width to accommodate the users.

4.6.2 Vertical Clearance

A minimum of 10 ft of vertical clearance to structures is required to allow access by emergency and maintenance vehicles. The vertical clearance requirement applies across the minimum unobstructed width of 12 ft or greater. If a separate pedestrian path and/or equestrian trail is adjacent/parallel to a 12 ft wide bikeway accessible to emergency vehicles, it does not need to be 12 ft wide, nor provide emergency vehicle access.

For equestrian-only trails, a minimum of 10 ft of vertical clearance shall be provided, while 12 ft is preferred (County of Los Angeles, 2021b).

When planning vegetation along greenways note that within the up to 17 ft. wide Limited Landscape Management Zone the Stormwater Maintenance District clears access roads, including greenways adjacent to channels used for maintenance access, of vegetation to a height of at least 13 ft, and may clear to a height of 15 ft as shown on Figure 4-12. Cantilever shade structures must be outside the up to 17 ft. width, and above the 15 ft. height.

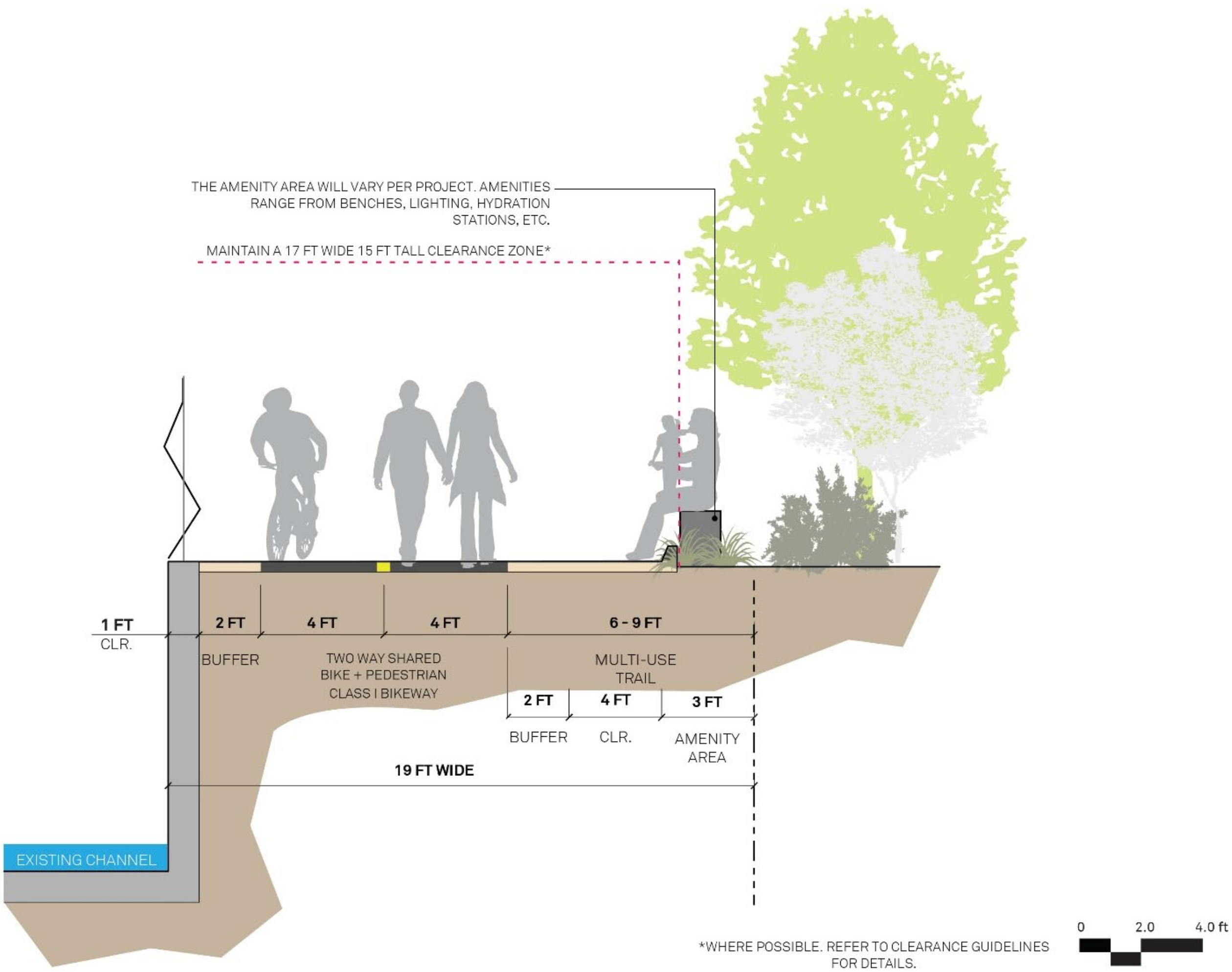

Figure 4-12. Greenway cross-section showing Limited Landscape Management Zone

4.6.3 Drainage and Slopes

Drainage and slope standards for Class I bikeways also apply to pedestrian and equestrian paths and trails (see Section 4.4.3). For paths used by pedestrians, additional accessibility requirements from the Americans with Disability Act apply. On trail segments (non-paved), lower erosion potential surface materials and permanent erosion control measures should be included in the design to minimize trail erosion and sediment transport.

4.6.4 Surface Types

Different surface types are appropriate for different greenway components and uses including paved and non-paved surfaces. For example, concrete and asphalt, regular and permeable, are the recommended surface materials for Class I bikeways. Cyclists prefer smooth continuous surfaces such as asphalt or concrete whereas pedestrians typically prefer more forgiving surfaces such as bonded stone fines. Equestrians, hikers, and mountain bike users usually prefer non-paved natural surfaces. The five primary surface types are illustrated on Figure 4-13. A description of the potential uses for the various surface types is included in Table 4-3 followed by a brief description of each.

When asphalt surfacing is specified, only use low VOC, warm mix asphalt to reduce the urban heat island effect. Designers can also use light-colored or high albedo surfaces, which reflect rather than absorb solar energy. Note that there is evidence coming out that while high-albedo surfaces keep pavement temperatures cooler, they increase the air temperature for users due to the light/heat being reflected back off the ground.

When possible, these “ideal” surfaces should be used; however, all design conditions, material thicknesses/assemblies, and colors should be reviewed by design professionals for site specific considerations. Additionally, paving has the potential to feature artwork. Permeable pavers can include decorative patters which provide an attractive surface for gateways and gathering spaces.

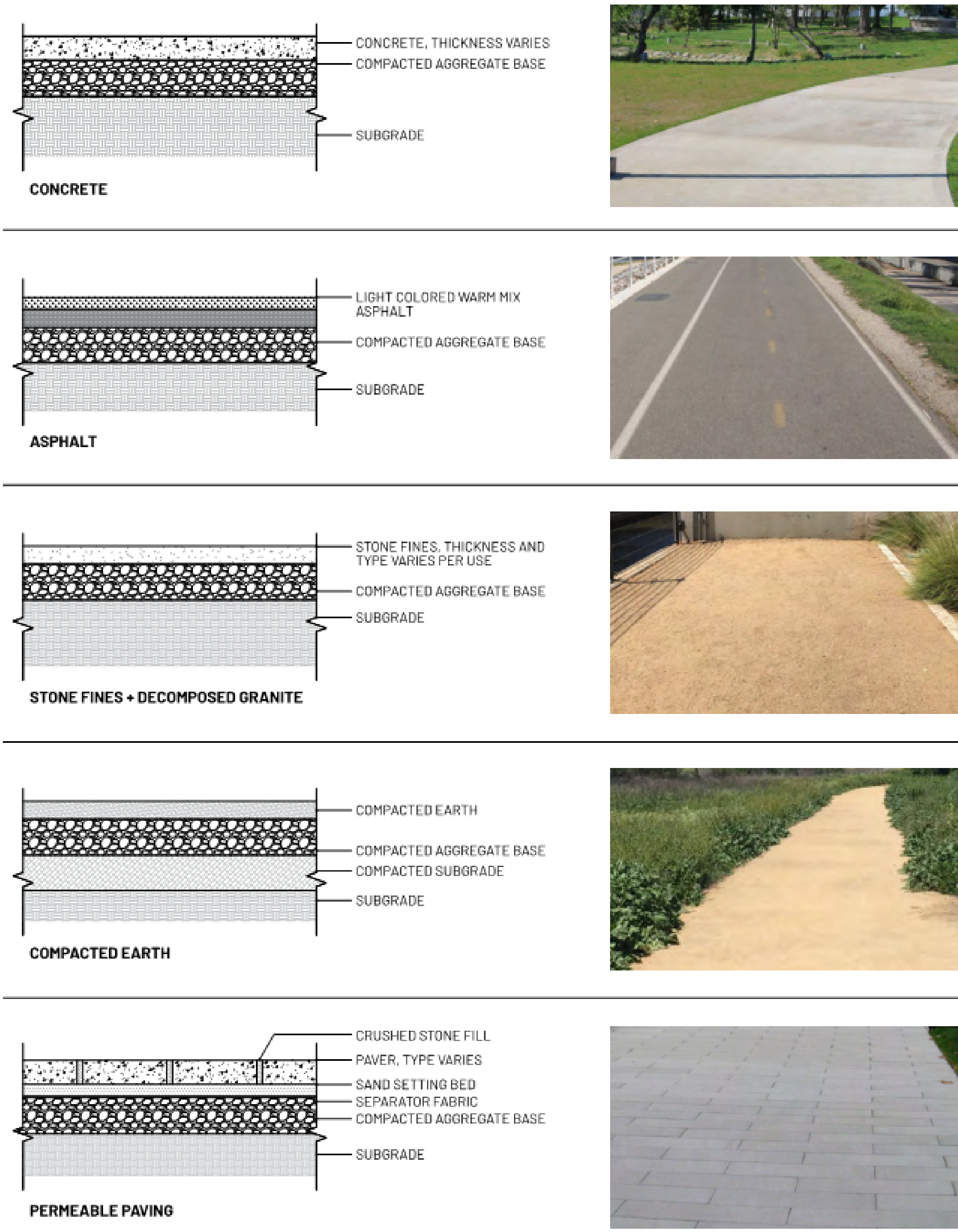

Figure 4-13. Five primary surface type sections to be used in the SGV Greenway Network

Table 4-3. SGV Greenway Surface Type Potential Uses	
Surface Type	**Potential Uses**
Concrete	Maintenance and service roads, bicycle paths, pedestrian paths, path shoulders. For shared-use path with equestrian use rough brushed concrete.
Asphalt	Maintenance and service roads, bicycle paths, pedestrian paths, path shoulders. When asphalt surfacing is specified only use low VOC, warm mix asphalt to reduce the urban heat island effect.
Stone fines and decomposed granite	Pedestrian trails, equestrian trails, multi-use trails, bikeway and greenway path shoulders
Compacted earth	Maintenance and service roads, pedestrian trails (e.g., walking, running, or hiking), equestrian trails. Not recommended, only if no other option is available due to issues with erosion and maintenance; stabilize with a well graded aggregate base.
Permeable pavement	Bicycle paths, pedestrian paths, path shoulders, amenity paved areas/parking. Only asphalt and concrete permeable pavement for bikeway and dual bicycle/pedestrian use (no pavers). Permeable pavers may be used for amenity paved areas, gathering areas, sidewalks, and parking.

A brief description of each surface type follows:

- **Concrete:** A durable paving material that consists of aggregate and cement over a compacted aggregate base. Suitable for maintenance roads and bicycle and pedestrian paths. Brushed concrete should be used if a shared use path including equestrian.
- **Asphalt:** Durable paving material that consists of aggregates held together by asphalt cement over a compacted aggregate base. Can withstand loads of a maintenance vehicle, while also being a suitable material for bicycle paths. A light-colored, low VOC warm mix must be used to offset the urban heat island effect.
- **Stone Fines and Decomposed Granite (DG):** A stable, natural-looking paving material consisting of crushed rock, which can be found in a variety of different colors and granular sizes, over a compacted aggregate base. A larger granular size is recommended, as fine DG becomes slippery when wet. Where erosion is a concern, DG should be protected with a resin- binder and should not be used on sloped areas greater than 3 percent unless a drainage system is installed. Generally higher maintenance than concrete or asphalt.
- **Compacted Earth:** This inexpensive method should be primarily used for equestrian trails when no other option is available since wear and erosion and sediment transport can be a maintenance problem. Care should be taken to stabilize the path with a well-graded and compacted aggregate base.
- **Permeable Pavement:** Crushed stone fill between paving, or open, coarse aggregate held together by asphalt concrete or cement over a compacted aggregate base. Problems can occur with silting which reduces permeability if surfaces are not cleaned and maintained regularly to allow maximum water percolation. Permeable pavers for use in amenity areas, not paved bikeway and greenway paths, are traffic bearing commercial concrete pavers with small aggregate for infiltration between the pavers. All permeable pavements can take the place of other required stormwater management.

Considerations for use of surface types include:

- Regardless of the selected material, the greenway must support routine use by emergency and maintenance vehicles.
- Crushed stone or other unpaved surfaces may not be practical for paths with a grade of 3 percent or higher.

- For more information on the use of permeable pavement, refer to Section 11 of this document and the LA Green Streets Design Guidelines (LACPW, 2021b).

Infrastructure such as inlet grates and manhole covers should be located outside of the bikeway and multi-use greenway travel lanes and shoulders. All utility and infrastructure components (manhole cover, stormwater grates, etc.) shall be flush with the surface and not contain openings or indentations to avoid trip or fall hazards for greenway users and obstructions for emergency and maintenance vehicles (Caltrans, 2020).

4.7 Grade-Separated Crossings

Grade-separated crossings, such as bridges and underpasses, provide consistent access for potential users where ROW conditions require. Where possible, the greenway on either side of the crossing should allow the same uses (e.g., the same configuration of pedestrian, bicycle, and equestrian uses).

The choice of an underpass or overpass will be dictated by adjacent topography and existing features. Bridges or overpasses have security advantages and are less likely to have drainage problems (AASHTO, 2012). On the other hand, bicyclists prefer underpasses with a vertical slope down followed by a vertical rise that reduces their pedaling effort.

Grade-separated crossings should be of sufficient width and designed to provide emergency and maintenance vehicle access.

4.7.1 Grade-Separated Undercrossing

A grade separated undercrossing provides a continuous greenway when crossing a roadway or other obstacle. These should be installed whenever possible instead of a surface crossing.

- **Horizontal and vertical clearance.** The travel way through the underpass should be at least 12 ft wide to accommodate emergency and maintenance vehicles. A minimum vertical clearance of 12 ft should be provided, as measured from the bottom of overhead lighting across the length of the undercrossing. If field conditions permit, a vertical clearance of 14 ft is preferred to allow heavy equipment access.

  Underpasses should be designed with smooth straight surfaces without notches to eliminate spaces between structural members.

  The greenway slope through the underpass should be less than 5 percent. If the site conditions do not permit a slope of 5 percent or less, the slope should not exceed 8.33 percent. Landings should be provided as needed per ADA requirements (County of Los Angeles, 2021b).
- **Drainage and slopes.** Cross slope standards for Class I bikeways also apply in an underpass (2 percent). Underpasses may have unique drainage requirements that require additional storm sewer infrastructure to provide proper drainage and direction of stormwater (County of Los Angeles, 2021b). Infrastructure shall be provided as needed for the undercrossing, so stormwater runoff drains immediately from the surface and does not pond. See Section 11 for additional requirements and information related to stormwater management.
- **Surface types.** Ground surface types through the underpass should withstand and promote proper drainage of stormwater and floodwater and prevent slipping. Concrete is the preferred material. Where a bike path is shared with equestrians on laterally constrained segments such as underpasses, a brushed coat finish on concrete should be applied to prevent horseshoes from slipping.

Figure 4-14 includes an example of a grade-separated underpass which provides a great opportunity to display local art and culture. As shown on Figure 4-14, lighting throughout all undercrossings is required to ensure user visibility and safety, see Section 10 for additional information on lighting.

An axonal diagram of a street undercrossing showing typical dimensions for clearance and ADA slope is shown on Figure 4-15.

Figure 4-14. Path undercrossings provide an opportunity to display local community art

Figure 4-15. Street undercrossing diagram with clearance and ADA slope

4.7.2 Grade Separated Overcrossing

The design, materials, and construction of the bridge will vary by project and should conform with city, LA County, and state requirements.

- **Horizontal and vertical clearance.** Bridges or overpasses should be a minimum of 12 ft wide between railings and provide a minimum of 10 ft of overhead clearance to allow passage by emergency and maintenance vehicles. Like underpasses, the grade of an overpass should be less than 5 percent. If the slope is above 5 percent, landings and railings must be provided per ADA requirements (County of Los Angeles, 2021b).

  In some cases, an overcrossing may be proposed across a channel to connect to a greenway or destination on the other side. If existing emergency and maintenance vehicle access is available on both sides of the channel, the proposed overcrossing does not need to be structurally designed for use by emergency and maintenance vehicles, but instead the intended pedestrian, cyclist, and/or equestrian users. Structural bollards or similar structural feature should be installed on both sides with signage to prohibit vehicle access.
- **Drainage and slopes.** The cross-slope standards for Class I bikeways also apply for bridges and overpasses (2 percent cross slope).
- **No channel hydraulic impact.** All bridges shall be analyzed for hydraulic impacts on the flood capacity of the channel and shall be designed and constructed to convey at a minimum the 100-year storm event, including freeboard, with no increase in peak water stage. Bridge height and width should also consider future climate and channel condition.
- **Connections and circulation.** Path and trail intersections should be carefully considered in the design of bridges to ensure seamless circulation between different kinds of users. For example, when building an equestrian bridge, that bridge should connect users to an equestrian trail. In all instances of crossing, ample environmental graphics and striping shall be included to warn users of a crossing.

- **Structural integrity.** Bridge structural integrity and not impacting the channel structural integrity are primary considerations that must be addressed by a CA licensed structural engineer in the planning, design, permitting, construction, and long-term operation and maintenance.

An axonal diagram of an example overcrossing along an on-channel greenway route is provided on Figure 4-16. Due to complexity, space requirements, and cost, these are typically only done at high priority locations and when other options are not feasible.

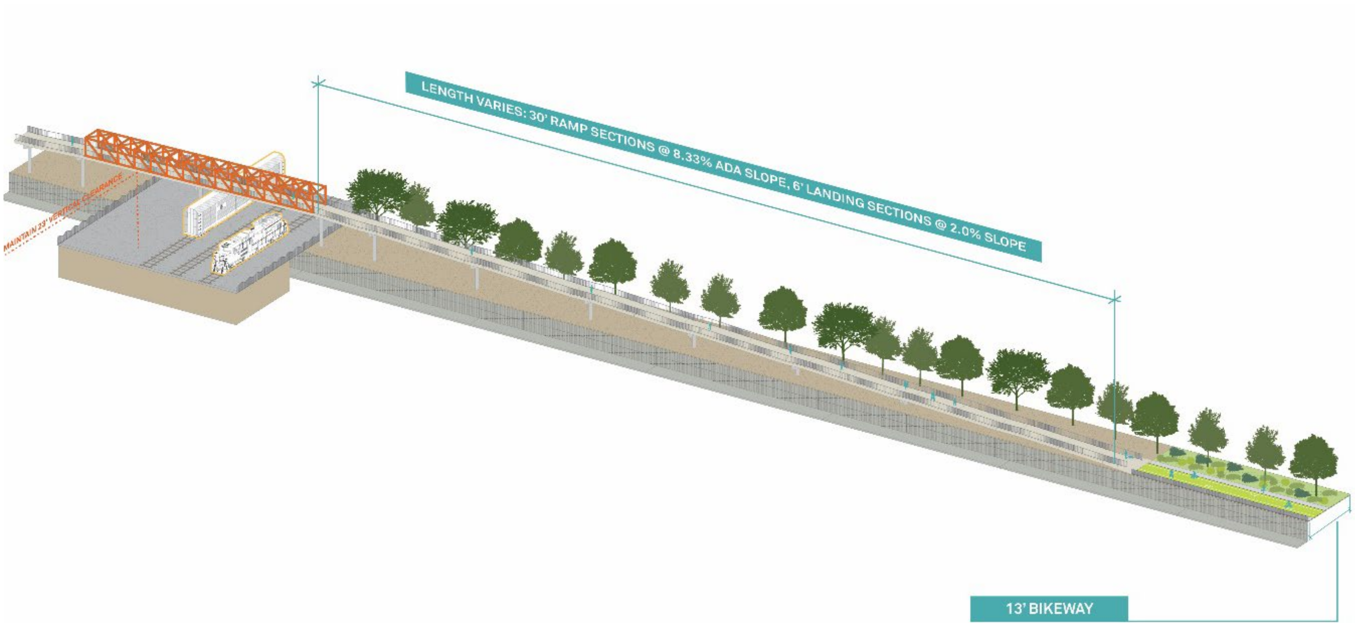

Figure 4-16. Overcrossing diagram with clearance and ADA slope

All bridges/overcrossings must also be designed and constructed to comply with all local and District or USACE requirements. Early coordination with all entities, depending on ROW jurisdiction, is required to understand the potential issues and requirements.

4.7.3 Channel Crossings

Connectivity across the SGV Greenway channels is just as important as connectivity along them. Where feasible, bridges should be implemented to connect all users across channels. While the overall look and structure of these bridges will be different based on the location and intended use, there are certain elements that should be present in all instances.

At a minimum, bicycles and pedestrians should be able to cross to enjoy amenities and destinations along both sides of the river. Bridges should also be ADA accessible. Guardrail heights should follow standards and applicable codes.

Wherever a bridge is implemented, connections to the correct trail systems and users is paramount. Trail intersections should be carefully considered in the design of bridges to ensure seamless circulation between different kinds of users. For example, when building an equestrian bridge, that bridge should connect users to a corresponding equestrian trail. In all instances of crossing, ample environmental graphics and striping must be included to warn users of a crossing. The specific design, materiality, and form of each bridge should be developed for intended use and on a project-by-project basis. Bridges also provide an opportunity for artwork.

All channel overcrossings shall meet the requirements and guidance provided at the beginning of this subsection. An axonal diagram of a channel overcrossing is provided in Figure 4-17.

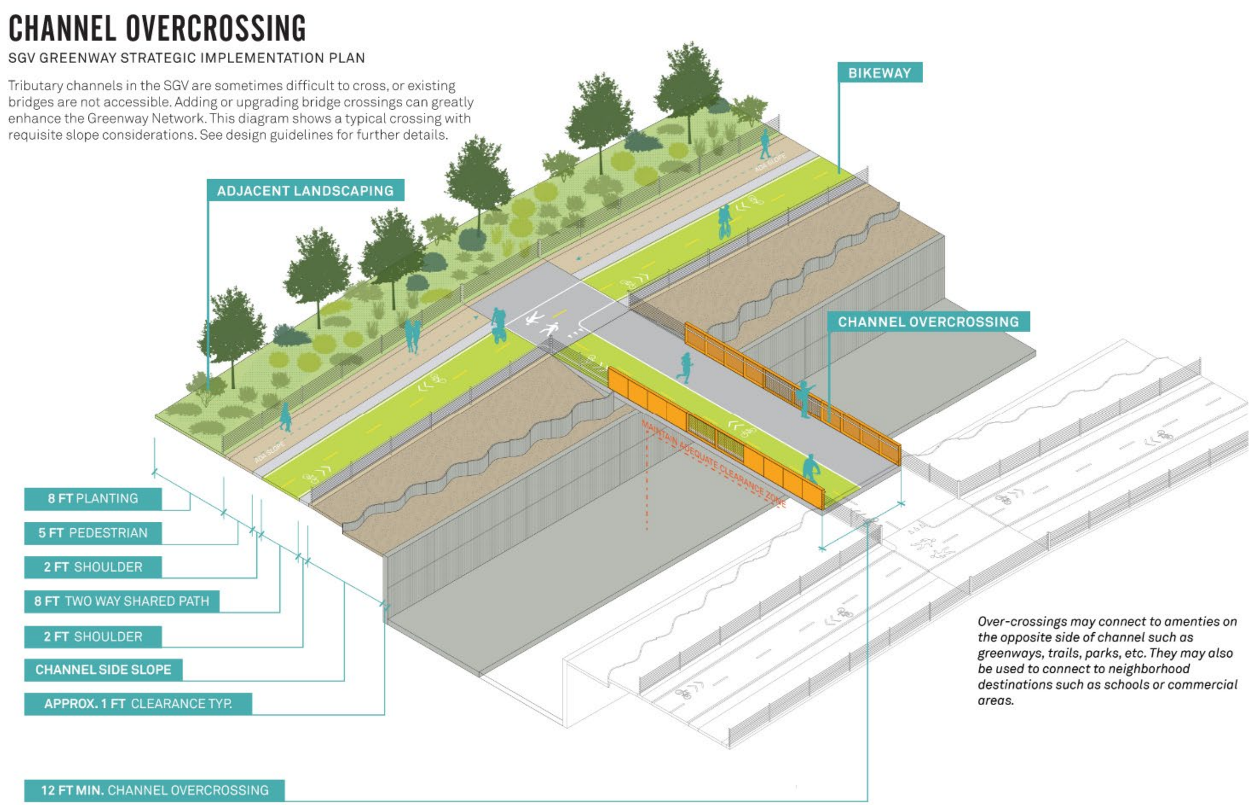

Figure 4-17. Channel overcrossing diagram showing typical dimensions and design

4.8 Rail Crossings

Modification of an existing at grade rail crossing is subject to California Public Utilities Commission approval under General Order 88-B (GO 88-B). The GO 88-B process could be relatively simple in the case of a Class II bike lane that is installed by means of striping on an existing roadway at a railroad crossing that is already protected with gates.

In contrast, the GO 88-B process could be onerous in the case of repurposing a service road along a channel to become a greenway at a railroad crossing that has only passive warning devices. In such a case, upgrades to the railroad track detection circuitry and installation of flashers, bells, and gates may be required. Coordination with the railway owner as early as possible in the project planning process, prior to design, is strongly recommended. Substantial time and effort will be required to pursue approval for this type of railroad crossing improvement, which may or not be approved. A pathway that crosses a railroad at grade must conform to Chapter 8D of the California Manual on Uniform Traffic Control Devices (MUTCD).

4.9 Cantilever and Elevated Sections

All information in these design guidelines and standards refer to at grade bikeways and multi-use greenways, which are highly preferred. In unique cases where there is very limited ROW, a cantilever or elevated section, either partial or completely over a channel, may be considered. A short cantilever section may allow the bikeway to remain on channel for an extended distance which is highly preferred over off-channel bike routes. When necessary and as discussed previously, paths can be shared by cyclists, pedestrians, and equestrians.

Cantilever and elevated sections are complex and costly to design and construct. Channel flow capacity and maintaining the channel's ability to convey at a minimum the 100-year design storm with no increase in peak water stage is a primary requirement that must be demonstrated. Section structural integrity and not impacting the channel structure integrity is another primary requirement that must be addressed by a CA licensed structural engineer in the planning, design, permitting, construction, and long-term operation and maintenance. Example sections are shown on Figures 4-18 and 4-19.

If a cantilever or elevated section is considered, early coordination with LA County Public Works and the District or USACE, depending on ROW jurisdiction, is required. Coordination is needed to understand the potential issues, requirements, and feasibility. If determined to be feasible, close coordination must continue throughout design, permitting, construction, and O&M.

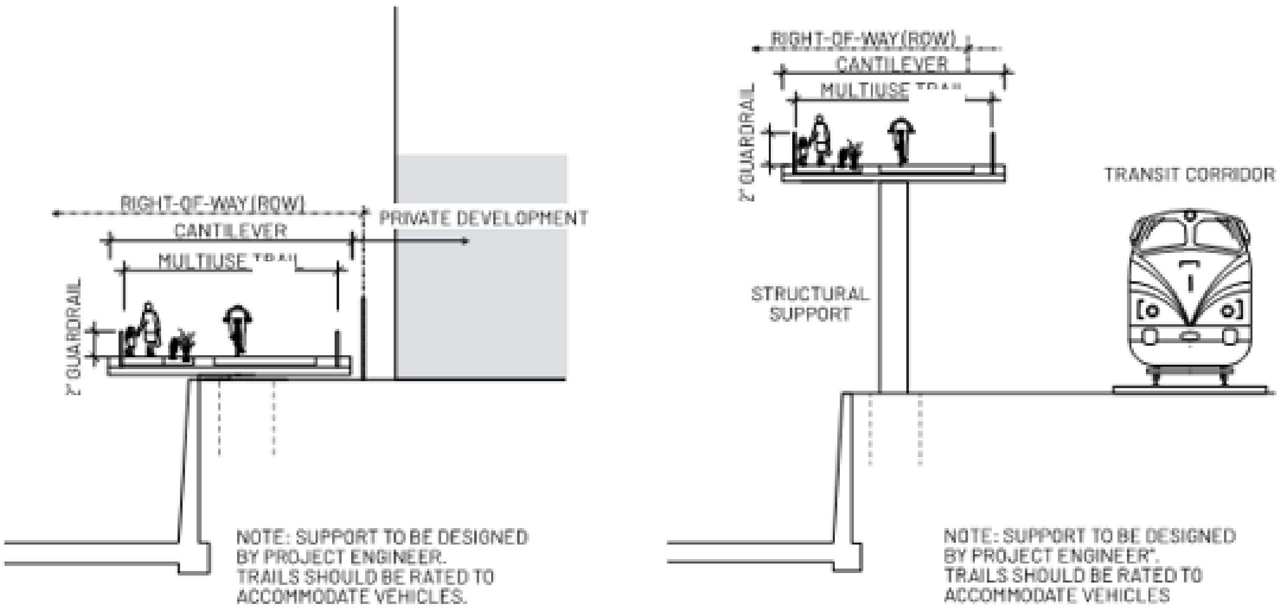

Figure 4-18. Example Cantilever and Elevated Multiuse Greenway Sections (NTS)

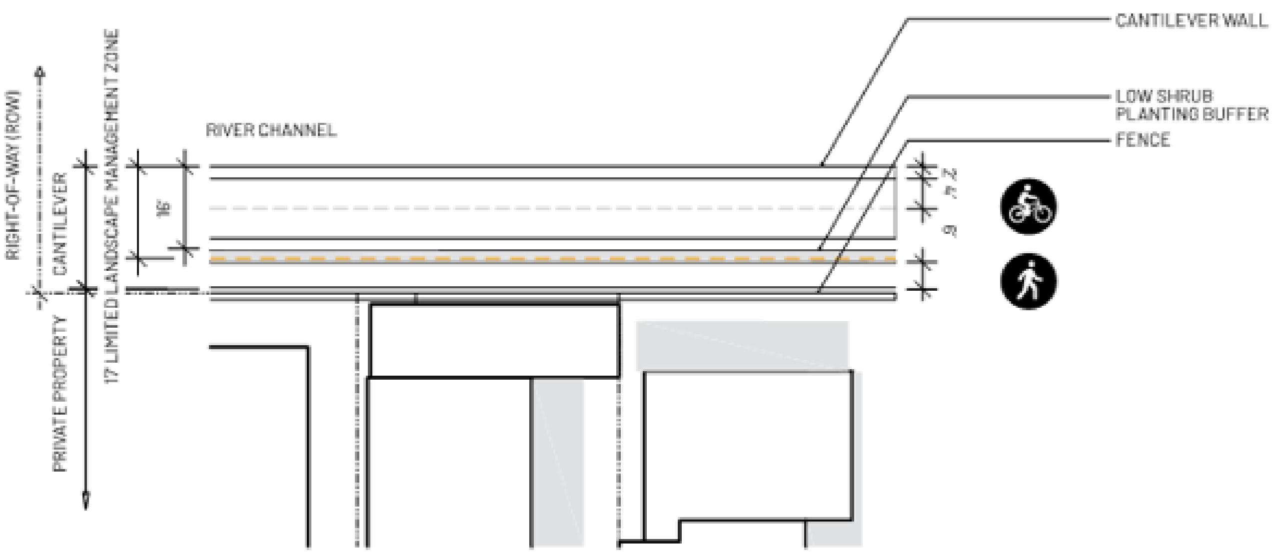

Figure 4-19. Example Cantilever Greenway Plan View (NTS)

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Section 5

Class II Bikeway Design Criteria

To create continuity between dedicated on-channel bikeways and multi-used greenways, connecting bicycle routes may need to be located along streets and/or roadways. Off-channel facilities may be designed as Class II, III, or IV bikeways depending on the road type, the posted speed limit, the surrounding area, and the preferred level of separation between the bicycle and vehicle ROW.

Class II and IV bikeways provide some type of division between the bicycle lane and motor vehicle lanes, are preferred for safety, and should be used if space is available, or if space can be provided with street improvements. Class IV bikeways include additional protection and safety through a physical barrier between bicycle and vehicle traffic. Although not preferred, Class III bike routes which provide for shared use of a roadway among bicyclists and motor vehicles, may also be used to provide continuity where a Class II or Class IV bikeway is not feasible. Class III bikeway design criteria are included in Section 6.

5.1 What's in This Section

The design criteria for Class II bikeways presented in this section are intended to create a dedicated space for bicyclists with a marked separation between motor vehicles and bicycle traffic. The following standards, which address major design elements associated with Class II bikeways, are based on the Caltrans Highway Design Manual and associated Caltrans guidance documents, the AASHTO Guide for the Development of Bicycle Facilities, and the California MUTCD.

Designers should refer to the most recent versions of these documents to ensure all applicable requirements are met.

Class II Bikeway Design Criteria

5.2 Definition

Class II bikeways provide a striped lane for one-way bike travel on a street or roadway. The preferred configuration is a painted buffer area between the bike lane and the traffic or parking lane to provide additional separation as shown on Figure 5-1. This type of bikeway is referred to as a buffered bikeway (Caltrans, 2020).

Class II bikeways should only be used for streets and roadways with a posted speed limit of 50 mph or lower. Where the posted speed limit is 35 mph or more, a painted buffer should be used (Figure 5-1) where the roadway width is sufficient, or can be modified, to accommodate the buffer width (Caltrans Bikeway Facility Selection Guidance, 2020).

It is important to note that a Class II bikeway is intended for the exclusive use of bicyclists. Pedestrian traffic shall be limited to the sidewalk or other adjacent adequate pedestrian facility, if present (California Vehicle Code 21966).

Figure 5-1. Class II bikeway includes dedicated ROW for bicyclists designated with a striped line and/or painted buffer zone

The buffered bike lane shown here includes a chevron-painted buffer zone.

5.3 Potential Configurations

The configuration of a Class II bikeway will depend on the type of vehicle traffic, the presence of on-street parking, and the preferred degree of separation from vehicle traffic. Some common examples of Class II bikeway cross-sections are shown on Figure 5-2.

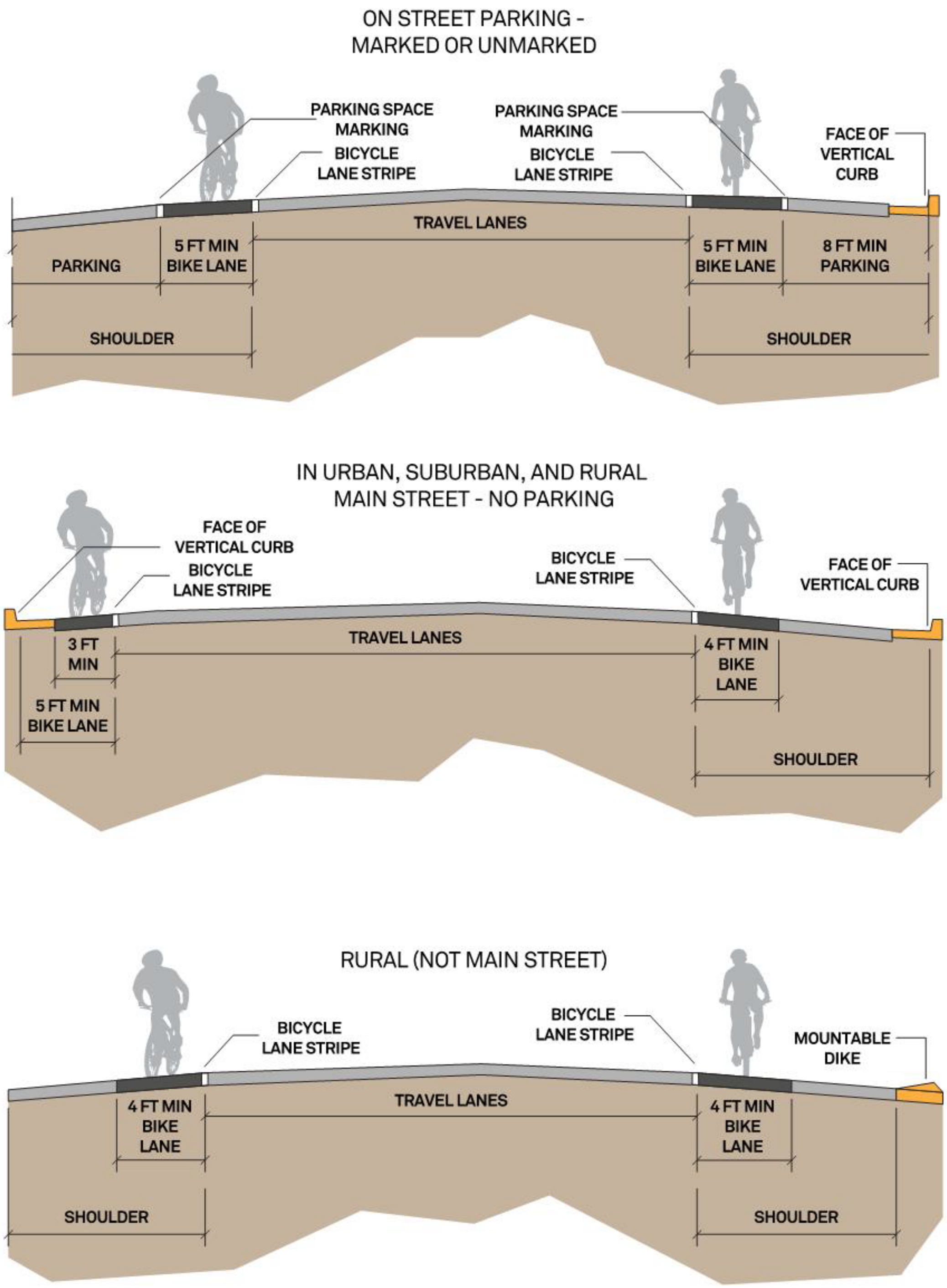

Figure 5-2. Sections for common configurations of a Class II bikeway with and without on-street parking and curb and gutter

Source: Caltrans, 2020. Adapted from Figure 301.2A from the California Highway Design Manual.

5.3.1 On-Street Parking

On two-way streets or in locations where on-street parking is present on both sides of a one-way street, the Class II bikeway should be located to the left of the parking lane adjacent to vehicle travel, as shown on Figure 5-3.

Figure 5-3. Class II bikeway located to the left of the parking lane adjacent to vehicle traffic

Source: National Association of City Transportation Officials (NACTO), 2014

The opening of driver-side doors can be a severe hazard for bicyclists. Per the Caltrans HDM Index 301.2, when the bike lane is adjacent to on-street parking, the minimum bike lane width is 5 ft (Caltrans, 2020). Designers are encouraged to provide additional bike lane width (6 to 7 ft total) in high-traffic areas with a high rate of parking turnover (AASHTO, 2012).

If feasible, a bike lane should be located on the side of a one-way street without a parking lane (Caltrans, 2020).

5.4 Standard Characteristics

Class II bikeways share many characteristics with Class I bikeways, including the vertical clearance, design speed, stopping sight distance, and drainage standards. This section includes additional guidance for the design of Class II bikeways.

5.4.1 Horizontal Clearance

The minimum bike lane width for a Class II bikeway is 4 ft. Table 5-1 includes additional guidance on minimum bike lane width based on the roadway conditions.

Table 5-1. Class II Minimum Bike Lane Width Guidance

Condition	Bike Lane Width, ft
Minimum ROW	4
Adjacent to on-street parking	5
Adjacent to curb and gutter	5
Speed limit of 40 mph or more	6
Adjacent to on-street parking with high turnover	6-7

Where a curb is not present, a tapered edge should be provided for Class II bikeways (see Caltrans HDM Section 302.3). The tapered edge is a sloped roadway boundary that is placed at the sides of the paved roadbed to allow for smooth reentry for vehicles that leave the roadway (Caltrans, 2020).

Rumble strips should not be placed in a Class II bikeway. Where rumble strips are present, the shoulder shall be a minimum of 4 ft wide to the right of the rumble strip when a curb, guardrail, or other vertical element is present. If a vertical element is not present, the shoulder shall be a minimum of 3 ft wide.

5.4.2 Surface Type

The surface type and pavement section for a Class II bikeway is typically the same as the adjacent street or roadway in accordance with the City, LA County, or state requirements, depending on jurisdiction.

5.4.3 Drainage and Stormwater Capture Opportunities

Stormwater drainage from and across the roadway and the bikeway must be evaluated and addressed in the design when developing a Class II bikeway. For vehicle and bicyclist safety, adequate drainage must be provided so that stormwater runoff will flow unimpeded across the surface to the nearest storm drain and will not pond in the roadway nor the bikeway. Comply with city, county, or state requirements, depending on jurisdiction(s), for maximum allowable depth of flow on the pavement edge and/or gutter flow line, and the need for drainage system improvements.

Where there is an opportunity to incorporate green infrastructure elements/stormwater retrofit with the project, designers should consider the use of permeable asphalt or concrete as an alternative surface type. Depending on the contributing street width, the bike lane/buffer zone width may be sufficient to capture stormwater runoff from the entire street contributing section, typically to the street centerline. Refer to Section 11 for more information on the use of permeable pavement.

5.4.4 Roadway Conditions

If retrofits to an existing roadway are needed to install the Class II bike lanes, the roadway design should meet all applicable City, LA County, or state requirements. These requirements are not addressed by this document; for more information, refer to the appropriate LA County Public Works Design Manual, or city or state design guidance.

5.5 Pavement Markings

As described in the California MUTCD, a 6-inch solid lane divider is sufficient to designate the bike lane. The bike lane markings shall be retroreflective, meaning that the surface will reflect light back to its source. The selected material should also minimize loss of traction under wet conditions.

Bike lanes should be denoted using the bike lane word or symbol, and direction arrow marking. The markings should be placed at the beginning of a bicycle lane and at periodic intervals along the bicycle lane based on engineering judgment (Caltrans, 2021). For example, in suburban areas with fewer intersections and locations where vehicles may cross the bike lane, the symbols may be up to 1,000 ft apart, whereas in urban areas with on-street parking and driveways, the symbols should be placed every 100 ft (AASHTO, 2012).

Bicycle lane markings on Class II bikeways shall be placed at a constant distance from the marked lane line or centerline, as appropriate. Figure 5-4 provides Details 39 and 39A from the California MUTCD shows the specifications for bike lane pavement markings.

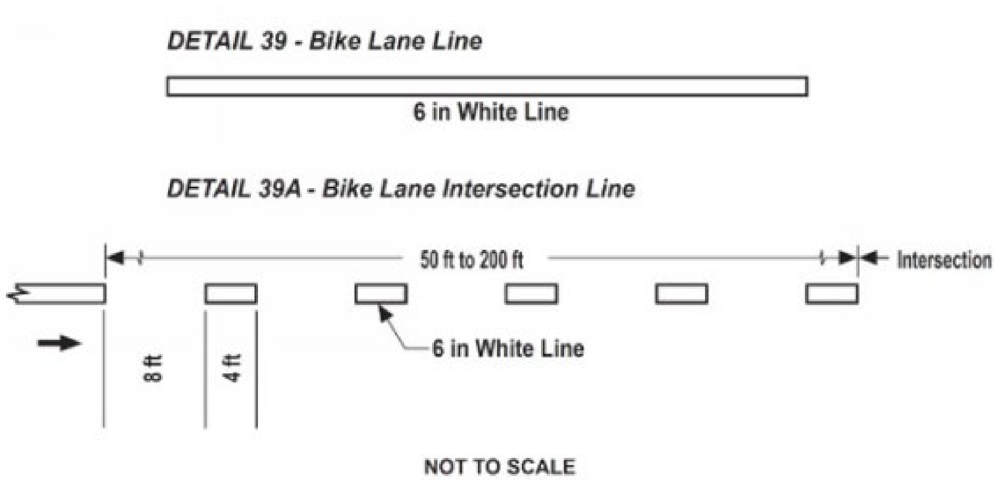

Figure 5-4. Details 39 and 39A standards for solid and dashed bike lane lines

Source: Caltrans, 2021, Figure 9C-101(CA)

The solid bike lane line may transition to a dashed line 50 to 200 ft in advance of an intersection to accommodate turning vehicles (Caltrans, 2021). Figure 5-5 demonstrates the pavement markings and signage to be used at an intersection when vehicle parking is prohibited and permitted.

Where additional separation is desired, either due to the posted speed limit, the presence of on-street parking, or another justification, a horizontal buffer zone at least 18 inches wide should be added. The buffer zone may be painted with interior white chevron or diagonal markings. Figure 5-6 includes example pavement markings of buffered bike lanes where vehicle parking is prohibited and permitted (Caltrans, 2021).

For buffered bikeways, if the buffer area is less than 4 ft wide, the interior chevron or diagonal markings may be omitted. If used, the chevron or diagonal markings should consist of 4-inch painted white lines angled at 45 degrees and striped at intervals of 10 to 40 ft. A shorter interval may encourage greater motorist compliance (Caltrans, 2021).

For a Class II bikeway, no raised barriers shall be used to separate the bike lane and vehicle traffic. If a raised barrier is present with an on-street bikeway, the bikeway may be considered a Class IV bikeway (see Section 7).

Per Caltrans Design Information Bulletin (DIB) 89-02, Green Pavement Marking, green pavement can typically be used in marked bike lanes, in extensions of bike lanes through intersections, and in other conflict areas to clearly mark the ROW and delineate the movement of vehicles and bicycles (Caltrans, 2022).

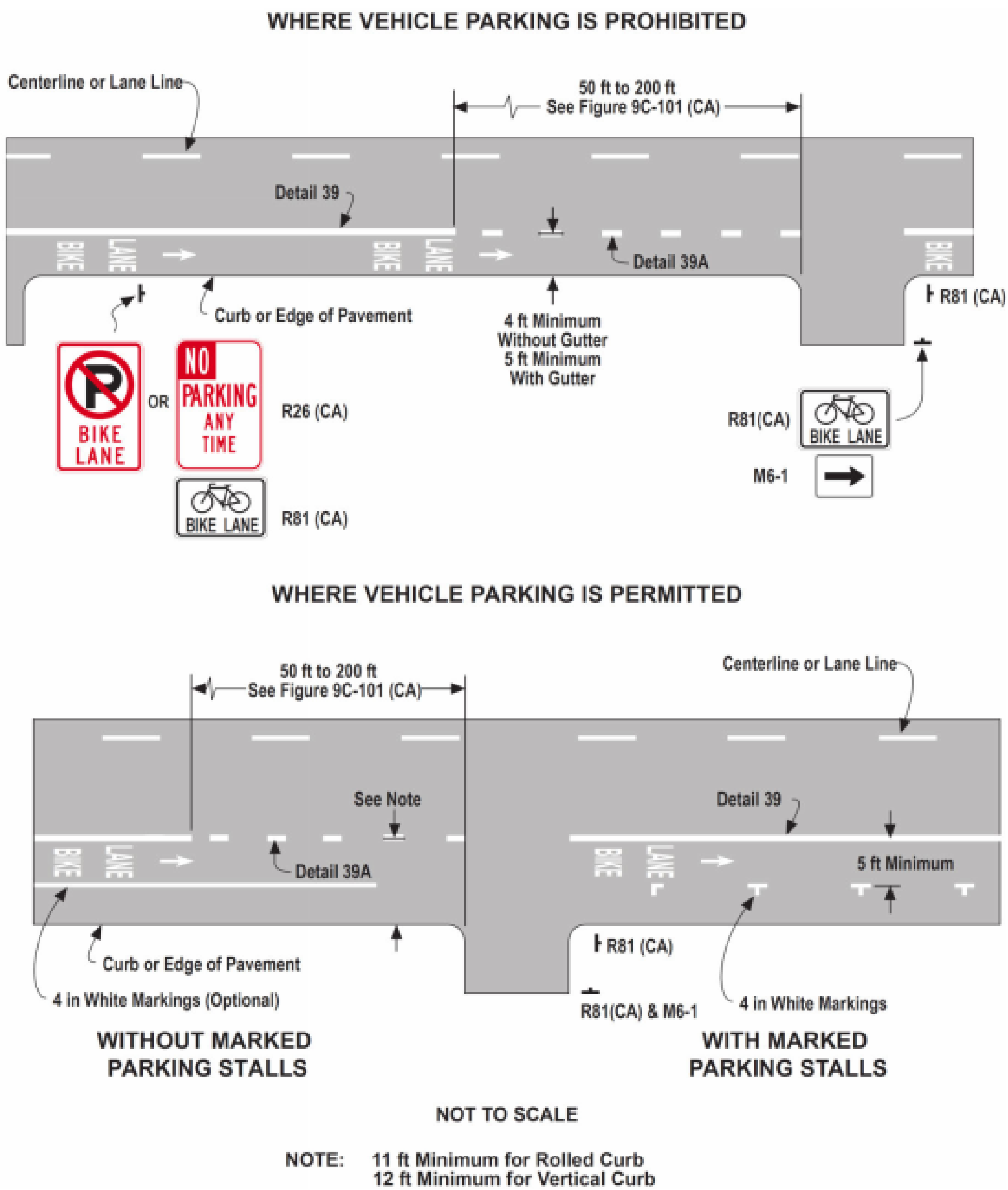

Figure 5-5. Pavement marking and signage standards for Class II bikeway with a solid line stripe where parking is prohibited and allowed

Details 39 and 39A are included on Figure 5-4.

Source: Caltrans, 2021, Figure 9C-102(CA)

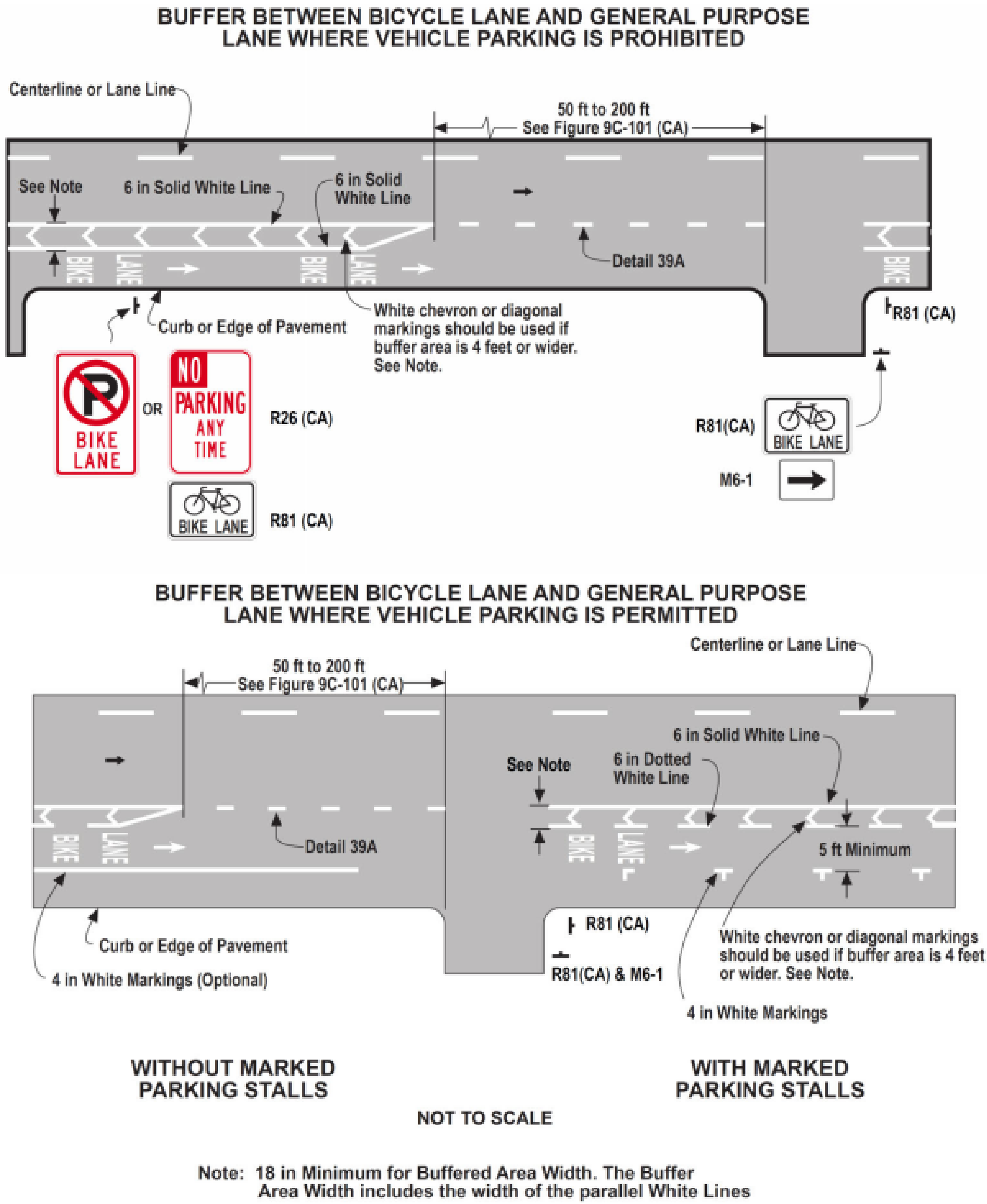

Figure 5-6. Pavement marking and signage standards for Class II bikeway with a painted barrier where parking is prohibited and allowed

Details 39 and 39A are included on Figure 5-4.

Source: Caltrans, 2021, Figure 9C-104(CA)

5.6 Intersections

Well-designed intersections are a key component of a safe and usable greenway network.

Class II bikeways are not typically extended through intersections, except in limited cases where the markings are deemed necessary to guide motorists and bicyclists through complex intersections.

Where right turns are not permitted, the solid bike lane stripe should extend to the edge of the intersection and may resume at the opposite end of the intersection, as shown on Figure 5-7.

Where right turns are permitted and there is no right-turn-only lane, the solid bike lane stripe should terminate 50 to 200 ft prior to the intersection and may be converted to a dashed line. The linear extent of the dashed line may be increased to 200 ft where vehicle speeds are higher (above 35 mph).

To avoid conflict with turning traffic, a through bicycle lane should not be positioned to the right of a right turn only lane or to the left of a left turn only lane. Instead, the bicycle lane should stop at least 100 ft before the start of the right turn only lane and resume to the left of the right turn only lane or to the right of a left turn only lane, as shown on Figure 5-8.

Figure 5-7. Example bike lane markings at an intersection where right turns are not permitted

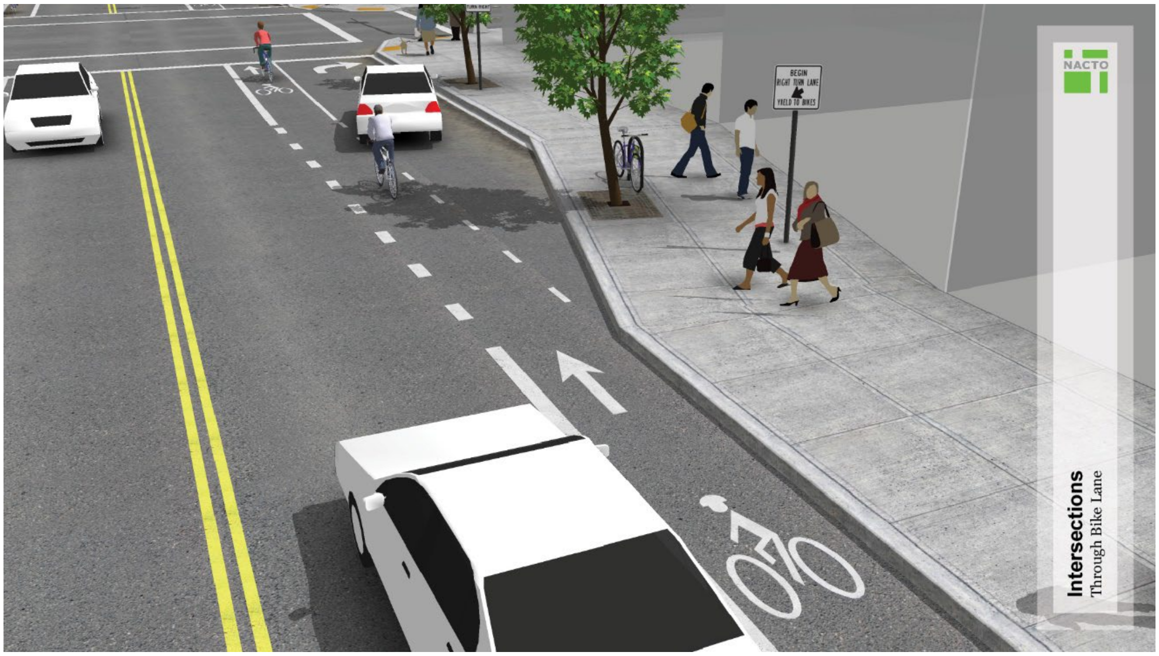

Figure 5-8. Example of a bike lane at an intersection with a right-turn-only lane

Source: NACTO, 2014

The bike lane text pavement marking shall be placed on the far side of each intersection to signal the continuation of the bike lane (Caltrans, 2021).

See Section 9 for additional information on intersections. Designers may also refer to the California MUTCD Section 9C.04 for additional requirements and guidelines for bikeways at interchanges and roundabouts.

Section 6

Class III Bikeway Design Criteria

Class III bike routes provide for shared use of a street or roadway among bicyclists and motor vehicles, generally with no striping or physical barrier for separation. Although they do not provide the separation and benefits of a Class II or IV bikeway, these may be appropriate for local streets with limited traffic and low speed limits. For most streets and roadways, a safer Class II or IV bikeway should be considered and implemented if feasible. This section includes a brief overview of design considerations for Class III bikeways.

6.1 What's in This Section

The following standards are based on the Caltrans Highway Design Manual and associated Caltrans guidance documents and the California Manual on Uniform Traffic Control Devices (MUTCD) and address major design elements associated with Class III bikeways. Designers should refer to the most recent versions of these documents to ensure all applicable requirements are met.

Class III Bikeway Design Criteria

6.2 Definition

A Class III bikeway is a shared facility intended to either provide continuity between other bicycle facilities or designate the preferred route for bicyclists in a high-demand area. In areas where a Class I, II, or IV bikeway is not feasible, a Class III bikeway may be used to connect segments of another bikeway class (Caltrans, 2021).

A Class III bikeway, as shown on Figure 6-1, must be suitable for use as a shared route, and maintained consistent with the needs of bicyclists. Sidewalks are not suitable for a Class III bikeway. Caltrans discourages bike/bus lane combinations although they may be allowed on constrained streets with city, LA County, or state approval, depending on jurisdiction.

Figure 6-1. Example Class III bikeway installed in Arlington, Va.

6.3 Standard Characteristics

Because bicyclists share the traffic lane with vehicles, the minimum widths for road/highway lanes and shoulders also apply for Class III bikeways. The presence of on-street parking does not impact the design of Class III bikeways as long as parking does not encroach into the driving lane. In areas with on-street parking, pavement markings can help to delineate the limits of parking as shown on Figure 6-1.

6.3.1 Signs and Pavement Marking

Designating a Class III bike route with signs and pavement markings benefits bicyclists, can be done when appropriate, and requires a higher standard and degree of service than alternate streets. Signs and pavement markings will encourage use by bicyclists. Bike route signs, as shown on Figure 6-2, and pavement markings should be provided if some of the following criteria are satisfied:

- The bikeway provides for through and direct travel in bicycle-demand corridors
- The bikeway connects discontinuous segments of bike lanes
- Bicyclists are given priority and ROW with traffic actuated signals at intersections
- Street parking has been removed or restricted especially in areas of reduced width to improve safety

- Surface imperfections have been corrected to accommodate the bikeway
- Bikeway maintenance will be at a higher standard than comparable streets without a bikeway

Figure 6-2. The Bike Route sign (designation D11-1) is recommended to designate a Class III bikeway

6.3.2 Pavement Marking

Pavement markings are also recommended for Class III bikeways, as long as some of the above characteristics for designating a Class III bikeway are achieved. The Shared Lane Marking, as shown on Figure 6-3, should be used with Class III bikeway signs. Pavement markings should also be used in a right or left turn only lane to indicate that a bicycle may travel straight through an intersection.

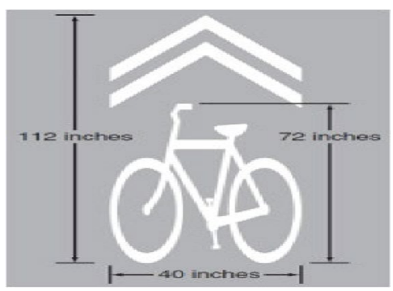

Figure 6-3. Shared lane pavement marking detail

Sources: Caltrans, 2021, Figure 9C-104(CA) as adapted from Figure 9C-9 CA MUTCD

Shared Lane Markings should be placed immediately after each intersection and spaced at an interval no more than 250 ft thereafter. A shorter interval should be used in areas with potential conflicts between bicyclists and motor vehicles and in locations with sight distance constraints (Caltrans, 2021).

In some cases, such as along rural roads or in urban areas with a shoulder and without on-street parking, a 4-inch white edge strip to separate the traffic lane and shoulder may provide sufficient separation.

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Section 7

Class IV Bikeway Design Criteria

Class IV bikeways are also referred to as separated bikeways or cycle tracks. They provide an added degree of safety compared to a Class II bikeway through the addition of a physical barrier between bicyclists and motor vehicles on the adjacent roadway. Class IV bikeways encourage greater use and provide access to a larger number of users. Due to adjacent roadway conditions and/or community preferences, Class IV bikeways are preferred and recommended.

7.1 What's in This Section

The standards and guidelines for Class IV bikeways in this section are based on the Caltrans Highway Design Manual, DB Number 89 and the California MUTCD and address major design elements associated with Class IV bikeways. Designers should refer to the most recent versions of these documents to ensure all applicable requirements are met, in addition to any city requirements.

Class IV Bikeway Design Criteria

7.2 Definition

A Class IV bikeway is a bikeway for the exclusive use of bicycles and must include a vertical element to separate bikeway and vehicular traffic. The separation may be, but is not limited to, grade separation, flexible posts, inflexible barriers, or on-street parking (Caltrans DIB 89-02).

Figure 7-1. Example Class IV bikeway with flexible posts and adjacent parking

See Figure 7-1 for an example. A Class IV bikeway is preferred on multilane roads or when the posted speed limit is 30 mph or higher. In urban areas where transit, on-street parking, or high-volume vehicle traffic may limit the safety of a Class II bikeway, a Class IV bikeway is the most appropriate option (Caltrans Bicycle Selection Internal Memorandum and DIB 89-02). Like Class II bikeways, a Class IV bikeway is intended for bicycle use only. Pedestrian traffic shall be limited to sidewalks or separate paths.

7.3 Potential Configurations

Like Class II bikeways, Class IV bikeways typically operate as one-way facilities in the same direction as vehicular traffic on the same side of the road. One-way bikeways are preferred over two-way separated bikeways for the SGV Greenway Network due to the potential for conflicts between turning motor vehicles and two-way bicycle traffic at intersections.

On one-way streets, the separated bike lane may be located on either side of the road, but the left side is preferred in some circumstances to avoid conflict with transit vehicles. In addition, the side of the street where bicyclists' destinations are located, the number and location of transit stops, the potential visibility of bicyclists to drivers, and the volume of turning traffic across the bikeway should be considered.

7.3.1 On-Street Parking

Where on-street parking is available, a Class IV bikeway is typically located between the parking lane and the sidewalk, as shown on Figure 7-2. Therefore, vehicle passengers must cross the separated bikeway to access the sidewalk.

Figure 7-2. On-street parking may be used to separate a Class IV bikeway from vehicle traffic
Source: NACTO, 2014

It is recommended that the separated bike lane be routed to avoid accessible parking areas where passengers may require additional time and space to enter and exit the vehicle. If the separated bikeway must be on the same side of the street with accessible parking, additional design elements, such as a marked crossing and curb ramp, may be necessary, to allow unobstructed access (Caltrans, 2022). Figure 7-3 includes standard sections for Class IV bikeways with and without parking.

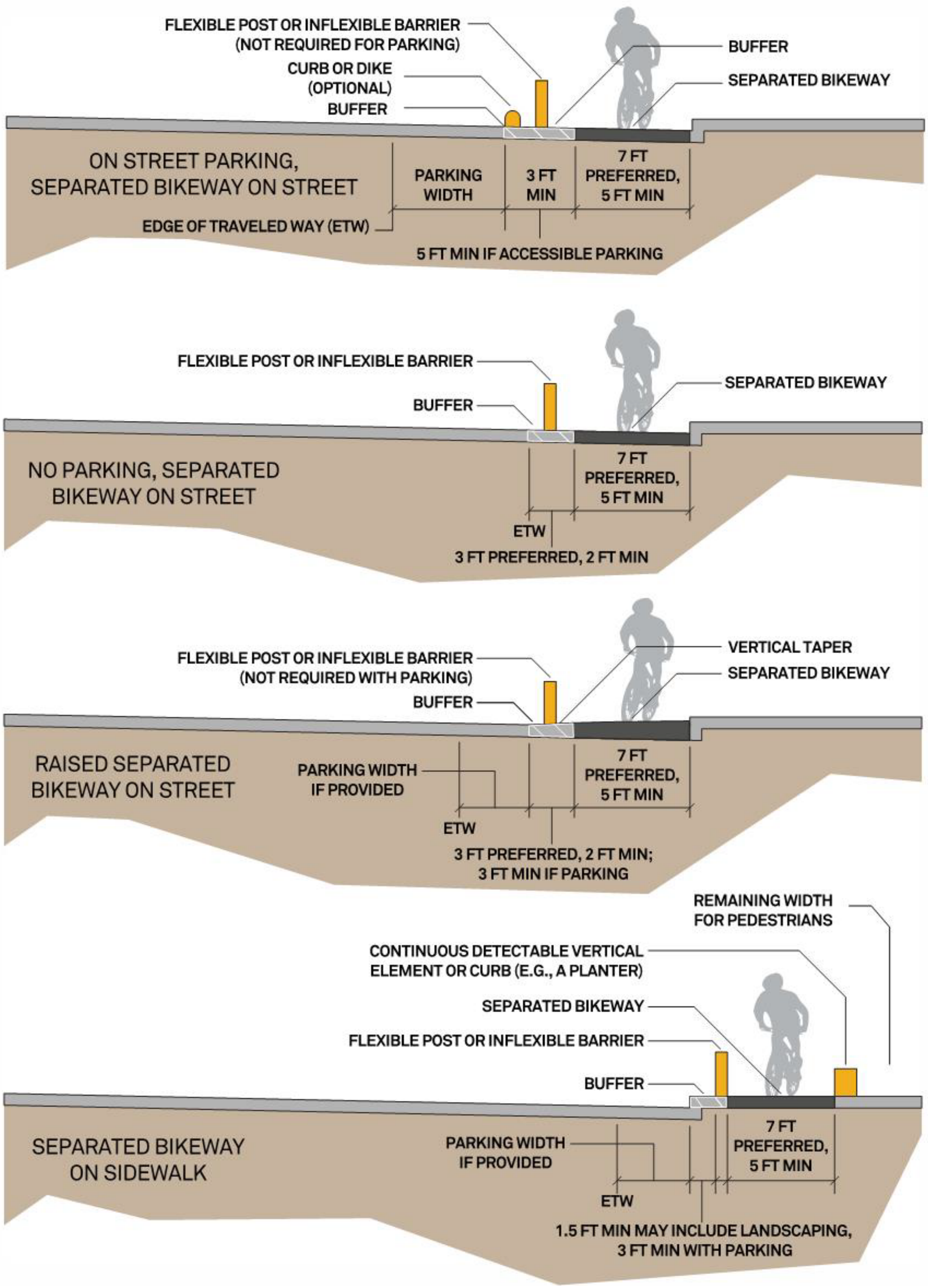


Figure 7-3. Sections of common configurations of Class IV bikeways

Adapted from Figure 4 of Caltrans DIB 89-02.

7.4 Standard Characteristics

Class IV bikeways share many characteristics with Class II bikeways (Section 5). The design criteria for vertical clearance, design speed, stopping sight distance, cross-slopes and drainage may be applied for Class IV bikeways. This section will discuss additional or different design criteria specific to Class IV bikeways.

7.4.1 Type of Separator

The type of vertical separator should be selected based on the speed and volume of vehicle traffic. In areas with higher speed and traffic volume, rigid and fixed separators, such as curbed medians or inflexible barrier, are recommended. Per Caltrans DIB 89-02, Class IV bikeway must use at least one of the following to separate vehicle and bicycle traffic (Caltrans, 2022):

- Grade separation
- Flexible posts
- Inflexible physical barriers
- On-street parking
- Raised islands, such as channelization islands, curbs, dikes, or wheel stops

The rest of this section includes additional guidance for the design of the separator from DB 89-02.

- **Grade separation.** To qualify as grade separation, the bikeway must be raised a minimum of 3 inches above the finished grade of the adjacent roadway. A vertical tapered edge with a slope of 4:1 or lower should be included in the buffer zone between the bikeway and roadway to adjust the elevation. The grade also must be lowered to the road level at intersections, alleys, and driveways. An example of grade separation is included on Figure 7-4.

Figure 7-4. Example Class IV grade-separated bikeway in Vancouver, British Columbia

- **Flexible posts.** Flexible posts should be Class I flexible posts located at 10- to 40-foot intervals on center. In lower speed areas, the posts should be located at smaller intervals to discourage vehicle intrusion into the bikeway. The vertical separator is typically located in a horizontal buffer zone. The buffer zone is typically striped using the striped chevron or diagonal pattern discussed in Section 5 for buffered bikeways. The flexible posts should be placed in the center of the horizontal buffer zone (see Figures 7-1 and 7-5).

- **Inflexible physical barrier.** Inflexible barriers are objects such as fence/railing, planter boxes, or landscape planters (see Figures 7-4 and 7-5). If the physical barrier is not continuous (e.g., a fence), the vertical elements may be spaced at 10 to 40-foot intervals on center.
- **On-street parking.** On-street parking that is allowed at all times of day may be used to separate a Class IV bikeway (see Figures 7-1 and 7-2). If a continuous physical barrier, raised island, curb, or dike is located in the buffer zone between the separated bikeway and the parking lane, then a 5-foot minimum clear width should be provided so pedestrians can cross the bikeway to reach their vehicle or the sidewalk.

  Additionally, on a hill with a grade of more than 3 percent, a curb or dike is required for wheels of parked vehicles to be turned against.
- **Raised island.** The raised channelization islands may include landscaping and signs/markers (see Figures 7-4 and 7-6). Additionally, curbs, dikes, or wheel steps are also considered to be raised islands.

  Where the bikeway is at the same grade as the adjacent sidewalk, a second vertical element should be used to separate pedestrian and bicycle traffic per the bottom section on Figure 7-3.

Figure 7-5. Examples of flexible post (left) and landscape island (right) separators

Figure 7-6. Example of an inflexible barrier (street planter) for a Class IV bikeway

7.4.2 Horizontal Clearance

The minimum width for a one-way Class IV bikeway is 5 ft. A width of 7 ft or greater is preferred to allow for side-by-side riding and passing (FHWA, 2015). Designers should consider the hazards associated with opening car doors (if adjacent to on-street parking) and pedal strikes (if curb and gutter are present) in the selection of a bikeway width.

Class IV bikeways include a horizontal buffer in addition to the vertical separation element. The width of the buffer will vary based on the type of separator, the elevation of the bikeway, and the presence and type of parking. Table 7-1 includes the minimum and preferred buffer widths associated with different street conditions and vertical elements (Caltrans, 2022).

Table 7-1. Class IV Bikeway Buffer Width Standard by Separator and Parking Condition

Separator Type and Adjacent Condition	Horizontal Buffer Width
Grade Separation and Parking Condition	**Width depends on bikeway grade and presence/type of parking**
• Bikeway at sidewalk grade with no parking	• 1.5 ft (minimum)
• Bikeway at sidewalk grade with parking	• 3 ft (minimum)
• Bikeway below sidewalk grade with no parking	• 2 ft (minimum), 3 ft (preferred)
• Bikeway below sidewalk grade with parking	• 3 ft (minimum)
• Bikeway below sidewalk grade with accessible parking	• 5 ft (minimum)
Flexible Posts and Elevation	**Width depends on if bikeway is at street or sidewalk level**
• If bikeway is at grade with street	• 2 ft (minimum), 3 ft (preferred)
• If bikeway is at grade with sidewalk	• 1.5 ft from the face of curb (minimum)
On-Street Parking	**Width depends on type of on-street parking present**
• If parking is present	• 3 ft (minimum)
• If parking is accessible parking	• 5 ft (minimum)
Raised Islands (bikeway at grade with street)	**Width depends on the presence and type of on-street parking**
• No parking present	• 2 ft (minimum), 3 ft (preferred)
• No parking present, if used with flexible posts	• 1 foot (minimum)
• With parking present	• 3 ft (minimum)
• With accessible parking present	• 5 ft (minimum)

The Class IV bikeway shown on Figure 7-7, which includes grade separation (below sidewalk grade with on-street parking), should have a buffer zone between the parking and bikeway that is a minimum of 3 ft wide, per Table 7-1.

Figure 7-7. Class IV bikeway example

The bikeway shown includes grade separation (below sidewalk grade with on-street parking), missing a buffer zone between the parking and bikeway that is a minimum of 3 ft wide, per Table 7-1.

Source: NACTO, 2014

7.4.3 Drainage and Stormwater Capture Opportunities

Stormwater drainage from and across the roadway and the bikeway must be evaluated and addressed in the design when developing a Class IV bikeway. For vehicle and cyclist safety, adequate drainage must be provided so that stormwater runoff will flow unimpeded across the surface to the nearest storm drain and will not pond in the roadway nor the bikeway. Comply with city, county, or state requirements, depending on jurisdiction(s), for maximum allowable depth of flow on the pavement and/or gutter flow line, and the need for drainage system improvements.

Where there is an opportunity to incorporate green infrastructure elements/stormwater retrofit with the project, designers should consider the use of permeable asphalt or concrete, or installation of a stormwater planter (form of bioretention). Depending on the contributing street width, the bike lane/buffer width may be sufficient to capture stormwater runoff from the entire street contributing section, typically to the street centerline. Refer to Section 11 for more information on the use of permeable pavement and bioretention.

7.4.4 Roadway Conditions

If retrofits to an existing roadway are needed to install the Class IV bike lanes, the roadway design should meet all applicable city, LA County, and/or state requirements. These requirements are not addressed by this document; for more information, refer to the appropriate LA County Public Works Design Manual, or city or state design guidance.

7.5 Pavement Markings

In addition to the vertical separation element, Class IV bikeways include a horizontal buffer between the bikeway and the adjacent sidewalk, on-street parking, or vehicle traffic. Pavement markings should be used to increase the visibility of bicyclists to drivers and to communication expectations to bicyclists.

Example pavement markings for one-way separated bikeways with and without on-street parking are included on Figure 7-8.

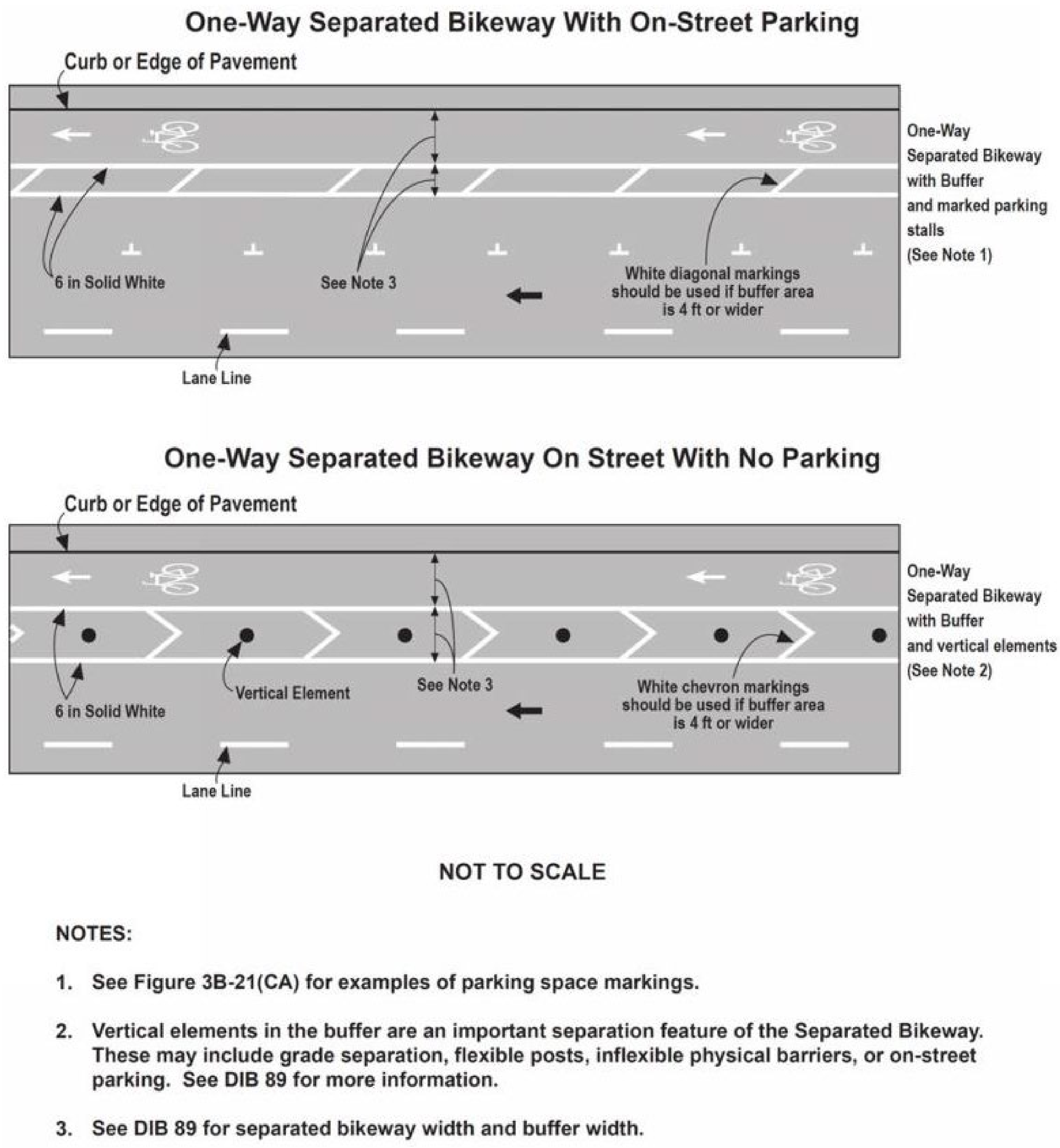


Figure 7-8. Example pavement markings for Class IV bikeways

Source: Caltrans, 2021, Figure 9C-110 (CA)

Per Caltrans DIB 89-02, green pavement marking, typically green pavement, can be used in marked bike lanes, in extensions of bike lanes through intersections, and in other conflict areas to clearly mark the ROW and delineate the movement of vehicles and bicycles (Caltrans, 2022).

7.6 Intersections

As with Class II bikeways, intersections should be designed to allow the safe passage of bicyclists, turning vehicles, and pedestrians.

A grade-separated crossing is preferred to avoid or eliminate conflicts with motor vehicle traffic at intersections (see Section 4.6). Unfortunately, this is rarely feasible, and most Class IV bikeways will cross an intersection at grade like a Class II bikeway, where the marked and separated bikeway ends before the intersection and resumes on the far side. For a Class IV bikeway, the bike symbol pavement marking, or helmeted bicyclist symbol should be placed at the far side of the intersection to signal the continuation of the bike lane. Similar to a Class II bikeway, where a right or left turn lane is present, the alignment must be adjusted so the bikeway shifts from outside of the vehicle traffic lane to the inside. See Section 5.5 for more information.

Other intersection design options, including protected intersections, signalized bicycle crossings, and “Bend In” or “Bend Out” layouts may be used to provide additional protection for bicyclists in the bike lane. An example protected intersection is shown on Figure 7-9. See Section 9 for more information about potential intersection and crossing designs.

Figure 7-9. Example protected intersection in San Francisco, Calif.

Where the bikeway crosses an alley or driveway, the vertical element should be temporarily discontinued to allow ingress and egress. Additional traffic devices, such as green pavement markings or a signalized intersection, may be used to alert drivers to the presence of the bikeway (see California MUTCD Part 9).

If a grade separation element is used, a slope between 10:1 and 5:1 should be applied to transition to the road elevation at intersections, driveways, and alleys (Caltrans, 2022). If pedestrians may cross the bikeway element, ADA requirements need to be met.

Section 8

Signage Graphics and Markings

Signage and pavement markings contribute to a safe and welcoming experience for users of the SGV Greenway Network and create a cohesive experience that connects the greenway to the surrounding landscape, neighborhood, and community.

Many projects within the SGV Greenway Network have previously developed their own branding and identity through signage, such as along the Emerald Necklace loop and along the San Gabriel River. The intent of these new guidelines is not to supersede those projects, but to create cohesion and identity over time with future projects.

8.1 What's In This Section

There are six categories of signage graphics: Informational, Regulatory, Confirmation, Interpretive, Directional, and Pavement Markings. This chapter includes guidelines for the SGV Greenway Network Plan graphics such as text formatting, color usage, branding, symbology, safety and language.

8.2 Standard Design Features

Wayfinding signage includes the use of all informational graphics and text displays that are located along the network corridor, both along adjacent streets, and the tributary greenway. A suite of wayfinding signage types should have a planned cadence and be designed to serve many purposes, such as:

- Provide positive exposure to attract more users.
- Provide information on the immediate and/or extended greenway and trail network, adjacent transit connections, and local landmarks.
- Mitigate safety concerns, and address user etiquette.
- Provide information about the natural landscape, geology, or urban ecologies.
- Indicate distance and directional information.

8.2.1 Use of Color

To establish cohesion across the extents of the SGV Greenway Network, while also celebrating the unique narratives of each tributary leg, common and unique design elements should be used. Common design features include terminology for the "SGV Greenway Network", the SGV logo, the use of the open-source Barlow font, and the Primary Contrasting Color palette.

Each tributary has a unique color, which should be used as an accent within the wayfinding signage suite as shown on Figures 8-1 and 8-2. This establishes an authentic identity for each tributary, while acknowledging its part of the larger urban network.

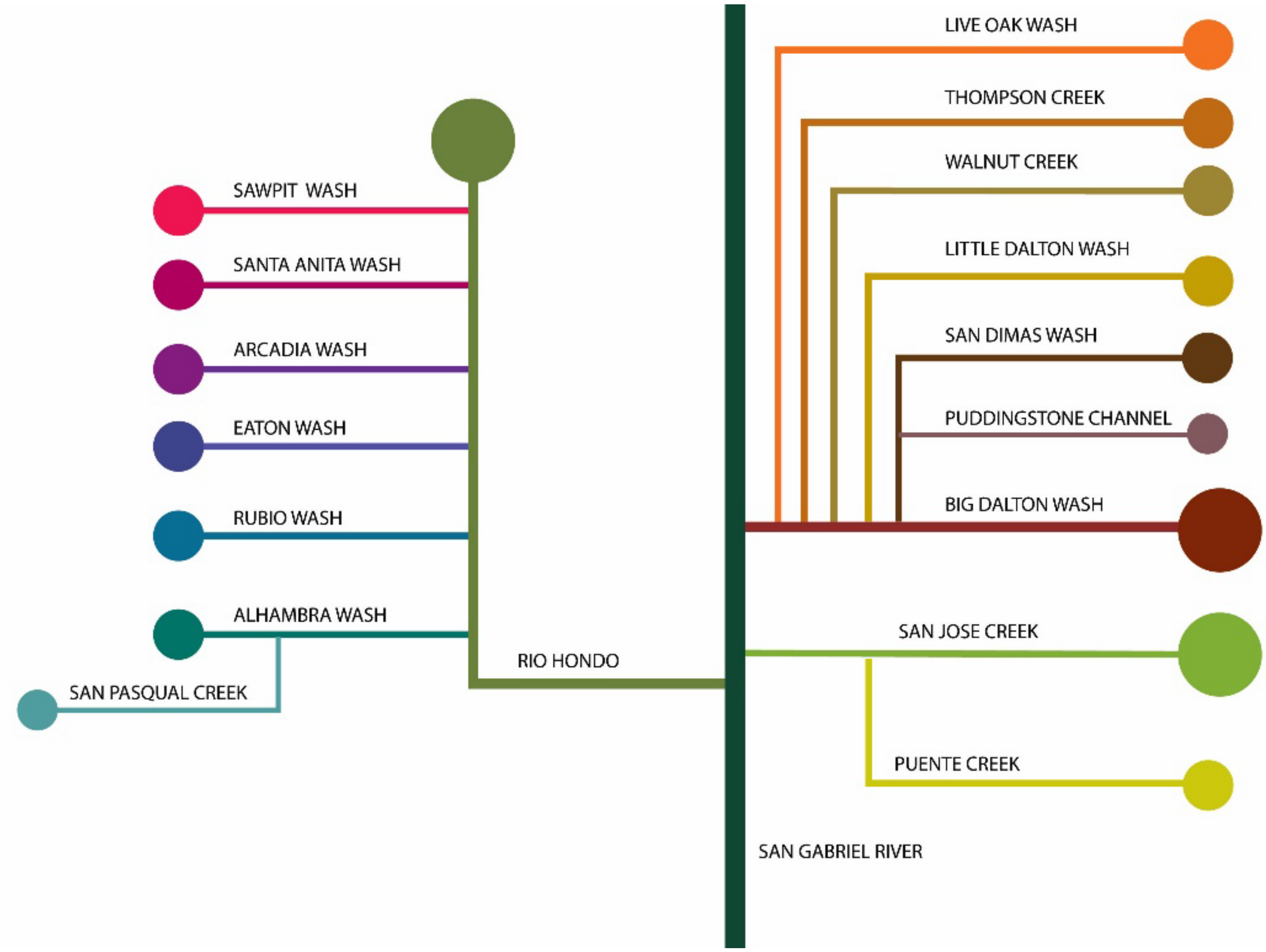


Figure 8-1. SGV Greenway Network tributary color diagram

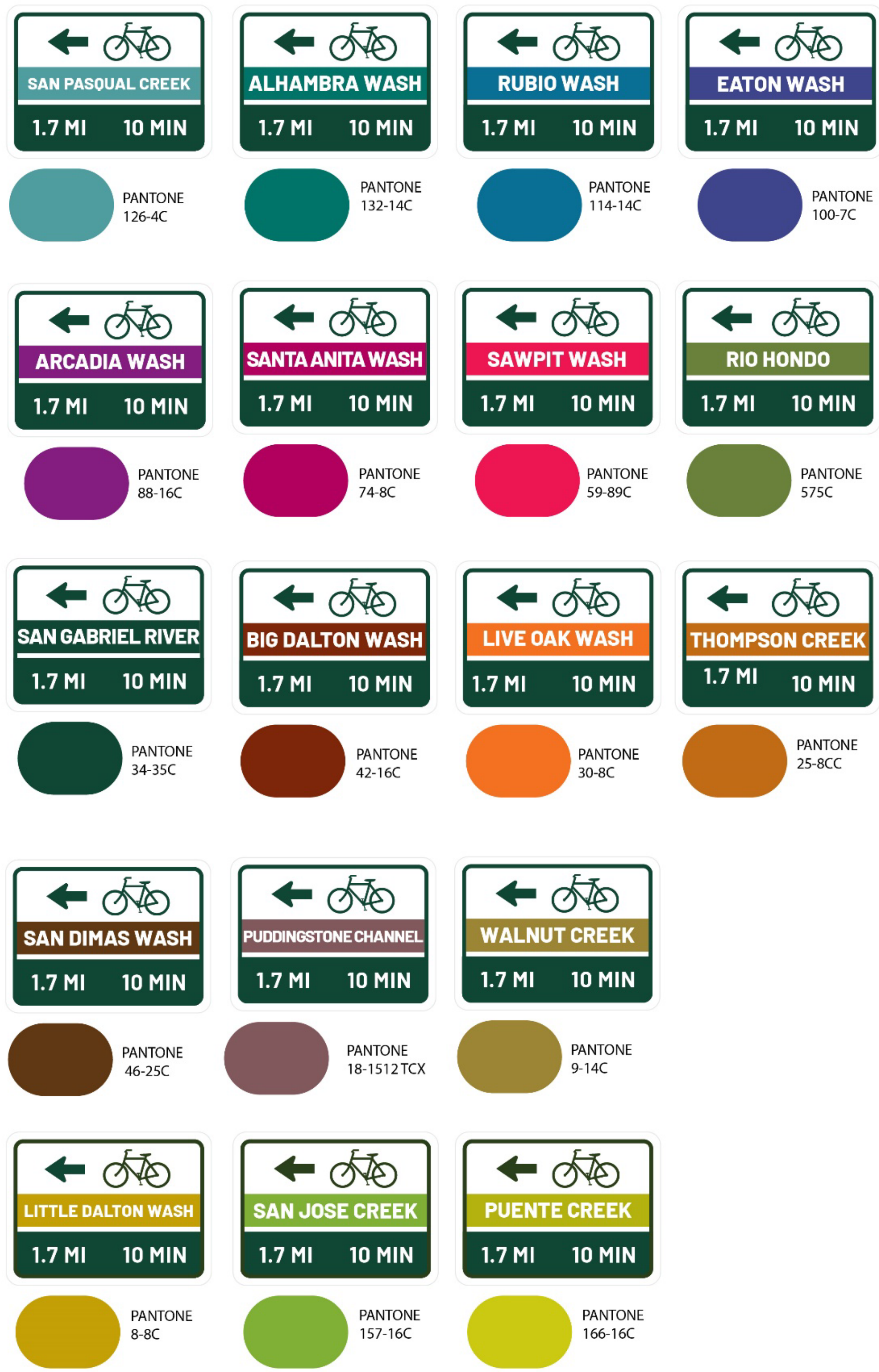


Figure 8-2. SGV Greenway Network tributary color book

8.2.2 Color Pantone

Pantone color guidance for wayfinding signage is provided below including the color map in Figure 8-3.

Primary Contrasting Colors: White and Dark Green (Pantone 3435C)

Accent Colors + Symbology by Tributary:

- Alhambra Wash Pantone 132-14C
- Arcadia Wash Pantone 88-16C
- Big Dalton Wash Pantone 42-16C
- Eaton Wash Pantone 100-7C
- Little Dalton Wash Pantone 8-8C
- Live Oak Wash Pantone 30-8C
- Puddingstone Channel 18--1512TCX
- Puente Creek Pantone 166-16C
- Rio Hondo Pantone 575C
- Rubio Wash 114-14C
- San Dimas Wash 46-25C
- San Jose Creek Pantone 157-16C
- San Pasqual Creek 126-4C
- Santa Anita Wash 74-8C
- Thompson Creek 25-8CC
- Walnut Creek Pantone 9-14C

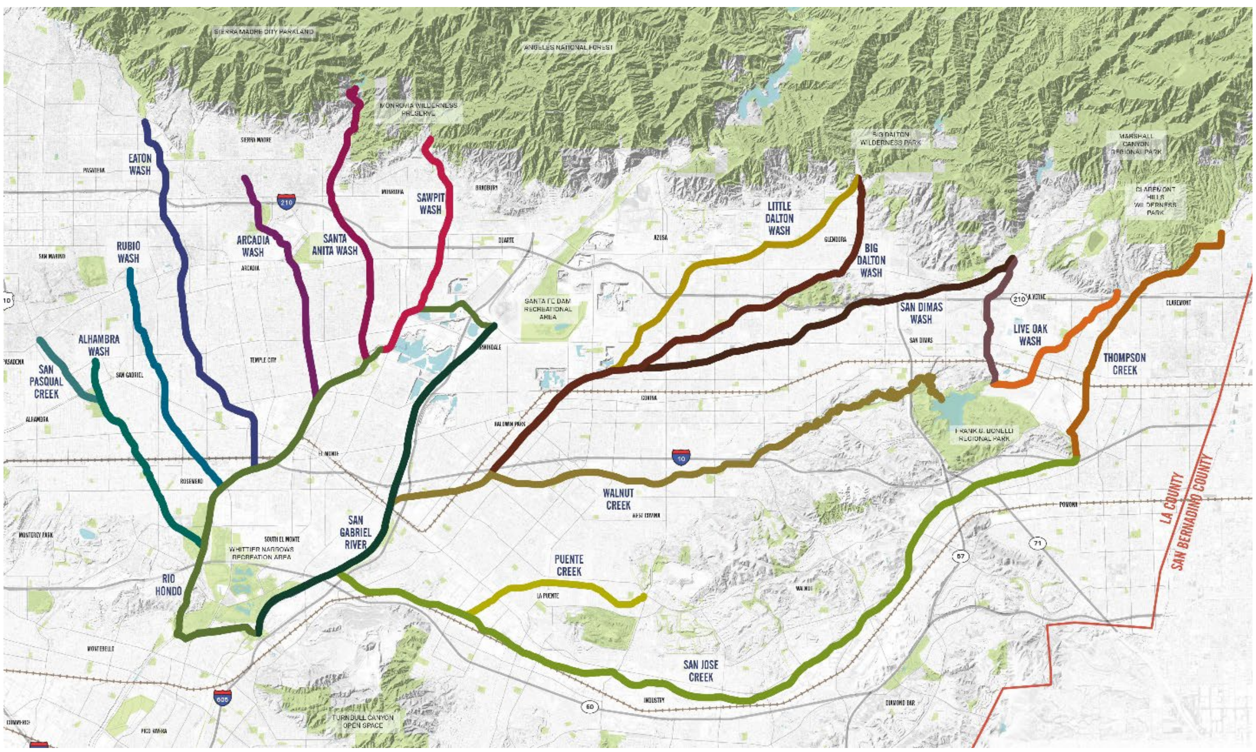


Figure 8-3. SGV Greenway Network tributary color map

The hierarchy of colors–termed the Tributary Color Book, as shown on Figure 8-2, delineates the order of the tributary's extents (river, wash, creek), and graphically maps them like a subway for a subtle educational opportunity. The accent colors can be used across other guidelines within this document like site furniture, pavement markings, or super graphics.

8.2.3 Logo

The SGV Greenway Network logo, see Figure 8-4, shall be incorporated into all signage.

Figure 8-4. SGV Greenway network color logo

8.2.4 Symbology

Symbology used to identify various amenities along the SGV Greenway Network should use the Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD). In cases where the symbol is not available from MUTCD, a new symbol can be designed but should be similar in style and weight as the CA MUTCD | Caltrans symbols.

8.2.5 Language

All signs shall be in multi-language format. English shall be the primary language, and used on all signs, with the secondary language selected by the community and by project. Creating bi-lingual signage contributes to the overall goal of inclusivity within the SGV Greenway Network. In general, a process of community outreach and engagement should always be central to branding efforts.

The following should be considered for bilingual signs:

- To better differentiate between different languages on the same sign, varying text weights is recommended. In some cases, English text will appear in bold, with the translated text at a thinner font weight either next to or below the English text. This will help the viewer to more easily and quickly digest the content that is intended for them.
- Translated text should appear in the same font and color of the English text.
- Where non-Latin fonts are used, choose a font that is clear and simple with no serif or no stylistic modifications (Google Noto Fonts is recommended and available for free in over 75 non-Latin languages)
- Translations should be proofread by native speakers of the language and/or community members before sign creation and installation.
- Translations should always appear on the same sign as the English text.
- Where feasible, use standardized or universal symbols to communicate without the need for text translations.

8.2.6 Accessibility

Designs that engage only one sense, such as sight, limit the audience's experience. The best practices for accessible design consider the ranges of eyesight, hearing, touch, and cognition, for example, difficulty with distinguishing sounds from background noises or difficulty focusing or staying on task.

The inclusion of braille or audio components is encouraged and should be considered on a project-by-project basis. Several different strategies and technologies include audio signals and cues, ranging from powered boxes with buttons to QR codes. The specific approach should be developed with what makes sense for the project, depending on the context and type of signage graphics to be installed.

Americans with Disabilities Act (ADA) Sign Guidelines

ADA requirements apply to signage graphics along routes that are designated as a path of travel. It is important to reference the latest ADA requirements as they are updated over time. ADA requirements for the minimum type size on a sign are determined by how high the sign is located off the ground and how close a viewer can approach and read it. For example, if a sign is located between 40 inches and 70 inches off the ground, and the viewer can approach within 6 ft of it.

For every additional foot beyond 6 ft that a viewer cannot approach the sign, the size of the font needs to increase by 1/8 inch. Visual characters should not be any lower than 40 inches from the ground. ADA requirements for single or double posts for freestanding signs depends on the placement of the sign along a path of travel, the height it is located, and the amount the sign overhangs each post. For example, a sign that has overhangs a single post more than 12 inches should have two posts and be located a maximum of 27 inches or a minimum of 80 inches off the ground. Always check the latest requirements. Please refer to Figures 8-5 and 8-6 for additional signage height requirements.

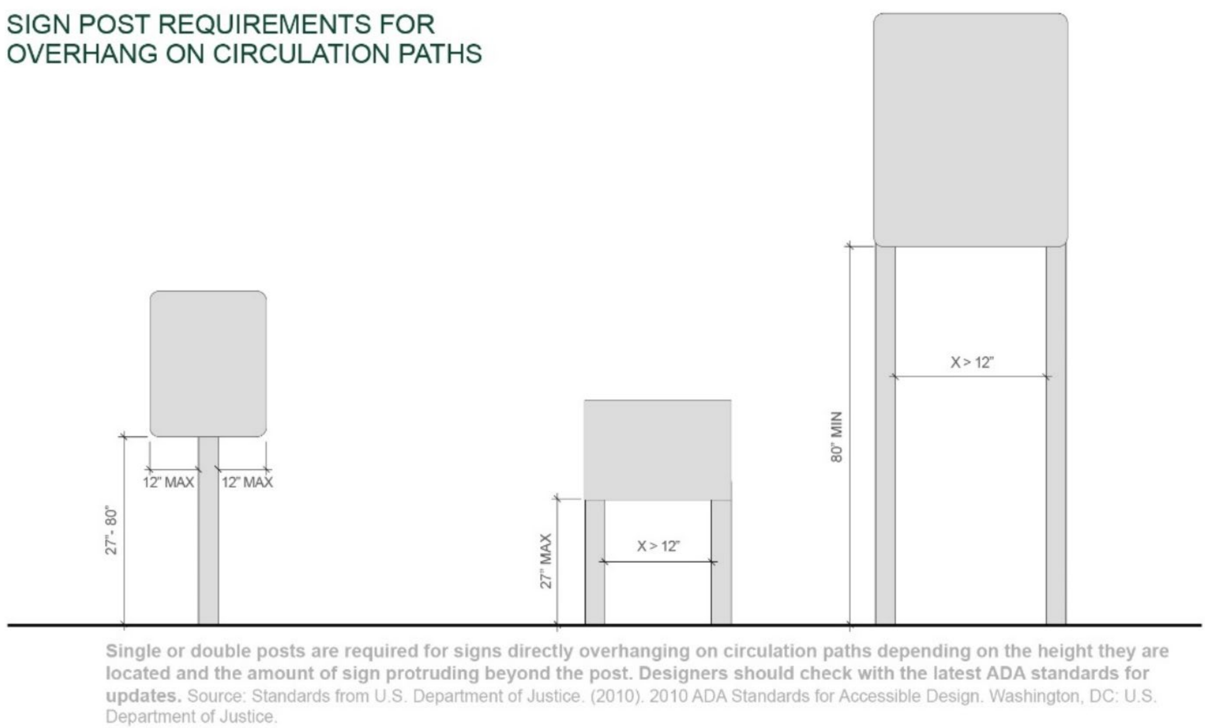


Figure 8-5. Signpost requirements for overhang on circulation paths

SIGNAGE HEIGHT PLACEMENT

Figure 8-6. Signage height requirements

8.2.7 Sequence & Placement of Signage

Lateral wayfinding is crucial in showing users how to navigate to the SGV Greenway Network tributaries, and clear placement of signs at gateways and along the trail notify users without being overwhelming. The vignettes on the following pages show examples of environmental graphics sequence and placement in typical contexts leading to and along the river. Directional environmental graphics should be placed so they are visible to pedestrians, bicyclists, those in vehicles, and equestrians where appropriate. These signs should be placed along a safe route that directs pedestrians and cyclists to the nearest access point. Informational, Regulatory, and other categories of signage should be place in a clear manner at access points and along trails to avoid sign clutter.

Note that references to “trail” in the text and sign examples throughout Section 8 also refer to a path, bikeway, and greenway. References to “river” also refer to SGV Greenway Network tributaries.

ACCESS POINT
ENVIRONMENTAL GRAPHICS

- Place one informational sign at the main entry of each access point.
- Place regulatory “park rules” sign further back, alongside river pavilion, trail, or other amenities.
- Apply regulatory Warning and safety environmental graphics along channel at regular intervals.
- Use environmental graphics for neighborhood expression.

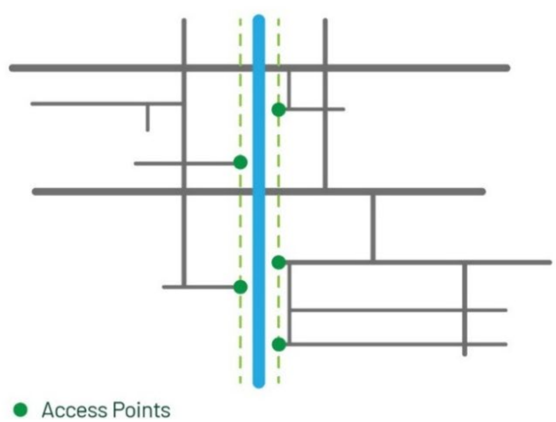


Figure 8-7. Example of signs at access point locations

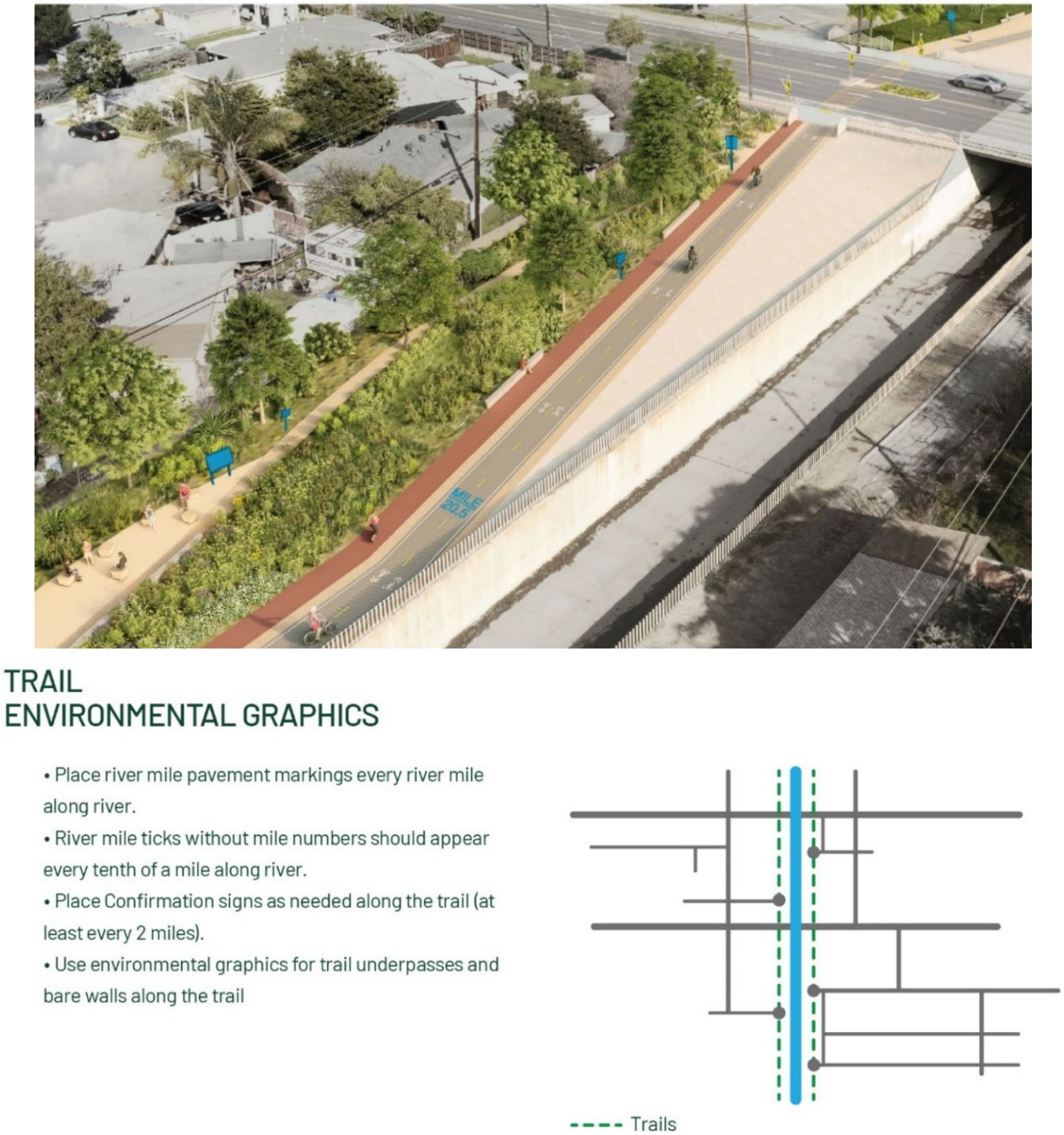


Figure 8-8. Example of signs at access point locations

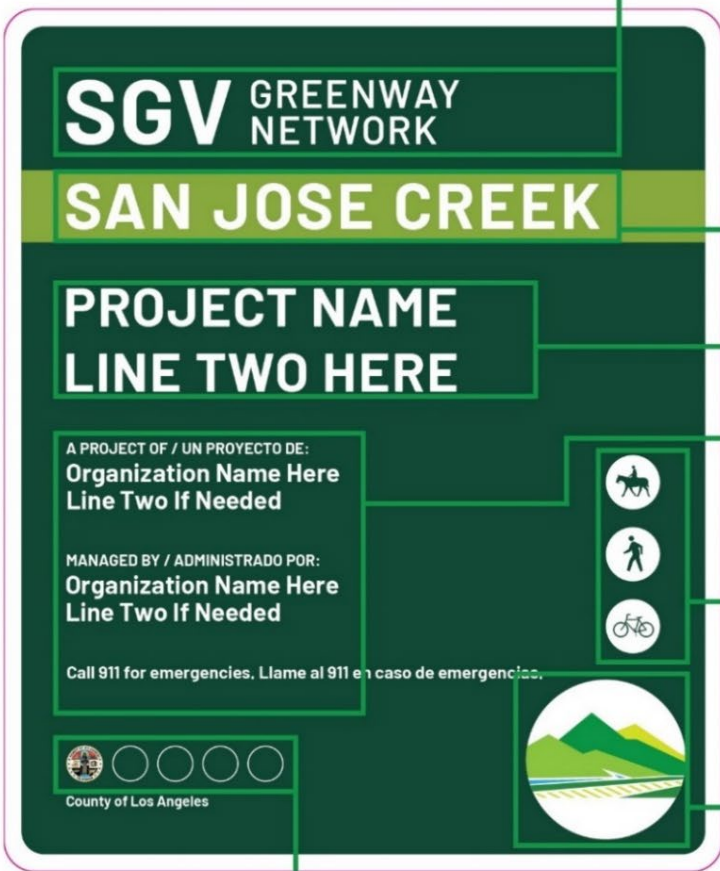
8.3 Informational Signage

Informational signs inform users about a location name such as a Park or Trail along the SGV Greenway Network, and/or a specific project along the greenway system. They also provide the owner or operator information, and funding source(s). This reinforces the message that the SGV Greenway Network crosses many communities and agencies, reinforcing the notion that each of us is responsible for its success and implementation.

Placement

Informational signs are typically located at primary access points and special project areas such as an Outdoor Classroom that are incorporated into the SGV Greenway Network.

INFORMATIONAL SIGN OPTION 1



TITLE 1

Text: SGV Greenway Network
Font: Barlow - Bold & Regular, All Caps
Size: 3.5" high and 2" high
Color: White
Position: Left aligned, 3" from top of green background and 2.5" from left

TITLE 2

Text: River, Channel, or Wash Name
Font: Barlow - Bold, All Caps
Size: 1.5" high
Color: White
Position: Left aligned, 2.5" from left edge of colored band and 0.75" from top

TITLE 3

TEXT: Location Name
Font: Barlow - Bold, Title Case
Size: 2" high
Color: White
Position: Left aligned, 2.5" from edge of green background and 3.25" below Title 2

INFORMATION TEXT

Font: Barlow - Bold, Title Case
Size: 0.625" minimum height of capital letter
Color: White
Position: Left aligned, 2.5" from edge of green background and 2.5" vertical space between groups of texts

TRAIL USAGE SYMBOLS

Size: Symbols centered in 3" circle
Color: Circle - White, Symbol - Pantone 34-35C
Position: 2.5" from right edge of green background, spaced 1" apart, vertically; top aligned with bottom of Information Text
* Only include symbols for usage on trail at this access point, remove all others
** See MUTCD for approved symbols

GREENWAY GRAPHIC

Size: 9.5" high
Position: 0.75 from right edge and bottom edge of green background

LOGOS

Size: 2" circles with 5 pt white stroke
Position: 2.5" from left edge of green background, 4" from bottom; spaced .5" apart horizontally

NOTE: Remove all unused logo circles

SIGN SPECIFICATIONS

- Size: 40x48" with 1.75" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: Pantone 34-35C with 1.25" radius rounded corners
- Margins within background: 3" from top, 2.5" on left, right, and bottom

INSTALLATION

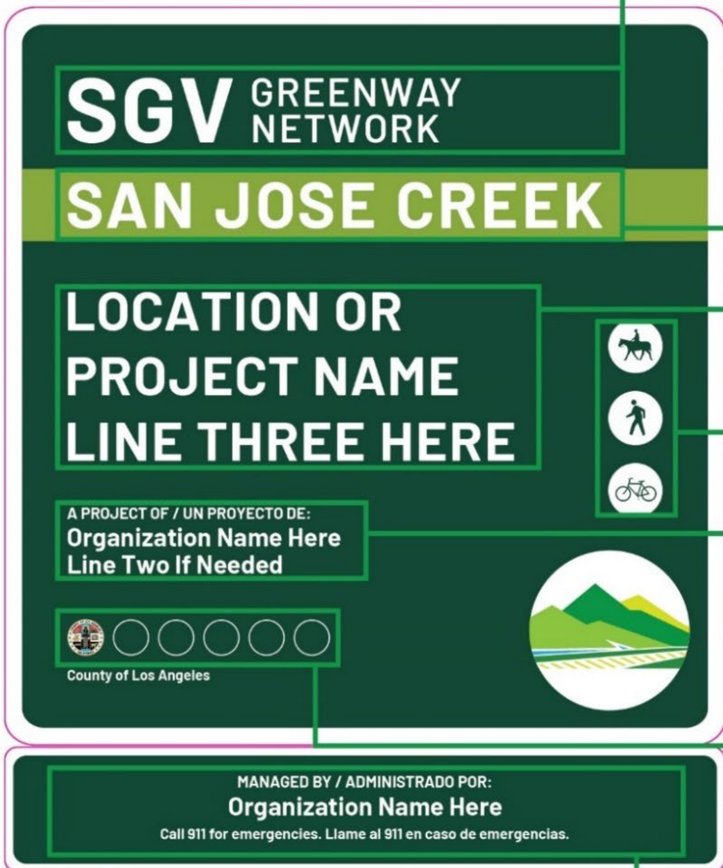
- At access point, not directly on a circulation path
- Bottom of sign located between 40" and 45" off the ground and on double posts if freestanding

NOTES

- Always confirm specifications with latest applicable guidelines
- In the case where a longer title, like Puddingstone Channel, is to be used for Title 2, use a minimum text height of 2" tall to ensure the title fits within the sign

Figure 8-9. Informational signs provide the location name, owner, operator, and funding source of a project

INFORMATIONAL SIGN
OPTION 2 - WITH BOTTOM PANEL



TITLE 1

Text: SGV Greenway Network
Font: Barlow - Bold & Regular, All Caps
Size: 3.5" high and 1.5" high
Color: White
Position: Left aligned, 3" from top of green background, 2.5" from left

TITLE 2

Text: River, Channel, or Wash Name
Font: Barlow - Bold, All Caps
Size: 2.5" high
Color: White
Position: Left aligned, 2.5" from left edge of colored band and 0.75" from top

TITLE 3

TEXT: Location Name
Font: Barlow - Bold, Title Case
Size: 2" high min
Color: White
Position: Left aligned, 2.5" from edge of green background and 3.25" below Title 2

TRAIL USAGE SYMBOLS

Size: Symbols centered in 3" circle
Color: Circle - White, Symbol - Pantone 34-35C
Position: 2.5" from right edge of green background, spaced 1" apart, vertically; top aligned with bottom of Information Text
* Only include symbols for usage on trail at this access point, remove all others
** See MUTCD for approved symbols

INFORMATION TEXT

Font: Barlow - Bold, Title Case
Size: 0.625" minimum height of capital letter
Color: White
Position: Left aligned, 2.5" from edge of green background and 2.5" vertical space between groups of texts

LOGOS

Size: 2" circles with 5 pt white stroke
Position: 2.5" from left edge of green background, 4" from bottom; spaced .5" apart horizontally

NOTE: Remove all unused logo circles

INFORMATIONAL PANEL

Size: 40x7" with .75" radius rounded corners
White border: .5" on all sides
Material: Aluminum with anti-graffiti treatment
Background: Pantone 34-35C with .75" radius rounded corners
Margins within background: 1.15" on all sides

Font: Barlow - Bold, title case,
Size: .625" minimum height of capital letter
Color: White
Text Position: Center aligned, 1.15" from all edges of green background

Placement: located below informational sign, flush edge to edge ; bottom of sign between 40" and 45" off the ground or a minimum of 80" off the ground and on double posts if freestanding

SIGN SPECIFICATIONS

- Size: 40x41" with 1.75" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: Pantone 34-35C with 1.25" radius rounded corners
- Margins within background: 3" from top, 2.5" on left, right, and bottom

INSTALLATION

- At access point, not directly on a circulation path
- Bottom of information sign combination (sign and below panel) located between 40" and 45" off the ground and on double posts if freestanding

NOTES

- Separate informational panel allows for flexibility to update only partial and potentially more frequently changing content
- Always confirm specifications with latest applicable guidelines
- In the case where a longer title, like Puddingstone Channel, is to be used for Title 2, use a minimum text height of 2" tall to ensure the title fits within the sign

Figure 8-10. The information panel allows for ease of updating information such as management and funding.

8.4 Confirmation Signage

Confirmation signs inform users about their location, their routes, and any upcoming street connections, landmarks, or other transit connections-related information. These signs should also highlight upcoming resources that are accessible along the SGV Greenway Network, but within two miles of the greenway, such as restrooms, hydrations stations, emergency call boxes, and first aid.

Placement

Confirmation signs should be placed at access points and along the river, wash, channel or creek. Confirmation signs showing destinations along the trail should occur at a frequency of no less than two miles. Trail map signs should be placed in areas where users can identify access points and exits before they embark on their route.

CONFIRMATION OVERPASS

SIGN SPECIFICATIONS

- Size: Width varies x 8″ with 1″ radius rounded corners
- White border of sign: 0.25″ on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: White with 0.375″ green border with 1″ radius rounded corners
- Margins within background: 1.375″ top and bottom, 2.375″ minimum left and right sides

INSTALLATION

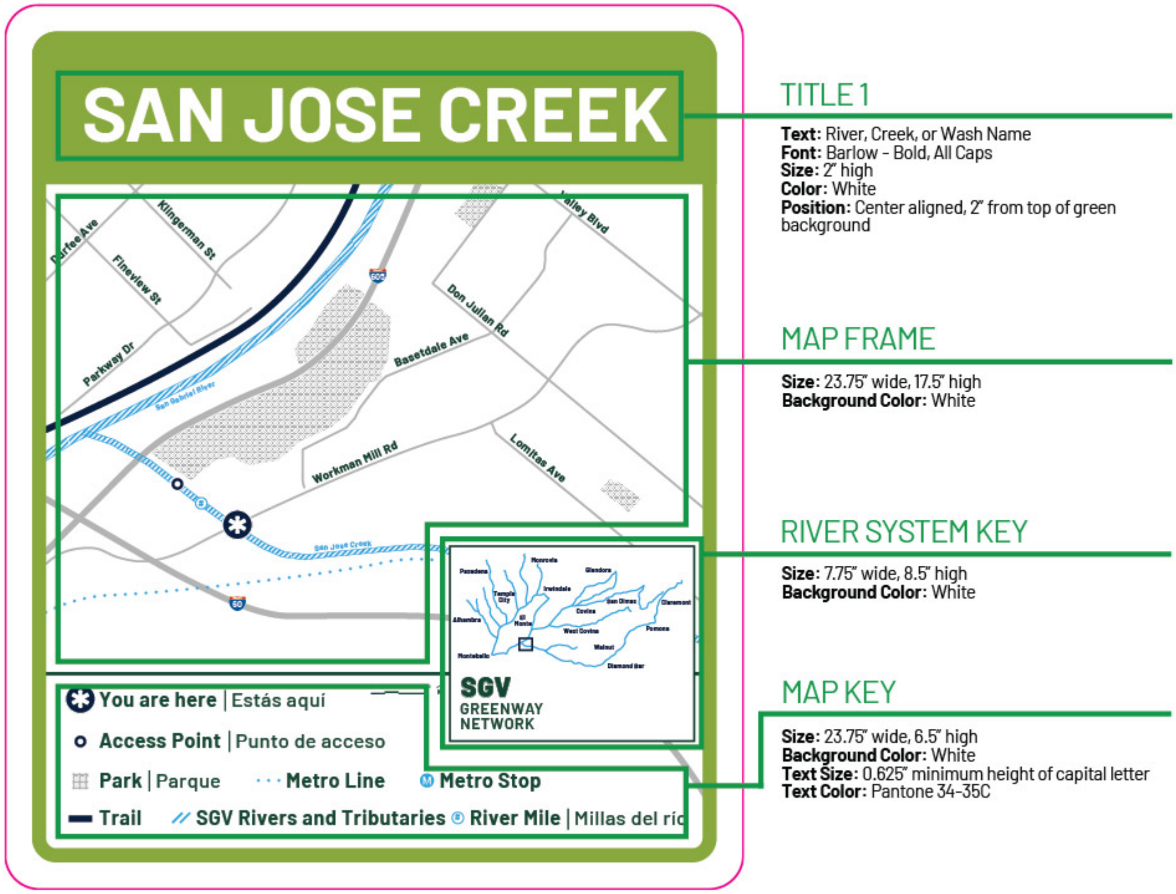
- On bridge or overpass above trail

NOTES

- Width of sign will vary base on the length of the name, but margins will remain standard, based on MUTCD guidelines
- Always confirm specifications with latest applicable guidelines

Figure 8-11. A Street identifying sign should be located above the SGV path or crossing over the trail/path.

CONFIRMATION MAP



SIGN SPECIFICATIONS

- Size: 26.75x32" with 1.25" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: White

INSTALLATION

- At access point
- Bottom of sign located between 40" and 45" off the ground
- Always confirm specifications with latest applicable guidelines

NOTES

- In the case where a longer title, like Puddingstone Channel, is to be used for Title 1, use a minimum text height of 1.75" tall to ensure the title fits within the sign

Figure 8-12. Confirmation maps help users locate where they are on the trail in relation to the SGV Greenway Network system, and access points.

CONFIRMATION DESTINATION

TITLE 1

Text: SGV Greenway Network
Font: Barlow - Bold & Regular, All Caps
Size: 2.5" high and 1" high
Color: White
Position: Left aligned, 2.5" from top of green background, 2.5" from left

DESTINATION NAME

Font: Barlow - Bold, Title Case
Size: .625" minimum height of capital letter
Color: White
Position: Left aligned; 2.5" from left edge of green background, 2" vertical space between separate groups of text

AMENITY SYMBOLS

Size: 1" high
Color: White
Position: 2.5" from left edge of green background; spaced 0.75" apart horizontally; 0.5" below Destination name
* See MUTCD for approved symbols

DESTINATION DISTANCE

Font: Barlow - Bold, sentence case
Size: 0.625" minimum height of capital letter
Color: White
Position: Right aligned; 2.5" from right edge of green background, aligned with Destination name vertically

LOGOS

Size: 2" circles with 5 pt white stroke
Position: 2.5" from left edge of green background, 4" from bottom; spaced .5" apart horizontally

NOTE: Remove all unused logo circles

SIGN SPECIFICATIONS

- Size: 26.75x32" with 1.25" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: Pantone 34-35C with 0.875" radius rounded corners
- Margins within background: 2.5" on all sides

INSTALLATION

- Along SGV Greenway Network trail
- Bottom of sign located between 40" and 45" off the ground

NOTES

- Amenity symbols should be MUTCD standard symbols whenever available, custom symbols can only be used when symbol does not exist in from MUTCD
- A left or right arrow replaces the destination distance when the sign is at the destination or at the trail exit for that destination
- Only three destinations per sign
- Always confirm specifications with latest applicable guidelines

Figure 8-13. Confirmation signs confirm to the viewer that they are traveling the correct direction and identify the next closest major destinations. They can also indicate arrival at a destination with the addition of an arrow.

CONFIRMATION AT TRIBUTARY

TITLE 1

Text: SGV
Font: Barlow - Black, all caps
Size: 5" high
Color: Pantone 34-35C
Position: Left aligned, 2" from top and left green border

TITLE 2

Text: GREENWAY NETWORK
Font: Barlow - SemiBold, all caps
Size: 2" high
Color: Pantone 34-35C
Position: Left aligned, 2" from left green border

TITLE 3

Text: RIVER, CREEK OR WASH NAME
Font: Barlow - Bold, all caps
Size: 2.5" high
Color: White
Position: Left aligned, 2" from left green border

GREENWAY GRAPHIC

Size: 8" high
Position: Flush with bottom green border

GREEN BORDER

Size: 0.5" width with 0.875" radius rounded corners
Color: Pantone 34-35C

SIGN SPECIFICATIONS

- Size: 26.75x32" with 1.25" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: White with 0.5" green border with 1.25" radius rounded corners
- Margins within background: 2" on all sides

INSTALLATION

- Key locations close to the SGV Greenway Network, such as on bridge overpasses
- Always confirm specifications with latest applicable guidelines

NOTES

- In the case where a longer title, like Puddingstone Channel, is to be used for Title 3, use a minimum text height of 2" tall to ensure title fits within sign

Figure 8-14. This Confirmation sign should be used at locations such as bridges crossings to confirm the location of the nearest wash, river, creek, or channel.

CONFIRMATION
OPTION 1 - SGV GREENWAY NETWORK

MUTCD SYMBOL

Size: 7.875" high and width varies per symbol
Color: Pantone 34-35C
Position: Center aligned; 1" from top green border

Note: See template for more MUTCD symbols

GREEN BORDER

Size: 0.5" width with 1.25" radius rounded corners
Color: Pantone 34-35C

TITLE 1

Text: SGV
Font: Barlow - Black, all caps
Size: 2.5" high
Color: White
Position: Center aligned, 1" from top of green background

TITLE 2

Text: GREENWAY NETWORK
Font: Barlow - Regular, all caps
Size: 1.75" high
Color: White
Position: Center aligned, 1.25" from bottom of green background

CONFIRMATION
OPTION 2 WITH TRIBUTARY NAME

MUTCD SYMBOL

Size: 7.875" high and width varies per symbol
Color: Per SGV Greenway Network Tributary Color Book
Position: Center aligned; 1" from top green border

Note: See template for more MUTCD symbols

COLORED BORDER

Size: 0.5" width with 1.25" radius rounded corners
Color: Per SGV Greenway Network Tributary Color Book

TITLE 1

Text: Rive, Creek or Wash Name
Font: Barlow - Black, all caps
Size: 2.5" high
Color: White
Position: Center aligned, 1" from bottom and top of green background

SIGN SPECIFICATIONS

• Size: 26.75x20" with 1.75" radius rounded corners
• White border of sign: 1" on all sides
• Material: Aluminum with anti-graffiti treatment
• Background: White with 0.5" green border with 1.25" radius rounded corners
• Margins within background: 2.5" from top, 2" on left, right, and bottom

INSTALLATION

• Along route, maximum two miles from SGV Greenway Network tributary
• Bottom of sign located between 70" and 120" off the ground

NOTES

• All environmental graphics should be retroreflective per MUTCD requirements.
• Always confirm specifications with latest applicable guidelines
• MUTCD Pedestrian and Equestrian symbols are included in template, allowing for this sign to be adaptable in creating a pedestrian sign, equestrian sign, or multi-use sign.
• In the case where a longer title, like Puddingstone Channel, is to be used for Title 1 in Option 2, use a minimum text height of 2" tall to ensure the title fits within the sign.

Figure 8-15. These confirmation signs can be used for pedestrians, equestrians, and cyclists.

8.5 Regulatory Signage

Regulatory signs shall be used to alert users to rules and regulations within and along the SGV Greenway Network. They are also used to warn park and trail users of dangerous conditions or to inform bicyclists and drivers of regulations and upcoming conditions. Under the California Code of regulations rules and specific code numbers must be posted to be enforced by patrolling police officers.

For additional Regulatory signs needed for flood safety or other municipal requirements, refer to the standard guidelines of the appropriate regulatory agency for color, size, content, and materials.

Placement

Regulatory signs are typically placed at or near park entrances or access points. Certain regulatory sign placement needs to follow uniform traffic standards and MUTCD guidelines. All users should be able to see the regulatory signs as they enter the park or multiuse trails. Signs warning users of flood danger should be placed along the channel itself. To prevent trespass, signs should be posted informing trail users of adjacent private property and instructing them to respect private lands by staying on the trail. Trail signs that are located on public and private property boundaries should inform trail users when they are entering and leaving private lands.

Regulatory Hazard

Certain Regulatory signs are standard and shall not be altered or customized to maintain recognition and consistency. Examples of these standardized signs include MUTCD signs for flood danger, equestrian requirements, parking requirements, and USACE signs for no dumping or littering. These guidelines will not provide the artwork for other agencies standard signage. Refer to appropriate jurisdiction codes for most up-to-date requirements and sign specifications.

1

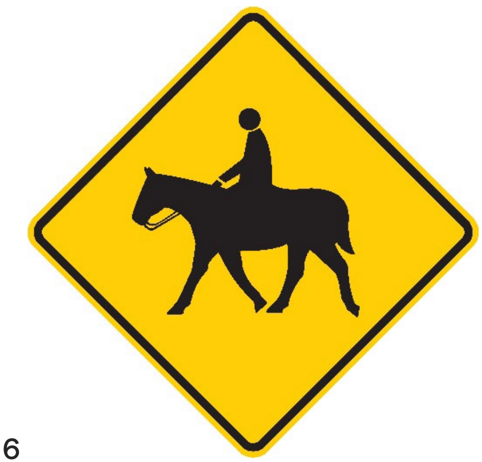
2

Figure 8-16. The signs shown above (1-2) are standard regulatory signs, created as part of these guidelines, which must not be altered. Artwork for these standard signs can be downloaded here: www.sgvgreenway.org

3

4

5

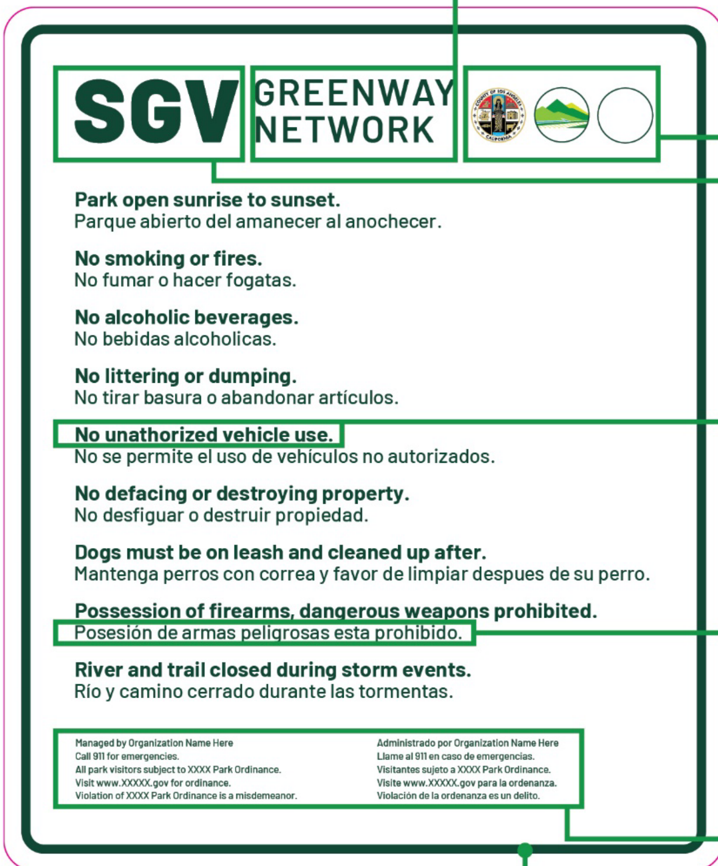


6

Figure 8-17. The signs shown above (3-6) are examples of warning and safety regulations signs that are standard designs and must not be altered. These guidelines do not provide artwork for these standard signs. Designers should consult latest MUTCD guidelines.

Source: 2009 MUTCD Edition with Revisions 1 and 2, 2012.

REGULATORY RULES OPTION 1



TITLE 2

Text: GREENWAY NETWORK
Font: Barlow - SemiBold, all caps
Size: 1.5" high
Color: Pantone 34-35C
Position: Left aligned, 1" from Title 1 and 2.5" below top green border

LOGOS

Size: 3" circles with 5 pt Pantone 34-35C stroke
Position: 2.5" from right green border; spaced .5" apart horizontally

TITLE 1

Text: SGV
Font: Barlow - Black, all caps
Size: 3.5" high
Color: Pantone 34-35C
Position: Left aligned, 2.5" from top and left green border

REGULATION TEXT: ENGLISH

Font: Barlow - Bold, sentence case
Size: .625" minimum height of capital letter
Color: Pantone 34-35C
Position: Left aligned; 2.5" from left green border, 1.25" vertical space between separate groups of text

REGULATION TEXT: SPANISH

Font: Barlow - Medium, sentence case
Size: .625" minimum height of capital letter
Color: Pantone 34-35C
Position: Left aligned; 2.5" from left green border, 1.25" vertical space between separate groups of text

INFORMATIONAL TEXT: ENGLISH AND SPANISH

Font: Barlow - Medium, sentence case
Size: .375" minimum height of capital letter
Color: Pantone 34-35C
Position: Left aligned; 2.5" from left and bottom green border

GREEN BORDER

Size: 0.5" width with 1.25" radius rounded corners
Color: Pantone 34-35C

SIGN SPECIFICATIONS

- Size: 40x48" with 1.75" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: White with 0.5" green border with 1.25" radius rounded corners
- Margins within background: 2.5" on all side

INSTALLATION

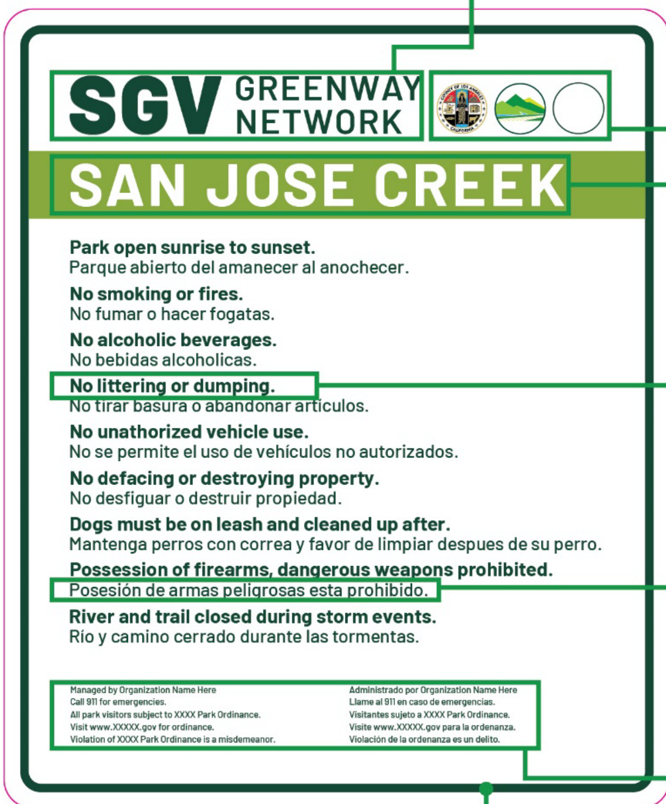
- At access point, not directly on a circulation path
- Bottom of sign located between 40" and 45" off the ground and on double posts if freestanding

NOTES

- Rules and regulations should always be bilingual
- Always confirm specifications with latest applicable guidelines
- Please note this is example language. Rules will vary per City and per project.

Figure 8-18. Regulatory Rule signs alert park and trail users to the rules and regulations in effect within river parks and on trails and must be bilingual.

REGULATORY RULES
OPTION 2 - WITH TRIBUTARY NAME



TITLE 1

Text: SGV GREENWAY NETWORK
Font: Barlow - Black and SemiBold, all caps
Size: 3.5" high and 1.5" high
Color: Pantone 34-35C
Position: Left aligned, 2.5" from top and left green border, 1" horizontal spacing between titles

LOGOS

Size: 3" circles with 5 pt Pantone 34-35C stroke
Position: 2.5" from right green border; spaced .5" apart horizontally

TITLE 2

Text: River, Creek, or Wash Name
Font: Barlow - Bold, all caps
Size: 2.5" high
Color: Pantone 34-35C
Position: Left aligned, 2.5" from left green border and 0.75" from top colored border

REGULATION TEXT: ENGLISH

Font: Barlow - Bold, sentence case
Size: .625" minimum height of capital letter
Color: Pantone 34-35C
Position: Left aligned; 2.5" from left green border, 0.8" vertical space between separate groups of text

REGULATION TEXT: SPANISH

Font: Barlow - Medium, sentence case
Size: .625" minimum height of capital letter
Color: Pantone 34-35C
Position: Left aligned; 2.5" from left green border, 0.8" vertical space between separate groups of text

INFORMATIONAL TEXT: ENGLISH AND SPANISH

Font: Barlow - Medium, sentence case
Size: .375" minimum height of capital letter
Color: Pantone 34-35C
Position: Left aligned; 2.5" from left and bottom green border

GREEN BORDER

Size: 0.5" width with 1.25" radius rounded corners
Color: Pantone 34-35C

SIGN SPECIFICATIONS

- Size: 40x48" with 1.75" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: White with 0.5" green border with 1.25" radius rounded corners
- Margins within background: 2.5" on all side

INSTALLATION

- At access point, not directly on a circulation path
- Bottom of sign located between 40" and 45" off the ground and on double posts if freestanding

NOTES

- Rules and regulations should always be bilingual
- Always confirm specifications with latest applicable guidelines
- In the case where a longer title, like Puddingstone Channel, is to be used for Title 2, use a minimum text height of 2" tall to ensure title fits within sign
- Please note this is example language. Rules will vary per City and per project.

Figure 8-19. Regulatory Rule signs alert park and trail users to the rules and regulations in effect within river parks and on trails and must be bilingual.

REGULATORY WARNING

REGULATION TEXT: ENGLISH

Font: Barlow - Bold, all caps
Size: .625" minimum height of capital letter
Color: Pantone 34-35C
Position: Center aligned; 2.5" minimum from green border on all sides, 1.625" vertical space between separate groups of text

REGULATION TEXT: SPANISH

Font: Barlow - Medium, all caps
Size: .625" minimum height of capital letter
Color: Pantone 34-35C
Position: Center aligned; 2.5" minimum from green border on all sides, 1.625" vertical space between separate groups of text

HORIZONTAL DIVIDER LINE

Size: .5" high, 32" long
Color: Pantone 34-35C
Position: Center aligned; 2.5" from green border on left and right; 1.625" vertical space between line and text

TITLE 1: ENGLISH

Font: Barlow - Bold, all caps
Size: 1.75" high (.625" minimum)
Color: Pantone 34-35C
Position: Center aligned; 2.5" minimum from green border on all sides, 1.625" vertical space between separate groups of text

TITLE 1: SPANISH

Font: Barlow - Medium, all caps
Size: 1.75" high (.625" minimum)
Color: Pantone 34-35C
Position: Center aligned; 2.5" minimum from green border on all sides, 1.625" vertical space between separate groups of text

CONTACT INFORMATION TEXT

Font: Barlow - Bold, sentence case
Size: .375" minimum height of capital letter
Color: Pantone 34-35C
Position: Center aligned; 2.5" minimum from green border on all sides

GREEN BORDER

Size: 0.5" width with 1.25" radius rounded corners
Color: Pantone 34-35C

SIGN SPECIFICATIONS

- Size: 40x48" with 1.75" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: White with 0.5" green border with 1.25" radius rounded corners
- Margins within background: 2.5" on all sides

INSTALLATION

- At access point, not directly on a circulation path
- Bottom of sign located between 40" and 45" and on double posts if freestanding

NOTES

- Rules and regulations should always be bilingual
- Always confirm specifications with latest applicable guidelines

Figure 8-20. Regulatory Warning signs alert users of flood dangers and trail violations, they should be placed on gates or fences at entrances to the trail.

8.6 Interpretive Signage

Interpretive signs and displays are used to educate users and expand the SGV Greenway Network to something more than a commuter corridor. These educational exhibits should be incorporated into projects whenever feasible and should touch upon a wide range of topics the community deems appropriate.

Suggested topics include geomorphology and engineering of the channels, ecological restoration, water supply, water quality, wildlife of the region, natural history of Los Angeles, Indigenous People's place markers and traditions, settlement history of Los Angeles, historic trail routes or corridors, and cultural history of local neighborhoods. Topic selection should consider the content of other interpretive signs and displays within the Greenway Network system and the unique features of the project site.

The specifications shown on the following pages for interpretive signs were designed to provide flexibility for the individual sign designers. Consistent to all interpretive signs are the title location, size, color, and font, and the logo size and location.

Placement

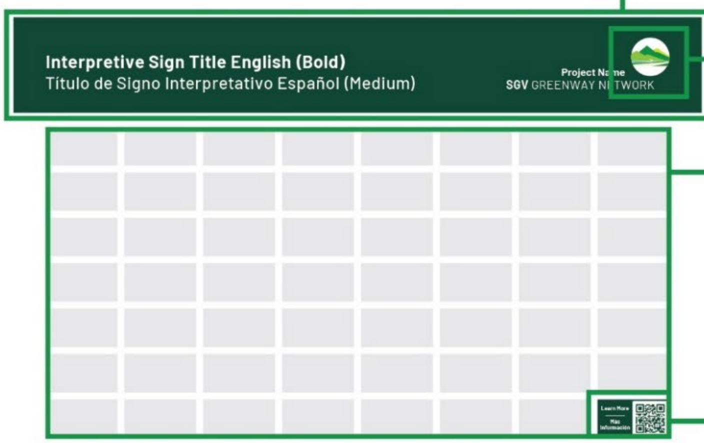
Interpretive signs and displays should be placed along trail lookouts, gateways, access, points, pocket parks, and within major projects themselves. The location of these environmental graphics is dependent on the educational content and where that is best viewed in context. Their placement should be coordinated with appropriate seating, shade, and other amenities where possible.

Using the Grid

Text, photographs, maps, and illustrations should be aligned on the grid at the discretion of the designer. Each grid box is 3.75 inches wide by 2 inches tall, and are evenly spaced 3/8 inch apart, allowing adequate space between different types of content. Images should not be any smaller than 4 grid boxes, 7& 7/8 inches wide by 4 & 3/8 tall. When using a large map or graphic they should be anchored in the top left corner of the grid and additional content should align below or to the right of the large map or graphic. Creating hierarchy between different types of content will help the viewer to digest the content more easily.

Larger sized text callouts can be used to draw attention to important points and can help to break up large amounts of text. Bold titles within text can also be used to better segment text on an interpretive sign. Interpretive signs should be bilingual. It is recommended to differentiate languages with different type weights for quicker and easier navigation of content.

INTERPRETIVE GRID



TITLE BAND

Size: 5" high, 36" wide
Color: Pantone 34-35C

GREENWAY GRAPHIC

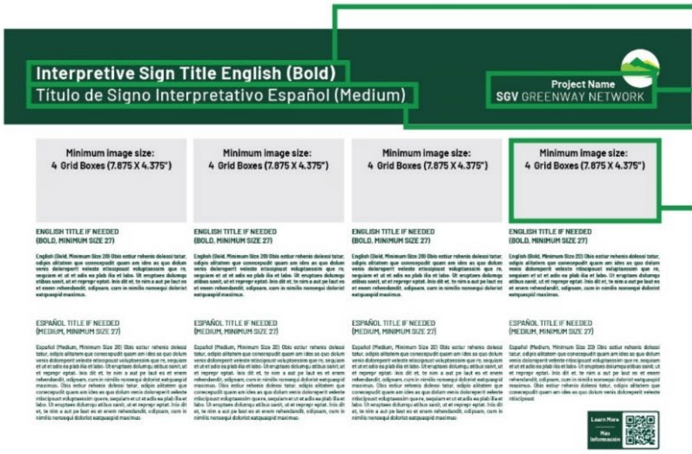
Size: 2" circle
Position: Left aligned, 1.6875" from left and 1.0625 from top edge of sign

CONTENT GRID

Size: 32.625x16.25"; each grid box size is 3.75x2"
Position: Center aligned; 1.6875" from left and right edge of sign, 0.75" from top title band, 2" from bottom edge of sign, 0.375" vertical and horizontal space between separate groups of text

QR CODE FOR MORE INFORMATION

Font: Barlow - Bold, Title Case
QR Code Size: 1x1" minimum
Color: Pantone 34-35C
Position: Aligned with grid
Note: Optional addition. Text and code will vary.



SIGN TITLE: ENGLISH

Font: Barlow - Bold, title case
Size: 0.625" minimum height of capital letter
Color: White
Position: Left aligned; 2" from top edge of sign, 1.6875" from left edge of sign

LOCATION

Font: Title 1: Barlow - Bold, Title Case; Title 2: Barlow - Bold and Regular, All Caps
Size: Title 1: 40 pt, Title 2: 45 pt
Color: White
Position: Title 1: Right aligned, 4" from right edge of sign; Title 2: Right aligned, 2.5" from right edge of sign

SIGN TITLE: SPANISH

Font: Barlow - medium, title case
Size: 0.625" minimum height of capital letter
Color: White
Position: Left aligned; 1.25" from bottom edge of title band, 1.6875" from left edge of sign

IMAGES

Minimum Size: 7.875" wide by 4.375" high; 4 grid boxes

SIGN SPECIFICATIONS

• Size: 36x24"
• Material: Varies per project with anti-graffiti treatment
• Background: White
• Header: 5" tall Pantone 34-45C band spanning width of sign
• Margins from edge of sign: 2" on top and bottom, and 1.6875" on left and right

INSTALLATION

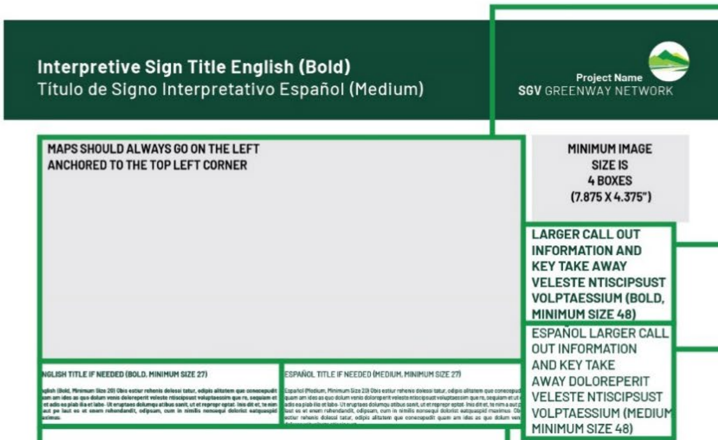
• Along trail, not directly on circulation path
• Bottom of sign located at a height where text is legible, on double posts if freestanding

NOTES

• Should always be bilingual
• Always confirm specifications with latest applicable guidelines

Figure 8-21. There are many ways that the grid can be used for the layout of Interpretive signs. The above example shows one method of basic organization with a hierarchy of text sizes.

INTERPRETIVE MAP



MAPS AND LARGE IMAGES/DIAGRAMS

Position: Top left corner, 1.6875" from left edge of sign, 0.75" from top green title Band

CALLOUT TEXT: ENGLISH

Font: Barlow - Bold, All Caps
Size: 48 pt minimum
Color: Pantone 34-35C
Position: Left aligned, 1.6875" minimum from right edge of sign

CALLOUT TEXT: SPANISH

Font: Barlow - Medium, All Caps
Size: 48 pt minimum
Color: Pantone 34-35C
Position: Left aligned, 1.6875" minimum from right edge of sign

INFORMATIONAL TEXT: ENGLISH

Font: Barlow - Bold, Sentence Case
Size: 20 pt minimum
Color: Pantone 34-35C
Position: Left justified, text box aligned with grid

INFORMATIONAL TEXT: SPANISH

Font: Barlow - Medium, Sentence Case
Size: 20 pt minimum
Color: Pantone 34-35C
Position: Left justified, text box aligned with grid

SIGN SPECIFICATIONS

- Size: 36x24"
- Material: Varies per project with anti-graffiti treatment
- Background: White
- Header: 5" tall Pantone 34-45C band spanning width of sign
- Margins from edge of sign: 2" on top and bottom, and 1.6875" on left and right

INSTALLATION

- Along trail, not directly on circulation path
- Bottom of sign located at a height where text is legible, on double posts if freestanding

NOTES

- Should always be bilingual
- Always confirm specifications with latest applicable guidelines

Figure 8-22. Large callouts or quotes can be incorporated into Interpretive signs to highlight key information. QR Codes can also be added as an additional resource to learn.

INTERPRETIVE - SMALL

INFORMATIONAL TEXT: ENGLISH

Font: Barlow - Bold
Size: Font size will vary based on content. Maximize font size for best readability, while maintaining appropriate spacing.
Color: Pantone 34-35C
Position: Left justified, 0.5" from green border

INFORMATIONAL TEXT: SPANISH

Font: Barlow - Medium
Size: Font size will vary based on content. Maximize font size for best readability, while maintaining appropriate spacing.
Color: Pantone 34-35C
Position: Left justified, 0.5" from green border

GREEN BORDER

Size: 0.5" width on all sides
Color: Pantone 34-35C

QR CODE FOR MORE INFORMATION

Font: Barlow - Bold, Title Case
QR Code Size: 1x1" minimum
Color: Pantone 34-35C
Note: Optional addition. Text and code will vary.

GREENWAY GRAPHIC

Size: 1" circle
Position: 0.5" from left and bottom green border

SIGN SPECIFICATIONS

- Size: 8x10"
- Material: Varies per project with anti-graffiti treatment
- Background: White
- Border: 0.5" wide Pantone 34-35C border on all edges of sign
- Margins from edge of sign: 1" on all sides

INSTALLATION

- Along trail and in planted areas, not directly on circulation path
- Bottom of sign located at a height between 7" and 22" off the ground
- Face of sign angled up, angle to be determined based on height and use

NOTES

- Should always be bilingual
- Always confirm specifications with latest applicable guidelines

Figure 8-23. Sample content for smaller Interpretive signs, typically located low to the ground in a planted area. Content for these signs will vary.

INTERPRETIVE - X-SMALL

INFORMATIONAL TEXT: ENGLISH

Font: Barlow - Bold
Size: Font size will vary based on content. Maximize font size for best readability, while maintaining appropriate spacing.
Color: Pantone 34-35C
Position: Left justified, 0.5" from green border

INFORMATIONAL TEXT: SPANISH

Font: Barlow - Medium
Size: Font size will vary based on content. Maximize font size for best readability, while maintaining appropriate spacing.
Color: Pantone 34-35C
Position: Left justified, 0.5" from green border

GREEN BORDER

Size: 0.5" width on all sides
Color: Pantone 34-35C

SIGN SPECIFICATIONS

- Size: 5x6"
- Material: Varies per project with anti-graffiti treatment
- Background: White
- Border: 0.5" wide Pantone 34-35C border on all edges of sign
- Margins from edge of sign: 1" on all sides

INSTALLATION

- Along trail and in planted areas, not directly on circulation path
- Bottom of sign located at a height between 7" and 22" off the ground
- Face of sign angled up. Angle to be determined based on height and use

NOTES

- Should always be bilingual
- Always confirm specifications with latest applicable guidelines

Figure 8-24. Small Interpretive signs should be installed and fabricated so that the face of the sign angled up. The angle is to be determined based on height and use.

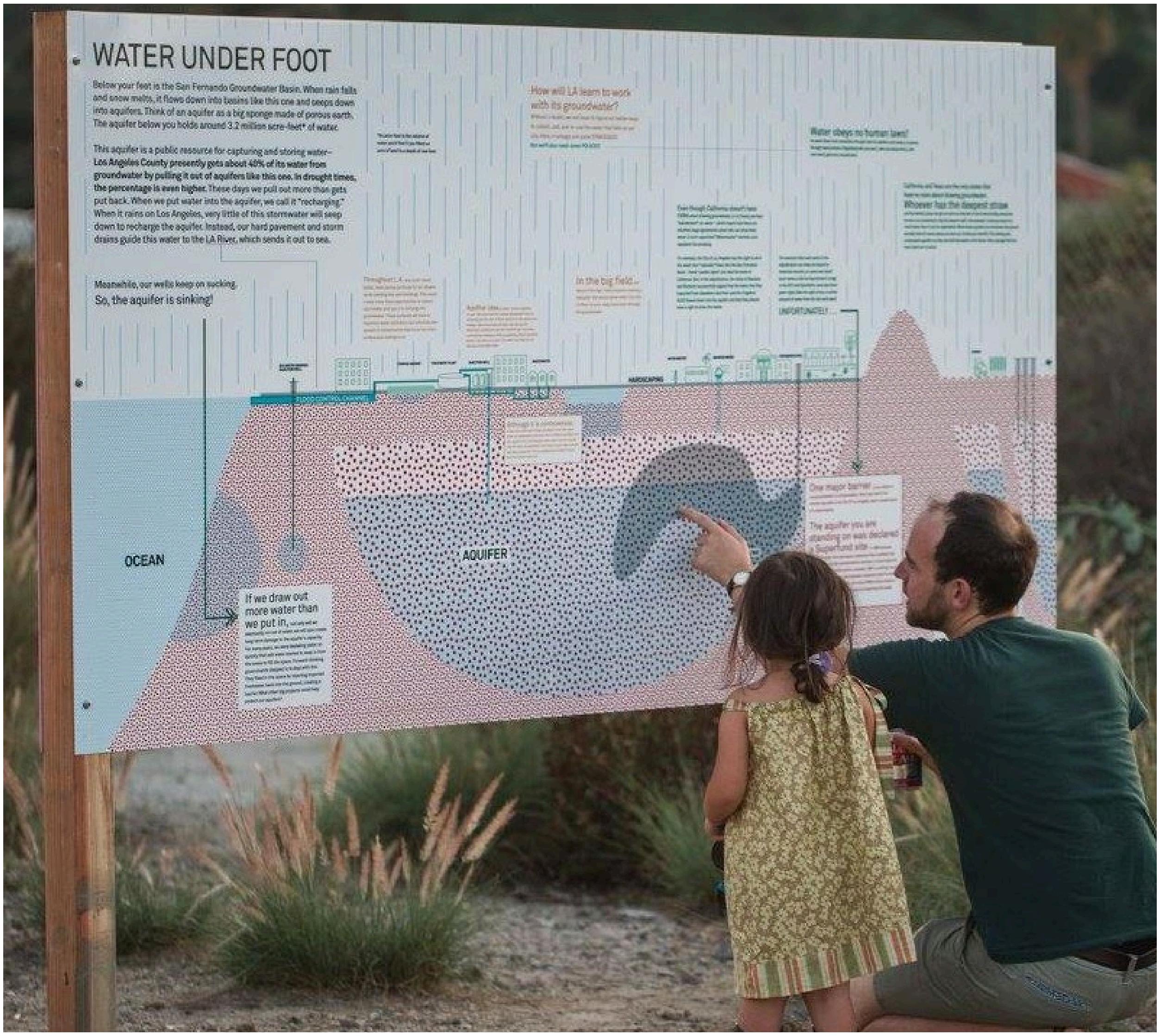


Figure 8-25. Example LA River educational signage

Figure 8-26. Emerald Necklace educational signage

8.7 Directional Signage

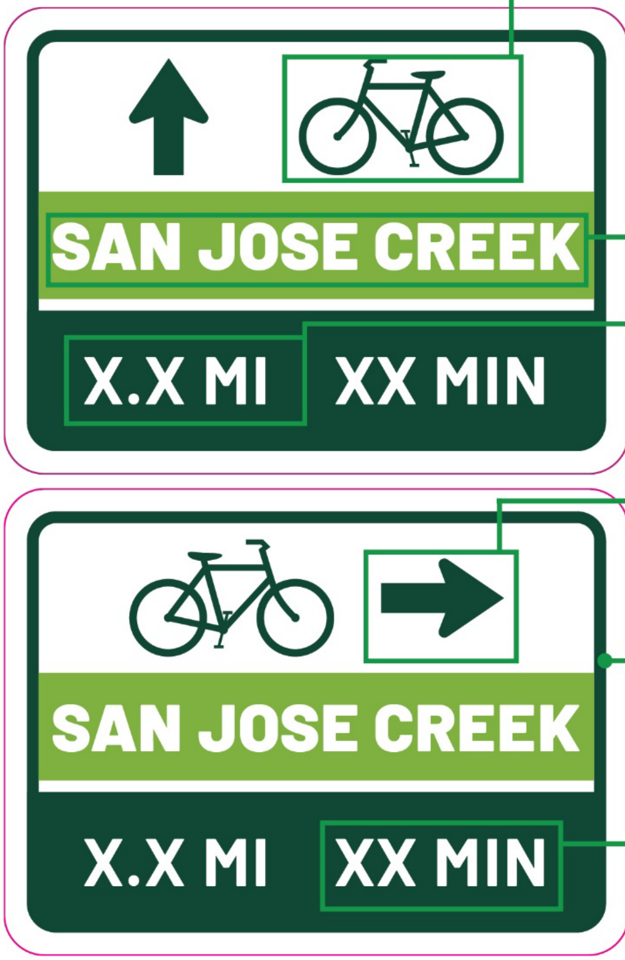
Directional signs are used to alert travelers to the location of the SGV Greenway Network. They serve an important wayfinding function and will set traffic patterns to and from each tributary. Jurisdictionally, these signs will typically be in Caltrans, local municipalities', or unincorporated LA County rights-of-way. All signs must conform to the appropriate jurisdictional regulations.

Placement

Directional environmental graphics should be placed along streets and at intersections that cater to pedestrians and cyclists. Locations chosen should direct users to the nearest access point.

To direct users to the nearest tributary from local streets where a Class I, II, or III bike path exists. To direct users to the nearest access point where there is no existing bike path, use signs that address cyclists, pedestrians, and equestrians. For direction within 500 feet of an access point, use signs with the directional arrow only.

DIRECTIONAL DESTINATION



MUTCD SYMBOL

Size: 5" high and width varies per symbol
Color: Pantone 34-35C
Position: 0.625" from top green border, 0.625" from bottom colored band, and right aligned 3.875" from green border

Note: See template for more MUTCD symbols

TITLE 1

Text: River, Creek, or Wash Name
Font: Barlow - Black, All Caps
Size: 2" high
Color: White
Position: Center aligned from right to left, 1.25" margin above and below colored band

DISTANCE

Font: Barlow - Bold, all caps
Size: 2" high
Color: White
Position: Left aligned, 2" from top and bottom of green background, 2.5" from left of green background

DIRECTIONAL ARROW

Size: 3.375" width of arrow head, length varies depending on direction pointing
Color: Pantone 34-35C
Position: Right aligned, 3.875" from green border and, and centered vertically

GREEN BORDER

Size: 0.5" width with 1.25" radius rounded corners
Color: Pantone 34-35C

ESTIMATED TIME

Font: Barlow - Bold, All Caps
Size: 2" high
Color: White
Position: Right aligned, 2" from top and bottom of green background, 2.5" from right of green background

SIGN SPECIFICATIONS

• Size: 26.75x20" with 1.75" radius rounded corners
• White border of sign: 1" on all sides
• Material: Aluminum with anti-graffiti treatment
• Background: White with 0.5" green border with 1.25" radius rounded corners
• Margins within background: 1.5" from top, 2" minimum on left and right, and 2" from bottom

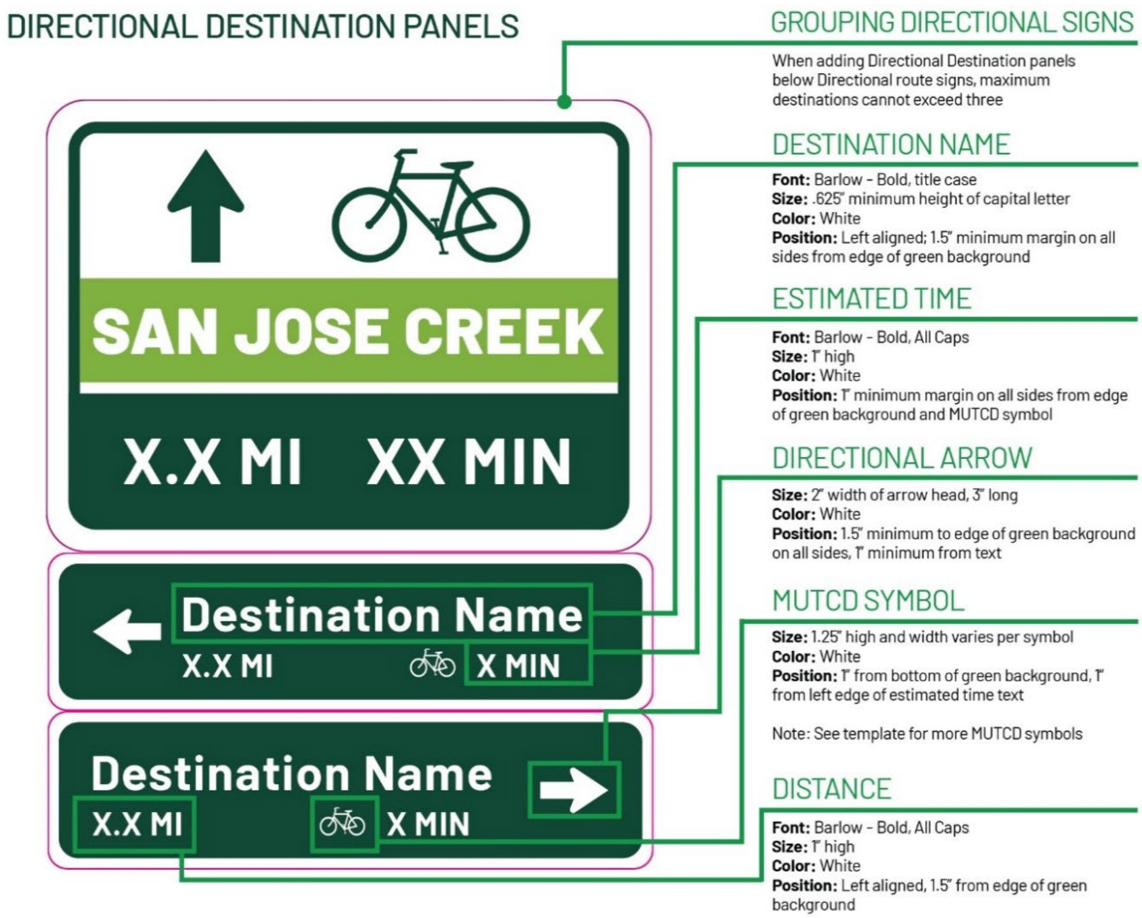
INSTALLATION

• Along route, maximum two miles from SGV Greenway Network
• Bottom of sign located between 70" and 120" off the ground

NOTES

• Arrow pointing right should appear on far right of sign, arrows point straight (up) and left should appear on the far left of sign, arrows pointing down should not be used
• Direction of MUTCD symbol travel should change to mimic direction of arrow
• Estimated bike travel time is based on an average of six minutes per mile, pedestrian is based on an average of twenty minutes per mile, and equestrian is based on an average of fifteen minutes per mile
• All directional environmental graphics should be retroreflective per MUTCD requirements
• Always confirm specifications with latest applicable guidelines
• MUTCD Pedestrian and Equestrian symbols are included in the template, allowing for this sign to be adaptable in creating a pedestrian sign, equestrian sign, or multi-use sign.
• In the case where a longer title, like Puddingstone Channel, is to be used for Title 1, use a minimum text height of 1.5" tall to ensure the title fits within the sign.

Figure 8-27. Place directional signs along bike, equestrian, and pedestrian paths/trails. These signs include a directional arrow, the distance to the nearest river or creek, and the time to bike, walk, or ride there.



SIGN SPECIFICATIONS

- Size: 26.75x7" with 0.875" radius rounded corners
- White border of sign: 0.5" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: Pantone 34-35C with 0.875" radius rounded corners
- Margins within background: 1.5" minimum on all sides

INSTALLATION

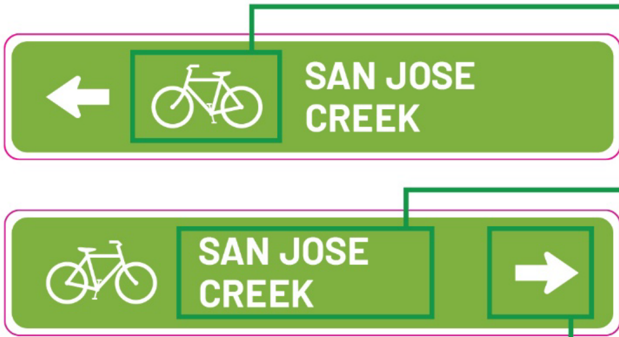
- Along route, maximum two miles from river
- Bottom of sign located between 48" and 70" off the ground

NOTES

- When grouping destination signs, maximum three destinations can be grouped per MUTCD standards
- The order of signs located below must be arranged with straight (up) arrow on top, followed by destinations to the left, and then destinations to the right
- Arrow pointing right should appear on far right of sign, arrows point straight (up) and left should appear on the far left of sign, arrows pointing down should not be used
- Direction of MUTCD symbol travel should change to mimic direction of arrow
- Estimated bike travel time is based on an average of six minutes per mile, pedestrian is based on an average of twenty minutes per mile, and equestrian is based on an average of fifteen minutes per mile
- All directional environmental graphics should be retroreflective per MUTCD requirements
- Always confirm specifications with latest applicable guidelines
- MUTCD Pedestrian and Equestrian symbols are included in the template, allowing for this sign to be adaptable in creating a pedestrian sign, equestrian sign, or multi-use sign

Figure 8-28. Directional Destination Panels direct users to major destinations and provide the distance and estimated time to bike, walk, or ride there. Separate panels to allow for multiple destinations to be added over time.

DIRECTIONAL PANEL



MUTCD SYMBOL

Size: 3″ high and width varies per symbol
Color: White
Position: 1.125″ from top and bottom of green background, 2″ margin on left and right

Note: See template for more MUTCD symbols

TITLE 1

Text: River, Creek, or Wash Name
Font: Barlow - Bold, All Caps
Size: 1.625″ high
Color: White
Position: Left aligned, 2″ from MUTCD Symbol, and centered vertically within sign

DIRECTIONAL ARROW

Size: 2″ width of arrow head, 3″ long
Color: White
Position: 1.625″ minimum to edge of colored background on all sides

SIGN SPECIFICATIONS

- Size: 29.25x6″ with 0.75″ radius rounded corners
- White border of sign: 0.375″ on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: Color per SGV Greenway Network Tributary Color Book with 0.75″ radius rounded corners
- Margins within background: 1.625″ on top and bottom, and 1.625″ minimum on left and right

INSTALLATION

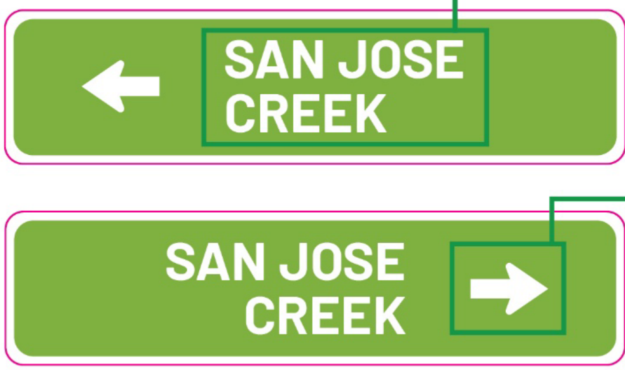
- Mounted above MUTCD route signs or stand alone within two miles of river access point

NOTES

- Arrow pointing right should appear on far right of sign, arrows point straight (up) and left should appear on the far left of sign, arrows pointing down should not be used
- Direction of MUTCD symbol travel should change to mimic direction of arrow
- The MUTCD symbol should be to the left of the destination name
- All directional environmental graphics should be retroreflective per MUTCD requirements
- Always confirm specifications with latest applicable guidelines
- MUTCD Pedestrian and Equestrian symbols are included in the template, allowing for this sign to be adaptable in creating a pedestrian sign, equestrian sign, or multi-use sign
- In the case where a longer title, like Puddingstone Channel, is to be used for Title 1, use a minimum text height of 1.25″ tall to ensure the title fits within the sign.

Figure 8-29. Directional panel sign can be mounted below or above another MUTCD sign within 2 miles of the nearest access point.

DIRECTIONAL - TRIBUTARY



TITLE 1

Text: River, Creek, or Wash Name
Font: Barlow - Bold, All Caps
Size: 1.5" high
Color: White
Position: 0.875" to top and bottom edge of colored background

DIRECTIONAL ARROW

Size: 2" width of arrow head, 3" long
Color: White
Position: 1.625" minimum to edge of colored background on all sides

SIGN SPECIFICATIONS

- Size: 24x6" with 0.75" radius rounded corners
- White border of sign: 0.375" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: Color per SGV Greenway Network Tributary Color Book with 0.75" radius rounded corners
- Margins within background: 1.625" on top and bottom, and 1.625" minimum on left and right

INSTALLATION

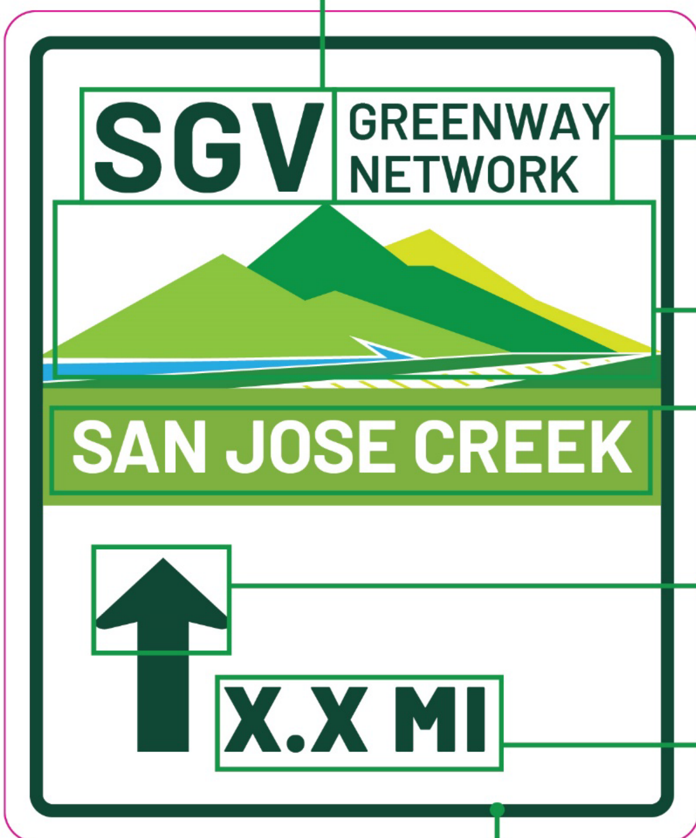
- Mounted above MUTCD Bike route signs within two miles of river access point

NOTES

- Arrow pointing right should appear on far right of sign, arrows point straight (up) and left should appear on the far left of sign, arrows pointing down should not be used
- Width of sign should match the width of the MUTCD Bike Route sign it is mounted above. Always confirm specifications with latest applicable guidelines
- MUTCD Pedestrian and Equestrian symbols are included in the template, allowing for this sign to be adaptable in creating a pedestrian sign, equestrian sign, or multi-use sign

Figure 8-30. This Directional Tributary panel can be mounted below or above another MUTCD sign within 2 miles of the nearest access point.

DIRECTIONAL WITH DISTANCE



TITLE 1

Text: SGV
Font: Barlow - Bold, All Caps
Size: 3.5″ high
Color: Pantone 34-35C
Position: Left aligned, 2″ from top and left green border

TITLE 2

Text: GREENWAY NETWORK
Font: Barlow - Regular, All Caps
Size: 1.375″ high
Color: Pantone 34-35C
Position: Left aligned, 1″ from Title 1, and 2″ below top green border

GREENWAY GRAPHIC

Size: 7.25″ x 23.75″
Position: Flush with bottom colored border

TITLE 3

Text: River, Creek, or Wash Name
Font: Barlow - Bold, All Caps
Size: 2″ high
Color: White
Position: Center aligned vertically and horizontally with colored border

DIRECTIONAL ARROW

Size: 5.25″ width of arrow head, length varies depending on direction pointing
Color: Pantone 34-35C
Position: 2″ from bottom of colored band, 2″ from left and bottom green border

DISTANCE

Font: Barlow - Black, All Caps
Size: 2.5″ high
Color: Pantone 34-35C
Position: Left aligned; 1.5″ from arrow tail on left, 2″ from bottom green border

GREEN BORDER

Size: 0.5″ width with 0.875″ radius rounded corners
Color: Pantone 34-35C

SIGN SPECIFICATIONS

• Size: 26.75x32″ with 1.25″ radius rounded corners
• White border of sign: 1″ on all sides
• Material: Aluminum with anti-graffiti treatment
• Background: White with 0.5″ green border with 1.25″ radius rounded corners
• Margins within background: 2″ on all sides

INSTALLATION

• Key locations leading up to la river access points from maximum two miles out to minimum 0.5 miles, includes distance
• Bottom of sign located between 48″ and 70″ off the ground

NOTES

• When grouping destination signs, maximum three destinations can be grouped per MUTCD standards (i.e., two destination panels can be below this large river directional sign)
• The order of signs located below must be arranged with straight (up) arrow on top, followed by destinations to the left, and then destinations to the right
• Always confirm specifications with latest applicable guidelines
• Arrows pointing down should not be used
• In the case where a longer title, like Puddingstone Channel, is to be used for Title 3, use a minimum text height of 1.5″ tall to ensure the title fits within the sign.

Figure 8-31. Large Directional signs provide direction and distance to the nearest SGV Greenway wash and serve as a visual marker.

DIRECTIONAL WITHOUT DISTANCE

TITLE 1

Text: SGV
Font: Barlow - Bold, All Caps
Size: 3.5" high
Color: Pantone 34-35C
Position: Left aligned, 2" from top and left green border

TITLE 2

Text: GREENWAY NETWORK
Font: Barlow - Regular, All Caps
Size: 1.375" high
Color: Pantone 34-35C
Position: Left aligned, 1" from Title 1, and 2" below top green border

GREENWAY GRAPHIC

Size: 7.25" x 23.75"
Position: Flush with bottom colored border

TITLE 3

Text: River, Creek, or Wash Name
Font: Barlow - Bold, All Caps
Size: 2" high
Color: White
Position: Center aligned vertically and horizontally with colored border

DIRECTIONAL ARROW

Size: 5.25" width of arrow head, length varies depending on direction pointing
Color: Pantone 34-35C
Position: Center aligned, 2" from bottom of colored band above, 2" from bottom green border

GREEN BORDER

Size: 0.5" width with 0.875" radius rounded corners
Color: Pantone 34-35C

SIGN SPECIFICATIONS

- Size: 26.75x32" with 1.25" radius rounded corners
- White border of sign: 1" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: White with 0.5" green border with 1.25" radius rounded corners
- Margins within background: 2" on all sides

INSTALLATION

- Key locations leading up to la river access points, maximum 0.5 miles out, does not include distance

NOTES

- Always confirm specifications with latest applicable guidelines
- Arrows pointing down should not be used
- In the case where a longer title, like Puddingstone Channel, is to be used for Title 3, use a minimum text height of 1.5" tall to ensure the title fits within the sign.

Figure 8-32. Larger Directional signs should be used within 0.5 miles from the nearest SGV Greenway creek. Mile numbers do not appear on signs within 0.5 miles of the destination.

DIRECTIONAL DESTINATION COMBINATION SIGN

GROUPING DIRECTIONAL SIGNS

When adding Directional Destination panels below Directional route signs, maximum destinations cannot exceed three

DESTINATION NAME

Font: Barlow - Bold, Title Case
Size: .625" minimum height of capital letter
Color: White
Position: Left aligned, 1.5" minimum margin on all sides from edge of green background

ESTIMATED TIME

Font: Barlow - Bold, All Caps
Size: 1" high
Color: White
Position: 1" minimum margin on all sides from edge of green background and MUTCD symbol

DIRECTIONAL ARROW

Size: 2" width of arrow head, 3" long
Color: White
Position: 1.5" minimum to edge of green background on all sides, 1" minimum from text

DISTANCE

Font: Barlow - Bold, All Caps
Size: 1" high
Color: White
Position: Left aligned with Destination Name, 1" from bottom of green background edge, 1.5" minimum from left of green background edge

MUTCD SYMBOL

Size: 1.25" high and width varies per symbol
Color: White
Position: 1" from bottom of green background, 15.5" from left edge of green background

Note: See template for more MUTCD symbols

SIGN SPECIFICATIONS

- Size: 26.75x20" with 0.875" radius rounded corners
- White border of sign: 0.5" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: Pantone 34-35C with 0.875" radius rounded corners
- Margins within background: 1.5" minimum on all sides

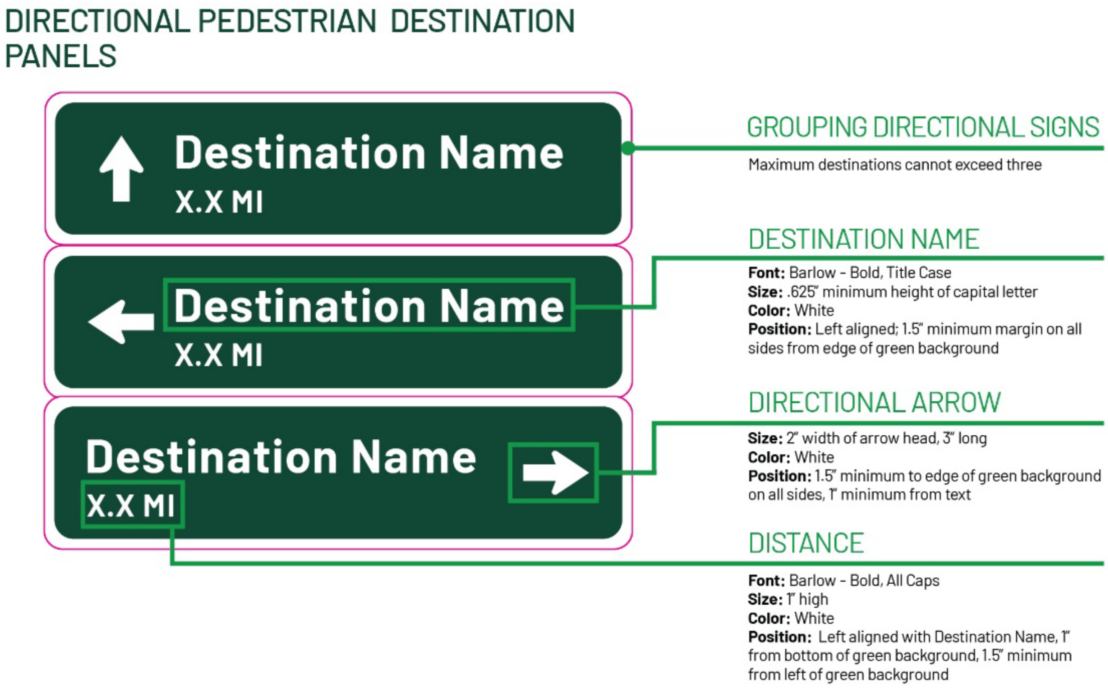
INSTALLATION

- Along route, maximum two miles from river
- Bottom of sign located between 48" and 70" off the ground

NOTES

- This single sign is a combination of the maximum three destinations allowed per MUTCD standards, as opposed to three separate signs panels
- The order of signs must be arranged with straight (up) arrow on top, followed by destinations to the left, and then destinations to the right
- Arrow pointing right should appear on far right of sign, arrows point straight (up) and left should appear on the far left of sign, arrows pointing down should not be used
- Direction of MUTCD symbol travel should change to mimic direction of arrow
- Can include logo to left of destination name (e.g., metro logo), height of logo or icon should not exceed height of capital letter in destination name
- Estimated bike travel time is based on an average six minutes per mile, pedestrian is based on an average of twenty minutes per mile, and equestrian is based on an average of fifteen minutes per mile
- All directional environmental graphics should be retroreflective per MUTCD requirements
- Always confirm specifications with latest applicable guidelines
- MUTCD Pedestrian and Equestrian symbols are included in the template, allowing for this sign to be adaptable in creating a pedestrian sign, equestrian sign, or multi-use sign.

Figure 8-33. This Directional destination combination sign allows for all three destinations to live on a singular sign.



SIGN SPECIFICATIONS

- Size: 26.75x7" with 0.875" radius rounded corners
- White border of sign: 0.5" on all sides
- Material: Aluminum with anti-graffiti treatment
- Background: Pantone 34-35C with 0.875" radius rounded corners
- Margins within background: 1.5" minimum on all side

INSTALLATION

- Key locations leading up to river access points from maximum two miles out to minimum 0.5 miles
- Bottom of sign located between 48" and 70" off the ground

NOTES

- When grouping destination signs, maximum three destinations can be grouped per MUTCD standards
- The order of signs must be arranged with straight (up) arrow on top, followed by destinations to the left, and then destinations to the right
- Arrow pointing right should appear on far right of sign, arrows point straight (up) and left should appear on the far left of sign, arrows pointing down should not be used
- Can include logo to left of destination name (e.g., metro logo), height of logo or icon should not exceed height of capital letter in destination name
- Always confirm specifications with latest applicable guidelines

Figure 8-34. Directional Destination sign panels direct users to major destinations and the distances to them. At a maximum, three should be stacked together per MUTCD guidelines.

8.8 Pavement Markings

In addition to the standard pavement markings for bike lanes and separation between use types, graphic markings should be used to assist in wayfinding for the off-street sections of the SGV Greenway Network. These include graphics to highlight mile markers, street crossings, and any distinctive features deemed appropriate by the project.

Pavement markings should follow the Tributary Color Book to develop a unique identity to each tributary.

8.8.1 Pavement Marking Types

Standard Striping

- All colors, line widths, patterns, symbols, and arrow markings for designated bikeways shall meet the general marking guidelines for roadway pavement markings, as described in previous document sections.
- For shared-use paths with two minimum width lanes, a solid yellow line may be used to separate locations where there is no passing and no traveling to the left of the marking.
- A broken yellow line may be used where passing is permitted. Broken lines on shared-use paths should have the usual 1-to-3 segment-to-gap ratio (3-foot segment with a 9-foot gap).
- A solid white line may be used to separate distinct types of shared-use path users.
- Smaller scale letters and symbols are appropriate for use on shared-use paths.

Other Graphics

- Mile markers should be placed along the greenway at 1-mile intervals
- Street Crossing Access
- Gateway Markers
- Confluence Markers

Figure 8-35. Example LA River pavement marking

8.8.2 Materials

Materials that minimize tripping or loss of traction to pedestrians, and bicyclists should be considered when choosing pavement markings. Two options are recommended:

Thermoplastic pavement markings use temperature-setting plastics that are heated to their melting point for use on asphalt paving. Due to the temperature-related expansion and contraction differentials between plastic and concrete (which can result in thermoplastic separation), thermoplastic is unsuitable for use on concrete paving.

Water-based paint, with glass beads to increase reflectivity, is the easiest, most inexpensive, and most used pavement marking material. It comes in standard and custom mixes to match the SGV Greenway Network tributary color book. Consult the project approval jurisdiction for material type and thickness requirements.

8.9 Installation & Maintenance

Project proponents will be responsible for sign installation and maintenance. Required maintenance consists of regular inspections for vandalism, cleaning and repair as necessary and periodic replacement. A UV coating on aluminum inhibits fading of sign colors, but aluminum signs likely will need replacement after five to ten years. Frequent vandalism may shorten the lifespan.

Sign Mounting

Where possible, signs should be mounted onto existing posts. For brand new sign installation for either new sign types or for completely new projects, these guidelines should be followed:

- Posts should be steel tube posts with finish matching RAL 9007
- The post cap should be made from welded aluminum with all edges and corners neatly finished.
- The sign should be mounted to bracket with tamper-proof bolts, lock washers, and nuts.
- Natural rock bases or podiums should be avoided due to maintenance concerns.

Vandalism

Much of the signage installed along the SGV Greenway Network will likely be vandalized at some point. Typical vandalism may consist of spray paint, etching or other destruction. Regular and diligent inspection of all signs is recommended weekly. At the time of inspection, if vandalism is found, it should be immediately repaired or cleaned.

Aluminum signs are to be manufactured with an anti-graffiti treatment. Anti-graffiti films and coatings must be specified to have a satin, non-glare finish for ADA compliance. The treatment allows spray paint to be cleaned off using commercial products that are applied directly to the sign to wipe off spray paint. Anti-graffiti coatings can be also used to add a clear, non-stick, protective coating to painted wood, aluminum, metal, masonry, bricks, concrete, and stone. This treatment can be used for large scale icon graphics such as murals.

Materials

The materials used for environmental graphics are very important for its consistency and performance once installed. Required materials for the signs in these guidelines are 0.080” thick aluminum with rounded corners and an anti-graffiti treatment. Anti-graffiti film provides a cleanable and clear layer on top of the graphics of a sign, and if damage is severe enough can be a layer that is removed entirely for ease of maintenance. High performance anti-graffiti coatings can also be used and protects a sign’s top surface allowing for easy cleaning and maintenance. Always confirm with the fabricator that graphics are protected for exterior environments, including UV protection to avoid fading. Best application of applied graphics using vinyl or direct print to be determined by fabricator.

A retroreflective substrate should only be used on all Directional signs per MUTCD requirements. Refer to latest MUTCD guidelines for the most current level of retro reflectivity requirements.

Section 9

Safe Crossing Design

By statute, all facilities intended primarily for bicyclists must conform to the Caltrans Highway Design Manual (HDM) and all signs, signals, and pavement markings must conform to the California Manual on Uniform Traffic Control Devices (CAMUTCD). If the facility also serves pedestrians, it must also conform to the requirements of the Americans with Disabilities Act.

Safe crossings are an essential greenway design element subject to the requirements and approval of the owner of the roadway being crossed, whether it be LA County, a city, the state, or a private entity. In addition, a California-licensed civil engineer must design a crossing that involves fixed works.

9.1 What's in This Section

This section describes recommended treatments where a greenway or bike path intersects with a street or highway.

Intersection Design

9.2 Uncontrolled Mid-Block Crossing

Where a new greenway or bike path intersects a highway at a midblock location, treatments for the bicycle crossing depend on:

- Motor vehicle speed and volume on the highway
- Angle of greenway alignment relative to the cross street
- Available ROW for installation of traffic control devices
- Ability to remove on-street parking or other sight obstructions
- Ability to alter access to adjacent residences or businesses
- Presence of bus stops
- Need to accommodate school-age pedestrians
- Relative position of the crossing to nearby intersections, and
- Receptiveness of the local agency to the use of specific traffic control strategies.

For example, at a low speed, lightly traveled street, a crosswalk marking with pedestrian warning sign might be sufficient. If the greenway consists of a pedestrian path separated from a bike path, dashed bike lane extension striping may be installed adjacent to the crosswalk, a feature sometimes known as a “crossbike.”

Depending on the site conditions of the crossing, additional features may be considered to make the crossing more conspicuous to approaching motorists, such as:

- A raised crosswalk, which is essentially a wide speed bump,
- Curb extensions on the side of the road, intended to reduce the width of the roadway,
- A median refuge island that provides two short crossings in lieu of one long crossing,
- Beacons to highlight the warning signs, such as rectangular rapid flashing beacons that would be activated by bicyclists or pedestrians,
- In-roadway lights lining the crosswalk markings that flash when activated by bicyclists or pedestrians

Figure 9-1 provides an example of a potential treatment for a midblock crossing of a four-lane road at right angles to the greenway, where the desired path needs to cross from one bank of a channel to the other over a bridge. This example has no curbside parking, no bus stops, and no adjacent access points for businesses or residences. With no vertical or horizontal curvature and no trees, sight distances are adequate. This crossing lacks the pedestrian and bicycle demand to meet the warrants for a signal or multi-way stop control.

For this hypothetical example, the roadway width on the bridge is sufficient to accommodate a striped median island and Class II bike lanes, and the local agency with jurisdiction over the crossing is receptive to the use of rectangular rapid flashing beacons to supplement crosswalk markings and warning signs at two closely spaced crosswalks. The actual treatment at any midblock crossing will require the approval of the owner of the roadway.

Figure 9-1. A hypothetical greenway midblock crossing treatment

Background Source: Google

Traffic signals in the form of either pedestrian hybrid beacons, also known as “HAWK signals,” or regular pedestrian midblock traffic signals may be considered where pedestrian demand is sufficient to meet the warrants contained in the California MUTCD under Section 4F for the HAWK or Section 4C for pedestrian midblock traffic signals. These warrants rely on existing pedestrian volumes exceeding a threshold, which would be difficult to meet for a new greenway with unproven demand. The threshold for a HAWK signal is lower than that of a pedestrian midblock signal, requiring 20 pedestrians per hour for one hour on an average day, whereas the hourly pedestrian volume for a pedestrian midblock signal would need to be close to 100 per hour. Bicyclists are typically included in the pedestrian count.

Other factors such as motor vehicle volumes are part of the MUTCD warrants. If pedestrian and bicycle demand on a new greenway at a crossing are expected to fail to meet the warrants for a signal, the crossing should be designed using the non-signalized treatments mentioned above. A signalized crossing may be provided at a later date when pedestrian and bicyclist demand increases.

9.3 Crossing of an Uncontrolled Approach Adjacent to an Intersection

Where a new greenway or bike path running parallel to a minor street crosses a busier street, and the minor street is controlled by a stop sign while the busier street is uncontrolled, possible crossing treatments could be similar to those mentioned for the uncontrolled mid-block crossing described above. In addition, the possible conversion to a multi-way stop control, should be considered if the California MUTCD's warrants are met. With multi-way stop control, stop signs would be posted facing all approaches to the intersection. The MUTCD's pedestrian volume thresholds in the warrants for multi-way stop control are difficult to meet, especially for a new greenway with no proven demand. However, other factors such as sight distance and reported crashes could be used to justify multi-way stop control.

Figure 9-2 depicts a greenway crossing adjacent to an intersection where the major street is uncontrolled. In addition to a marked crosswalk, crossing treatments such as push button-activated flashing beacons, a regular traffic signal, a HAWK, or multi-way stop control could be installed if they conform to the standards contained in the California MUTCD.

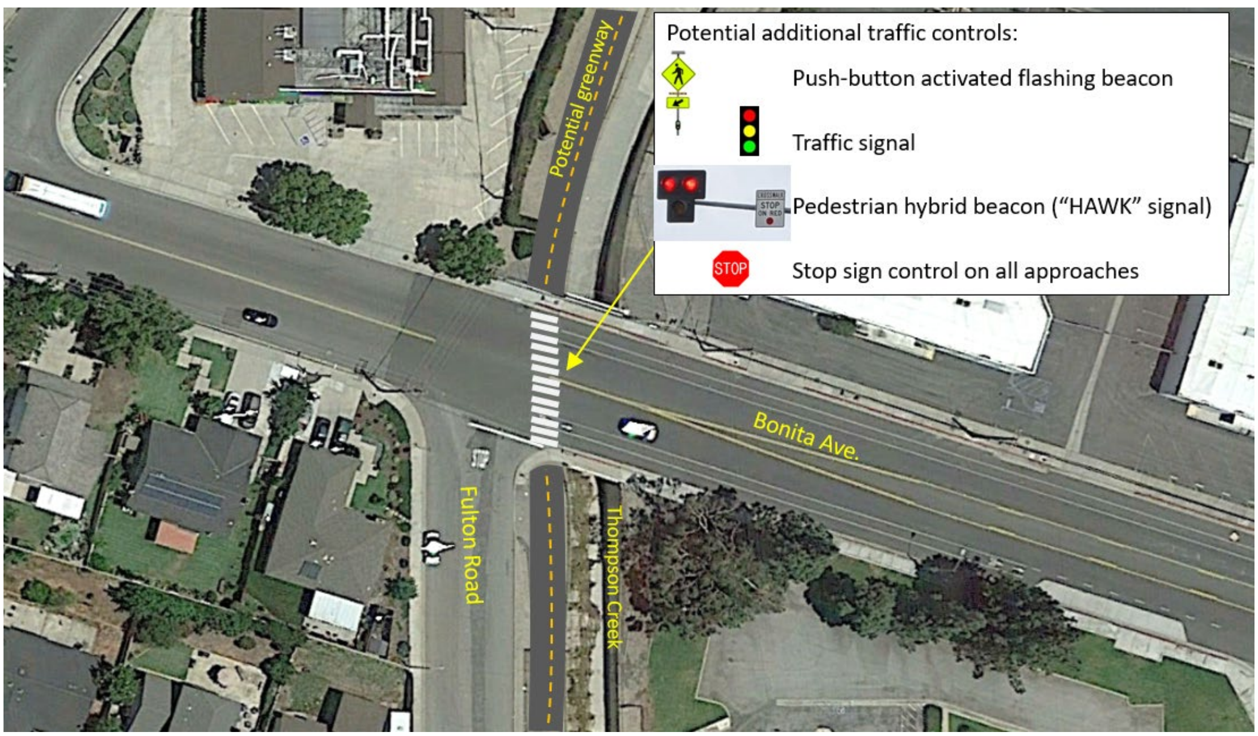


Figure 9-2. Potential greenway crossing treatments adjacent to an intersection

Background Source: Google

9.4 Crossing at a Signalized Intersection

The following describes the approach to designing crossings at signalized intersections that include one or two approaches.

9.4.1 One-Approach Crossing

Where a new greenway needs to cross one of the approaches at a signalized intersection, pedestrian and bicyclist crossings could be controlled by the pedestrian signal phase at the intersection. If a pedestrian signal phase is unavailable at the desired crossing point, and installation of a crosswalk is physically feasible, the signal phasing sequence could be modified for the intersection to provide a new pedestrian signal phase. Because the alignment of flood control channels in the SGV rarely run parallel and directly adjacent to major roadways, the potential for a greenway to cross a single approach of a signalized intersection is low.

9.4.2 Two-Approach Crossings

Where a new greenway needs to cross two approaches at a signalized intersection, such as where the greenway alignment runs diagonal to the street network grid, consideration may be given to installation of a "scramble" crossing where all vehicle traffic is held by red lights and pedestrians may cross in any direction, including diagonally. While a scramble phase may be beneficial for pedestrians wishing to cross an intersection diagonally, the additional signal phase would impose increased delay for all other users. It should be noted that currently the MUTCD disallows bicyclists from proceeding during an all-pedestrian scramble phase. A scramble crossing should be implemented only after determining whether pedestrian demand in the diagonal direction is sufficiently high to override the delays imposed to other users such as bicyclists, transit riders, motorists, or pedestrians wishing to cross only one leg of the intersection.

Where an on-street bikeway facility such as Class II bike lanes or Class IV separated bikeway meets a signalized intersection, the typical solution is to drop the bike lanes as they approach the intersection to allow mixing of turn movements between bicyclists and motorists. The exception would be cases where such a mixing is unlikely, such as the intersection of one-way streets, in which case the bike lane could be installed up to the limit line of the intersection. Where left turn demand for bicyclists needs to be accommodated, a two-stage turn box could be provided so that a bicyclist may proceed straight across one approach of an intersection and pause in a turn box before proceeding when the signal turns green for the cross street.

The treatment of a crossing of two approaches to a signalized intersection will require an understanding of the specific conditions of the site. Figure 9-3 shows a hypothetical treatment at a diagonal crossing of a signalized intersection. The suggested treatment is a "protected intersection" in which the intersection corners are modified to have bike lanes separate from pedestrian routes. This treatment serves all possible movements for bicyclists: not just the two movements from one greenway segment to the other, but the twenty-eight other possible turning movements involving bicyclists coming from or headed down the intersecting roadways.

Some factors considered for this particular location include:

- Availability of public ROW next to a residence on one of the corners
- City-owned property on another corner
- High school nearby
- Two transit bus stops
- Cul-de-sac residential street along the channel

- Need to accommodate heavy traffic movements destined for a freeway interchange
- Very wide County-owned property next to one segment of the flood control channel, and
- Potential realignment of an existing developed greenway on the other segment.

Another feature used is a midblock crossing treatment that includes a jug-handle cutout into a sidewalk to serve left turning bicyclists. Implementation of this hypothetical treatment will depend on ROW becoming available, the public's acceptance of loss of traffic capacity for motor vehicles, and the approval of the design by a city, LA County, or state, depending on roadway jurisdiction.

Figure 9-3. Hypothetical greenway crossing treatment near a signalized intersection

Background Source: Google

Additional information related to greenway intersections and safe crossings is provided in the SGV Greenway Network Plan, Sections 5 and 6, and Appendix F – Attachment C. Attachment C in Appendix F includes guidance developed for 121 potential greenway crossings including driveways, local streets, roads, freeways, and railroad spurs and tracks. Developing efficient and safe crossings are essential to creating a desirable and continuous greenway system. Information provided on the 121 example crossings can be used to help design safe crossings at other SGV tributary intersections. The flood control channels cross the street and railroad networks at unpredictable angles, so a detail design by a qualified CA professional engineer is needed for each crossing.

Section 10

Architectural and Safety Elements

Architectural elements are essential parts of the character and function of SGV greenways that will define the user experience. They also contribute to user's sense of safety and can help deter crime and vandalism. This section will document the minimum requirements for architectural and safety elements, expectations for SGV greenway projects, and enhancement opportunities for communities to consider.

10.1 What's in This Section

This section presents details on key architectural and safety elements that may be included in greenway projects:

Architectural and Safety Elements

Most of these primary elements have been organized into the following sub-sections:

- **Existing Regulations and Conditions**
  - Outlines existing regulations that must be followed at a minimum. In some cases, existing conditions are shown to illustrate how these elements currently exist throughout the project area.
- **SGV Greenway Network Standard**
  - Suggests standard elements or designs that will bring harmony and a consistent look and feel to the SGV Greenway Network.
- **Community Character Opportunities**
  - The SGV is a large and diverse area. Applying one design approach to the project area would not reflect the rich character of these places. In this section, suggestions are given for how each design element might be customized to the different needs and identity of the surrounding community, while still maintaining function, safety, and a consistent SGV Greenway Network identity.
- **Design Precedents**
  - Examples of architectural elements that meet or exceed existing standards.

10.2 Fencing

A fence is defined as a barrier at least 5 ft high that separates any public space and the LA County watercourse channel. Please note Guardrails, Railings, and Privacy Screen guidelines are defined in sections 10.3 and 10.4.

10.2.1 Existing Regulations and Conditions

Most existing fencing within the SGV Greenway Network area consists of 5 ft chain-link barriers that ensure public safety and restrict access to the waterways and maintenance areas as shown on Figures 10-1 and 10-2.

Figure 10-1. Existing fencing along Rio Verde

Figure 10-2. Existing chain-link fence along Sawpit Wash/Rio Hondo

As the SGV Greenway Network expands, the form and function of fencing in public areas should be re-evaluated, while maintaining its primary function of protecting public safety.

10.2.2 SGV Greenway Network Standard

Fencing is most critical and required in areas adjacent to a vertical drop or steep slope, such as along the watershed channel wall. The minimum requirement for fencing along the Channel Wall is at least 5 ft high, however it is strongly recommended to use 6 ft high welded wire fencing, also known as Omega Style Fencing. In most cases 6ft is used for multi-use projects. Please note the minimum requirement for fencing along a residential home and the access road is 8 ft and is also recommended to use Omega Style Fencing.

All fencing separating the greenway from the watercourse should:

- Allow greenway users to see the tributary and habitat.
- Add to the greenway's feel as an inviting space.
- Provide a physical barrier for public safety.
- Be of a sufficient gauge, materials, and coatings to deter damage and degradation.

Standard chain-link fencing is not attractive or durable, therefore usage should be minimized as much as possible. An example of desirable welded wire fencing is provided on Figure 10-3. This fencing is similar to what was used on the Puente Creek Bikeway project. Other desirable fencing types are shown on Figure 10-4.

Figure 10-3. Standard welded wire (Omega Style) fence located between the residential property and the proposed greenway

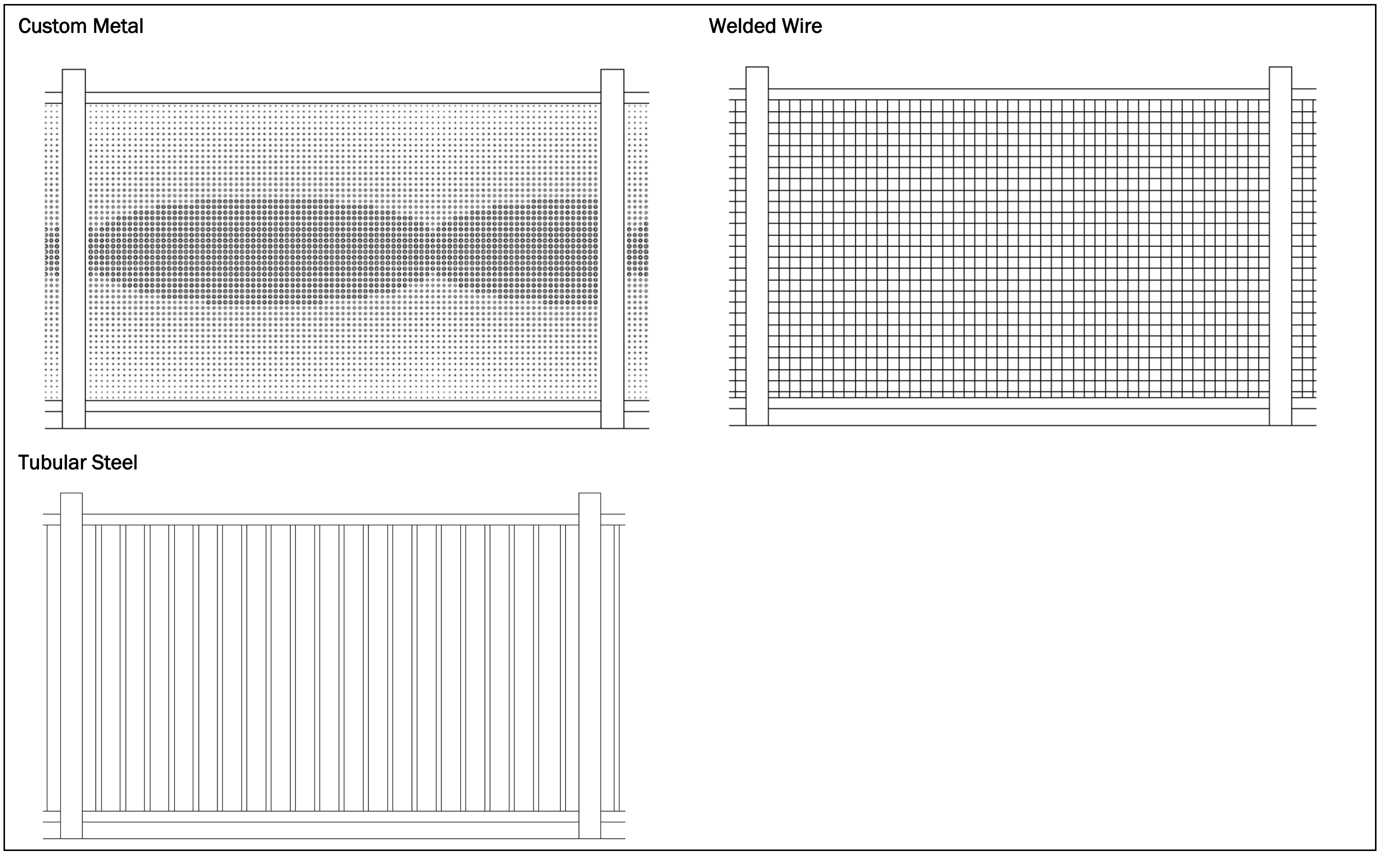


Figure 10-4 Other standard fence typologies

10.2.3 Community Character Opportunities

The appearance of the SGV Greenway Network could be enhanced by integrating public art into the fencing installed along the greenway that reflects community character and enhances overall aesthetics. Fences should incorporate designs that feel inviting, and that allow users to see the waterway and potential habitat.

10.2.4 Design Precedents

Examples of fencing used to enhance the appearance of public spaces are provided on Figures 10-5 through 10-7.

Figure 10-5. Botanical garden decorative fencing (Brooklyn, N.Y.)

Figure 10-6. Decorated chain-link fencing

Figure 10-7. Undulating fence along LA River path

Fenceless Conditions

In some cases where a vertical drop does not exist, and other safety considerations are satisfied (e.g., wide shoulder, mild side slopes, etc.), a fence between the public space and the watercourse channel may not be required, as shown on Figures 10-8 and 10-9. Because of the potential safety issues, a physical barrier such as railing at the top of a sloped channel is still highly recommended (see Figure 10-11). Note that during and after storm events, the channel water level can rise several feet, even deeper than 10 ft which could cause a substantial safety hazard.

Figure 10-8. Fenceless condition along Rio Hondo bike path

Figure 10-9. Fenceless condition along San Jose Creek path

10.3 Guardrails/Railings/Barriers

Guardrails and railings are useful tools for improving safety and separating uses throughout the greenway when necessary. Guardrails are a barrier at least 42-inches high near the open sides of the elevated surfaces that minimizes the possibility of a fall. Guardrails should follow the latest code and ADA requirements (such as restrictions on openings).

A railing is a barrier that separates multi-use greenway uses or provides a visual separation but is not required by code. When there is a separate equestrian trail, a barrier should be used whenever possible to add to the visual delineation of space and improve safety. When a barrier is used, it is important to make sure a level of permeability exists or there are breaks at regular intervals that users can move from one side to the other easily.

10.3.1 Existing Regulations and Conditions

Many considerations and guidelines for equestrian trails can be found in the LA County Trails Manual including standards for equestrian fencing/barrier (County of Los Angeles, 2011). Typical for equestrian fencing is a wooden triple rail fence; second and third rails prevent ponies from ducking under fencing. A wooden post and boulder barrier is shown on Figure 10-10. Railings are also used when a greenway is adjacent to a sloped condition to prevent falls onto the channel slope as shown on Figure 10-11.

Figure 10-10. Minimal wooden post and boulder barrier between equestrian trail and bikeway path in Duarte

Figure 10-11. Railing along LA River bike path

10.3.2 SGV Greenway Network Standard

Guardrails and barriers should be implemented when necessary to increase the overall safety of greenway facilities, but designers should be mindful not to restrict movement and access for users and wildlife into safe spaces. An example of a three-rail barrier is shown on Figure 10-12.

Figure 10-12. Three rail barrier along **Santa Ana River greenway**

10.3.3 Community Character Opportunities

Guardrails and barriers are a minimal design element used for safety, however there may be opportunities to specify elements that reflect character and the overall design of each greenway. For instance, more rural communities may prefer the look and feel of a wooden barrier, while others may prefer something more modern. However, wooden structures come with increased maintenance cost and should only be used when able to be well maintained and in good repair. Figure 10-13 shows a low gabion wall used for seating and as barrier between greenway users. A decorative wire railing at a greenway gateway park is provided on Figure 10-14.

Figure 10-13. Low gabion wall barrier and seating

Figure 10-14. Wire railing at LA River Greenway gateway park

10.4 Privacy Screens

Given that many channels in the project area abut residential areas, screening should be considered on all greenway projects to create separation between private property and the greenway. Adding screening along the property line can be an opportunity to give the greenway a cohesive feel, add character, landscaping, public art, as well as increase privacy. Masonry walls are recommended in areas adjacent to high-security land use. Materials such as plastic slats, tarps, or fabrics deteriorate quickly and should be avoided. Any landscaping on or along privacy screens should be outside the channel 17-ft. Limited Landscape Zone, be well maintained, and not interfere with regular inspections or maintenance of the fencing. Vegetation should not be grown on channel ROW fencing.

10.4.1 Existing Regulations and Conditions

Along a sizable portion, if not the entirety, of the SGV Greenway Network, the District maintains a 5ft chain-link fence along all property lines, separating private property from the ROW. This is to maintain basic public safety and restrict access to potentially dangerous channels.

As seen on Figure 10-15, homeowners often add their own privacy fence along their property line–to their own visual taste, creating a hodgepodge of fence conditions that can be seen behind the transparency of the existing chain-link fence. Screening can help that inconsistency as well as provide additional privacy for the adjacent property. Any screening proposed would be in addition to, or in replacement of the chain-link fence barrier.

Figure 10-15. Privacy fencing in front of residential fencing along San Jose Creek

10.4.2 SGV Greenway Network Standard

When planted buffers are not a viable option, privacy screens should be implemented when necessary to enable lack of disturbance or interference in residential areas that may benefit from having them.

10.4.3 Community Character Opportunities

Unlike more typical fencing, privacy screens should avoid integrating public art or other inviting visual expressions to deter lingering activity. Privacy screens should incorporate designs that feel subdued, but that also allow passersby to appreciate their material expression. Chain-link fencing should be avoided as much as possible. Tall landscaping can be used as a privacy screen but should carefully follow landscaping guidelines and maintenance protocols. Where planting areas are too small, vines can sometimes be used to cover fencing using vine pockets.

10.4.4 Design Precedents

Privacy screen examples are shown on Figures 10-16 to 10-18. Figure 10-19 provides a vine trellis design detail from the Eaton Canyon Early Implementation Project.

Figure 10-16. Landscaped wall with residential fence along Ballona Creek path

Figure 10-17. LA River Bike Path in Frogtown with trees and masonry wall

Figure 10-18. Bike Path in Lancaster, CA with landscaping and fencing

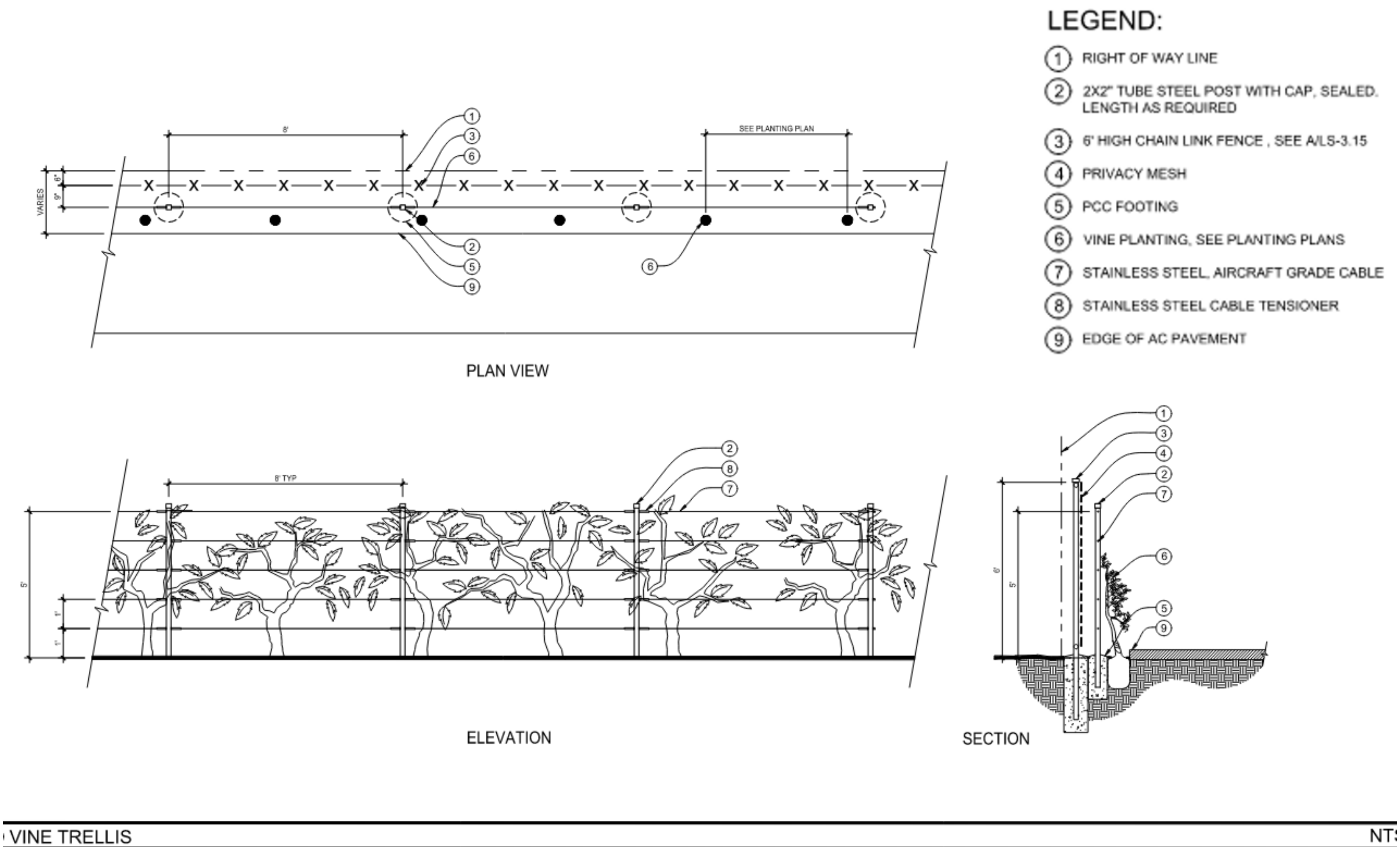


Figure 10-19. Vine trellis detail from Eaton Canyon Early Implementation Project

Source: LA County Public Works

10.5 Gates

Gates play an important role in public safety as well as the programming and operation of Greenways. Gates may need to be closed then re-opened during flood events and in some instances restrict access during evening hours. Gates should have the ability to close and lock, safely preventing any access to the greenway in case of closures due to flood events or maintenance. In addition to gates at the ends of greenway segments (at street crossings), gates may be needed for channel access for maintenance along the greenway. These will be indicated during the LA County Public Works permit review process.

Careful consideration should be given to the operation and maintenance of gates, ensuring resources are allocated and appropriate agreements are made for them to be opened and closed in a timely and consistent manner. In some cases, it may be possible to use automated gates.

10.5.1 Existing Regulations and Conditions

As part of the current security measures maintained by District, many of the existing access points are controlled with a chain link gate. As shown on Figures 10-20 and 10-21, when vehicular access is possible, a double opening swing gate (12-ft minimum width) should be installed that can be locked with an additional pedestrian gate.

Figure 10-20. Existing double fence gate on San Jose Creek

Figure 10-21. Existing double fence gate in Duarte

10.5.2 SGV Greenway Network Standard

Gates located at visible entry points, such as gateways (pod or plaza) should have a large or eye-catching visual element that might include a combination of text and/or welcoming material and sculptural interest. A seamless connection to fencing on either side should also be maintained. At a minimum, it is suggested that gates are designed with the inclusion of a distinctive visual marker that demonstrates noticeable access to passersby.

10.5.3 Community Character Opportunities

Gates can also include public art and/or wayfinding signage that celebrate or identify connected spaces. A nuanced characterization of gates has the potential to bring added value in distinguishing key areas throughout the SGV Greenway Network.

10.5.4 Design Precedents

Examples of desirable and artistic gates/entry points are provided on Figures 10-22 through 10-24.

Figure 10-22. Maywood River Park gate

Figure 10-23. LA River Greenway Park gate

Figure 10-24. Gate at Marsh Park on the LA River

10.6 Lighting

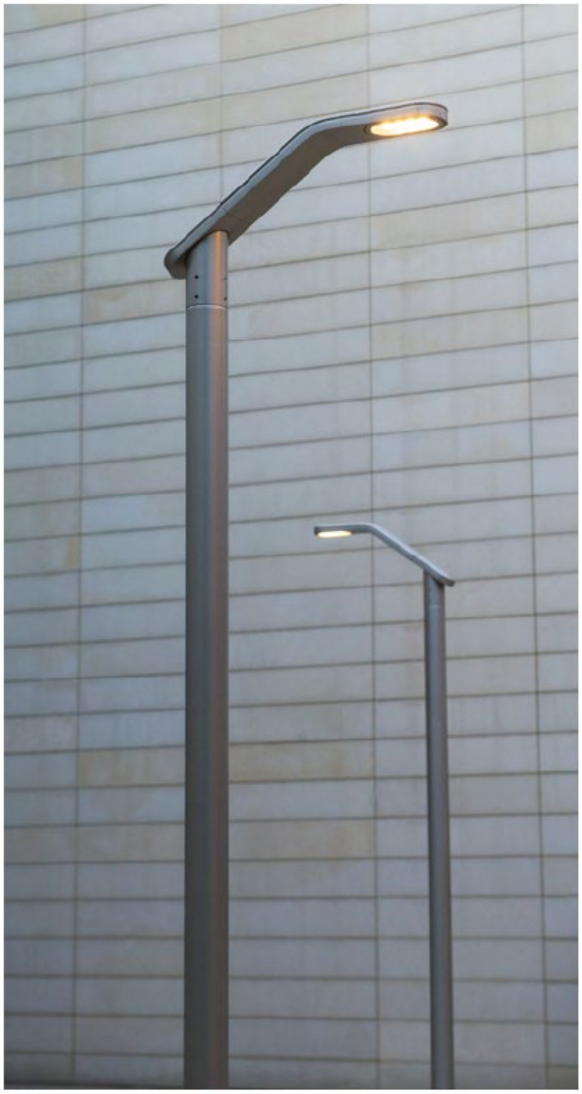
Lighting plays an important role in keeping greenways safe and accessible for all. Adjacent parks, gathering spaces, undercrossings, overcrossings, wayfinding signage, call boxes, and other important amenities require attention to lighting with regards to safety and visibility. All greenway and adjacent project area lighting shall be sensitive to the greenway's users, and area's residents and habitat. Professional discretion should be used especially in areas of significant ecological value. Lighting technology is constantly evolving, and fixtures used throughout the SGV Greenway Network should strive to be energy efficient as well as incorporate design that is cohesive.

10.6.1 Existing Regulations and Conditions

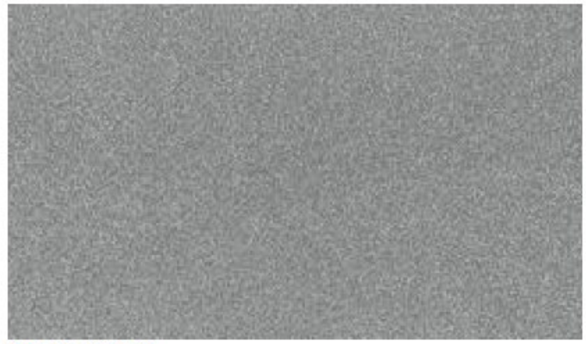
Example greenway lighting examples are shown on Figures 10-25 to 10-27.

Figure 10-25. Light post along Donald & Berenice Watson Recreation Trail–Duarte

Figure 10-26 Existing light fixture along LA River path



EXAMPLE LUMINAIRE



RAL 9007 GREY

EXAMPLE LUMINAIRE

Figure 10-27 Example lighting fixtures and color from the LA River Master Plan

10.6.2 SGV Greenway Network Standard

Maintaining consistency in lighting design approach throughout the SGV Greenway Network is imperative. Light factors such as color temperature should lower incrementally when transitioning from street lighting to sensitive habitat areas that are not lit as shown on Figure 10-28. It is highly suggested to limit the number of light fixtures, generally reduce color temperature, and eliminate light spillover as projects develop.

Provide fixtures and controls capable of shutting off lighting on a timer, such as when a park is closed, to limit the duration of lighting to the absolute minimum period possible.

Aesthetics

- Select fixtures that have a modern, urban aesthetic free of extraneous decorative elements.
- Acorn light fixtures and light masts are prohibited.

- Integrate lighting into architecture where possible rather than having standalone fixtures.
- Finish for luminaries and pole must be available in a neutral solid metallic gray color matching RAL 9007 or comparable equal.

Light Quality and Locations

- Complete lighting study to determine appropriate light levels and fixture types, locations, and heights.
- Install lighting at over/underpasses, intersections, and trailheads for safety.
- Ensure lighting is consistent for all project areas and will not be blocked by growing trees/shrubs and any other obstructions.
- Use light-emitting diode (LED) or more efficient light source.
- Use Dark Sky compliant and BUG rated (backlight, up-light, glare) fixtures. These ratings should be as efficient as possible and eliminate spillover lighting. Fixtures should meet these requirements without adding additional shielding.
- Use downlighting and yellow-spectrum lighting to minimize overall impacts on people, wildlife, and the night sky.
- Provide fixtures that have Illuminating Engineering Society files for illumination measured in lumens (bulb strength depending on pole height) and footcandles (light falling on a surface determined by lighting designer).
- Engineer poles and footings to withstand all project loads, including but not limited to, wind loads.
- Luminaire housing to be IP66 suitable for damp locations.

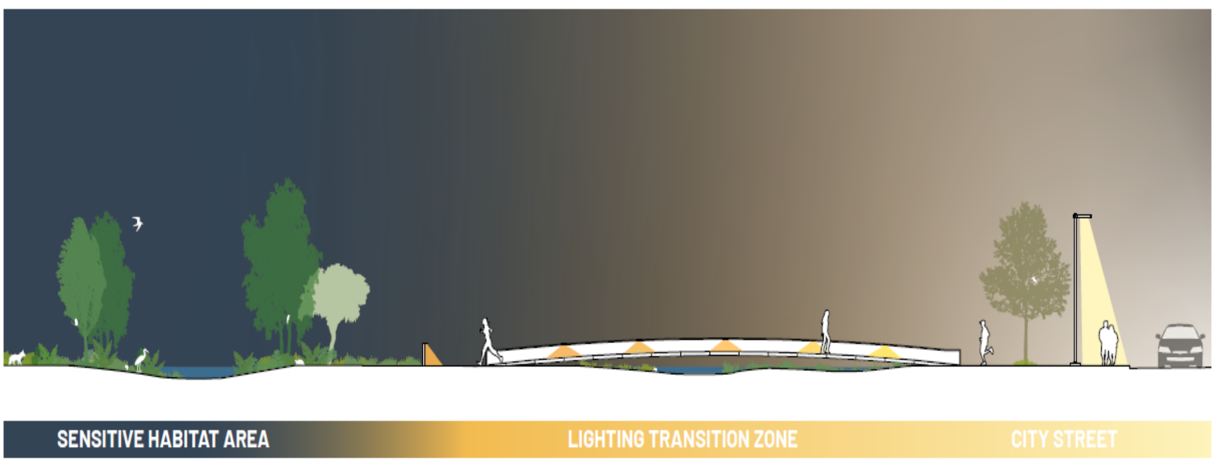


Figure 10-28. Illustration of typical lighting transition near sensitive habitat

Installation, Assembly, and Manufacturer

- Require UL listed products.
- Require manufacturers with an established history of light fixture production.
- Snap together assembly or comparable system for ease of installation.
- Use fixtures that can host other uses including emergency call boxes, banners, and signs.
- Use products supported with complete engineering drawings and patents.

Energy Use and Maintenance

- Use solar powered light fixtures.
- Use fixtures made with recycled content as much as possible.
- Ensure fixtures have LED cartridges that are easily replaced.

Additional Guidance for Wildlife and Habitat Areas

- Use only what fixtures are needed, and the warmest color temperature possible to provide safety and egress.
- Do not over-light or make lights unnecessarily bright.
- Provide fixtures and controls capable of dimming or shutting off lighting when occupancy loads are low (example: dimmable driver and occupancy sensor).
- Color rendering should be at least 80 CRI.
- Avoid light bollards where possible.
- Use as few fixtures as possible. Fixtures should be low-level lighting. Avoid tall poles where possible.
- Use the warmest color temperature possible, no more than 2200K as a maximum. Consider other measures that impact wildlife when selecting an appropriate fixture, such as the light spectrum emitted.
- Transition to a warm color temperature in gradual steps if moving from a street or path of egress to a habitat area.
- Provide fixtures and controls capable of shutting off lighting on a timer, such as when a park is closed, to limit the duration of lighting to the absolute minimum period possible.
- No CRI level is required. Light should be as amber as possible.
- Sample fixtures that may meet requirements include Landscape Forms RAMA, Landscape Forms Torres, and Hess Linea. BEGA also carries low-level lighting fixtures that may meet requirements for lighting wildlife habitat areas.

10.6.3 Community Character Opportunities

In addition to the guidelines above, there may be opportunities for lighting to reflect community character and contribute to an overall cohesive sense of place. Lighting can also be used in creative ways to highlight iconic features, landscaping, or to make spaces more inviting as shown on Figures 10-29 and 10-30.

Figure 10-29. Light terraces with an urban feel

Figure 10-30. (left) Low lighting with natural features (right) lighting in a planted area

Solar powered lights should be used to reduce energy consumption as shown on Figures 10-31 and 10-32.

Figure 10-31. Solar lighting fixture on LA River bike path

Figure 10-32. Solar lighting fixture on Whittier greenway

10.7 Seating

Seating along the SGV Greenway Network provides a sense of respite along paths, trails, green spaces, and other facilities, along with the added benefit of becoming a moment to pause and connect with the immediate surroundings.

10.7.1 Existing Regulations and Conditions

Existing seating within the project area, particularly along bicycle and walking paths and trails, occurs in a variety of forms and styles. Benches are commonly used as a seating type and are typically sited alongside a form of shade cover, whether artificial or vegetative; see Figures 10-33 through 10-35.

Figure 10-33. Benches along Santa Anita Wash-Emerald Necklace

Figure 10-34. Benches along Donald & Berenice Watson Recreation Trail-Duarte

Figure 10-35. Benches along Rio Hondo–Emerald Necklace

10.7.2 SGV Greenway Network Standard

Aesthetics

It is imperative to correlate bench and seating design with an overall design approach. Seating elements are desirable locations for art and community expression but can also become a way to create synergy with a natural setting in certain contexts.

Typical Best Practices

- Ensure bench sitting surface is not bare metal. For metal supports or other elements, utilize satin or matte finish solid metallic gray matching RAL 9007 or comparable equal.
- Provide flexibility for various sitting options. Bench forms should prioritize users' comfort and provide optimal variability in use.
- Provide a variety of seating elements in addition to benches, such as seat walls, seat steps, and rock outcroppings.
- Incorporate group benches to promote gathering and social interaction.
- Seating areas at gateways should also consider shade structures to provide respite on hot days and shelter. Shade structures should always be outside of established clearance zones. For further guidance on vertical and horizontal clearances see section 4.5. Shade structures can in certain cases be fit with solar panels to provide power for charging phones or other uses.

Installation, Assembly, and Manufacturer

- Locate benches so that they are easily accessible from the greenway.
- Locate benches at greenway intersections and special views.
- Where freestanding benches are used, provide anchorages to adjacent pavement, and engineer appropriate footings.

Maintenance

Maintain benches, deter graffiti where possible, and inspect for other damages.

10.7.3 Community Character Opportunities

Benches may offer opportunities for integrating art and community expression. Benches and other features intended to be artistic elements are approved through the arts approval process and do not necessarily need to meet these guidelines. Examples are provided on Figures 10-36 through 10-40.

Figure 10-36. Swinging benches along 39th Avenue Greenway (Denver, Co.)

Figure 10-37. Bench along Emerald Necklace

Figure 10-38. Seating along Bloomingdale Trail-The 606 (Chicago, Ill.)

Figure 10-39. Seating at Quilapilún Botanic Garden (Colima, Chile)

Figure 10-40. Gabion seating along LA Riverfront Greenway

10.8 Bicycle Parking

Providing adequate and ample bike parking opportunities along the SGV Greenway Network should be included as a key element to the greenway design. The following guidelines follow standards and guidelines set forth in the following documents:

- Essentials of Bike Parking Revision 1.0, September 2015 by Association of Pedestrian and Bicycle Professionals
- California MUTCD
- AASHTO Guide for Development of Bicycle Facilities
- Caltrans Highway Design Manual (Chapter 1000)

10.8.1 SGV Greenway Network Standard

Bike Parking shall follow the following guidelines:

- **Configuration**
  - Provide racks that are individual loops
  - Support bikes that lack a diamond-shaped frame or have step-through frames.
  - Can lock the frame and wheel to the bike rack
- **Material**
  - Galvanized steel, stainless steel, or powder coat.
  - *Custom Option*—If a powder coat finish is used, the color shall match the color schemes by the water body outlined under signage.
  - Material must deter bending or cutting while accommodating typical-sized U-shaped bike locks—consider metal tube diameter of 2-inch maximum thickness

Installation

- Securely anchored with stainless steel hardware, in-ground or surface mounted.
- Locate short-term racks at gateways, and entrances to the SGV Greenway Network, adjacent destination locations, planned rest areas, and any transition areas from Class I Bikeways to natural surface trails
- Gateways near transit locations should provide both short-term and long-term parking.
- Provide racks in areas where the greenway terminates, or transitions to an on-street network.

Short-Term Parking

- Short-term bike parking facilities are single racks that facilitate locking the bicycle frame, and at least one wheel (for up to two bikes) to support and secure the bike without causing damage.
- Effective short-term bike parking depends primarily on its ease of use; the racks need to be visible, easily accessible, convenient to one's destination, intuitive to use and secure. If these needs are not met, other street furniture such as signage post will be used.
- Short-term parking can be placed along the SGV Greenway at locations such as
  - Access points and gateways
  - Rest areas and adjacent destinations
  - Transitions from a Class I Bikeway condition

10.8.2 Community Character Opportunities

Areas with bicycle parking along the SGV Greenway Network may offer opportunities for integrating art and community expression. Loop parking stalls can be intentionally curated as artistic elements so long as they meet standards for configuration, material, and installation. Alternatively, loop parking stalls can converge with artful expressions that occur on the ground plane, whether as a painted surface or other type of creative pavement scheme. An example is provided on Figure 10-41.

Figure 10-41. Tactical art with individual loop bike parking

10.8.3 Design Precedents

Figure 10-42 shows an example of individual loop bike parking that is both attractive and functional.

Figure 10-42. Sculpted individual loop bike parking

10.9 Equestrian Amenities

Horses play a significant role in many of the watershed's communities, and where feasible, equestrian trails and amenities should be incorporated into projects along the channel ROW. There are examples of well-used equestrian trails along waterways throughout SGV including along the Rio Hondo, San Gabriel River, and San Jose Creek, However, when constrained, the priority would be to provide pedestrian and bicycle connections over equestrian. Where appropriate, equestrian amenities can be incorporated in a multi-use greenway as defined by the California State Parks Trails Handbook. When the ROW is generous, equestrian amenities should be planned alongside, and in parallel to, other greenway alignments but as separately as practical.

10.9.1 Trail Barriers

The primary safety concern for shared use areas between cyclists and equestrians is the inherent behavioral characteristics of horses to be startled by the movement of cyclists. A secondary concern is pets on an adjacent pedestrian path. Safety concerns can be partially mitigated by posting speed limits, but barriers are recommended. Barriers can be a landscape area greater than 2 ft, or, when constrained, a physical barrier. Examples of equestrian trail barriers are provided on Figures 10-43 through 10-45. Information about landscaping is included in Section 10.10.

Figure 10-43. Equestrian trail barriers v1

Figure 10-44. Equestrian trail barriers v2

Figure 10-45. Equestrian trail barriers v3

10.9.2 Additional Amenities and Details

Providing water amenities such as a trough, big bowl, tub, or any method in which horses share sources of water, increases the potential for disease transmission. If the context calls for the incorporation of a water amenity, install faucets or hydrants, with all trail users bringing buckets or collapsible buckets for water. Figures 10-46 through 10-48 show examples of additional amenities.

Regardless of whether the trail is multi-use or dedicated, additional amenities should be planned for and include:

- Protocol signage. All multi-use greenways should have signage that identifies the ROW protocol. When different user groups share the same trail, bicyclists and hikers on a multi-use greenway must yield the ROW to equestrians; bicyclists yield to pedestrians.
- Hitching posts
- Shaded rest corrals
- Troughs
- Trail crossings and bridges
- Trailer parking

Figure 10-46. Equestrian trail street crossing

Figure 10-47. Native soil bridge crossing

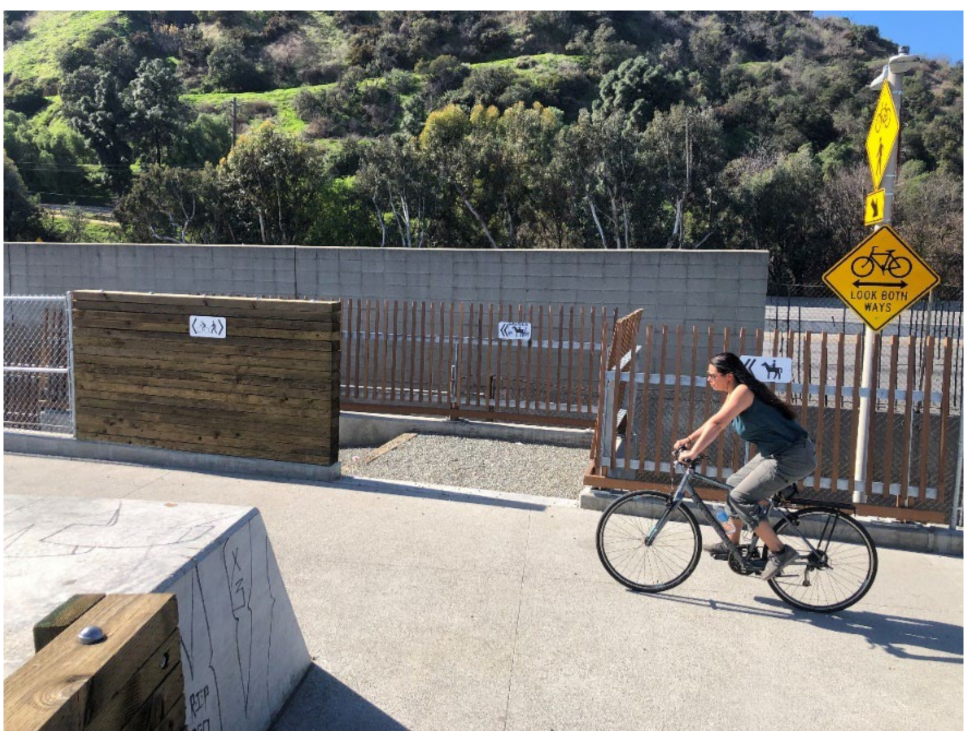


Figure 10-48. Equestrian/multi-use bridge crossing

10.10 Landscaping and Irrigation

The SGV's rivers and tributaries sit within one of the world's most diverse Mediterranean biodiversity hotspots. Supporting species richness and diversity has never been more important, and among the best ways projects can optimize habitat are the cultivation of healthy soil and locally native and drought tolerant plants that sustain regional wildlife. Given the importance of this geographic condition, guidelines for landscaping the SGV Greenway Network have the unique potential to increase urban biodiversity with the establishment of connectivity across and along the tributary network, utilizing a series of patches and habitat areas. The resilience of these native landscapes to changes in hydrology and climate should be critically considered and, where needed, planting palettes should be modified and adaptively managed.

The following presents the guidelines for the design and installation of planting along the SGV Greenway Network. This chapter will provide information regarding planting setbacks, buffers, and other planting aspects related to the creation of habitats and functioning ecosystems. Desired guideline elements may include:

- Planting along Levees and Flood Walls
- Maintenance Buffers and Clearances
- Rights-of-Way
- Safety Best Practices
- Stormwater BMPs
- Productive Landscapes
- Tree and Plant Protection
- Site Preparation and Soil
- Tree and Shrub Planting
- Maintenance Best Practices
- Walls
- Slope Stabilization and Management
- Wildfire
- Plant Communities
- Native Plant Species Appropriate Use

For an additional resource see the LA River Master Plan Design Guidelines. Greenway and adjacent amenities landscaping examples are provided on Figures 10-49 and 10-50.

Figure 10-49. Milton Street Park landscaping

Figure 10-50. Sunnynook Park landscaping

10.10.1 Setbacks and Buffers

While important to the overall goals of the SGV Greenway Network plan, planting along the SGV Greenway Network is affected by setback requirements dictated by the District/USACE and are necessary for flood control channel maintenance and emergency vehicle access. All new projects must comply with these requirements or seek a variance with the appropriate jurisdiction.

The primary setback requirement is the **Limited Landscape Management Zone** as shown on Figure 10-51. This zone is designated to extend up to 17 ft from the channel wall and prohibits any structures or obstructions, including trees, lighting, and benches within that setback. 12 ft of the zone is dedicated to a maintenance access road (i.e., bike path, multi-use trail etc.). Followed by 5 ft of planting (i.e., low shrubs) is allowed after the 12 ft access road, anything planted after the 17 ft can include structures such as benches, bike aid stations, shading etc. Please note anything planted within the Limited Landscape Management Zone must comply with the following:

- Any landscape within this zone is restricted to low-growing species and will not exceed 3-5 ft in height.
- Planting areas against the channel walls, may be considered if they are planted with low shrubs (18-inches or less), ground cover, and grasses (no trees or large woody shrubs). Further, these planting areas may be located between expansion joints but not directly behind one, at a minimum of 5 ft from an expansion joint.
- When planning vegetation along greenways note that within the up to 17 ft. wide Limited Landscape Management Zone the District clears vegetation to a height of at least 13 ft, and may clear to a height of 15 ft. along access roads, including greenways adjacent to channels used for maintenance access.

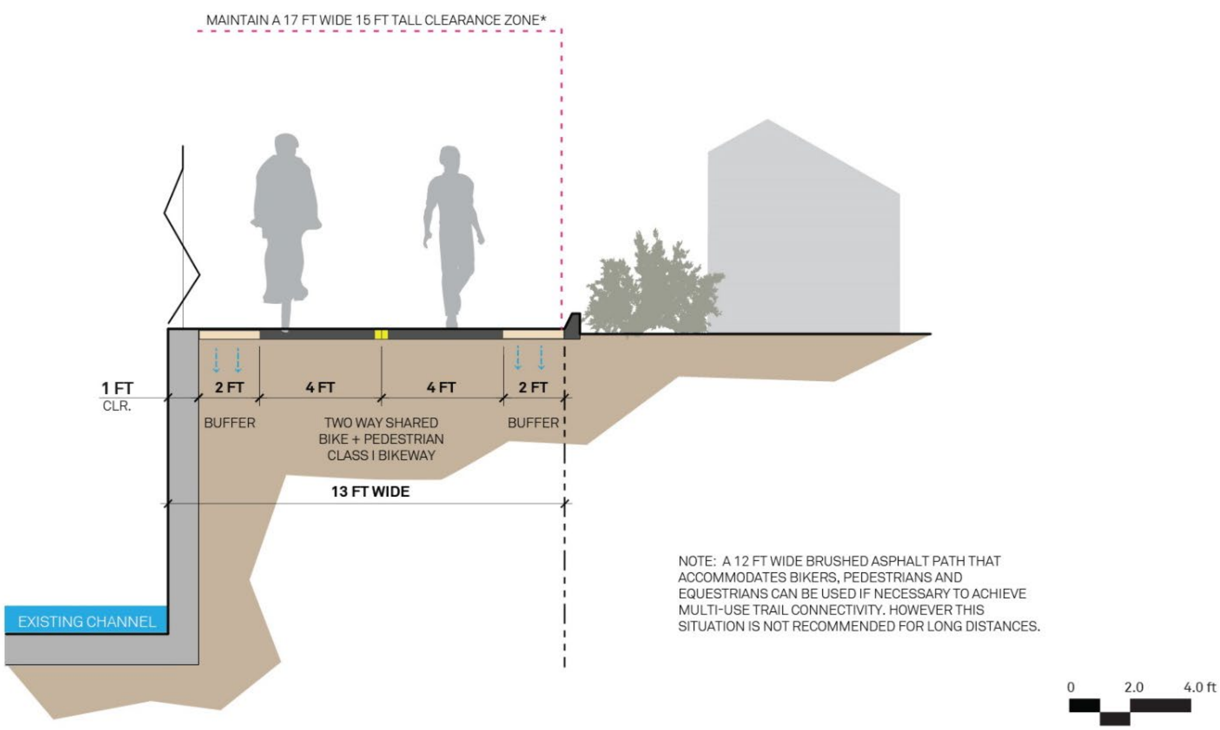


Figure 10-51. Example of the Limited Landscape Management Zone.

10.10.2 Planted Buffers

Planted buffers along the SGV Greenway Network provide comfort for pedestrians along the greenway, promote a unique sense of place, and provide an opportunity for the treatment of stormwater before it enters the creek/wash. Planting should follow the latest standards set forth by USACE's and FEMA Guidelines and Best Practices for Vegetation Management at Levees, Floodwalls, etc.

Wherever a neighborhood street drains directly into the creek/wash, new projects should aim to create bioswales or treatment basins to collect stormwater runoff. Furthermore, new greenways, especially those that are paved with impervious materials, should slope to drain away from the channel towards a bioswale or other BMP area.

Trees and shrubs above 5 ft tall should be set back a minimum of 5 ft from the edge of the pavement. This setback distance can be halved if a 24-inch root barrier is installed immediately next to the pavement, and if the limited landscape management zone clearance is met (see Section 10.10.1). See Figures 10-52 through 10-54 for examples of a planted buffer.

Figure 10-52. LA Riverfront planted buffer

10.10.3 SGV Greenway Network Standard

To ensure success in planting projects along the SGV Greenway Network, design considerations must include everything from site preparation, sourcing plant material, to maintenance post-installation. These guidelines highlight the top standards for projects along the greenway network:

- Plant species appropriate to the planning frame of the project.

- Provide successional development of plantings into communities of plants that are ultimately best suited to the conditions of their environment, including considerations for water conservation and potential to support local wildlife.
- Provide a continuous native tree and plant corridor along the greenway with linkages to riparian habitat (if applicable) and upland areas near the creek/wash.
- Support nurseries and organizations that specifically collect and propagate indigenous native plant species for planting along the greenway corridor.
- Achieve healthy soil biology, not just chemistry, by providing the critical foundation for each stage of succession that will ultimately host a sound ecological system.
- Eradicate invasive species and deter the use of non-native species that provide little or no habitat value.
- Encourage the use of permeable paving solutions where appropriate, filtration and percolation of rainwater, and on-site water retention/detention to mitigate/eliminate water pollution and to reduce runoff. Refer to section 11.3.1 for further guidance on permeable pavement.
- Consider the resilience of the SGV tributary system and the future effects of climate change in project planning and design.
- Ensure there is a maintenance plan for the installed landscape that is appropriate to the needs of the planted species.
- Provide opportunities for artwork through habitat creation and planting.

Figure 10-53. Plantings along Ballona Creek Path

Figure 10-54. Plantings along Walnut Creek Nature Park

10.10.4 Planting Strategies

The historical vegetation of the SGV's rivers and tributaries was a complex landscape of riparian and wash plant communities intermixed with sage scrub varieties. Washes are naturally composed of silt, sand, gravel, rocks, and boulders washed down from the mountains during floods and heavy rainfall. A typical wash plant community is made up of a wide variety of constantly changing vegetation. Over time, certain areas of a natural wash may not be touched by flooding, permitting undisturbed shrubs and trees to grow quite large, a condition that could influence a particular landscape design approach. The historic vegetation is difficult to install within the confines of the present ROW due to limited access to water, changes in soil biotic activity and organic matter and other alterations resulting from the development of the channel system. Project teams should keep in mind the species and communities that probably existed along project tributary reaches and determine whether or not those species can still thrive within the constraints now existing along the greenway ROW.

While restoration of historic plant communities is highly favored ecologically, a range of possible limitations exist in the form of site infrastructure, maintenance requirements, stormwater mitigation, and climate change. Prioritizing the self-sustainability of proposed planting areas along the greenway is of utmost importance and therefore other local native plant communities may be better suited based on future project goals and strategies.

Plantings are to be designed to include a range of native and drought tolerant plants with the intent of achieving similar levels of species diversity as occurs in natural landscapes. Successional planting strategies from shorter lived perennials to established shrubs should be considered in planting design and maintenance. The diversity of the landscape plantings is to provide a variety of benefits ranging from soil development, erosion control, and habitat value to educational benefit, native community ceremonies and harvesting, and other community involvement.

In order to enhance ecological health and achieve the richest wildlife habitat opportunities, designers should seek to achieve diverse vertical structure in their projects by including the full range of vegetative layers present in both the short list or the native community—from tree canopy where applicable, through mid-layer and understory species as enumerated on the lists. The arrangement of plants in plan should aim to mimic natural plant communities in terms of species type, quantity, and association to other species in the community. This helps to ensure compatibility and mutual support among the installed plant species. When designing habitats targeted for specific wildlife species, a qualified botanist or ecologist should be consulted.

Impacts from any prevailing insect and disease outbreaks, particularly those that target native trees, should be carefully considered with any proposed planting, and may influence species selection for a project. Overall, monocultures should be avoided, and a diversity of species encouraged. Maintenance and monitoring plans should establish practices for the surveillance and treatment of species threatened by any insect or disease outbreaks.

Suitable conditions for native plant communities may also be achieved by strategic grading and drainage patterns that guide vegetated and urban runoff into artificial “riparian/wash zones”. In areas with unrestricted soil depths, deep tillage of planting areas may be achieved by auguring the planting hole and breaking up hard subsoil layers. This strategy is strongly recommended for riparian tree species to provide a substrate through which developing tree roots can most readily reach the moisture they require for robust growth.

Planting Irrigation

The most common and broadly applicable strategy to ensure success of planting is the type and timing of supplemental irrigation during the three-year course of the establishment period. It is important to gradually wean plants off of irrigation to avoid shock related to stress from reduced water levels. Irrigation techniques should be applied to encourage deep rooting, such as allowing irrigation to run less frequently but for longer consecutive hours so that the soil can soak deeply. Match water application to soil type and root zone depth to reduce water run-off and loss of water below the active root zone of the target plant type. Projects should prioritize grouping of planting materials with compatible water requirements to avoid irrigation of different overlapping zones.

The following guidelines may be implemented in accordance with latest water use and code compliance, such as the LA County Low Impact Development Manual, LA County water sources, conservation standards, and the current California Green Building Standards Code to establish native plant materials using drip irrigation:

- Provide separate drip zones to plant materials with differing watering requirements, target root zone depths, and application.
- Irrigation to be applied to the entire dripline of mature trees and shrubs.
- Where possible, utilize irrigation approaches that allow for the phased expansion of the drip irrigation area as trees and shrubs mature.

Project requirements for proposed designs shall include strategies to integrate long-term maintenance and success, such as including automatic irrigation controllers to collect data that can generate reports for use during review of maintenance contractors. For more information regarding maintenance responsibilities, see Section 12.2 Operations & Maintenance Responsibilities.

10.10.5 SGV Greenway Network Plant Communities and Planting List

The SGV Greenway Network planting list in Table 10-1 was developed to give landscape designers a palette of appropriate and native species to use when developing projects in the SGV Greenway Network area. Adapted from the LA River Master Plan list as well as a list developed by biologist Bart

O'Brien, these plants can help build resiliency and habitat into landscape projects. Not all of these species will be readily available at nurseries but can be cultivated from seed or sapling in time.

While this planting list was developed with the importance of fostering native plant communities and habitat in mind, there may be specific instances where using a non-native yet "climate-adaptive" species may be appropriate.

Native Plant Species Appropriate Use

Within the SGV Greenway Network Channel right-of-way, the following criteria for species selection should be followed:

- **95% minimum (up to 100%)** of the total number of plants of the same pot size should be from SGV Greenway Network Native Plants table below. The 95% minimum will be considered on a case by basis where special conditions exists such as restrictions due to utilities, etc.
  - **It is preferred that a 10% minimum** of the total number of the SGV Greenway Network native plants of the same pot side should be locally sourced in the SGV Greenway Network Watersheds. Higher percentages should be achieved as local supply capacity increases. This is not required due to current nursery plant availability, but it should be pursued whenever possible.
- **5% maximum** of the total number of plants shall be from the Climate-Adaptive Species table below.

Within the SGV Greenway Network Channel access point gateways, the following criteria for species selection should be followed:

- **85% minimum (up to 100%)** of the total number of plants of the same pot size should be from SGV Greenway Network Native Plants table below. The 85% minimum will be considered on a case by basis where special conditions exists such as restrictions due to utilities, etc.
- **15% maximum** of the total number of plants shall be from the Climate-Adaptive Species table below.

LEGEND for Table 10-1:

- **Limited Landscape Management Zone:** These species would be appropriate for use within the Limited Landscape Management Zone (See Section 10.10.1)
- **Vine/Fence Screening:** These species would be appropriate to plant along fences to provide a privacy/screened condition (See Section 10.4.4)
- **North Slopes/Shade:** These species thrive in shaded/north slope conditions
- **Hot, Dry, Exposed Sites:** These species thrive in hot, dry, exposed conditions
- **Water Usage:** Estimated amount of irrigation needed
- **PLANT COMMUNITIES:**

AFSS	Alluvial
CH	Chaparral
CSS	Coastal Sage Scrub
CLOW	Coast Live Oak
CT	Climate Trees
DM	Dry Meadow
DS	Desert Scrub

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)

Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
SGV Greenway Network Native Plants									
Achillea millefolium	Yarrow	Groundcover	Evergreen	X		X		Low	CLOW, DM
Acourtia microcephala	Acourtia	Perennial	Deciduous	X		X		Low	AFSS, CH, CSS
Adenostoma fasciculatum	Chamise	Shrub	Evergreen				X	Very low	AFSS, CH
Amorpha californica var. *californica*	California False Indigo	Shrub	Deciduous	X		X		Low	CH, CLOW
Arctostaphylos glandulosa ssp. *glaucomollis***	Eastwood Manzanita	Shrub	Evergreen	X		X	X	Very low	CH
Arctostaphylos glauca	Big Berry Manzanita	Shrub	Evergreen			X	X	Very low	AFSS, CH
Artemisia californica	California Sagebrush	Shrub	Semi-evergreen	X			X	Very low	AFSS, CH, CLOW, CSS
Artemisia dracunculus	Tarragon	Perennial	Semi-evergreen	X				Low	AFSS, CH, CLOW, CSS
Artemisia ludoviciana	Silver Wormwood	Perennial	Semi-evergreen	X				Low	AFSS, CH, CSS
Asclepias fascicularis	Narrow-Leaf Milkweed	Perennial	Deciduous	X				Very low	CH, CSS
Baccharis pilularis var. *consanguinea*	Coyote Brush	Shrub	Evergreen	X				Low	CLOW, CSS, DM
Baccharis pilularis var. *pilularis*	Prostrate Coyote Brush	Groundcover	Evergreen	X				Low	CLOW, CSS
Bothriochloa barbinodis	Silver Beardgrass	Grass	Evergreen	X			X	Low	CH
Brickellia californica	California Bricklebush	Shrub	Evergreen	X		X		Very low	AFSS, CH, CLOW, CSS

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)

Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Calystegia macrostegia ssp. *arida*	Finger-Leaf Morning Glory	Vine	Evergreen		X		X	Low	AFSS
Calystegia macrostegia ssp. *intermedia*	Wild Morning Glory	Vine	Evergreen		X		X	Low	CSS
Carex alma	Sturdy Sedge	Groundcover	Evergreen	X		X		Moderate	CSS
Carex praegracilis	Slender Sedge	Groundcover	Evergreen	X		X		Moderate	CLOW, CSS
Ceanothus crassifolius	Hoary-Leaf Ceanothus	Shrub	Evergreen				X	Very low	AFSS, CH
Ceanothus leucodermis	Chaparral Whitethorn	Shrub	Evergreen			X		Very low	AFSS, CH, CLOW
Ceanothus oliganthus var. *oliganthus*	Hairy-Leaf Ceanothus	Shrub	Evergreen				X	Very low	CH, CLOW
Cercocarpus betuloides var. *betuloides*	Mountain Mahogany	Shrub	Evergreen				X	Very low	AFSS, CH
Clematis lasiantha	Chaparral Pipestems	Vine	Deciduous		X	X	X	Very low	CH, CLOW
Clematis ligusticifolia	Virgin's Bower	Vine	Deciduous		X	X		Low	AFSS, CH, CLOW, CSS
Clematis pauciflora	Ropevine	Vine	Deciduous		X			Very low	CH
Dendromecon rigida	Bush Poppy	Shrub	Evergreen				X	Very low	AFSS, CH, CSS
Dudleya lanceolata	Live Forever	Perennial	Evergreen	X		X	X	Very low	AFSS, CSS
Encelia californica	California Encelia	Shrub	Evergreen	X				Very low	AFSS, CSS
Epilobium canum ssp. *canum*	Hoary California Fuchsia	Shrub	Semi-evergreen	X		X	X	Very low	CH, CSS, DM

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)

Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Epilobium canum ssp. *latifolium*	Wideleaf California Fuchsia	Shrub	Semi-evergreen	X		X	X	Very low	CH, CLOW, CSS
Ericameria parishii var. *parishii*	Parish Goldenbush	Shrub	Evergreen				X	Low	AFSS, CH, CSS
Ericameria pinifolia	Pine-Bush	Shrub	Evergreen				X	Low	AFSS, CH, CLOW, CSS
Eriocoma coronata	Crested Needlegrass	Grass	Semi-evergreen				X	Low	AFSS, CH, CSS
Eriodictyon crassifolium	Thickleaf Yerba Santa	Shrub	Evergreen				X	Very low	AFSS, CSS
Eriodictyon trichocalyx var. *trichocalyx*	Yerba Santa	Shrub	Evergreen	X			X	Very low	AFSS
Eriogonum elongatum var. *elongatum*	Long-Stemmed Buckwheat	Perennial	Evergreen	X			X	Very low	AFSS, CH, CLOW, CSS
Eriogonum fasciculatum var. *fasciculatum*	California Buckwheat	Shrub	Evergreen	X			X	Very low	AFSS, CLOW, CSS
Eriogonum fasciculatum var. *foliolosum*	Leafy California Buckwheat	Shrub	Evergreen	X			X	Low	AFSS, CLOW, CSS, DS
Eriogonum fasciculatum var. *polifolium*	Interior California Buckwheat	Shrub	Evergreen	X			X	Low	AFSS, DS
Eriophyllum confertiflorum	Golden Yarrow	Shrub	Semi-evergreen	X			X	Very low	AFSS, CH, CLOW, CSS
Euthamia occidentalis	Western Goldenrod	Perennial	Semi-evergreen	X				Low	AFSS, CSS
Fraxinus dipetala	Chaparral Ash	Tree	Deciduous			X		Low	CH, CLOW
Fremontodendron californicum	Fremontia	Shrub	Evergreen				X	Very low	CH

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)

Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Garrya veatchii	Veatch Silktassle	Shrub	Evergreen			X		Very low	CH, CLOW
Gutierrezia californica	California Matchweed	Shrub	Evergreen	X			X	Very low	AFSS, CH, CSS
Hazardia squarrosa var. *grindelioides*	Saw-Toothed Goldenbush	Shrub	Evergreen	X			X	Low	AFSS, CH, CSS
Helianthus gracilentus	Slender Sunflower	Perennial	Deciduous	X			X	Moderate	AFSS, CH, CLOW, CSS
Hesperoyucca whipplei (*Yucca whipplei*)	Chaparral Yucca	Perennial	Evergreen				X	Very low	AFSS, CH, CLOW, CSS
Heteromeles arbutifolia var. *arbutifolia*	Toyon	Shrub	Evergreen			X		Very low	CH, CLOW, CSS
Juglans californica var. *californica***	California Black Walnut	Tree	Deciduous			X		Low	CH, CLOW
Juniperus californica	California Juniper	Tree	Coniferous				X	Very low	AFSS, CSS
Keckiella cordifolia	Heartleaf Penstemon	Shrub	Deciduous	X		X		Very low	CH, CLOW, CSS
Lathyrus vestitus var. *vestitus*	Chaparral Pea	Vine	Semi-evergreen		X	X		Low	AFSS, CH, CLOW, CSS
Lepidospartum squamatum	Scale-Broom	Shrub	Evergreen	X			X	Low	AFSS, CSS
Lessingia filaginifolia var. *filaginifolia*	California-Aster	Groundcover	Semi-evergreen	X		X	X	Low	AFSS, CH, CLOW, CSS
Leymus condensatus	Giant Ryegrass	Groundcover	Evergreen	X		X		Low	CH, CLOW, CSS
Lonicera subspicata var. *denudata*	Honeysuckle	Vine	Evergreen		X	X		Low	CH

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)									
Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Lotus scoparius	Deerweed	Shrub	Deciduous	X			X	Very low	AFSS, CH, CLOW, CSS, DM
Lupinus excubitus var. *hallii*	Hall's Grape Soda Lupine	Shrub	Evergreen	X				Low	AFSS, CH, CSS
Lupinus longifolius	Lupine	Perennial	Deciduous	X		X	X	Low	AFSS, CH, CSS
Malacothamnus fasciculatus	Bush Mallow	Shrub	Evergreen				X	Very low	AFSS, CSS
Malosma laurina	Laurel Sumac	Shrub	Evergreen				X	Very low	AFSS, CH, CLOW, CSS
Melica imperfecta	Coast Melic Grass	Grass	Semi-evergreen	X		X		Very low	AFSS, CH, CLOW, CSS
*Mimulus aurantiacus***	Bush Monkeyflower	Shrub	Evergreen	X		X	X	Very low	CH, CLOW, CSS
Mirabilis californica	Wishbone Bush	Perennial	Evergreen	X		X		Very low	AFSS, CSS
Muhlenbergia rigens	Deergrass	Grass	Evergreen	X				Low	CH, CLOW, DM
Nassella (*Stipa*) *cernua*	Nodding Needlegrass	Grass	Semi-evergreen	X			X	Very low	CH, CLOW
Nassella (*Stipa*) *lepida*	Foothill Needlegrass	Grass	Semi-evergreen	X			X	Very low	CH, CLOW, CSS
Nassella (*Stipa*) *pulchra*	Purple Needlegrass	Grass	Semi-evergreen	X			X	Very low	CH, CLOW
Opuntia littoralis	Coastal Prickly Pear	Perennial	Evergreen				X	Very low	AFSS
Opuntia parryi	Cane Cholla	Perennial	Evergreen				X	Very low	AFSS

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)									
Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Penstemon centrantifolius	Scarlet Bugler	Perennial	Evergreen	X			X	Low	AFSS, CH, CLOW, CSS
Penstemon heterophyllus var. *australis*	Southern Foothill Penstemon	Perennial	Evergreen	X			X	Low	CH, CLOW, DM
Penstemon spectabilis	Showy Penstemon	Perennial	Evergreen	X			X	Low	AFSS, CH, CLOW, CSS
Peritoma arborea	Bladderpod	Shrub	Evergreen	X			X	Very low	CLOW, CSS, DS
Pinus coulteri	Coulter Pine	Tree	Coniferous			X	X	Low	CH, CT
Platanus racemosa	California Sycamore	Tree	Deciduous					Moderate	AFSS
Potentilla glandulosa ssp. *glandulosa*	Sticky Cinquefoil	Perennial	Semi-evergreen	X		X		Low	AFSS. CH, CSS
Prunus ilicifolia ssp. *ilicifolia*	Hollyleaf Cherry	Shrub	Evergreen			X	X	Very low	AFSS, CH, CLOW, CSS
Pseudotsuga macrocarpa	Bigcone Douglas-Fir	Tree	Coniferous			X		Low	CH
Quercus agrifolia var. *agrifolia*	Coast Live Oak	Tree	Evergreen			X	X	Very low	AFSS, CLOW
Quercus durata var. *gabrielensis***	San Gabriel Leather Oak	Tree	Evergreen				X	Low	CH, CLOW, CSS
*Quercus engelmannii***	Engelmann Oak	Tree	Evergreen					Very low	CLOW
Rhamnus californica ssp. *californica*	California Coffeeberry	Shrub	Evergreen			X		Low	CH, CLOW
Rhamnus crocea	Spiny Redberry	Shrub	Evergreen	X		X	X	Very low	AFSS, CH, CSS

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)									
Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Rhamnus ilicifolia	Hollyleaf Redberry Or Buckthorn	Shrub	Evergreen			X	X	Very low	CH, CLOW, CSS
Rhus integrifolia	Lemonadeberry	Shrub	Evergreen				X	Very low	AFSS, CH, CLOW, CSS
Rhus ovata	Sugar Bush	Shrub	Evergreen				X	Very low	AFSS, CH, CLOW, CSS
Rhus trilobata	Basket Bush	Shrub	Deciduous	X		X	X	Low	CH, CLOW
Ribes aureum var. *gracillimum*	Golden Currant	Shrub	Deciduous	X		X		Very low	CLOW
Ribes californicum var. *hesperium*	Hillside Gooseberry	Shrub	Deciduous	X		X		Low	CH, CLOW
Ribes indecorum	White Flowering Currant	Shrub	Deciduous	X		X		Very low	AFSS, CH, CSS
Ribes malvaceum var. *malvaceum*	Chaparral Currant	Shrub	Deciduous			X		Very low	CH, CLOW
Ribes malvaceum var. *viridifolium*	Chaparral Currant	Shrub	Deciduous	X		X		Very low	CH, CLOW
Ribes speciosum	Fuchsia-Flowered Gooseberry	Shrub	Deciduous			X		Very low	CH, CLOW
Rosa californica	California Wild Rose	Shrub	Deciduous			X		Low	CLOW
Salvia apiana	White Sage	Shrub	Evergreen	X			X	Very low	AFSS, CH, CLOW, CSS, DS
Salvia leucophylla	Purple Sage	Shrub	Evergreen	X			X	Very low	CLOW, CSS
Salvia mellifera	Black Sage	Shrub	Evergreen	X			X	Very low	AFSS, CH, CLOW, CSS

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)

Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Sambucus mexicana	Western Elderberry	Tree	Deciduous				X	Low	AFSS, CSS, CLOW
Scrophularia californica ssp. *floribunda*	California Figwort	Perennial	Deciduous	X		X		Low	CH, CLOW, CSS
Senecio flaccidus var. *douglasii*	Bush Groundsel	Shrub	Evergreen	X			X	Very low	AFSS, CH, CLOW, CSS
Sisyrinchium bellum	Blue-Eyed Grass	Perennial	Semi-evergreen	X			X	Low	CLOW, CSS, DM
Solanum xanti	Purple Nightshade	Shrub	Semi-evergreen	X		X		Very low	AFSS, CH, CSS
Solidago californica	California Goldenrod	Groundcover	Evergreen	X				Low	AFSS, CH, CLOW, CSS
Solidago confinis	Southern Goldenrod	Groundcover	Evergreen	X				Moderate	AFSS, CH, CLOW, CSS
Stachys ajugoides var. *rigida*	Hedge Nettle	Groundcover	Evergreen	X		X		Moderate	AFSS, CLOW, CSS
Stachys albens	White Hedge Nettle	Groundcover	Evergreen			X		Moderate	AFSS, CLOW, CSS
Symphoricarpos mollis	Creeping Snowberry	Groundcover	Deciduous	X		X		Low	CH, CLOW
Tauschia arguta	Tauschia	Perennial	Deciduous	X		X		Low	CH, CLOW
Tetradymia comosa	Cotton-Thorn	Shrub	Deciduous	X		X		Low	AFSS, CH, CSS
Thalictrum fendleri var. *polycarpum*	Meadow Rue	Perennial	Deciduous	X		X		Moderate	CH, CLOW
Umbellularia californica	California Bay	Tree	Evergreen			X		Low	CLOW

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)

Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Urtica holosericea	Hoary Nettle	Perennial	Deciduous			X		Moderate	CLOW
Venegasia carpesioides	Canyon Sunflower	Shrub	Semi-evergreen	X		X	X	Low	CLOW
Verbena lasiostachys	Verbena	Perennial	Semi-evergreen	X				Moderate	CSS
Vicia americana ssp. *americana*	American Vetch	Vine	Deciduous		X	X		Low	CLOW
Vitis girdiana	Desert Grape	Vine	Deciduous		X	X		Low	DS
Climate-Adaptive Species									
Arbutus unedo	Strawberry Tree	Tree	Evergreen				X	Low	CT
Calocedrus decurrens	Incense Cedar	Tree	Evergreen					Moderate	CT
Cercis occidentalis	Western Redbud	Tree	Deciduous					Low	CT
Chilopsis linearis	Desert Willow	Tree	Deciduous				X	Very low	CT
Chitalpa tashkentensis	Chitalpa	Tree	Deciduous					Moderate	CT
Cordia boissieri	Texas Wild Olive	Tree	Evergreen				X	Low	CT
Cupressus arizonica	Arizona Cypress	Tree	Evergreen					Moderate	CT
Dalbergia sissoo	Indian Rosewood	Tree	Semi-evergreen					Low	CT
Forestiera neomexicana	Desert Olive	Tree	Deciduous				X	Low	CT
Hesperocyparis forbesii	Tecate Cypress	Tree	Evergreen				X	Very low	CT
Laurus nobilis	Sweet Bay	Tree	Evergreen					Low	CT
Lophostemon confertus	Brisbane Box	Tree	Evergreen					Moderate	CT
Lyonothamnus floribundus ssp. asplenifolius	Ironwood	Tree	Evergreen					Low	CT
Pinus canariensis	Canary Island Pine	Tree	Coniferous					Low	CT
Pinus eldarica	Eldarica Pine	Tree	coniferous				X	Low	CT
Pinus halepensis	Aleppo Pine	Tree	Coniferous				X	Low	CT

Table 10-1. SGV Greenway Network Plant Species Index (Alphabetical)									
Scientific Name	Common Name	Growth Form	Notes	Limited Landscape Management Zone	Vine/Fence Screening	North Slopes Or Shade	Hot, Dry, Exposed Sites	Water Usage	Plant Communities
Pinus muricata	Bishop Pine	Tree	Coniferous					Low	CT
Pinus pinea	Stone Pine	Tree	Coniferous				X	Low	CT
Quercus chrysolepis	Canyon Live Oak	Tree	Evergreen					Low	CT
Quercus douglasii	Blue Oak	Tree	Deciduous					Very low	CT
Quillaja saponaria	Soapbark Tree	Tree	Evergreen					Low	CT
Searsia lancea	African Sumac	Tree	Evergreen				X	Low	CT
Tipuana tipu	Tipu Tree	Tree	Semi-evergreen					Low	CT
Vitex agnus-castus	Chaste Tree	Tree	Deciduous				X	Low	CT

10.11 Gateways

For the SGV Greenway Network, gateways are defined as points of access along the network that welcome and inform users and the community at large about the open space network. They should be identified by a visual marker, either through a large specimen tree, environmental graphics, or another kind of community artwork or cultural expression. They should provide information about the larger SGV Greenway Network, the individual tributaries, the neighborhoods, their connectivity to other modal systems, and when space permits, have a suite of site amenities.

All gateways should call attention to the presence of the SGV Greenway Network and represent a fantastic opportunity to connect adjacent communities to the network and create a neighborhood identity and pride around their adjacency. An example gateway is shown on Figure 10-55.

Figure 10-55 Gateway at Donald & Berenice Watson Recreation Trail–Duarte

10.11.1 Existing Regulations and Conditions

All Gateways should meet or exceed ADA accessibility standards. Gateways are often composed of many architectural elements such as seating, lighting, gates, or signage, all of which should be designed according to their respective guidelines.

10.11.2 SGV Greenway Network Standard

Within the SGV Greenway Network, gateways should be defined at the following scales:

- Point-(small gateway)
- Pod (medium gateway)
- Plaza (large gateway)
- Figures 10-56 through 10-58 in the following subsection illustrate the three gateway types.

Point–Small Gateway

The smallest gateways, and likely the most common—they can be as simple as providing gate access with minimal amenities. As shown on Figure 10-56, site elements to provide at a minimum should be gate access, safety lighting and call box, bike parking, and SGV Greenway Network signage.

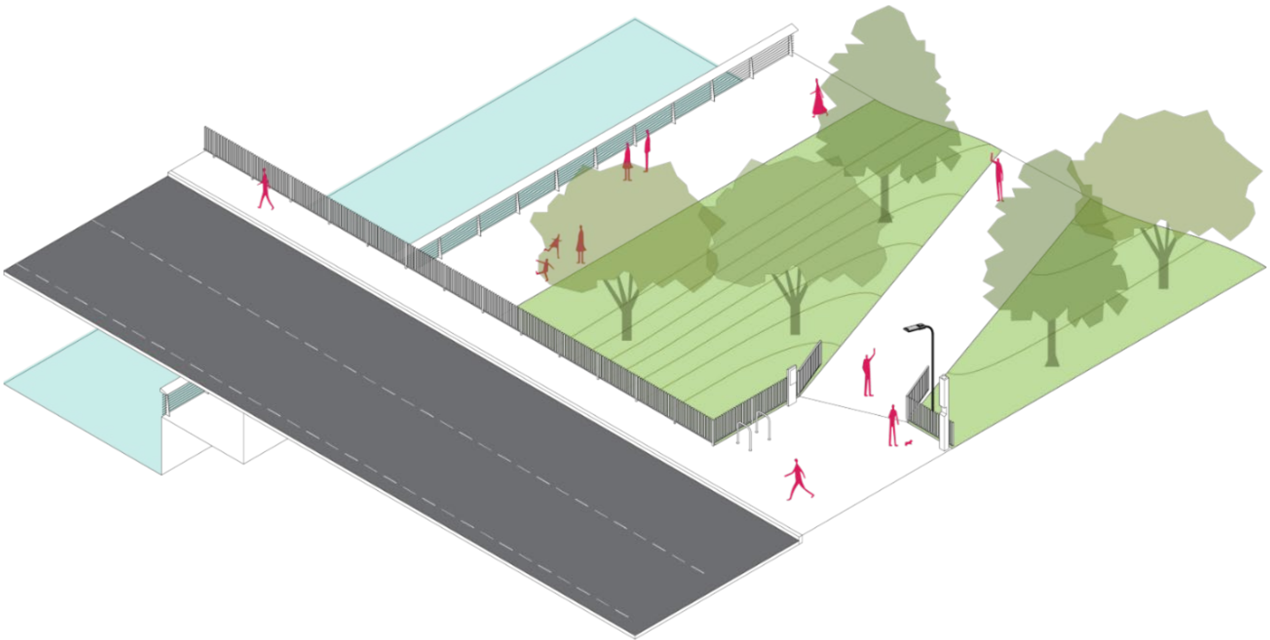


Figure 10-56. Example of a point (small) gateway

Pod–Medium Gateway

At key intersections along the network alignment, at local transit hubs, and at community landmarks, a more prominent gateway should be created, as shown on Figure 10-57. These would provide an enhanced experience and information about the tributary greenway, sites within a 5-mile vicinity, and the SGV Greenway Network. The Pod gateway should be equipped with additional amenities and a gateway moment such as a decorative gate, archway, or public art piece. More substantial bike parking should be provided.

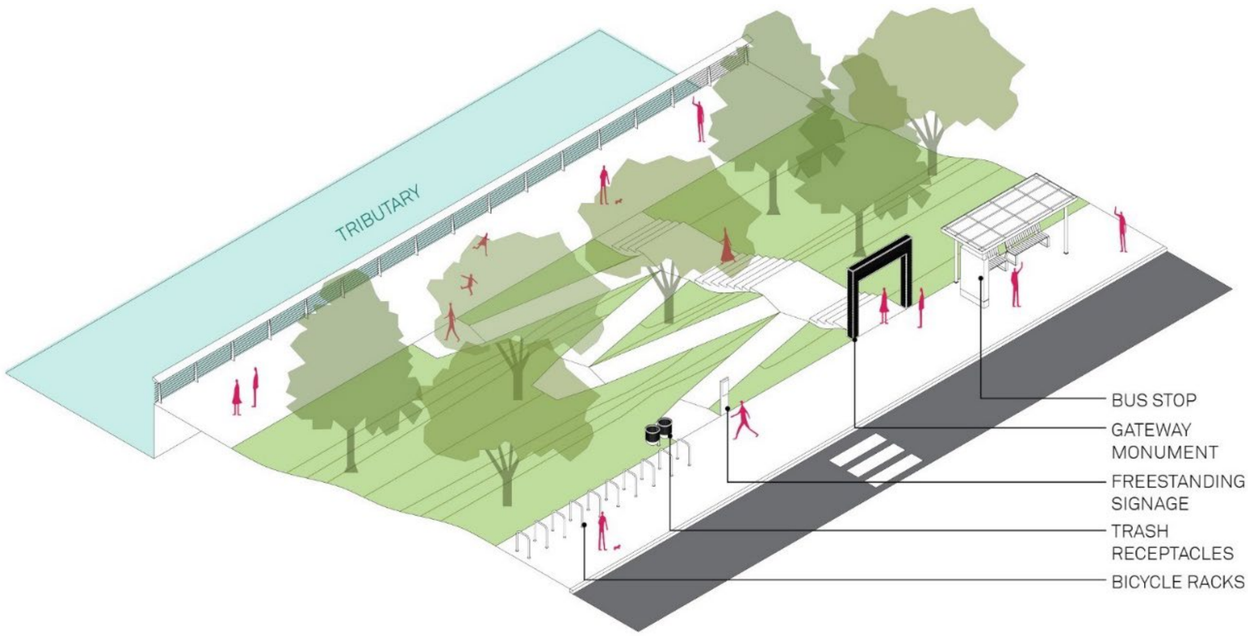


Figure 10-57. Example of pod (medium) gateway

Plaza – Large Gateway

When space permits, like in the instance of a vacant lot, enlarged right of way, or other publicly owned land, a more significant gateway should be planned as shown on Figure 10-58. These should be, at a minimum at each end of the tributary—the headwater, and the confluence. Other location considerations include near regional transit hubs, or sizeable public parking areas and event spaces.

With more space available, these sites should celebrate individual communities, inform users about the SGV Greenway Network, and provide additional open space amenities that focus on building a platform for communities to activate. This could include areas dedicated to food vending, pop-up events, community activism, or small performance spaces.

As primary access points, gateways need to provide physical access to the greenway system, which often requires navigating a significant grade change, and in some instances providing an ADA accessible path may not be possible. Ramps should be incorporated to provide ADA access whenever possible.

Figure 10-58. Example of plaza (large) gateway

10.11.3 Community Character Opportunities

Gateways are an opportunity to connect adjacent communities to the network and create neighborhood identity and pride around their adjacency. Gateways are a great place to site public art, community message boards, or even community gardens if space and permitting allow. Additionally, Gateways are a good place to host community programming such as group walk/bike meetups, or outreach events.

10.11.4 Design Precedents

Design precedents for gateways are shown on Figures 10-59 and 10-60.

Figure 10-59. Thienes Avenue gateway (medium)

Figure 10-60. Cudahy gateway park (large)

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Section 11

Stormwater Management

Stormwater management is a priority across the LA Basin. SGV Greenway Network project proponents are encouraged to use every opportunity to capture and reuse stormwater, recharge groundwater, reduce flooding, and improve water quality. Stormwater associated with new infrastructure (impervious surface) must be managed per LA County requirements to infiltrate and/or treat post-construction runoff. Standards necessitate implementation of stormwater BMPs to mitigate impervious project areas. Materials included in this section specify stormwater management requirements, BMP designs and standards, subsurface requirements and setbacks, and regulatory coordination. The most common practices include bioretention, subsurface infiltration, and permeable pavement. Permeable pavement can be used for the greenway surface and narrow bioretention strips (bioswales) can be used along the greenway to capture runoff from asphalt and concrete surfaces.

Numerous storm drains convey stormwater runoff from adjacent watershed areas through pipes and discharge directly to the large tributary channels throughout the SGV. On planned greenway projects with wider ROWs and adjacent project elements (gateway, park, etc.) larger stormwater BMPs can be planned and constructed to capture and reuse runoff from adjacent drainage areas (beyond the greenway project limits) and further capture stormwater, recharge groundwater, reduce flooding, and improve water quality. These project elements broadly benefit area water resources including water supply. In some cases, it may be possible to supplement runoff with dry weather baseflow from an adjacent existing storm sewer currently discharging to the wash, or the wash itself.

As described in Section 6 of the SGV Greenway Network Plan, LA County Safe Clean Water Program (Measure W) funding is available for the design and construction of larger stormwater BMPs. The funds are used to increase stormwater capture and reuse, recharge groundwater, reduce stormwater pollution, and invest in disadvantaged communities.

11.1 What's in This Section

This section describes stormwater management requirements, BMP designs and standards, subsurface requirements and setbacks, and regulatory coordination.

Stormwater Management

11.2 Stormwater Management Requirements

LA County requires a stormwater BMP to infiltrate and/or treat a site's stormwater quality design volume (SWQDv) where new infrastructure (greenway and other impervious surface) is proposed with a preference for nature-based solutions. To quantify the SWQDv, the modified rational method must be used, which includes the following steps (LA County, 2014):

1. Identify the greater of 0.75 in/24 hr rain event or the 85th percentile 24-hr rain event.
2. Assume initial time of concentration
3. Calculate rainfall intensity
4. Calculate impervious area and stormwater runoff coefficient
5. Calculate the time of concentration
6. Compare assumed time of concentration with calculated time of concentration
7. Repeat steps 2 through 6 until assumed and calculated time of concentration are equivalent
8. Calculate peak flow rate
9. Calculate SWQDv using calculated flow rates and associated timing of variable rainfall intensity during a rain event

LA County's HydroCalc program (LA County, 2018) may be used complete each of the nine steps above without manual calculation, undeveloped runoff coefficient curve lookup, time of concentration iteration, or mathematical integration of the flow curve to quantify SWQDv. The project area must be specified, which may be done by reviewing LA County stormwater infrastructure (LA County, n.d.) in concert with the United States Geological Survey (USGS) topography and watershed boundary datasets (USGS, n.d.).

Alternative actions must be taken if a selected stormwater BMP does not capture the entire SWQDv and infiltrate it, in its entirety, on-site (LA County, 2014):

- ✓ On-site biofiltration and discharge of 1.5 times the SWQDv minus any volume infiltrated on-site to a constructed or natural drainage system. If discharge is to a natural drainage system, hydromodification. Underdrains are often used with stormwater BMPs to leverage this alternative action.
- ✓ Off-site infiltration of SWQDv minus any volume infiltrated on-site
- ✓ Groundwater replenishment of SWQDv minus any volume infiltrated on-site
- ✓ Retrofit an existing development with similar land uses and hydrology to infiltrate SWQDv minus any volume infiltrated on-site

In cases where the SWQDv is not feasible to infiltrate on the greenway/implementation area, alternative actions will be key to successful greenway implementation. Where feasible, there would be significant benefits to maximizing treatment of off-site stormwater via multi-benefit projects on useable parcels beyond what is required for a proposed bikeway development area. While guidelines presented herein for calculating the SWQDv meet LA County standards, the LA County sees significant benefit in leveraging greenway network and network adjacent space to maximize stormwater capture. Off-site stormwater runoff can be from overland flow or from existing storm outfalls that currently discharge directly to the tributary channels. This runoff can be intercepted, treated, and infiltrated.

11.3 BMP Elements and Design Considerations

With any new construction (e.g., bikeway), a stormwater BMP must be selected to manage the calculated SWQDv through on-site infiltration or an alternative action. There are three primary categories of stormwater BMPs that could be used as part of greenway development:

- On-channel stormwater management (from the greenway project impervious area)
- Off-channel stormwater management for less than 10 acres of drainage area
- Off-channel stormwater management for more than 10 acres of drainage area

BMP implementation will depend on available ROW and specific greenway project formulation which may limit the use of some types of BMPs. BMP selection should be at the design engineer's discretion considering project objectives and constraints but is subject to District approval. In cases where specific pollutants are of concern, the appropriate treatment technology should be implemented on a case-by-case basis. All stormwater BMPs shall minimize vector production, where the California Department of Public Health outlines a checklist of items for minimizing vector production in stormwater management structures for consideration.

11.3.1 On-Channel Stormwater Management

On-channel stormwater BMPs may be used to manage stormwater runoff from greenway project impervious areas (e.g., bike paths, other paved areas, etc.). On-site stormwater management acts to mimic natural conditions where water would infiltrate through pervious surfaces in the absence of anthropogenic infrastructure. Incremental on-site stormwater BMP implementation would provide diffuse benefits as opposed to routing stormwater to discrete locations for treatment and/or infiltration.

Bioretention

Bioretention (practices include planter, curb extension, and basin) is a shallow landscaped depression that provides stormwater storage, infiltration, and evapotranspiration (LA County, 2014). Bioretention can be constructed along the sides of greenways, streets, in the median, or adjacent to parking and other impervious surfaces. Areas are typically planted with native, drought-tolerant plant species (e.g., wildflowers, sedges, rushes, ferns, shrubs, small trees) that do not require fertilization and can withstand wet soils for at least 24 hours. Underdrains are used for flow through treatment systems (also called biofiltration) in areas with lower permeability native soils, or where there is a desire to limit infiltration into adjacent soils (e.g., along wash channel walls). Treated water discharges through the underdrain and into a storm drain or wash.

The invert of the stormwater infiltration BMP shall be setback at least 15 ft and outside a 1:1 plane drawn up from the bottom of adjacent feature of concern, see Table 11-1), unless otherwise recommended by the geotechnical consultant. Impermeable liners should be used along vertical walls to limit horizontal migration of infiltrating water towards foundations, structures, or channel walls.

Coordination with the District is required to verify the acceptability of the bioretention application within or immediately adjacent to the channel ROW and O&M responsibility. The local greenway project proponent is responsible for maintenance in most cases. Examples of bioretention swales, bioretention basins, planters, and curb extensions are shown on Figures 11-1 through 11-4.

See Table 11-1 for bioretention design considerations from the LA County Public Works Green Streets Design Guidelines (LA County, 2021b). For the LA County Public Works Green Streets Bioretention Design Guidelines and Standard Plans, see Attachment A.

The LA County Public Works Green Streets Design Guidelines and Standard Plans are to be used for green infrastructure project design and implementation throughout LA County. They include design information for multiple types of bioretention, subsurface infiltration, and permeable pavement, with and without underdrains, and multiple related components such as curb inlets, curb outlets, check dam, gravity walls, underdrains, etc.

Figure 11-1. Example bioretention swale next to greenway

Figure 11-2. Example bioretention basin with surface inflow

Figure 11-3. Example stormwater planter with surface inflow

Figure 11-4. Example curb extension with surface inflow

Table 11-1. Bioretention Design Considerations	
Design Feature	**Requirements**
Street Slope	Do not use bioretention cells in areas with longitudinal slopes greater than 15%. Where longitudinal slopes exceed 2%, install check dams to limit longitudinal slope to 2%.
Walkways	Bioretention cells must not encroach upon clear walking paths and cannot impede designated accessible parking spaces or loading zones. Where pedestrian activity is moderate or high, maintain a minimum of 8 ft of clear width between edge of bioretention and building or property line. Where pedestrian activity is low, provide 5 ft minimum.
Ponding Depth and Volume Recovery	The maximum ponding depth is 6 in. unless approved by LA County Public Works. The entire above and below ground treatment volume must be recovered within 96 hours (hrs.).
Infiltration Capacity and Rates	• Bioretention requires a minimum corrected in-situ infiltration rate of greater than or equal to 0.3 in/hr. or use of an underdrain. • The invert of stormwater infiltration shall be setback at least 15 ft and outside a 1:1 plane drawn up from the bottom of adjacent foundations, unless otherwise recommended by the geotechnical consultant. Increase wall depth or use impermeable liners along vertical walls to mitigate water migration at sites adjacent to channel walls and structures. • Stormwater infiltration shall not place an increased surcharge on structures or foundations on or adjacent to the site.
Sediment Capture	A sediment sump will be provided at the primary inflow point(s) to the bioretention practice equal to at least 10% of the total infiltration practice length as shown on the Standard Plans. Sumps will include drawdown features to enable dewatering of the sump area within 48 hrs. Design appropriate erosion control measures to protect the bioretention system from receiving sediment from adjacent pervious areas.

Source: LA County, 2021b. Adapted from the LA County Public Works Green Streets Design Guidelines.

Permeable Pavement

Permeable pavement (including "*permeable interlocking concrete pavers, pervious concrete, and porous asphalt*") "*is a surface that can infiltrate stormwater runoff through sublayers of sand and gravel. Permeable interlocking concrete pavers is comprised of a layer of durable concrete pavers separated by joints filled with small stones. Pervious concrete is made from carefully controlled amounts of water and cement materials with little to no sand or fine aggregate particles which creates void spaces that convey water through the surface. Porous asphalt, or "open-graded" asphalt, pavement contains no fine aggregate particles, which creates void spaces in the pavement and allows water to collect within and drain through the pavement*" (LA County, 2014).

Underdrains are used for flow through treatment systems in areas with lower permeability native soils, or where there is a desire to limit infiltration into adjacent soils (e.g., along wash channel walls). Treated water discharges through the underdrain and into a storm drain or wash. Impermeable liners should be used along vertical walls to limit horizontal migration of infiltrating water towards foundations, structures, or channel walls.

For on-channel greenway and adjacent path surfaces (to be used by pedestrians and/or bicyclists), only pervious concrete or porous asphalt should be used. Permeable pavers may be used for non-greenway parking areas and pedestrian surfaces, or as a feature to reduce bicycle speed. On-channel permeable pavement surfaces may accept only de minimis additional adjacent drainage area flowing onto the permeable surface (no more than 25 percent of the permeable pavement surface width and area), and only if those surfaces can maintain a continuous vegetative cover or have another surface (e.g., clean washed gravel) that minimizes sediment loading onto the permeable surface.

For use with on-street bike routes, additional stormwater infiltration and treatment can be provided by expanding the permeable pavement and/or subsurface reservoir stone to the bike route buffer zone and/or immediately adjacent vehicle parking, if present. With additional storage, it may be possible to provide treatment for the entire paved width of the street. Permeable pavement can also be used in areas adjacent to the greenway (gateways, parks, etc.) for most impervious surfaces.

With all permeable pavement designs, the design engineer must ensure the pavement section will be able to withstand the long-term vehicle loads expected including emergency and maintenance vehicles. Routine maintenance is also required to keep the permeable system operable and durable.

Coordination with the District is required to verify the acceptability of the permeable pavement application within the channel ROW and O&M responsibility. In most cases the local greenway project proponent will be responsible for permeable pavement maintenance. The primary benefit of permeable pavement is that no other stormwater treatment should be required for the greenway surface. Permeable pavement mimics the behavior of a pervious surface during routine rainfall events.

Examples of permeable pavement are shown on Figures 11-5 through 11-9.

See Table 11-2 for permeable pavement design considerations from the LA County Public Works Green Streets Design Guidelines (LA County, 2021b). For more detail on Permeable Pavement design guidelines and standard plans, see Attachment A.

Figure 11-5. Example permeable paver application

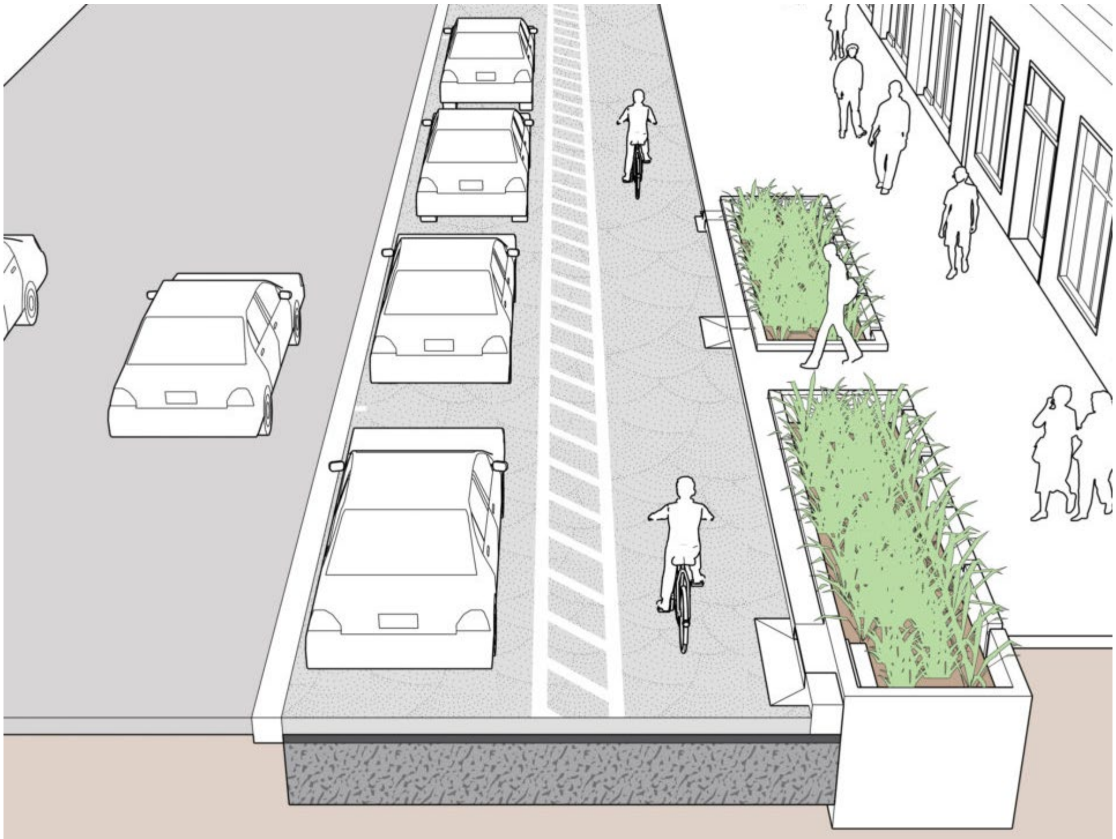

Figure 11-6. Permeable pavement bike lane and parking with stormwater planters

Figure 11-7. Permeable concrete bikeway

Figure 11-8. Permeable asphalt greenway

Figure 11-9. Permeable asphalt bike lane and roadside bioswale

Table 11-2. Permeable Pavement Design Considerations	
Design Feature	**Requirements**
Edge Restraint	Permeable pavement must be surrounded by a concrete edge restraint with sufficient width and depth to maintain the integrity of the pavement system. The concrete edge may be an existing or new concrete curb.
Adjacent Pavement	Solid asphalt or concrete pavement for vehicle movement lanes should be used leading up to permeable pavement areas.
Infiltration Capacity and Rates	• Permeable pavement requires a minimum corrected in-situ infiltration rate of greater than or equal to 0.3 in/hr. or use of an underdrain. • The invert of stormwater infiltration shall be setback at least 15 ft and outside a 1:1 plane drawn up from the bottom of adjacent foundations, unless otherwise recommended by the geotechnical consultant. Increase wall depth or use impermeable liners along vertical walls to mitigate water migration at sites adjacent to channel walls and structures. • Stormwater infiltration shall not place an increased surcharge on structures or foundations on or adjacent to the site.
Overflow Device	Provide an overflow drainage pathway to convey higher stormwater runoff flows to another stormwater treatment feature or nearest storm drain system. Design the overflow pathway so that water stages a maximum of two inches above the level of the permeable pavement surface. Ensure that the 2-inch ponding depth is contained and does not extend beyond the permeable pavement limits.
Sediment	Assess the contributing drainage area and do not place permeable pavement in areas that receive runoff from unvegetated soil or other high sediment loading areas without sediment pretreatment. Design appropriate erosion control measures to protect all layers of the permeable pavement system from sediment containing runoff during construction.
Structural Integrity	Evaluate the expected traffic loading (type, number, and weight of vehicles) and design the permeable paver section to accommodate long term. This may require additional stone depth and/or the use of geotextile and/or geogrid. During design assess the type and stability of the existing soil subgrade beneath the paver system and address any unsuitable soils by removal and replacement and/or use of geogrid per the project geotechnical engineer's recommendations.

Source: LA County, 2021b. Adapted from the LA County Public Works Green Streets Design Guidelines.

11.3.2 Off-Channel Stormwater Management Less than 10 acres

The purpose of capturing off-channel drainage would be to 1) treat stormwater routed from newly constructed impervious greenway areas (e.g., bike paths) where on-channel drainage is not an option, or is not sufficient to meet the volume capture requirements, or 2) to provide a stormwater retrofit for existing off-site impervious areas which drains to a channel or other larger drainage system. The first case could occur during greenway implementation where newly generated stormwater drainage could not be captured on-channel, especially in segments with a narrow ROW width (13'-19'). The second case represents an instance where additional stormwater infiltration and/or treatment benefits are pursued to meet regional groundwater recharge and surface water quality improvement goals (e.g., Safe Clean Water Program).

BMPs discussed in this section should be used when on-site treatment is not feasible, and when the contributing stormwater drainage area to be treated is less than 10 acres.

Bioretention

Bioretention practices, as discussed in Section 11.3.1, treat off-site drainage areas less than 10 acres. Bioretention may be incorporated into gateways, pocket parks, and other off-channel elements. Multiple bioretention elements may be used to treat drainage areas greater than 10 acres.

Permeable Pavement

Permeable Pavement, as discussed in Section 11.3.1, is also applicable to treat certain off-site drainage areas usually less than 10 acres. Permeable pavement may be used in lieu of traditional pavement (i.e., parking, greenways, sidewalks, paved/paver open areas, etc.).

Proprietary Devices

"*Proprietary devices are commercial products that typically aim at providing stormwater treatment in space-limited applications, often using patented innovative technologies. The most commonly encountered classes of proprietary stormwater quality control measures include hydrodynamic separation, catch basin insert technologies, cartridge filter-type controls, and proprietary biotreatment devices*" (LA County, 2014). A list of accepted technologies may be found online (LA County, 2013), and must be approved by LA County Public Works on a case-by-case basis.

Proprietary Devices can treat drainage areas with a relatively small footprint and be useful for capturing some stormwater pollutants. A primary disadvantage of most Proprietary Devices is that they provide flow through treatment, and no stormwater capture, infiltration, or groundwater recharge, which are primary objectives throughout LA County and the SGV Greenway Network. Because of this limitation, they likely will need to be combined with other described treatment BMPs to meet LA County requirements for new impervious surfaces.

Subsurface Infiltration

Subsurface infiltration (practices include tree well filter, surface flow and piped flow) is a "*narrow trench constructed in pervious areas designed to retain and infiltrate stormwater runoff into the underlying native soils and groundwater table. [Subsurface infiltration practices] are typically filled with gravel or engineered soil or may instead contain manufactured underground stormwater storage chambers. [Subsurface infiltration] provides stormwater runoff treatment through filtration, adsorption, biological treatment, evapotranspiration, and infiltration as water flows through the media profile and into surrounding soils. [Subsurface infiltration] is used for small contributing drainage areas to store and treat stormwater runoff underground and out of sight*" (LA County, 2014 and 2021b).

Subsurface infiltration shall only be used in pervious areas outside the channel ROW. See Table 11-3 for subsurface infiltration design considerations from the LA County Public Works Green Streets Design Guidelines (LA County, 2021b). For more detail on subsurface infiltration design guidelines and standard plans see Attachment A.

Table 11-3. Subsurface Infiltration Design Considerations	
Design Feature	**Requirements**
Sizing	Subsurface infiltration practices are sized using a simple sizing method where the SWQDv must be completely filtered within 96 hours.
Flow Entrance and Energy Dissipation	Energy dissipation controls, constructed of sound materials such as stones, concrete, or proprietary devices that are rated to withstand the energy of the influent flow, must be installed at the inlet to these practices.
Vegetation	• For tree well filters, trees should be suited to well-drained soil; be dense and strong enough to stay upright; have minimum need for fertilizers; comply with Integrated Pest Management practices; be able withstand multiple days of inundation; and be consistent with local water conservation ordinance requirements. • Other subsurface infiltration practices must be kept free of vegetation and outside of the drip lines of trees and other large vegetation.
Use of Geomembranes	• For tree well filters, a geomembrane liner may be placed between the planting media and the drain rock. Minimum permittivity rate is 75 gallons/minute/square ft and should not impede the infiltration rate of the soil medium. • Other subsurface infiltration practices must be lined with a geomembrane as shown on the Standard Plan to prevent soil from migrating into the media and reducing the infiltration capacity. Provide 12-inch minimum overlap at any seams.
Overflow Devices	An overflow device/drainage pathway must be provided if stormwater runoff may exceed the capacity/maximum ponding depth of the practice. The overflow device/pathway must be able to convey stormwater runoff to the nearest storm drain or a downstream BMP for further treatment and limit surface water ponding to less than 6-inches within the practice limits.
Sediment Capture	Pretreatment to remove sediment is required to protect subsurface infiltration practices from sediment loads. Contributing drainage areas must be vegetated/stabilized to prevent soil transport to the practice. Design appropriate erosion control measures to protect the subsurface infiltration system from sediment containing runoff during construction.

Source: LA County, 2021b. Adapted from LA County Public Works Green Streets Design Guidelines.

11.3.3 Off-Channel Stormwater Management More than 10 acres

The purpose of capturing off-channel drainage would be to 1) treat stormwater routed from newly constructed impervious area (e.g., bike paths) where on-channel drainage is not an option or is not sufficient to meet the volume capture requirements, or 2) to provide a stormwater retrofit for existing off-site impervious areas. The first case could occur during bike path implementation where newly generated stormwater drainage could not be captured on-site (see Section 11.2.1). The second case represents an instance where additional stormwater infiltration and/or treatment benefits are pursued to meet regional groundwater recharge and surface water quality improvement goals (e.g., Safe Clean Water Program). BMPs discussed in this section should be used when on-channel treatment is not feasible, and when the stormwater drainage area to be treated is greater than 10 acres.

Constructed Wetlands

A constructed wetland is a "*treatment system consisting of a forebay and permanent pool with aquatic plants. Constructed wetlands typically consist of an inlet with energy dissipation, a sediment forebay for settling out coarse solids and to facilitate maintenance, a base with shallow sections (1 to 2 ft deep) planted with emergent vegetation, deeper areas or micro pools (3 to 5 ft deep), and an outlet structure*" (LA County, 2014). An impermeable liner is routinely required to maintain the permanent pool.

Before designing a constructed wetland for stormwater management, consider the hydrology of the project area, and water availability for maintaining wetland vegetation. The LA area receives very limited rainfall. In some cases, it may be possible to supplement runoff with dry weather baseflow from an adjacent existing storm sewer currently discharging to the wash, or the wash itself.

See Table 11-4 for constructed wetlands design considerations from the LA County Public Works Green Streets Design Guidelines. An example constructed wetland is shown on Figure 11-10. For more detail on constructed wetlands practices see the LA County LID Standards Manual Appendix E (see Appendix E of linked document: LA County, 2014). LA County Public Works includes the Geotechnical and Materials Engineering Division (GMED) which is referenced in Table 11-4 and provides requirements and reviews related to geotechnical and materials engineering.

Figure 11-10. Constructed wetland in urban area

Table 11-4. Constructed Wetland Design Considerations

Design Feature	Requirements
Pretreatment	• The sediment forebay should have a volume equal to 10 to 20% of the total constructed wetland volume. • The depth of the sediment forebay should be between 4-8 ft. At least 1 ft of sediment storage must be provided in the sediment forebay. • Permanent steel post depth markers must be placed in the sediment forebay to identify the settled sediment removal limits at 50 and 100% of the sediment storage depth. • A gravity drain outlet from the sediment forebay (min. 4-in. dia.) must extend the entire width of the internal berm. • The sediment forebay outlet must be off set from the inflow flow line to prevent short-circuiting.
Embankments	• The minimum top width of all berm embankments must be 20 ft, unless otherwise approved by a licensed geotechnical engineer and the GMED. • Berm embankments must be constructed on native consolidated soil or adequately compacted and stable fill soils approved by a licensed geotechnical engineer. Soils must be free of loose surface soil materials, roots, and other organic debris. • All earthworks must be conducted in accordance with the latest edition of the Standard Specifications for Public Works Construction.

Table 11-4. Constructed Wetland Design Considerations	
Design Feature	**Requirements**
	• Berm embankments greater than 4 ft in height must be constructed by excavating a key equal to 50% of the berm embankment cross-sectional height and width. This requirement may be waived if specifically recommended by a licensed geotechnical engineer. • Berm embankments must be constructed of compacted soil (95% minimum dry density, Modified Proctor method per American Society for Testing and Materials (ASTM) D1557) and placed in 6-in. lifts. • Low growing native or non-invasive perennial grasses must be planted on downstream embankment slopes. See Attachment B of the Vegetation Management on Embankment Dams of Public Works' Debris Control Facilities for a recommended plant list.
Sizing	Constructed wetlands must be designed to capture and retain the SWQDv. If extended detention is included, then the extended detention volume must provide at least 12 hrs. detention of 20% of the mitigation volume.
Flow Entrance and Energy Dissipation	The inlet to the constructed wetland must be submerged with the inlet pipe invert a minimum of two ft from the bottom (not including sediment storage). The top of the inlet pipe should be submerged at least one foot, if possible. A submerged inlet will dissipate energy from incoming flow. The distance from the bottom is set to minimize resuspension of settled sediments. Alternative inlet designs that accomplish these objectives are acceptable. Energy dissipation controls must also be used at the outlet from the construction wetland unless the wetland discharges to the storm drain system or a hardened channel. Consult with LA County Public Works for the appropriate type and design of the energy dissipation structure.
Water Supply	A water balance must be conducted to demonstrate that adequate water supply will be present to maintain a permanent pool of water during a drought year when precipitation is 50% of average for the site. The water balance must consider evapotranspiration, infiltration, precipitation, spillway discharge, and nuisance flow (where appropriate). If a water balance indicates that losses will exceed inputs, a source of water must be provided to maintain the water surface elevation throughout the year. The water supply must be of sufficient quantity and quality to not have an adverse impact on the water quality of the constructed wetland.
Vegetation	The wetland basin must be planted with emergent wetland plants based on recommendations from a wetland specialist.
Outlet Structure and Spillway	Spillways must meet the California Department of Water Resources, Division of Safety of Dams Guidelines for the Design and Construction of Small Embankment Dams (www.water.ca.gov/damsafety/docs/GuidelinesSmallDams.pdf).
Exterior Landscaping	No trees or shrubs may be planted within ten ft of inlet or outlet pipes or manmade drainage structures such as spillways, flow spreaders, or earthen embankments. Species with roots that seek water, such as willow or poplar, shall not be used within 50 ft of pipes or manmade structures. Prohibited non-native plant species will not be permitted. Other resources for identifying suitable plant types can be found by consulting a nursery, arborist, landscape architect, or referring to online resources

Source: LA County, 2014, Low Impact Development Standards Manual.

Bioretention

Bioretention practices, as discussed in Section 11.3.1, treat off-site drainage areas less than 10 acres. Multiple bioretention elements may be used to treat drainage areas greater than 10 acres.

Permeable Pavement

Permeable Pavement, as discussed in Section 11.3.1, is also applicable to treat portions of off-site drainage areas, usually less than 10 acres. Permeable pavement may be used in lieu of traditional pavement (i.e., parking, greenways, sidewalks, paved/paver open areas, etc.).

Proprietary Devices

Proprietary devices, as discussed in Section 11.3.2, can also be used to treat drainage areas greater than 10 acres. It is important to consider their benefits and limitations, as discussed above, when evaluating use.

Extended Detention Basin

"Extended detention basins are permanent basins formed by excavation and/or construction of embankments to temporarily detain stormwater runoff to allow for settling of sediment particles before the stormwater runoff is discharged. An extended detention basin reduces peak stormwater flow rates, provides stormwater runoff treatment, and can provide hydromodification control. Extended detention basins are designed to drain completely between storm events over a specified period of time. The slopes, bottom, and forebay of extended detention basins are typically vegetated" (LA County, 2014). See Table 11-5 for extended detention basin design considerations. An example extended detention basin is shown on Figure 11-11.

Figure 11-11. Extended detention basin

For detailed extended detention basin practices see the LA County LID Standards Manual Appendix E (see Appendix E of linked document: LA County, 2014).

Table 11-5. Extended Detention Basin Design Considerations

Design Feature	Requirements
Pretreatment	• The sediment forebay must have a volume equal to 25% of the total extended detention basin volume. • Permanent steel post depth markers must be placed in the sediment forebay to identify the settled sediment removal limits at 50 and 100% of the sediment storage depth. • A gravity drain outlet from the sediment forebay (min. 4-in-dia.) must extend the entire width of the internal berm. • The sediment forebay outlet must be off set from the inflow flow line to prevent short-circuiting.
Embankments	• The minimum top width of all berm embankments must be 20 ft, unless otherwise approved by a licensed geotechnical engineer and GMED. • Berm embankments must be constructed on native consolidated soil or adequately compacted and stable fill soils approved by a licensed geotechnical engineer. Soils must be free of loose surface soil materials, roots, and other organic debris. • All earthworks must be conducted in accordance with the Standard Specifications for Public Works Construction. • Berm embankments greater than 4 ft in height must be constructed by excavating a key equal to 50% of the berm embankment cross-sectional height and width. This requirement may be waived if specifically recommended by a licensed geotechnical engineer. • Berm embankments must be constructed of compacted soil (95% min. dry density, Modified Proctor method per ASTM D1557) and placed in 6-in. lifts. • Low growing native or non-invasive perennial grasses must be planted on downstream embankment slopes. See Attachment B of the Vegetation Management on Embankment Dams of Public Works' Debris Control Facilities for a recommended plant list.
Sizing	Extended detention basins must be sized to treat the volume of stormwater runoff that must be mitigated within a 96-hr retention time.
Flow Entrance and Energy Dissipation	Energy dissipation controls, constructed of sound materials such as stones, concrete, or proprietary devices that are rated to withstand the energy of the influent stormwater runoff flow, must be installed at the inlet to the sediment forebay. Flow velocity into the sediment forebay must be 4 ft per second or less. Consult with LA County Public Works for the type and design of energy dissipation structure.
Vegetation	Vegetation provides erosion protection from both wind and water and biofiltration of stormwater runoff. The bottom and slopes of the extended detention basin must be vegetated. A mix of erosion-resistant plant species that effectively bind the soil should be used on the slopes and a diverse selection of plants that thrive under the specific site, climatic, and irrigation conditions should be specified for the basin bottom. The basin bottom should not be planted with trees, shrubs, or other large woody plants that may interfere with maintenance activities. Only native perennial grasses, forbs, or similar vegetation that can be replaced via seeding should be used on the basin bottom.
Outlet Structure	The extended detention basins must drain within 96 hrs. after a storm event. The outlet structure is designed to release the bottom 50% of the detention volume (half-full to empty) over 24-48 hrs. and the top 50% (full to half-full) in 48-96 hrs. Detention of low flows, which account for the majority of incoming flows, for longer periods enhances stormwater runoff treatment.
Overflow Structure and Spillway	Spillways must meet the California Department of Water Resources, Division of Safety of Dams Guidelines for the Design and Construction of Small Embankment Dams (www.water.ca.gov/damsafety/docs/GuidelinesSmallDams.pdf).
Exterior Landscaping	No trees or shrubs may be planted within ten ft of inlet or outlet pipes or manmade drainage structures such as spillways, flow spreaders, or earthen embankments. Species with roots that seek water, such as willow or poplar, shall not be used within 50 ft of pipes or manmade structures. Prohibited non-native plant species will not be permitted. Other resources for identifying suitable plant types can be found by consulting a nursery, arborist, landscape architect, or online.

Source: LA County, 2014, Low Impact Development Standards Manual.

11.4 Subsurface Requirements and Setbacks

LA County Public Works GMED provides guidance for subsurface requirements where stormwater infiltration is proposed (LA County, 2021a). The subsurface geology must be characterized, and then potential BMP implementation must be formulated to meet subsurface geology requirements and setbacks where infiltration based BMPs are proposed.

11.4.1 Geologic Characterization

Successful implementation of infiltration reliant stormwater BMPs require subsurface characterizations that must be conducted before construction begins as shown in Table 11-6. Geologic considerations are meant to ensure infiltration BMP implementation is both feasible and does not pose undue adverse impacts to the built and natural environment.

Table 11-6. Required Subsurface Studies SGV Greenway Network Stormwater BMPs

Site Feature	Requirement	Including but not Limited to the Following Resource(s)
Desktop Study	Groundwater Levels	• CA Water Resources Control Board • California Department of Water Resources • SGMA Data Viewer • LA County Public Works • Water Replenishment District
	Potential for Contamination	• CA Water Resources Control Board GAMA • CA Water Resources Control Board Cleanup Sites • US EPA Water Data
	Geologic Characteristics	• Soil Classification Standard • LA County Soil Classification • LA County Soil Class Meaning (Appendix C)
	Previous Geotechnical Investigations	Site Specific • LA County Storm Drain System Infrastructure
	Preliminary Environmental Site Screening	• LA County CEQA Information
Site Investigation	Groundwater Evaluation	At least one boring shall be used to characterize subsurface conditions, and where the groundwater table is less than 50 ft below the surface, the boring shall go at least 25 ft below the point of infiltration. Design groundwater level shall be at least 10 ft above what is measured.
Infiltration Test	Field infiltration rate of infiltration zone	Test Types: • Double ring • Shallow test pit • Small diameter boring • Large diameter boring
Geotechnical Report	Provide guidance for development	Identifies site-specific geotechnical hazards and potential adverse impacts of stormwater infiltration to nearby structures and improvements. Identifies potential zones of infiltration and recommended reduction factors for field infiltration rates. The report must be stamped by state licensed engineering geologist, geotechnical engineer, or civil engineer with geotechnical experience.

Note: As specified by GMED, 2021 (LA County, 2021a). Adapted from LA County, 2021b.

11.4.2 Stormwater Infiltration Constraints

Where infiltration reliant BMPs are proposed, they must meet LA County requirements as shown in Table 11-7. A stormwater infiltration project shall not put existing soils, existing structures, and sub-surface utilities at risk of failure. Further, site filtration rate must be sufficient to infiltrate water onsite and pollutants shall not be mobilized.

Table 11-7. Infiltration Requirements

Infiltration Requirement	Description
Infiltration Rate	Infiltration rate should be greater than or equal to 0.3 in/hr (Table 11-6)
Pollutants	Infiltration should not risk pollutant mobilization (Table 11-6)
Static Settlement	Infiltration shall not represent a potential cause for static settlement of structures in direct proximity to the infiltration location. Hydro collapse potential of soils 10 ft below the infiltration location must be tested at lab-scale
Seismic Settlement	Infiltration shall not represent a potential cause for seismic settlement of structures in direct proximity to the infiltration location (e.g., via liquefaction). The design volume of stormwater infiltration shall inform liquefaction potential
Pore-water Pressure	Pore-water pressure of nearby structures or foundations shall not be increased via stormwater infiltration

Note: As specified by GMED, 2021 (LA County, 2021a).

BMPs must be setback from existing infrastructure as shown in Table 11-8. The LA County Green Streets Design Guidelines were developed specifically for the stormwater BMPs discussed herein.

Table 11-8. Constraints for stormwater BMPs

Subsurface Utility/Constraint	Subsurface Setback from Infiltration Location
Water Mains	4 ft horizontal from edge of facility to outside diameter of water main or valve box
Drinking Water Well	100 ft horizontal to groundwater production wells used for drinking water
Sanitary Sewer	4 ft horizontal from edge of facility to outside diameter of sewer main or outside edge of structure
Water and Sewer Laterals	Water services shall be located outside of the facility footprint. Sewer laterals shall be located outside of the facility footprint if possible. Sewer laterals within the facility footprint shall be protected
Private Utilities	Horizontal and vertical clearances for Power, Gas, Communication and other private utilities must be coordinated with individual utility companies
Property Lines	Facility should not be located within 5 ft of property lines.

Source: LA County, 2021b, LA County Green Streets Design Guidelines.

11.5 Coordination with District and/or USACE

Implementation of any stormwater BMP on District or USACE ROW requires coordination and permitting with the applicable agency. The agency maintaining a select portion of channel may be identified using the following GIS tool: LA County Storm Drain System Infrastructure. This should be confirmed through discussion with the permitting agency early in the design process. Land ownership may be identified using LA County GIS data download(s).

Additional information related to project coordination and permitting is provided in Section 1.3 of these Design Guidelines and Standards, and Section 6 of the SGV Greenway Network Plan.

Section 12

Operations & Maintenance

Operations and maintenance refer to specific day-to-day tasks and programs performed to ensure greenway resources and facilities are kept in good usable condition. The goal of operation and maintenance is to promote and maintain a quality outdoor recreation and transportation experience.

12.1 What's in This Section

This section describes the operations and maintenance responsibilities of the project proponents, including landscape improvements, fencing and gate guidance, graffiti and litter control, and information on the maintenance of other multi-use greenway features.

12.2 Operations & Maintenance Responsibilities

The maintenance responsibilities of project proponents will be delineated through a Use Agreement established between the District and the Project Proponent. Execution of a use agreement will be required to obtain a permit for the development of a proposed greenway project.

The project proponent's role in operation and maintenance is to maintain greenway elements, such as landscaping, an irrigation system, pocket parks, signage, fencing, access gates, gateways, seating, lighting, recreational trails etc., as well as the active transportation elements such as the bike path, paving, vehicle ramps, bike aid stations, striping, etc. The project proponent must maintain all project features, including but not limited to fencing, benches, trash receptacles, bike repair stations, shade structures, vegetation, irrigation, pavement, signing and striping, graffiti cleanup, people experiencing homelessness encampment cleanup, and litter and dumping removal.

12.3 Landscape Improvements

Vegetation management, including access road clearance of all vegetation, brush, weeds, and tree limbs up to 15 ft high etc. and landscape maintenance, including decorative plants, irrigation, pruning, and other gardening type activities, will be performed by the project proponent.

The Use Agreement executed by the Project Proponent and the District will include a table with the required scope of work for landscape maintenance. Please refer to the example shown below on

Table 12-1 Exhibit B- Scope of Work: Landscape Maintenance, included in all greenways use agreements.

Table 12-1. Exhibit B Scope of Work Landscape Maintenance		
Action	**Description**	**Frequency**
Tree Trimming	Remove dead, deceased, insect-infested and damaged branches and limbs	As needed
	Prune Elm, Eucalyptus, and Pepper trees	Every two (2) years
	Prune all other trees	Every three (3) years
	Dispose of all trees downed by natural or unnatural causes	As needed
Tree Staking	Install stakes when tree is damaged, requires support, or is less than three (3) inches in diameter	As needed
	Check ties, and stakes	Once (1) a month
Shrubbery/ Vines Trimming	Shrubs and vines shall be trimmed to restrict growth onto the adjacent roads, driveways, and walkways	As needed
	Shrubs should be trimmed to not grow taller than 4 feet, and no shorter than 3 ½ feet	Once (1) a year, in March
	Trimming should look natural – no shearing	
	Remove dead or diseased plant materials	As needed
Ground Cover Trimming and Care	Keep ground covers adjacent to roadways away from paved surfaces	Twice (2) a year, in March and September
	Edges should look natural – no shearing	
Ornamental Grass Trimming	Trim vines and ornamental grass in an artisan-like manner – no scalping	Once (1) a year, in September.
	Ornamental grass and vines along bicycle trails	Twice (2) a year, in March and September
Weed Control	Keep landscaped areas free of weeds	Once (1) a week
	Remove all weeds from walkways, drainage areas, and cracks in all hard surface areas	Once (1) a week
Watering and Irrigation System	Operation of automatic irrigation controllers in a way to not cause excessive wetness	
	Inspect and maintain irrigation system	As needed
Rodent Control	Maintain all areas free of rodents, in compliance with Federal, State and local laws – to be completed by California Certified Applicator	As needed

12.4 Fencing & Gates

Project proponent will be responsible for the repairs of fencing and gates. Proponents will also be responsible for closing and opening gates, including when weather forecast for the next 24-hour period is for (1) inch of rain or more, or when notified by the District.

12.5 SGV Greenway Network Hours of Operation

The sponsor municipality or agency will be responsible for setting the hours of operation for the SGV greenway segment and posting signage along the greenways stating the hours of operation . The SGV Greenway Network may also be closed at the discretion of the District for any purpose, not limited to maintenance or repair of the greenway or channel.

12.6 Graffiti

Project proponent shall remove graffiti from premise and improvements such as walls, fences, and signs. Graffiti coatings can be instrumental in combating graffiti. There are two types of graffiti coatings: permanent and sacrificial.

- Permanent coatings seal the undersurface and make it impervious to paint, tar, markers, etc. These coatings are not preferred because graffiti removal involves the use of solvents and intensive scrubbing.
- Sacrificial coatings are intended to be removed along with the graffiti. Some of these products have a waxy, polymer base that is removed with a hot water pressure sprayer. After cleaning graffiti in this manner, the coating needs to be immediately replaced to be effective. In certain cases, vegetation can also be an effective graffiti deterrent.

The best deterrent to graffiti is immediate removal. If graffiti is removed within 24 hours of its first appearance, it is less likely to be re-painted. Graffiti in unincorporated areas of LA County should be reported to the Public Works Graffiti Abatement Crew at (800) 675-4357. Visit pw.lacounty.gov/general/graffiti.cfm to learn how users can report graffiti found in other parts of LA County. Occurrences can be removed with a cloth and graffiti removal product such as “Goop-Off”. Care should be taken to remove the underlying paint if any is present. Graffiti should not be painted over without prior LA County approval.

12.7 Litter Control

All trash, debris, and other unsightly material should be removed from the SGV Greenway Network area on a regular basis. Litter problems should be corrected as soon as they are noticed regardless of when it is discovered. Trash receptacles should be checked on a weekly basis and should be emptied no less than every 2 weeks. All other debris should also be removed at this time. Trails, paths, and access roads should be cleared of rocks, branches, or any other debris. See Table 12-2 for the requirements for the frequency of litter control that will be included in the use agreement.

Table 12-2. Use Agreement excerpt example, Exhibit B Landscape Maintenance

Litter Control	Remove litter and accumulated debris from landscaped areas	Once (1) a week
	Empty and clean trash cans/receptacles	Once (1) a week
	Replace pet litter bags	Once (1) a week
	DO NOT handle hazardous waste materials except as necessary to comply with Section 2.6 of the Use Agreement.	

12.8 Hardscape

Hardscape elements include asphalt access roads, bike paths, bike racks, and pathways, concrete paths/walkways, pavers, decomposed granite and other “softer” paving materials, as well as boulders, cobble, and walls.

Asphalt surfaces must be monitored for excessive cracking. Dirt, rock, mulch, and other dry materials should be swept from the path or road surfaces. Due to environmental and/or noise concerns, gas powered blowers or water should not be used for surface cleaning.

Walls, cobble, boulders, and concrete surfaces should be monitored for graffiti and other damage on a regular basis. Any area that appears to be unsafe should be immediately barricaded until it can be repaired.

12.9 Multi-Use Greenway Features and Improvements

Features along greenways must be designed to be vandalism resistant. Greenway features include water stations, benches, shaded areas, bike racks, emergency call boxes, lighting, interpretive signage, and litter and recycling receptacles. These items should be inspected weekly. Specific repair procedures are not included in this document. Refer to the Greenbook (PWSI, 2021) and specifications included in the project construction contract documents for more information on repairs. All greenway landscape improvements shall include manufacturer’s product information and maintenance recommendations shall be included in the final Operations and Maintenance (O&M) manual. O&M manuals will be required on all projects as part of the design services of creating the construction documents unless otherwise specified by LA County.

12.10 Restriping & Signage

Project Proponents will be responsible for striping and signage as needed based on complaints or at LACFCD’s request.

12.11 Stormwater BMP Operation & Maintenance

While stormwater BMPs themselves provide passive as opposed to active treatment, there are still actions that must be taken to maintain their efficacy. The LA County Low Impact Development Standards Manual outlines maintenance requirements including (LA County, 2014):

- Operation plan, including a site plan and schedule
- Maintenance plan, including cleaning activities and schedule
- Resource needs to operate and maintain the stormwater BMP
- The responsible party to carry out the O&M plans

Elements to meet the above requirements include: a site map, baseline descriptions, a spill plan, facility changes, training, basic inspection and maintenance activities, revisions to pollution mitigation measures, funding, and a maintenance agreement. Additional details about requirements and associated elements may be referenced in Section 9 of this document or in Appendix E from the Low Impact Development Standards Manual (LA County, 2014).

Section 13

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Section 14

Figures, Tables, and Abbreviations

List of Figures

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List of Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
ADA	Americans with Disabilities Act
APWA	American Public Works Association
BMP	best management practice
CalEPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CPTED	Crime Prevention Through Environmental Design
DG	decomposed granite
DIB	Design Information Bulletin
District	Los Angeles County Flood Control District
DPR	Los Angeles County Department of Parks and Recreation
EPA	United States Environmental Protection Agency
ft	foot/feet
GMED	Geotechnical and Materials Engineering Division (LA County)
HAWK	Pedestrian hybrid beacon signal
HDM	Highway Design Manual (Caltrans)
hrs.	hours
LA	Los Angeles
LA County	Los Angeles County
District	Los Angeles County Flood Control District
LA County Public Works	Los Angeles County Public Works
LARWQCB	Los Angeles Regional Water Quality Control Board
LED	light-emitting diode
mph	miles per hour
MUTCD	Manual on Uniform Traffic Control Devices (California)
NACTO	National Association of City Transportation Officials
NEPA	National Environmental Policy Act
O&M	operation and maintenance
PEIR	Program Environmental Impact Report
ROW	right-of-way
SGMA	Sustainable Groundwater Management
SGV Greenway Network Plan	San Gabriel Valley Greenway Network Strategic Implementation Plan
SGV	San Gabriel Valley
SWMD	Los Angeles County Public Works Stormwater Maintenance Division
SWQDv	Stormwater Quality Design Volume
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VOC	volatile organic carbon
WDR	Waste Discharge Requirements

Attachment A: LA County Public Works Green Streets Design Guidelines and Standards

LA County Public Works Green Streets Design Guidelines

LA County Public Works Green Streets Standard Plans

LA County Public Works Green Streets Specifications

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Green Streets Design Guidelines

LACPW Guidelines for Green Infrastructure Implementation throughout LA County

May 2021

The LACPW Green Streets Design Guidelines (GSSP) are to be used for green infrastructure projects throughout LA County. To ensure must updated design guidelines, please refer to the most recent LACPW LID manual and Construction Division Special Provisions.

Bioretention – *General*

Description

Bioretention (practices include planter, curb extension, basin, and rain garden) is a shallow landscaped depression that provides stormwater storage, infiltration, and evapotranspiration. Practices can be constructed along the sides of streets, in the median, or adjacent to parking and other impervious surfaces. Areas are typically planted with native, drought-tolerant plant species (i.e., wildflowers, sedges, rushes, ferns, shrubs, small trees) that do not require fertilization and can withstand wet soils for at least 24 hours. Underdrains are used for flow through treatment systems (also called biofiltration) in areas with lower permeability native soils. Treated water discharges through the underdrain to the storm drain. For Bioretention practices see Standard Plans 3100-3106 in the GSSP.

Geotechnical Considerations

Refer to most recent Geotechnical and Materials Engineering Division (GMED) Policy GS 200 for technical guidance and specific requirements for geotechnical investigations to evaluate subsurface conditions for proposed stormwater infiltration sites. A summary of the key requirements are provided in the following table:

Site Feature	Requirements
Regional Desktop Study	Evaluating groundwater levels, potential for contamination, geologic characteristics, previous geotechnical investigations, preliminary environmental site screening, geotechnical hazards
Site Investigation	Preliminary site characterization, groundwater evaluation
Infiltration Test	Performed within the optimal zone(s) of infiltration as identified in the preliminary site characterization and groundwater evaluation. Reports the field infiltration rate of that zone.
Geotechnical Report	Identifies site-specific geotechnical hazards and potential adverse impacts of stormwater infiltration to nearby structures and improvements. Identifies potential zones of infiltration and recommended reduction factors for field infiltration rates.

Bioretention – *General*

Surface Setbacks

All bioretention facilities must be sited following requirements from the most recent LACPW LID Standards Manual, Americans With Disabilities Act (ADA), Standard Specifications for Public Works Construction (SSPWC), and any other applicable regulations. Minimum surface setback distances are presented in the following table:

Surface Feature	Minimum Distance
Bus Stops	10 feet from edge of facility to bus stop shelter. Facility should allow for all-door bus boarding.
Driveways	5-10 feet from edge of facility to edge of driveway/curb opening. 5 feet minimum is acceptable where vegetation height is 3 feet or less.
Crosswalks	10-20 feet from edge of facility to beginning/end of curb radius. 10 feet is acceptable in residential areas. 20 feet should be provided in commercial areas.
Sidewalks	5 feet clear path for pedestrian passage from edge of facility where pedestrian volumes are low. Maintain a 5-foot egress pathway to the street at least every 25 feet longitudinally.
Hydrants	5 feet from edge of facility to hydrant on center.
Trees	Facility should not be located within drip line of mature trees (greater than 4-inch DBH) unless otherwise approved by LACPW.

Underground Utilities

Underground utilities can be a major physical and financial constraint in implementing green streets. Utilities and stormwater facilities can coexist with proper assessment and design. Designers must address:

1) Fully understanding the type and location of all underground utilities within the project limits of disturbance
2) Providing adequate setbacks and cover around utility features
3) Minimizing the migration of infiltrated stormwater and protecting utilities
4) Providing adequate space for vaults and structures next to stormwater facilities

Stormwater infiltration shall not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill. Prior to designing, it is critical for the designer to conduct necessary utility searches, coordination with utility companies, and subsurface utility engineering to determine the actual vertical and horizontal location of underground utilities and structures. This may extend outside of the facility footprint if there is a discharge pipe from the facility (e.g. overflow or underdrain discharge).

Avoiding utility conflicts with facility placement is the preferred approach. If this is not possible, more costly solutions, such as relocation/replacement of utilities, can be explored with the affected utility provider. The table below lists minimum separation from underground utilities for projects served by LA County. Designer shall confirm there are no more restrictive setback requirements for projects in areas served by other utilities.

Subsurface Utility	Minimum Distance
Water Mains	4 feet horizontal from edge of facility to outside diameter of water main or valve box
Drinking Water Well	100 feet horizontal to groundwater production wells used for drinking water
Sanitary Sewer	4 feet horizontal from edge of facility to outside diameter of sewer main or outside edge of structure.
Water and Sewer Laterals	Water services shall be located outside of the facility footprint. Sewer laterals shall be located outside of the facility footprint if possible. Sewer laterals within the facility footprint shall be protected.
Private Utilities	Horizontal and vertical clearances for Power, Gas, Communication and other private utilities must be coordinated with individual utility companies.

Bioretention – *General*

Design Considerations

Design Feature	Requirements
Street Slope	Do not use bioretention on streets with slopes greater than 15 percent. Where street slopes exceed 2 percent, install check dams within bioretention unit to limit longitudinal slope to 2 percent.
Walkways	• Bioretention cells must not encroach upon clear walking paths and cannot impede designated accessible parking spaces or loading zones. • Where pedestrian activity is moderate or high, maintain a minimum of 8 feet of clear width between edge of bioretention and building or property line. Where pedestrian activity is low, provide 5 feet minimum.
Infiltration Capacity and Rates	• Bioretention requires a minimum corrected in-situ infiltration rate of greater than or equal to 0.3 in/hr. or use of an underdrain. • For sites with infiltration rates less than 0.3 in/hr., use Case A from Standard Plans to ensure underdrain/overflow is incorporated into the design. Only use Case A with overflow structure when a single inlet trench is used. For sites with infiltration rates greater than 0.3 in/hr., use Case B Standard Plans, which do not include underdrains. • The invert of stormwater infiltration shall be setback at least 15 feet and outside a 1:1 plane drawn up from the bottom of adjacent foundations, unless otherwise recommended by the geotechnical consultant. Increase wall depth or use impermeable liners along vertical walls to mitigate water migration at sites adjacent to basements and structures. • Stormwater infiltration shall not place an increased surcharge on structures or foundations on or adjacent to the site.
Ponding Depth and Volume Recovery	The maximum ponding depth is 6” unless approved by LACPW. The entire above and below ground treatment volume must be recovered within 96 hours.
Sediment Capture	A sediment sump will be provided at the primary inflow point(s) to the bioretention practice equal to 10 percent of the total infiltration practice length as shown on the Standard Plans. Sumps will include drawdown features to enable dewatering of the sump area within 48 hours. Design appropriate erosion control measures to protect the bioretention system from sediment containing runoff during construction.

Bioretention – *General*

Relevant Standard Specifications

- SSPWC Section 200: Rock Materials
- SSPWC Section 201: Concrete, Mortar and Related Materials
- SSPWC Section 202: Masonry Materials
- SSPWC Section 207: Gravity Pipe
- SSPWC Section 208: Pipe Joints Types and Materials
- SSPWC Section 212: Water and Sewer System Valves and Appurtenances
- SSPWC Section 213: Engineering Geosynthetics
- SSPWC Section 217: Bedding and Backfill Materials
- SSPWC Section 300: Earthwork
- SSPWC Section 301: Subgrade Preparation, Treated Materials and Placement of Base Materials
- SSPWC Section 303: Concrete and Masonry Construction
- SSPWC Section 402: Utilities
- SSPWC Section 800: Landscaping and Irrigation - Materials
- SSPWC Section 801: Landscaping and Irrigation – Installation
- GSSS Section 3100: Bioretention Soil

Relevant LACPW Sustainable Infrastructure Strategies

- Integrative Design (ID): 1, 2, 4, 5
- Site (S): 3 - 6, 8
- Water (W): 1 - 6
- Materials (M): 4 - 6
- Climate Mitigation and Resilience (CR): 1
- Construction (C): 2, 5, 6, 8
- Operation and Maintenance (OM): 1, 2, 4,7

Operations and Maintenance Activities

The County is in the process of developing an operation and maintenance manual. Until completed, please refer to the LID Standards Manual (2014).

Application

Bioretention planters are vegetated sidewalk infiltration cells with vertical concrete sides, flat bottom area, and capacity to capture, treat, and manage stormwater runoff from the street and sidewalk. Planters are most commonly installed in commercial areas with wider sidewalks but can be adapted to widely varying urban street contexts. Planters are effective where right-of-way width is constrained, or multi-modal capacity is high. Planters without step-out zones* can be used in applications where parking is not adjacent to the planter.

See GSSP 3100 Planter with Step-Out Zone and 3101 Planter Without Step-Out Zone for more details.

Specific Design Considerations

Planter with Step-out Zone

Design Feature	Requirements
Dimensions	The recommended minimum internal bed length is 20 feet. Maintain a 5-foot egress pathway to the street at least every 25 feet longitudinally.
Street Setback	For applications adjacent to parking provide a minimum 2'-6" wide step-out zone*.

Planter without Step-out Zone

Design Feature	Requirements
Dimensions	The recommended minimum internal bed length is 20 feet. Maintain a 5-foot egress pathway to the street at least every 25 feet longitudinally.
Street Setback	For applications with no adjacent parking the minimum step-out zone width, between the top of curb (inclusive of the curb width) and the planter, is 12".

*** Step-Out Zone** – A clear space that is free from obstructions to allow passengers to conveniently exit vehicles parked along the curb.

Sizing and Design

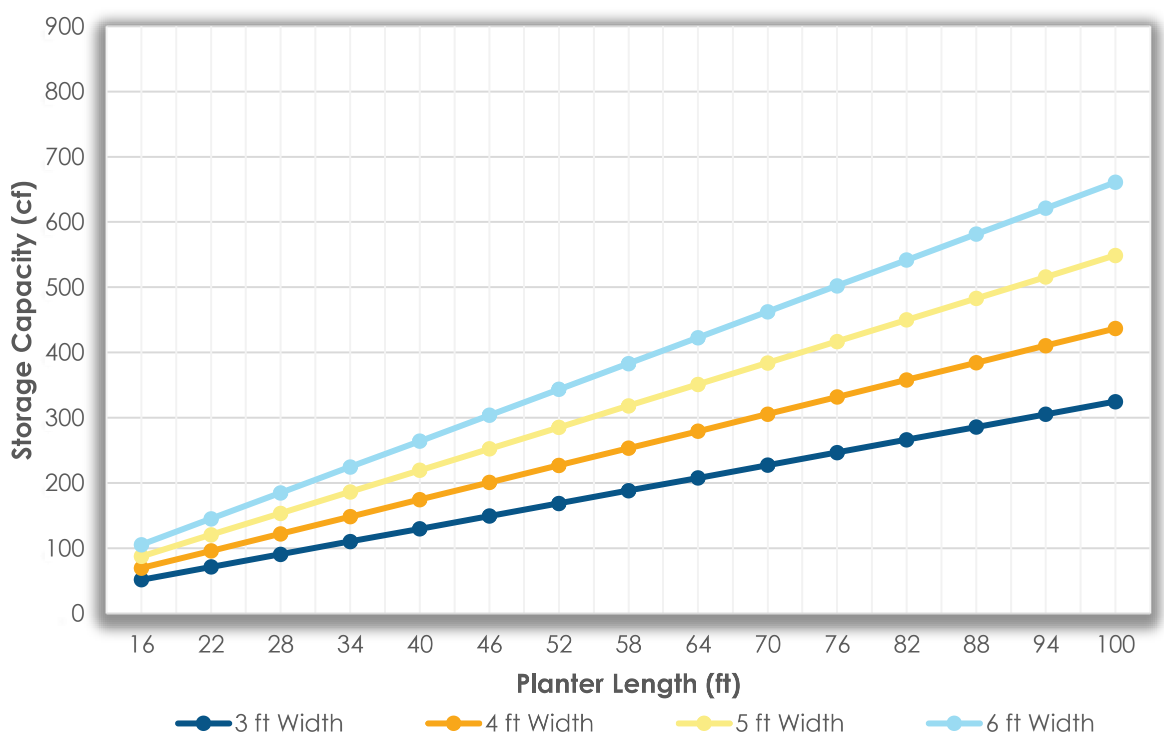
Size facility in accordance with the LACPW LID Standards Manual (2014) to capture and retain the SWQDv (the greater of the runoff from the 0.75-inch, 24-hour or the 85th percentile, 24-hour rain event). For a desired storage capacity, total planter length may be estimated using the following nomographs. For systems with underdrains, 1.5 times the required storage capacity must be provided for the portion of the SWQDv that cannot be reliably retained on the project site.

Steps:

1. Calculate the runoff volume for the facility contributing drainage area using HydroCalc.
2. Determine feasible planter width(s).
3. Select the line color matching the planter width.
4. Go to intersection of desired storage capacity to determine planter length.
5. If applicable, determine the additional storage capacity for the portion of the SWQDv that cannot be reliably retained.
6. Use the Green Street Standard Plans to determine number of planter cells and final configuration.
7. Confirm total storage capacity is equal to or greater than calculated runoff volume.

Planters

Storage Capacity Based on Surface Area



Notes:

1. Sizing based off GSSP 3100 Planter with Step-out Zone and 3101 Planter without Step-out Zone
2. Approximate necessary length for planters wider than 6 feet by interpolating the above graph. For example, if planter width is 8 feet, divide the required length of a 4 feet wide planter by 2.
3. For designs including underdrains, multiply storage capacity by 1.5 for the portion that cannot be reliably maintained on the project site.
4. Designer should calculate and confirm the exact storage capacity (based on the practice final design configuration) meets the storage requirement.

Bioretention – *Curb Extensions*

Application

Curb extensions, also known as bulb-outs, extend the sidewalk and/or parkway into the street. Curb extensions not only shorten the crossing distance for pedestrians, slow turning vehicles, and enhance the ability for pedestrians and motorists to see each other, but can also provide a space to capture, treat, and manage stormwater runoff from the street.

See GSSP 3102 Curb Extension (Mid-Block), 3103 Curb Extension (Mid-Block with Pedestrian Ramp), and 3104 Curb Extension (Corner) for more details.

Specific Design Considerations

Curb Extension (Mid-Block)

Design Feature	Requirements
Dimensions	The total curb extension width is dependent on if a curb ramp for pedestrian access needs to be accommodated in the design. The recommended minimum internal bioretention bed length is 30 feet. Maintain a 5-foot egress pathway to the street at least every 25 feet longitudinally.
Street Setback	Curb extensions are not regularly adjacent to parking, but if there is space, a 2'-6" step-out zone; a clear space that is free from obstructions to allow passengers to conveniently exit vehicles parked along the curb, is recommended.
Pedestrian Ramp	If pedestrian access is required through the mid-block curb extension, refer to GSSP 3103 for design details.

Curb Extension (Corner)

Design Feature	Requirements
Dimensions	The total curb extension width is dependent on if a curb ramp for pedestrian access needs to be accommodated in the design. The recommended minimum length is 30 ft (see GSSP 3102 for detailed dimensions).
Street Setback	Curb extensions are not regularly adjacent to parking, but if there is space, a 2'-6" step-out zone; a clear space that is free from obstructions to allow passengers to conveniently exit vehicles parked along the curb, is recommended.

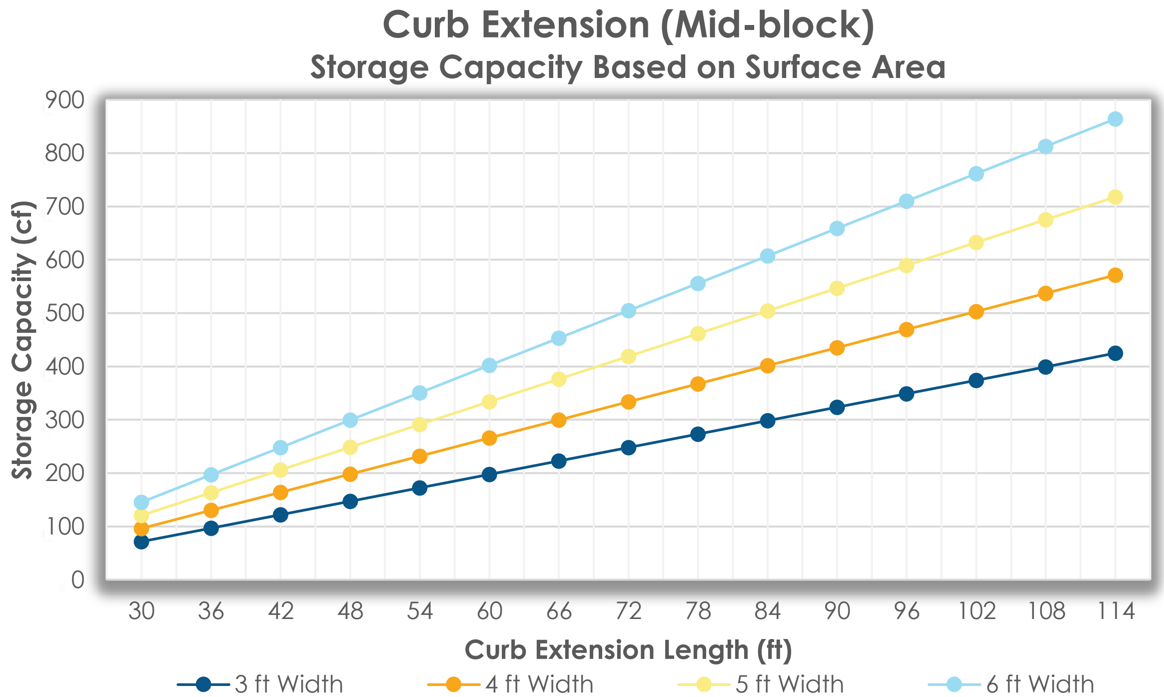
Sizing and Design

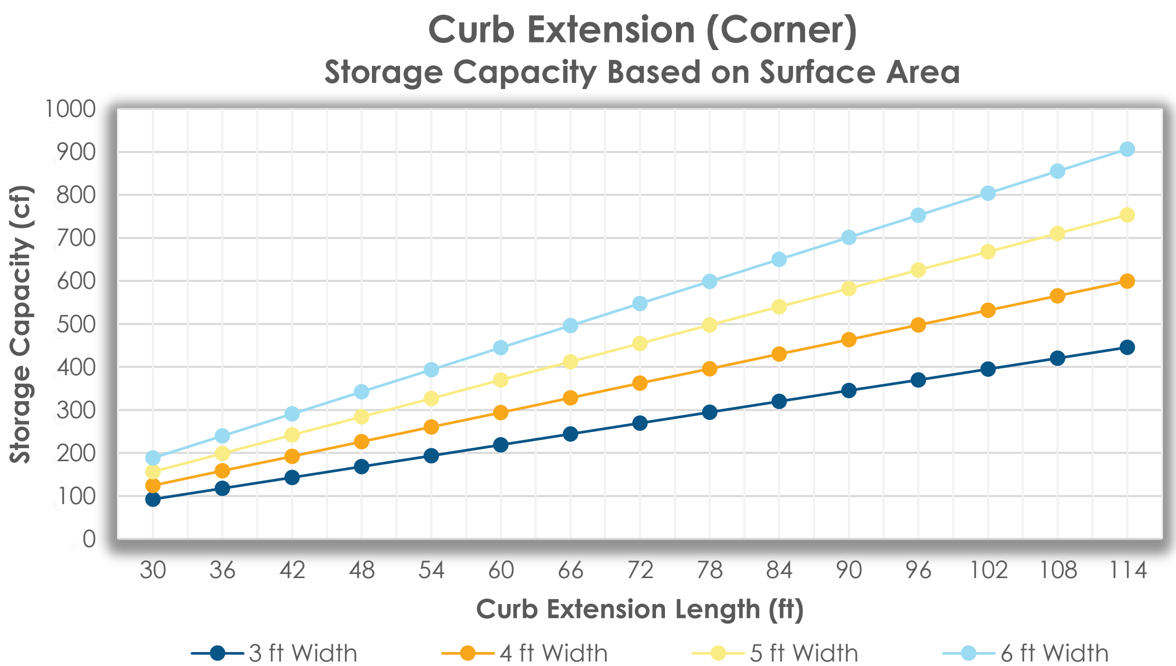
Size facility in accordance with the LACPW LID Standards Manual (2014) to capture and retain the SWQDv (the greater of the runoff from the 0.75-inch, 24-hour or the 85th percentile, 24-hour rain event). For a desired storage capacity, total planter length may be estimated using the following nomographs. For systems with underdrains, 1.5 times the required storage capacity must be provided for the portion of the SWQDv that cannot be reliably retained on the project site.

Steps:

1. Calculate the runoff volume for the facility contributing drainage area using HydroCalc.
2. Determine feasible planter width(s).
3. Select the line color matching the planter width.
4. Go to intersection of desired storage capacity to determine planter length.
5. If applicable, determine the additional storage capacity for the portion of the SWQDv that cannot be reliably retained.
6. Use the Green Street Standard Plans to determine number of planter cells and final configuration.
7. Confirm total storage capacity is equal to or greater than calculated runoff volume.

Sizing and Design (Continued)





Notes:

1. Sizing based off GSSP 3102 Curb Extension (Mid-Block), 3103 Curb Extension (Mid-Block with Pedestrian Ramp), and 3104 Curb Extension (Corner).
2. Approximate necessary length for curb extensions wider than 6 feet by interpolating the above graph. For example, if curb extension width is 8 feet, divide the required length of a 4 feet wide planter by 2.
3. For designs including underdrains, multiply storage capacity by 1.5 for the portion that cannot be reliably maintained on the project site.
4. Designer should calculate and confirm the exact storage capacity (based on the practice final design configuration) meets the storage requirement.

Application

A bioretention basin is a trench filled with permeable materials (gravel, sand, etc.) for retaining and infiltrating stormwater runoff into the underlying native soils and the groundwater table. They can either be constructed with a rock border or without.

See GSSP 3105 Basin with Rock Border and 3106 Basin without Rock Border for more details.

Specific Design Considerations

Basin with Rock Border

Design Feature	Requirements
Dimensions	Minimum length recommended is 20 ft. Level width minimum recommended 3 ft.

Basin without Rock Border

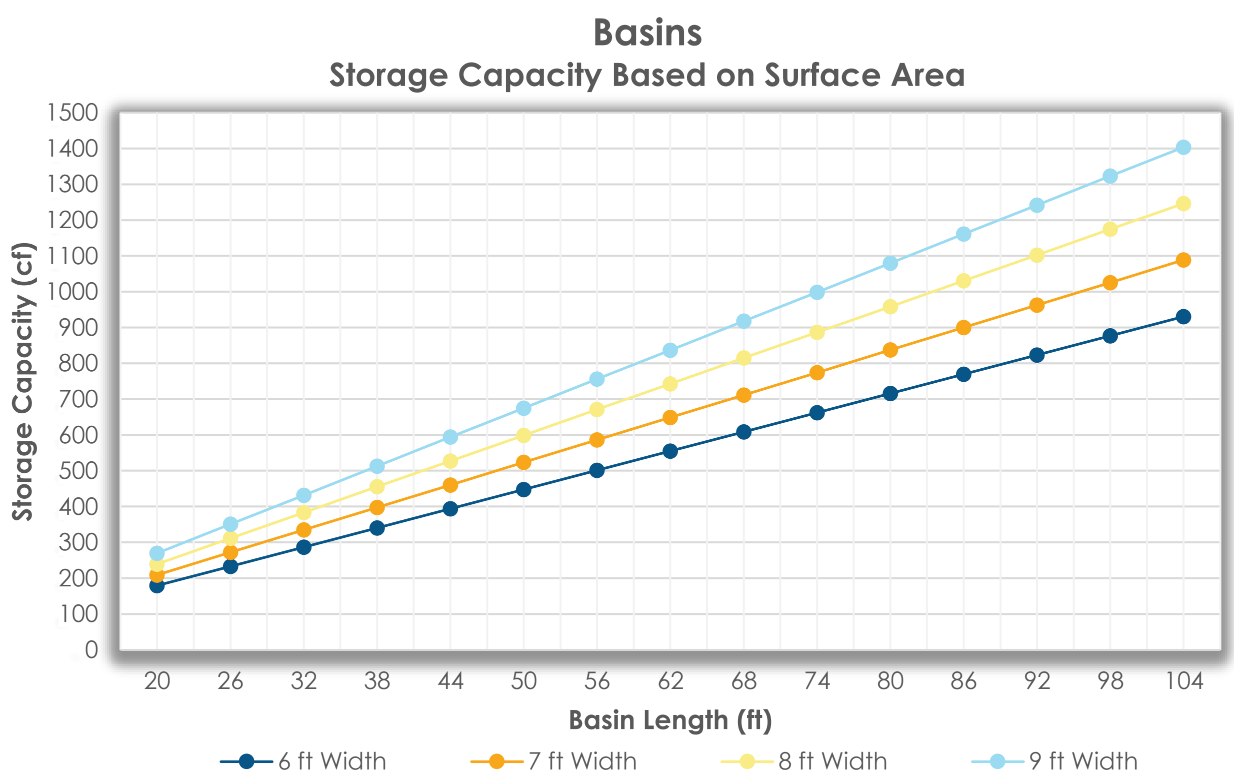
Design Feature	Requirements
Dimensions	Minimum length recommended is 20 ft. Level width minimum recommended 3 ft.

Sizing and Design

Size facility in accordance with the LACPW LID Standards Manual (2014) to capture and retain the SWQDv (the greater of the runoff from the 0.75-inch, 24-hour or the 85th percentile, 24-hour rain event). For a desired storage capacity, total planter length may be estimated using the following nomographs. For systems with underdrains, 1.5 times the required storage capacity must be provided for the portion of the SWQDv that cannot be reliably retained on the project site.

Steps:

1. Calculate the runoff volume for the facility contributing drainage area using HydroCalc.
2. Determine feasible planter width(s).
3. Select the line color matching the planter width.
4. Go to intersection of desired storage capacity to determine planter length.
5. If applicable, determine the additional storage capacity for the portion of the SWQDv that cannot be reliably retained.
6. Use the Green Street Standard Plans to determine number of planter cells and final configuration.
7. Confirm total storage capacity is equal to or greater than calculated runoff volume.



Notes:

1. Sizing based off GSSP 3105 Basin with Rock Border and 3106 Basin without Rock Border.
2. Approximate necessary length for basins wider than 9 feet by interpolating the above graph. For example, if basin width is 12 feet, divide the required length of a 6 feet wide basin by 2.
3. For designs including underdrains, multiply storage capacity by 1.5 for the portion that cannot be reliably maintained on the project site.
4. Designer should calculate and confirm the exact storage capacity (based on the practice final design configuration) meets the storage requirement.

Subsurface Infiltration – *General*

Description

Subsurface infiltration (practices include tree well filter, surface flow and piped flow) is a narrow trench constructed in pervious areas designed to retain and infiltrate stormwater runoff into the underlying native soils and groundwater table. Subsurface infiltration practices are typically filled with gravel or engineered soil or may instead contain manufactured underground stormwater storage chambers. Subsurface infiltration provides stormwater runoff treatment through filtration, adsorption, biological treatment, evapotranspiration, and infiltration as water flows through the media profile and into surrounding soils. Subsurface infiltration is used for small contributing drainage areas to store and treat stormwater runoff underground and out of sight.

Geotechnical Considerations

Refer to most recent Geotechnical and Materials Engineering Division (GMED) Policy GS 200 for technical guidance and specific requirements for geotechnical investigations to evaluate subsurface conditions for proposed stormwater infiltration sites. A summary of the key requirements is provided in the following table:

Site Feature	Requirements
Regional Desktop Study	Evaluating groundwater levels, potential for contamination, geologic characteristics, previous geotechnical investigations, preliminary environmental site screening, geotechnical hazards
Site Investigation	Preliminary site characterization, groundwater evaluation
Infiltration Test	Performed within the optimal zone(s) of infiltration as identified in the preliminary site characterization and groundwater evaluation. Reports the field infiltration rate of that zone.
Geotechnical Report	Identifies site-specific geotechnical hazards and potential adverse impacts of stormwater infiltration to nearby structures and improvements. Identifies potential zones of infiltration and recommended reduction factors for field infiltration rates.

Subsurface Infiltration – *General*

Surface Setbacks

All subsurface infiltration facilities must be sited following requirements from the most recent GMED Policy LACPW LID Standards Manual, Americans With Disabilities Act (ADA), Standard Specifications for Public Works Construction (SSPWC), and any other applicable regulations. Minimum surface setback distances are presented in the following table:

Surface Feature	Minimum Distance
Bus Stops	10 feet from edge of facility to bus stop shelter. Facility should allow for all-door bus boarding.
Driveways	5 feet from edge of facility to edge of driveway/curb opening with the exception of 10 feet for a tree well filter
Crosswalks	10-20 feet from edge of facility to beginning/end of curb radius. 10 feet is acceptable in residential areas. 20 feet should be provided in commercial areas.
Sidewalks	5 feet clear path for pedestrian passage from edge of facility where pedestrian volumes are low. Maintain a 5-foot egress pathway to the street at least every 25 feet longitudinally
Hydrants	5 feet from edge of facility to hydrant on center.
Trees	Facility should not be located within drip line of mature trees (greater than 4-inch DBH) unless otherwise approved by LACPW.
Property Line	5 feet from edge of facility

Underground Utilities

Underground utilities can be a major physical and financial constraint in implementing green streets. Utilities and stormwater facilities can coexist with proper assessment and design. Designers must address:

1) Providing adequate setbacks and cover around utility features
2) Minimizing the migration of infiltrated stormwater and protecting utilities
3) Providing adequate space for vaults and structures next to stormwater facilities

Stormwater infiltration shall not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill. Prior to designing, it is critical for the designer to conduct necessary utility searches, potholing and subsurface utility engineering to determine the actual location of underground utilities and structures. This may extend outside of the facility footprint if there is a discharge pipe from the facility (e.g. underdrain discharge).

Avoiding utility conflicts with facility placement is the preferred approach. If this is not possible, more costly solutions, such as relocation/replacement of utilities, can be explored with the affected utility provider. The table below lists minimum separation from underground utilities for projects served by LA County. Designer shall confirm there are no more restrictive setback requirements for projects in areas served by other utilities.

Subsurface Utility	Minimum Distance
Water Mains	4 feet horizontal from edge of facility to outside diameter of water main or valve box
Drinking Water Well	100 feet to groundwater production wells used for drinking water
Sanitary Sewer	4 feet horizontal from edge of facility to outside diameter of sewer main or outside edge of structure.
Water and Sewer Laterals	Water services shall be located outside of the facility footprint. Sewer laterals shall be located outside of the facility footprint if possible. Sewer laterals within the facility footprint shall be protected.
Private Utilities	Horizontal and vertical clearances for Power, Gas, Communication and other private utilities must be coordinated with individual utility companies.

Subsurface Infiltration – *General*

Design Considerations

Design Feature	Requirements
Sizing	Subsurface infiltration practices are sized using a simple sizing method where the Stormwater Quality Design Volume (SWQDv) must be completely filtered within 96 hours.
Flow Entrance and Energy Dissipation	Energy dissipation controls, constructed of sound materials such as stones, concrete, or proprietary devices that are rated to withstand the energy of the influent flow, must be installed at the inlet to these practices.
Vegetation	For tree well filters, trees should be suited to well-drained soil; be dense and strong enough to stay upright; have minimum need for fertilizers; comply with Integrated Pest Management practices; be able withstand multiple days of inundation; and be consistent with local water conservation ordinance requirements. Other subsurface infiltration practices must be kept free of vegetation and outside of the drip lines of trees and other large vegetation.
Use of Geomembranes	For tree well filters, a geomembrane liner may be placed between the planting media and the drain rock. Minimum permittivity rate is 75 gallons/minute/square feet and should not impede the infiltration rate of the soil medium. Other subsurface infiltration practices must be lined with a geomembrane as shown on the Standard Plan to prevent soil from migrating into the media and reducing the infiltration capacity. Provide 12-inch minimum overlap at any seams.
Overflow Devices	An overflow device/drainage pathway must be provided if stormwater runoff may exceed the capacity/maximum ponding depth of the practice. The overflow device/pathway must be able to convey stormwater runoff to the nearest storm drain or a downstream BMP for further treatment and limit surface water ponding to less than 6-inches within the practice limits.
Sediment Capture	Pretreatment to remove sediment is required to protect subsurface infiltration practices from sediment loads. Contributing drainage areas must be vegetated/stabilized to prevent soil transport to the practice. Design appropriate erosion control measures to protect the subsurface infiltration system from sediment containing runoff during construction.

Subsurface Infiltration – *General*

Relevant Standard Specifications

- SSPWC Section 200: Rock Materials
- SSPWC Section 201: Concrete, Mortar and Related Materials
- SSPWC Section 202: Masonry Materials
- SSPWC Section 207: Gravity Pipe
- SSPWC Section 208: Pipe Joints Types and Materials
- SSPWC Section 212: Water and Sewer System Valves and Appurtenances
- SSPWC Section 213: Engineering Geosynthetics
- SSPWC Section 217: Bedding and Backfill Materials
- SSPWC Section 300: Earthwork
- SSPWC Section 301: Subgrade Preparation, Treated Materials and Placement of Base Materials
- SSPWC Section 303: Concrete and Masonry Construction
- SSPWC Section 402: Utilities
- SSPWC Section 800: Landscaping and Irrigation - Materials
- SSPWC Section 801: Landscaping and Irrigation – Installation
- GSSS Section 3100: Bioretention Soil

Relevant LACPW Sustainable Infrastructure Strategies

- Integrative Design (ID): 1, 2, 4, 5
- Site (S): 3 - 6, 8
- Water (W): 1 - 6
- Materials (M): 4 - 6
- Climate Mitigation and Resilience (CR): 1
- Construction (C): 2, 5, 6, 8
- Operation and Maintenance (OM): 1, 2, 4, 7

Operations and Maintenance Activities

The County is in the process of developing an operation and maintenance manual. Until completed, please refer to the LID Standards Manual (2014).

Subsurface Infiltration – *Tree Well*

Application

A tree well is a biofiltration area similar to a stormwater planter that consists of one or multiple chambered pre-cast concrete boxes with a small tree or shrub planted in a bed filled with soil media. Tree wells are typically installed where street trees are normally planted and receive stormwater runoff from adjoining paved areas. Tree wells provide both stormwater retention and treatment services as well as serving aesthetic purposes and take up little space, making them ideal at highly-developed sites.

See LACPW Standard Plan 3110 Tree Well for more details.

Specific Design Considerations

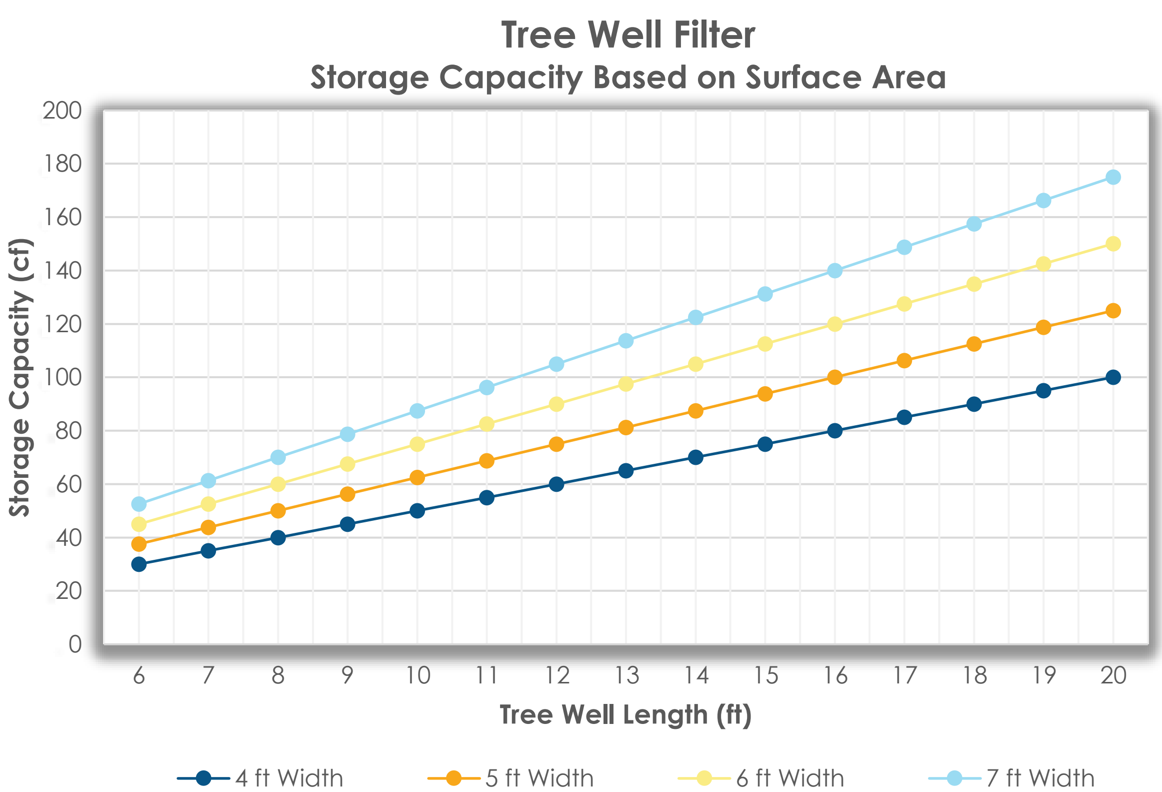
Design Features	Requirements
Sizing	Minimum recommended dimensions of a tree well are 4 ft by 6 ft.
Above Ground Storage	If the incoming stormwater runoff flow rate is lower than the long-term filtration rate, above ground storage does not need to be provided. If the incoming stormwater runoff flow rate is higher than the long-term filtration rate, above ground storage shall be provided.

Sizing and Design

Size facility in accordance with the LACPW LID Standards Manual (2014) to capture and retain the SWQDv (the greater of the runoff from the 0.75-inch, 24-hour or the 85th percentile, 24-hour rain event). For a desired storage capacity, total planter length may be estimated using the following nomographs. For systems with underdrains, 1.5 times the required storage capacity must be provided for the portion of the SWQDv that cannot be reliably retained on the project site.

Steps:

1. Calculate the runoff volume for the facility contributing drainage area using HydroCalc.
2. Determine feasible planter width(s).
3. Select the line color matching the planter width.
4. Go to intersection of desired storage capacity to determine planter length.
5. If applicable, determine the additional storage capacity for the portion of the SWQDv that cannot be reliably retained.
6. Use the Green Street Standard Plans to determine number of planter cells and final configuration.
7. Confirm total storage capacity is equal to or greater than calculated runoff volume.



Notes:

1. Sizing based off GSSP 3110 Tree Well Filter .
2. Approximate necessary length for filter wider than 6 feet by interpolating the above graph. For example, if filter width is 8 feet, divide the required length of a 4 feet wide planter by 2.
3. For designs including underdrains, multiply storage capacity by 1.5 for the portion that cannot be reliable maintained on the project site.
4. Designer should calculate and confirm the exact storage capacity (based on the practice final design configuration) meets the storage requirement.

Subsurface Infiltration – *Galleries*

Application

Infiltration galleries are narrow formed channels filled with filter media of multiple sizes that capture, treat, and manage stormwater runoff from contributing upgradient areas. Infiltration trench size is highly customizable, making them well suited for placement in narrow spaces on development sites. Infiltration trenches are most effective on sites with average soil permeability without steep slopes or fill soils.

See LACPW Standard Plan 3112-1 Infiltration Gallery (Piped Flow) and 3112-2 Infiltration Gallery (Surface Flow) for more details.

See GSSP 3104 Basin with Rock Border and 3105 Basin without Rock Border for more details.

Specific Design Considerations

Infiltration Gallery (Surface Flow)

Design Feature	Requirements
Dimensions	Minimum surface width of 4 ft. Minimum subsurface width of 2 ft. Length to be determined by designer.

Infiltration Gallery (Piped Flow)

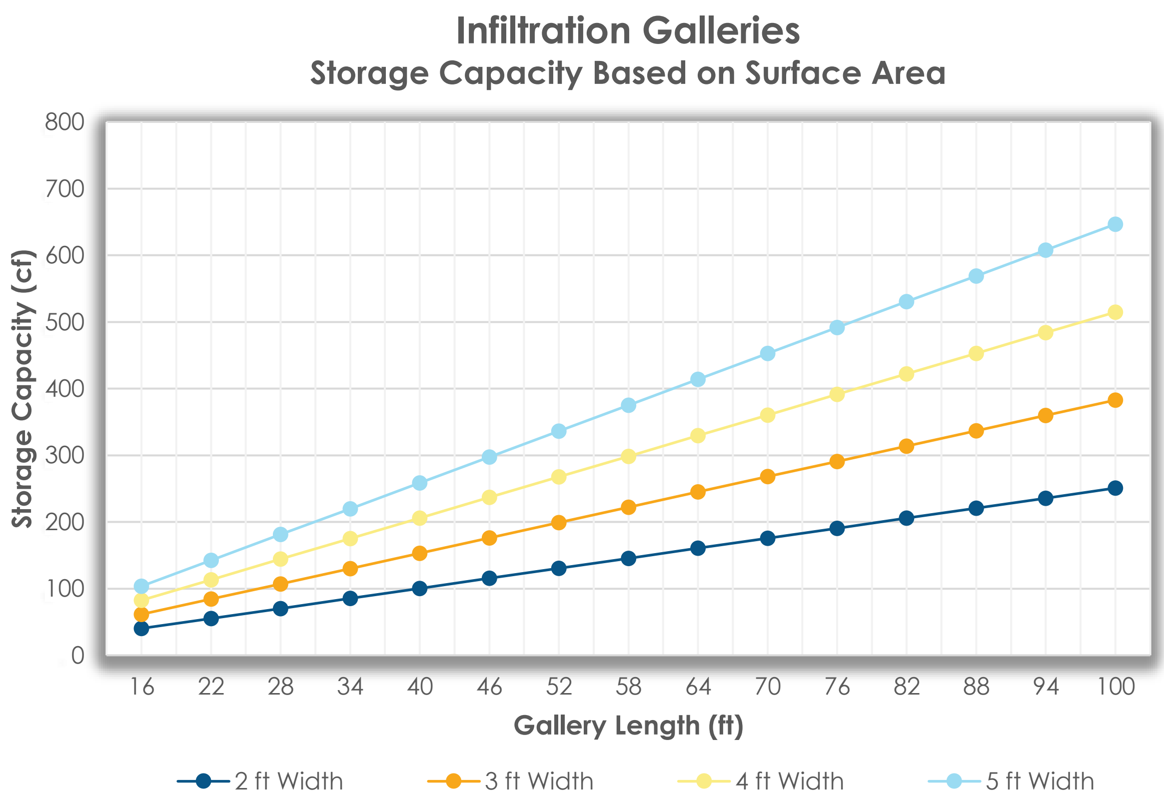
Design Feature	Requirements
Dimensions	Minimum width of 30 ft. Maximum length of 100ft. No minimum length.

Sizing and Design

Size facility in accordance with the LACPW LID Standards Manual (2014) to capture and retain the SWQDv (the greater of the runoff from the 0.75-inch, 24-hour or the 85th percentile, 24-hour rain event). For a desired storage capacity, total planter length may be estimated using the following nomographs. For systems with underdrains, 1.5 times the required storage capacity must be provided for the portion of the SWQDv that cannot be reliably retained on the project site.

Steps:

1. Calculate the runoff volume for the facility contributing drainage area using HydroCalc.
2. Determine feasible planter width(s).
3. Select the line color matching the planter width.
4. Go to intersection of desired storage capacity to determine planter length.
5. If applicable, determine the additional storage capacity for the portion of the SWQDv that cannot be reliably retained.
6. Use the Green Street Standard Plans to determine number of planter cells and final configuration.
7. Confirm total storage capacity is equal to or greater than calculated runoff volume.



Notes:

1. Sizing based off GSSP 3112 Infiltration Gallery (Surface Flow) and 3113 Infiltration Gallery (Piped Flow).
2. Approximate necessary length for galleries wider than 6 feet by interpolating the above graph. For example, if planter width is 8 feet, divide the required length of a 4 feet wide basin by 2.
3. For designs including underdrains, multiply storage capacity by 1.5 for the portion that cannot be reliably maintained on the project site.
4. Designer should calculate and confirm the exact storage capacity (based on the practice final design configuration) meets the storage requirement.

Permeable Pavement – *General*

Description

Permeable pavement (including permeable interlocking concrete pavers, pervious concrete, and porous asphalt) is a surface that can infiltrate stormwater runoff through sublayers of sand and gravel. Permeable interlocking concrete pavement is comprised of a layer of durable concrete pavers separated by joints filled with small stones. Pervious concrete is made from carefully controlled amounts of water and cement materials with little to no sand or fine aggregate particles which creates void spaces that convey water through the surface. Porous asphalt, or "open-graded" asphalt, pavement contains no fine aggregate particles, which creates void spaces in the pavement and allows water to collect within and drain through the pavement. Underdrains are used in areas with lower permeability native soils. Treated water discharges through the underdrain to the storm drain. For Permeable Pavement practices see Standard Plan 3120.

Geotechnical Considerations

Refer to most recent Geotechnical and Materials Engineering Division (GMED) Policy GS 200 for technical guidance and specific requirements for geotechnical investigations to evaluate subsurface conditions for proposed stormwater infiltration sites. A summary of the key requirements are provided in the following table:

Site Feature	Requirements
Regional Desktop Study	Evaluating groundwater levels, potential for contamination, geologic characteristics, previous geotechnical investigations, preliminary environmental site screening, geotechnical hazards
Site Investigation	Preliminary site characterization, groundwater evaluation
Infiltration Test	Performed within the optimal zone(s) of infiltration as identified in the preliminary site characterization and groundwater evaluation. Reports the field infiltration rate of that zone.
Geotechnical Report	Identifies site-specific geotechnical hazards and potential adverse impacts of stormwater infiltration to nearby structures and improvements. Identifies potential zones of infiltration and recommended reduction factors for field infiltration rates.

Permeable Pavement – *General*

Siting Guidance

All permeable pavement facilities must be sited following requirements from the most recent LACPW LID Standards Manual, Americans With Disabilities Act (ADA), Standard Specifications for Public Works Construction (SSPWC), and any other applicable regulations. Minimum surface setback distances are presented in the following table:

Consideration	Requirements
Placement	Use for sidewalk, walkways, and low vehicle movement pavement areas (e.g. street parking lanes, maintenance drives, parking areas, emergency stopping/parking lanes).
Restrictions	Not appropriate for industrial sites or locations with contaminated soils or where spills may occur, high turning areas or areas with heavy truck or equipment use.
Property Lines	Facility should not be located within 5 feet of property lines.
Trees	Facility should not be located within drip line of mature trees (greater than 4-inch DBH) unless otherwise approved by LACPW.

Underground Utilities

Underground utilities can be a major physical and financial constraint in implementing green streets. Utilities and stormwater facilities can coexist with proper assessment and design. Designers must address:

1) Fully understanding the type and location of all underground utilities within the project limits of disturbance
2) Providing adequate setbacks and cover around utility features
3) Minimizing the migration of infiltrated stormwater and protecting utilities
4) Providing adequate space for vaults and structures next to stormwater facilities

Stormwater infiltration shall not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill. Prior to designing, it is critical for the designer to conduct necessary utility searches, coordination with utility companies, and subsurface utility engineering to determine the actual vertical and horizontal location of underground utilities and structures. This may extend outside of the facility footprint if there is a discharge pipe from the facility (e.g. overflow or underdrain discharge).

Avoiding utility conflicts with facility placement is the preferred approach. If this is not possible, more costly solutions, such as relocation/replacement of utilities, can be explored with the affected utility provider. The table below lists minimum separation from underground utilities for projects served by LA County. Designer shall confirm there are no more restrictive setback requirements for projects in areas served by other utilities.

Subsurface Utility	Minimum Distance
Water Mains	4 feet horizontal from edge of facility to outside diameter of water main or valve box
Drinking Water Well	100 feet to groundwater production wells used for drinking water
Sanitary Sewer	4 feet horizontal from edge of facility to outside diameter of sewer main or outside edge of structure.
Water and Sewer Laterals	Water services shall be located outside of the facility footprint. Sewer laterals shall be located outside of the facility footprint if possible. Sewer laterals within the facility footprint shall be protected.
Private Utilities	Horizontal and vertical clearances for Power, Gas, Communication and other private utilities must be coordinated with individual utility companies.

Permeable Pavement – *General*

Design Considerations

Consideration	Requirements
Edge Restraint	Permeable pavement must be surrounded by a concrete edge restraint with sufficient width and depth to maintain the integrity of the pavement system. The concrete edge may be an existing or new concrete curb.
Adjacent Pavement	Solid asphalt or concrete pavement for vehicle movement lanes should be used leading up to permeable pavement areas.
Infiltration Capacity and Rates	• Permeable pavement requires a minimum corrected in-situ infiltration rate of greater than or equal to 0.3 in/hr. or use of an underdrain. • The invert of stormwater infiltration shall be setback at least 15 feet and outside a 1:1 plane drawn up from the bottom of adjacent foundations, unless otherwise recommended by the geotechnical consultant. Increase wall depth or use impermeable liners along vertical walls to mitigate water migration at sites adjacent to basements and structures. • Stormwater infiltration shall not place an increased surcharge on structures or foundations on or adjacent to the site.
Overflow Device	Provide an overflow drainage pathway to convey higher stormwater runoff flows to another stormwater treatment feature or nearest storm drain system. Design the overflow pathway so that water stages a maximum of two inches above the level of the permeable pavement surface. Ensure that the two-inch ponding depth is contained and does not extend beyond the permeable pavement limits.
Sediment	Assess the contributing drainage area and do not place permeable pavement in areas that receive runoff from unvegetated soil or other high sediment loading areas without sediment pretreatment. Design appropriate erosion control measures to protect all layers of the permeable pavement system from sediment containing runoff during construction.
Structural Integrity	Evaluate the expected traffic loading (type, number, and weight of vehicles) and design the permeable paver section to accommodate. This may require additional stone depth and/or the use of geotextile and/or geogrid. During design assess the type and stability of the existing soil subgrade beneath the paver system and address any unsuitable soils by removal and replacement and/or use of geogrid per the project geotechnical engineer's recommendations.

Permeable Pavement – *General*

Relevant Standard Specifications

- SSPWC Section 200: Rock Materials
- SSPWC Section 201: Concrete, Mortar and Related Materials
- SSPWC Section 202: Masonry Materials
- SSPWC Section 207: Gravity Pipe
- SSPWC Section 208: Pipe Joints Types and Materials
- SSPWC Section 211: Material Tests
- SSPWC Section 212: Water and Sewer System Valves and Appurtenances
- SSPWC Section 213: Engineering Geosynthetics
- SSPWC Section 217: Bedding and Backfill Materials
- SSPWC Section 300: Earthwork
- SSPWC Section 301: Subgrade Preparation, Treated Materials and Placement of Base Materials
- SSPWC Section 302: Roadway Surfacing
- SSPWC Section 303: Concrete and Masonry Construction
- SSPWC Section 402: Utilities
- SSPWC Section 403: Manhole Adjustment and Reconstruction
- SSPWC Section 800: Landscaping and Irrigation - Materials
- SSPWC Section 801: Landscaping and Irrigation – Installation
- GSSS Section 3120: Permeable Pavement

Relevant LACPW Sustainable Infrastructure Strategies

- Integrative Design (ID): 1, 2, 3, 4, 5
- Site (S): 3 - 6, 8
- Water (W): 1 - 6
- Materials (M): 1 - 6
- Climate Mitigation and Resilience (CR): 1
- Construction (C): 1, 2, 5, 6, 8
- Operation and Maintenance (OM): 1, 2, 4, 6, 8

Operations and Maintenance Activities

The County is in the process of developing an operation and maintenance manual. Until completed, please refer to the LID Standards Manual (2014).

Permeable Pavement

Application

Permeable pavement is a class surfaces which allow for the flow of water through void spaces within or around the surface structure. Pervious pavement surfaces are effective at providing dual use stormwater and community needs and are ideal for placement in limited space developments. Frequent inspections are required to ensure that the void spaces remain open, and the pavement is performing properly.

See GSSP 3120 Permeable Pavement.

Specific Design Considerations

Interlocking Pavers

Design Feature	Requirements
Dimensions	If constructed as sidewalk, minimum width is 5 ft. Otherwise, no minimum/maximum dimensions.
Parking	For applications adjacent to parking provide a minimum 2'-6" wide step-out zone.

Pervious Concrete

Design Feature	Requirements
Dimensions	If constructed as sidewalk, minimum width is 5 ft. Otherwise, no minimum/maximum dimensions.
Parking	For applications adjacent to parking provide a minimum 2'-6" wide step-out zone.

Porous asphalt

Design Feature	Requirements
Dimensions	If constructed as sidewalk, minimum width is 5 ft. Otherwise, no minimum/maximum dimensions.
Parking	For applications adjacent to parking provide a minimum 2'-6" wide step-out zone.

*** Step-Out Zone** – A clear space that is free from obstructions to allow passengers to conveniently exit vehicles parked along the curb.

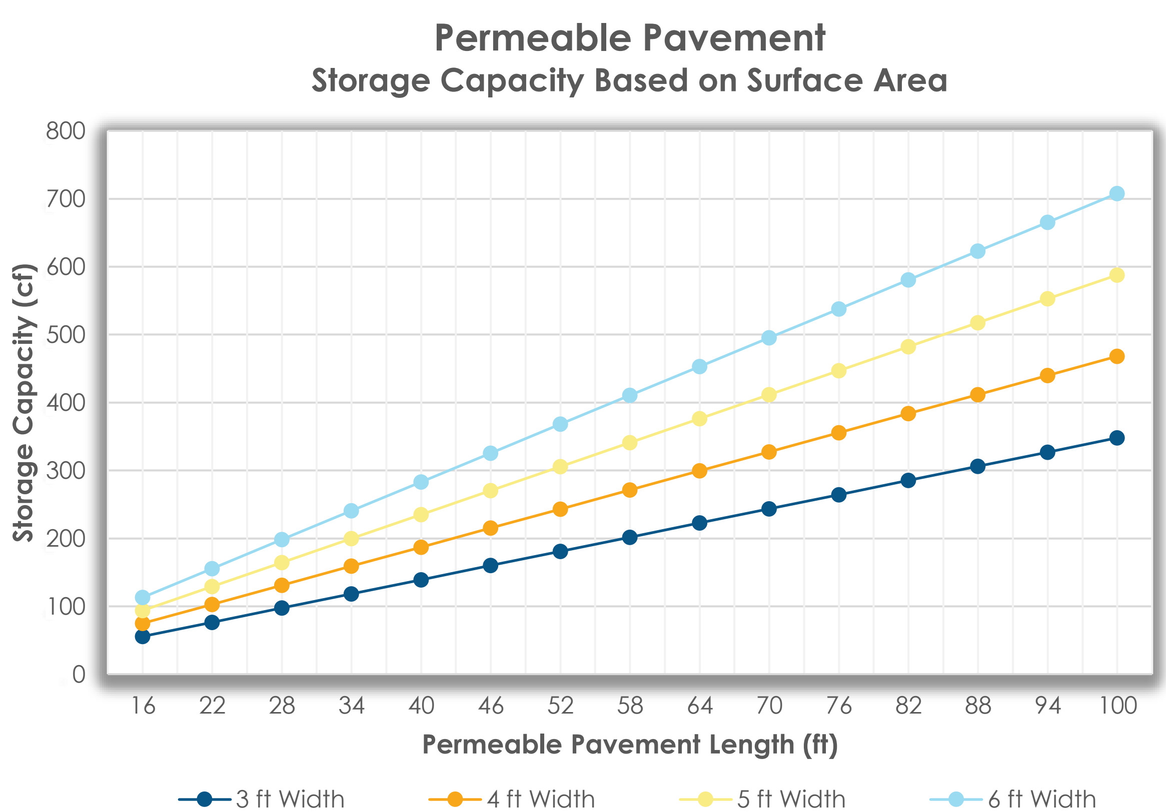
Permeable Pavement

Sizing and Design

Size facility in accordance with the LACPW LID Standards Manual (2014) to capture and retain the SWQDv (the greater of the runoff from the 0.75-inch, 24-hour or the 85th percentile, 24-hour rain event). For a desired storage capacity, total planter length may be estimated using the following nomographs. For systems with underdrains, 1.5 times the required storage capacity must be provided for the portion of the SWQDv that cannot be reliably retained on the project site.

Steps:

1. Calculate the runoff volume for the facility contributing drainage area using HydroCalc.
2. Determine feasible planter width(s).
3. Select the line color matching the planter width.
4. Go to intersection of desired storage capacity to determine planter length.
5. If applicable, determine the additional storage capacity for the portion of the SWQDv that cannot be reliably retained.
6. Use the Green Street Standard Plans to determine number of planter cells and final configuration.
7. Confirm total storage capacity is equal to or greater than calculated runoff volume.



Notes:

1. Sizing based off GSSP 3120 Permeable Pavement.
2. Approximate necessary length for pavement wider than 6 feet by interpolating the above graph. For example, if pavement width is 8 feet, divide the required length of a 4 feet wide planter by 2.
3. For designs including underdrains, multiply storage capacity by 1.5 for the portion that cannot be reliably maintained on the project site.
4. Designer should calculate and confirm the exact storage capacity (based on the practice final design configuration) meets the storage requirement.

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May 7, 2021

DRAFT FINAL GREEN STREETS STANDARD PLANS (GSSP)

TABLE OF CONTENTS

SECTION 3100

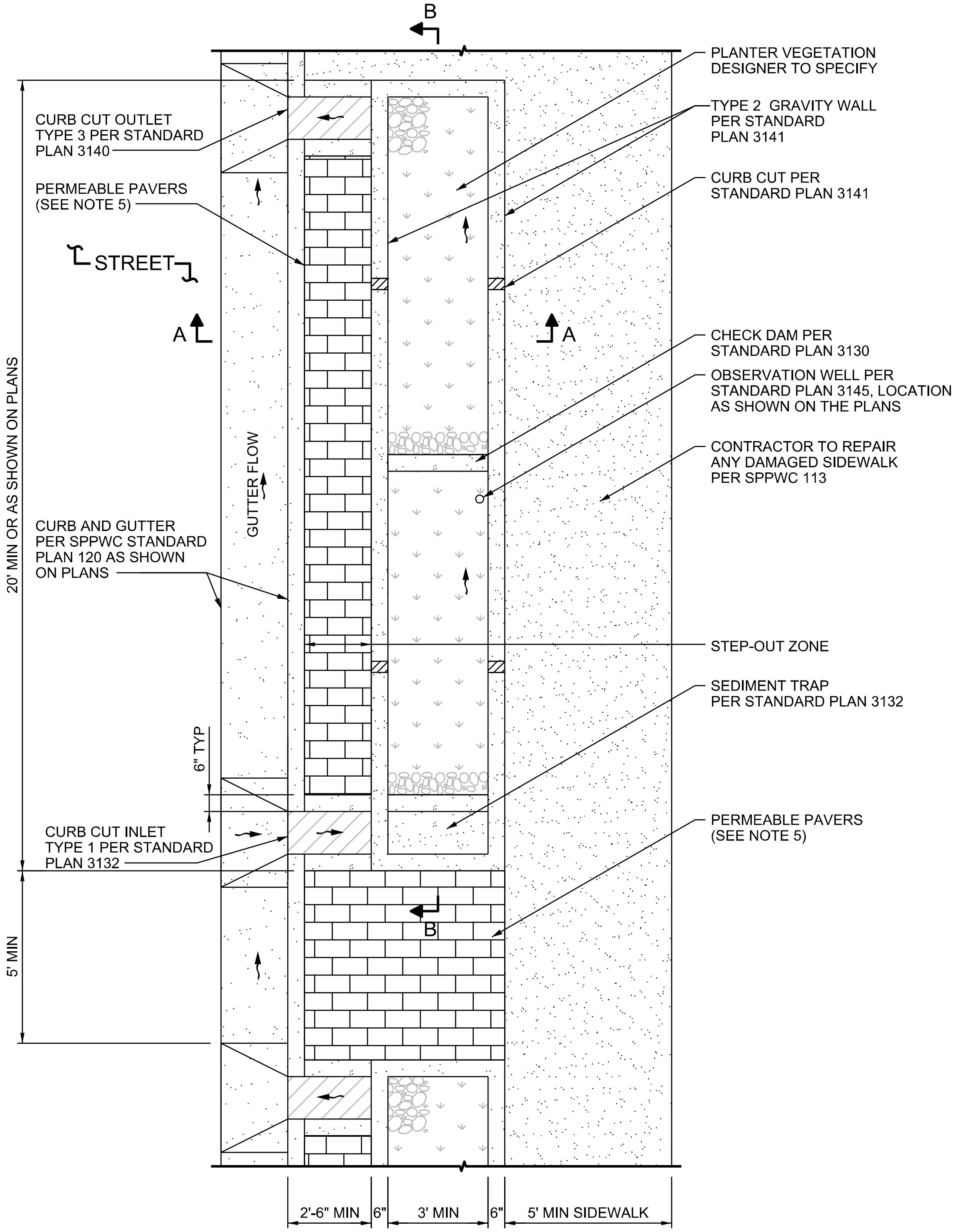
GREEN STREETS

NOTES FOR REVIEWERS:

1. CAD PLANS AND DRAWING NUMBERS CORRESPOND TO LACPW STANDARD PLANS, 2000 EDITION (LACPW SP).
2. GREEN STREET PRACTICES ARE FOR RIGHT-OF-WAY ONLY EXCEPT FOR BASIN PLANS.
3. STANDARD DETAILS NOTES ARE FOR CONSTRUCTION ONLY. DESIGN NOTES WILL BE LISTED IN THE GREEN STREET DESIGN GUIDELINES (GSDG) DOCUMENT.
4. CONTRACTOR SHOULD ADHERE TO THE COUNTY'S SPECIAL PROVISIONS, ON TOP OF GREENBOOK STANDARD SPECIFICATIONS OR SSPWC. REACH OUT TO LACPW CONSTRUCTION DIVISION TO IDENTIFY ANY UPDATED SPECIAL PROVISIONS THAT MAY AFFECT DESIGN.

LACPW GREEN STREETS STANDARDS PLANS

	GENERAL SHEET INDEX	STANDARD PLAN
	USE WITH LACPW GREEN STREETS STANDARD GUIDELINES	



NOTES:

1. SIDEWALK AND DRIVEWAY REPLACEMENT PER SPPWC 113.
2. PLANTERS SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
3. CHECK DAM REQUIRED IF MAX PONDING LEVEL IS 6" OR GREATER.
4. CHECK DAMS SHALL BE SPACED AS SHOWN ON PLANS.
5. PERMEABLE PAVERS TO CONFORM TO STANDARD PLAN 3120.
6. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.

PLAN DETAIL

NOT TO SCALE

LACPW GREEN STREETS STANDARD PLANS

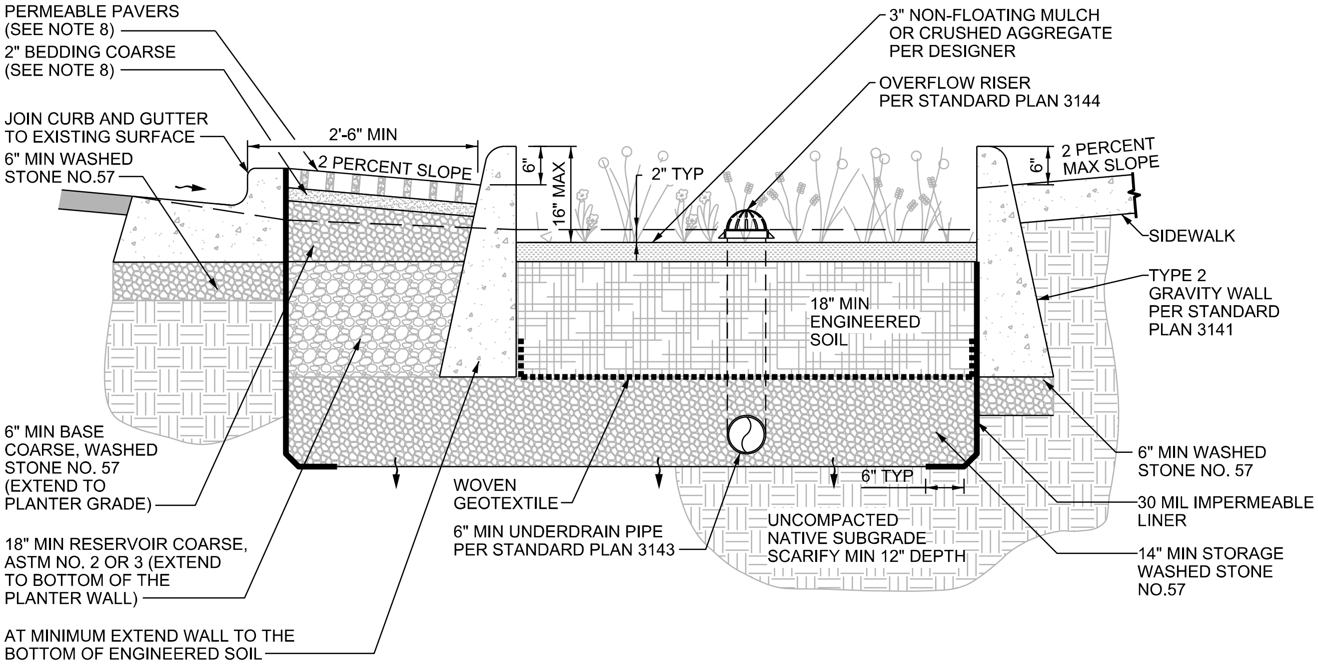
PLANTER WITH STEP-OUT ZONE
PLAN VIEW

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

3100-1

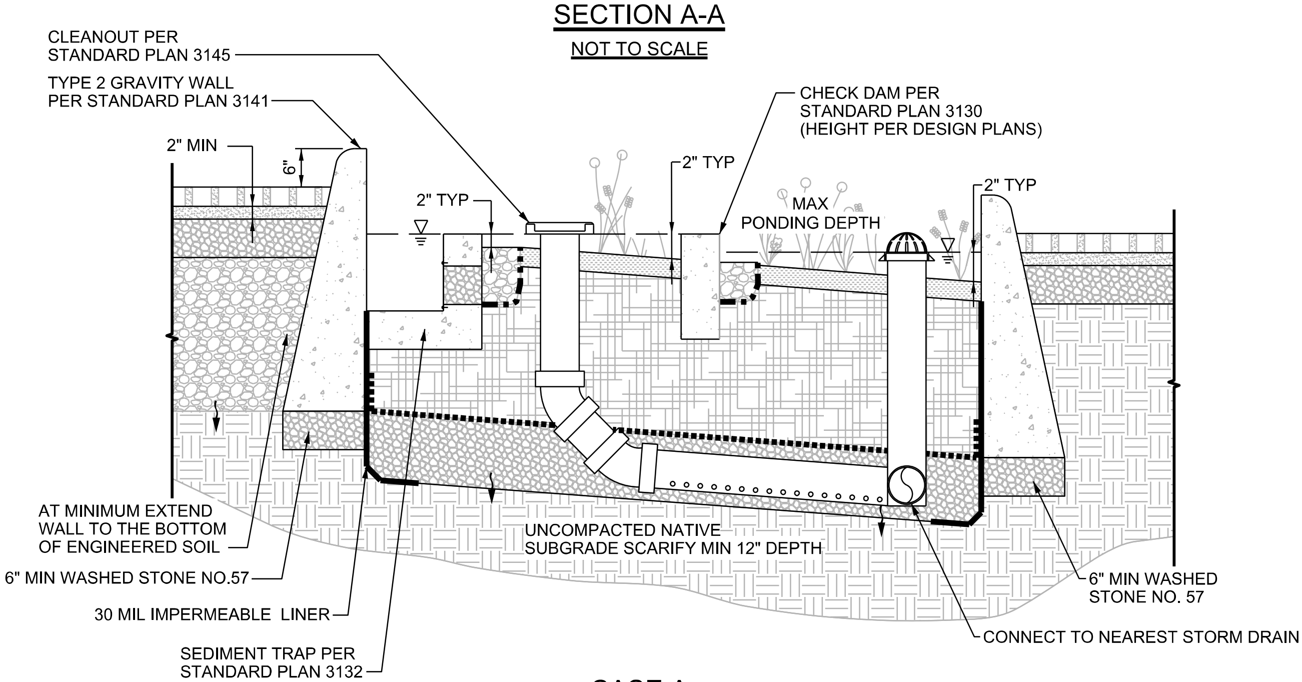
SHEET 1 OF 3



CASE A

SECTION A-A

NOT TO SCALE



CASE A

SECTION B-B

NOT TO SCALE

NOTES:

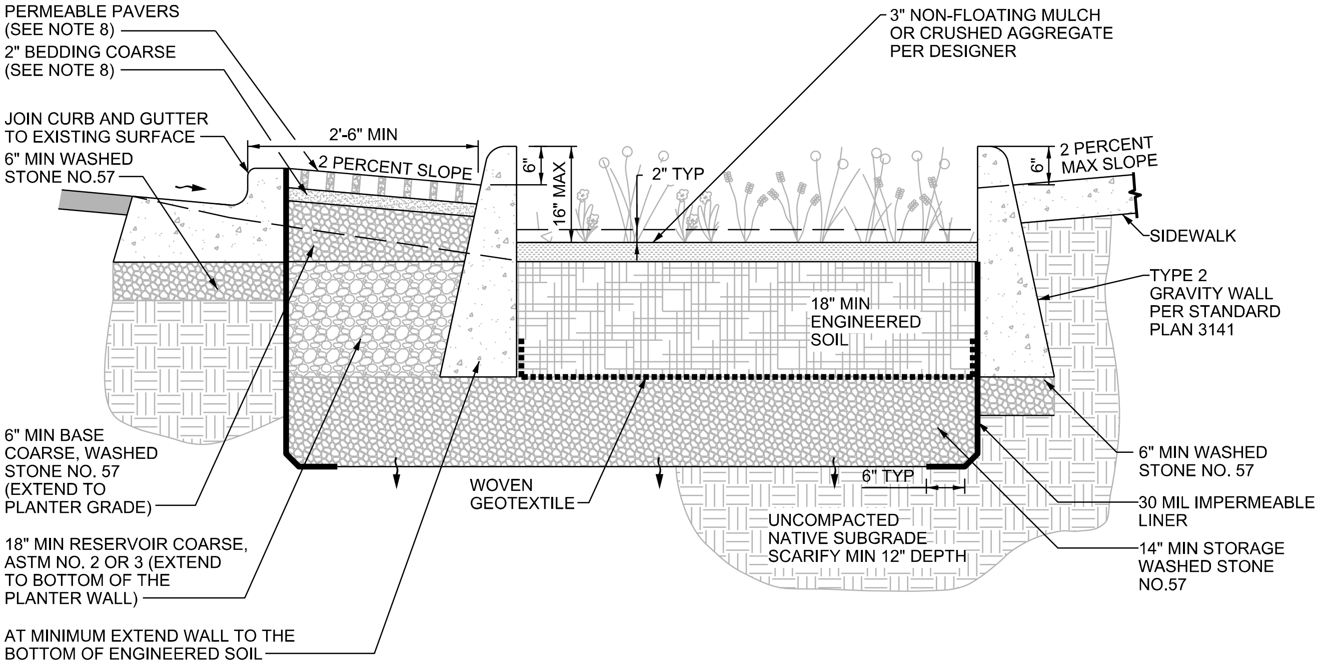
1. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
2. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
3. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
4. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
5. CHECK DAM REQUIRED IF MAX PONDING LEVEL 6" OR GREATER.
6. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
7. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
8. SEE PERMEABLE PAVERS STANDARD PLAN 3120 FOR ADDITIONAL INFORMATION.
9. USE UNDERDRAINS (CASE A) WHERE SITE SOIL INFILTRATION RATE IS LESS THAN 0.3 INCHES PER HOUR.
10. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

PLANTER WITH STEP-OUT ZONE CASE A, WITH UNDERDRAIN

STANDARD PLAN

3100-1

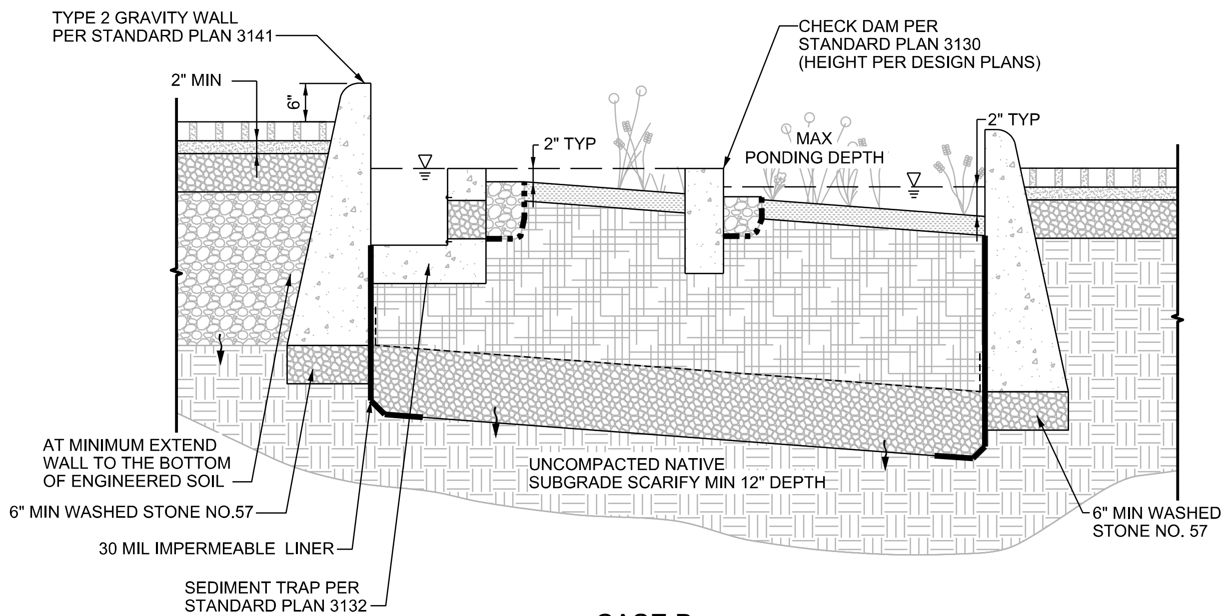
USE WITH LACPW GREEN STREETS DESIGN GUIDELINES



CASE B

SECTION A-A

NOT TO SCALE



CASE B

SECTION B-B

NOT TO SCALE

NOTES:

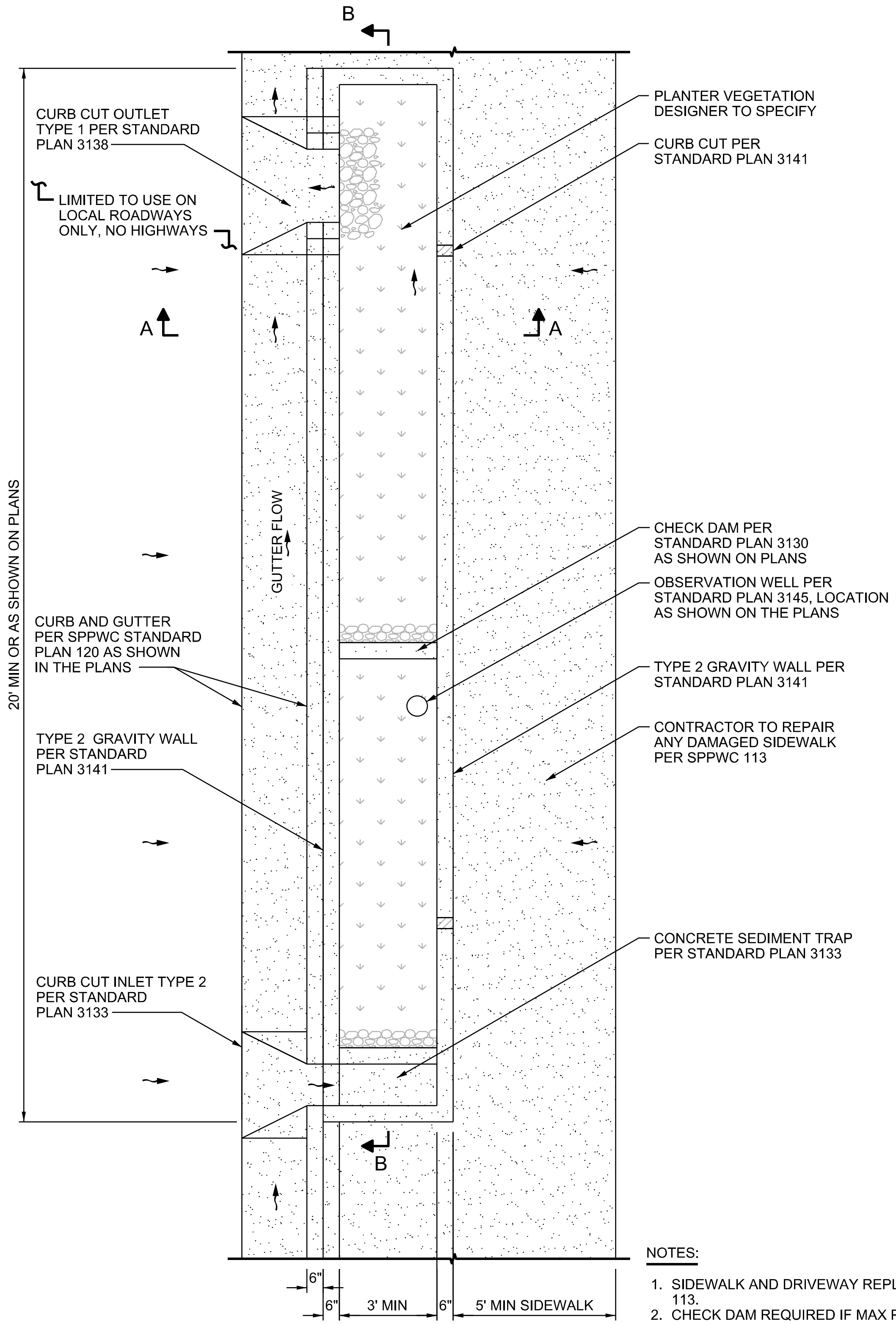
1. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
2. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
3. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
4. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
5. CHECK DAM REQUIRED IF MAX PONDING LEVEL 6" OR GREATER.
6. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
7. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
8. SEE PERMEABLE PAVERS STANDARD PLAN 3120 FOR ADDITIONAL INFORMATION.
9. USE UNDERDRAINS (CASE A) WHERE SITE SOIL INFILTRATION RATE IS LESS THAN 0.3 INCHES PER HOUR.
10. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

PLANTER WITH STEP-OUT ZONE
CASE B, WITHOUT UNDERDRAIN

STANDARD PLAN 3100-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES



NOTES:

1. SIDEWALK AND DRIVEWAY REPLACEMENT PER SPPWC 113.
2. CHECK DAM REQUIRED IF MAX PONDING LEVEL 6" OR GREATER.
3. CHECK DAM SHALL BE SPACED AS SHOWN ON THE PLANS.
4. PLANTERS SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
5. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.

PLAN DETAIL

NOT TO SCALE

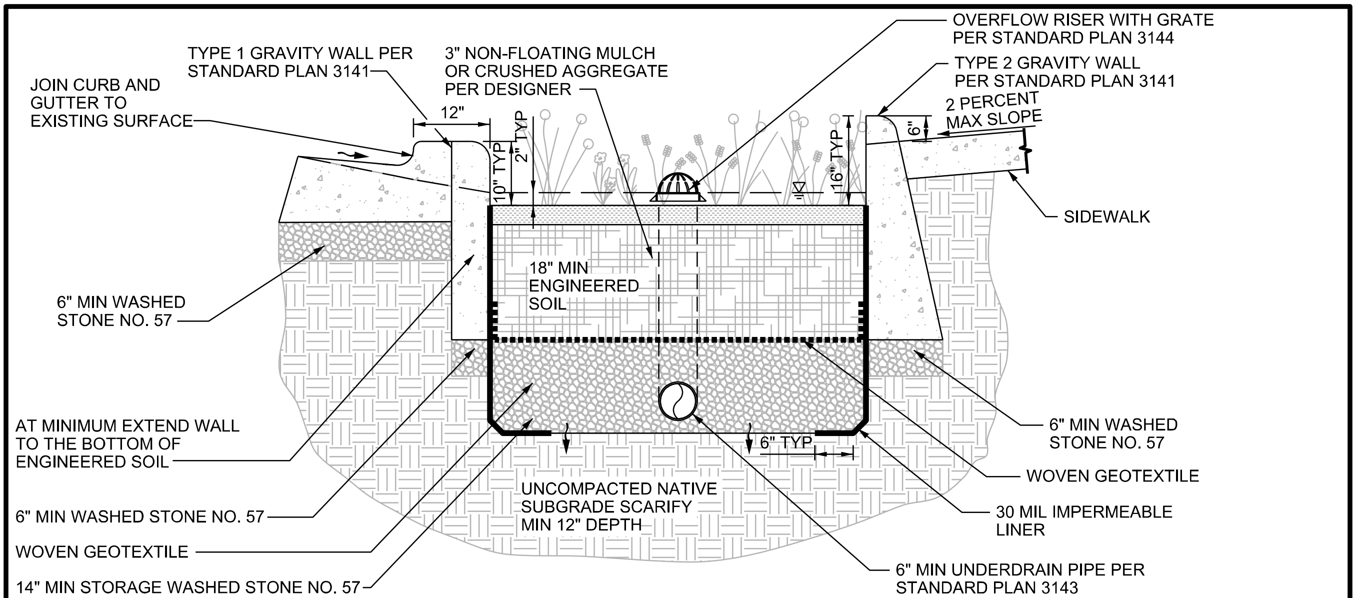
LACPW GREEN STREETS STANDARD PLANS

PLANTER WITHOUT STEP-OUT ZONE PLAN VIEW

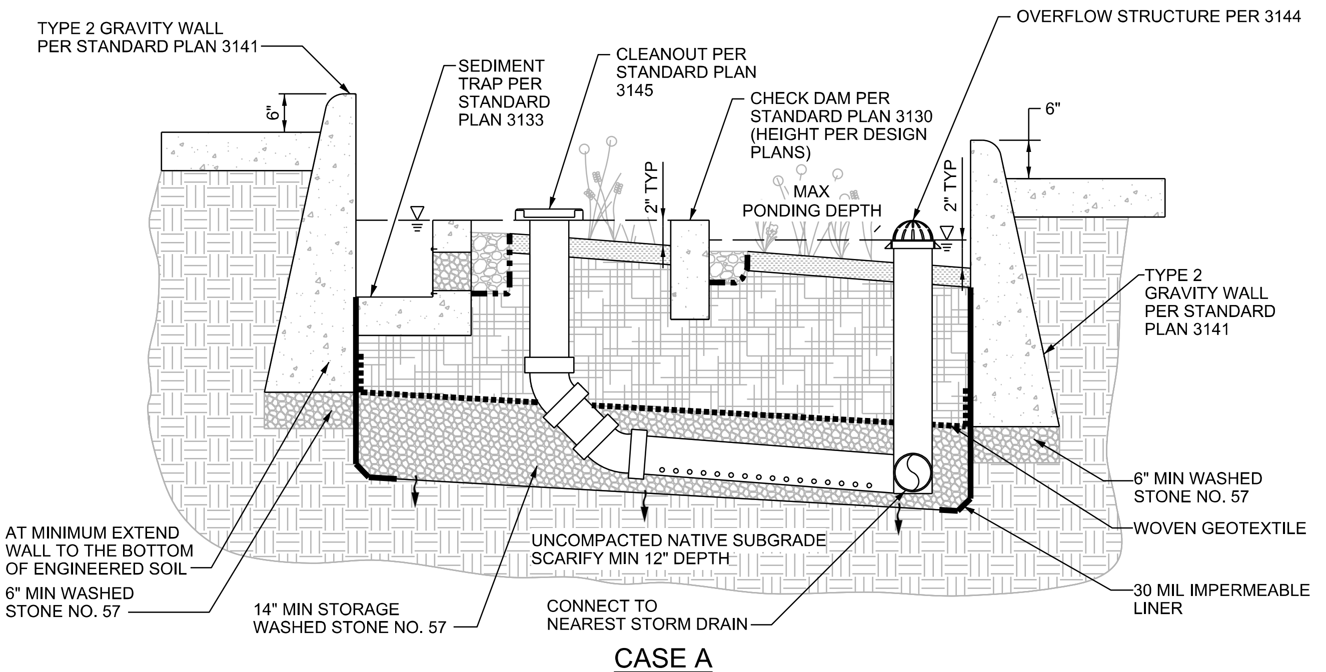
STANDARD PLAN

3101-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES



CASE A
SECTION A-A
NOT TO SCALE



CASE A
SECTION B-B
NOT TO SCALE

NOTES:

1. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
2. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
3. JOINTS BETWEEN WALLS SHALL BE SEALED PER SPPWC SECTION 303-1.8.7.
4. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
5. CHECK DAM REQUIRED IF MAX PONDING LEVEL 6" OR GREATER.
6. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
7. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
8. SEE PERMEABLE PAVERS STANDARD PLAN 3120 FOR ADDITIONAL INFORMATION.
9. USE UNDERDRAINS (CASE A) WHERE SITE SOIL INFILTRATION RATE IS LESS THAN 0.3 INCHES PER HOUR.
10. WOVEN GEOTEXTILE TO BE TYPE 20WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

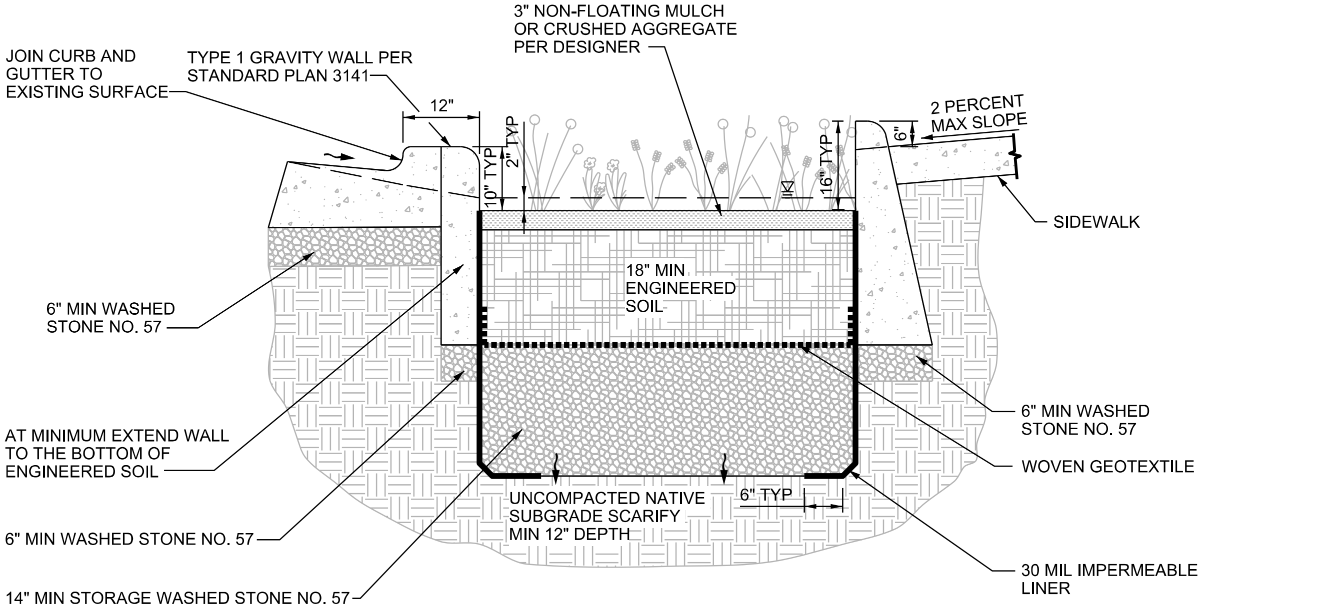
LACPW GREEN STREETS STANDARD PLANS

PLANTER WITHOUT STEP-OUT ZONE CASE A, WITH UNDERDRAIN

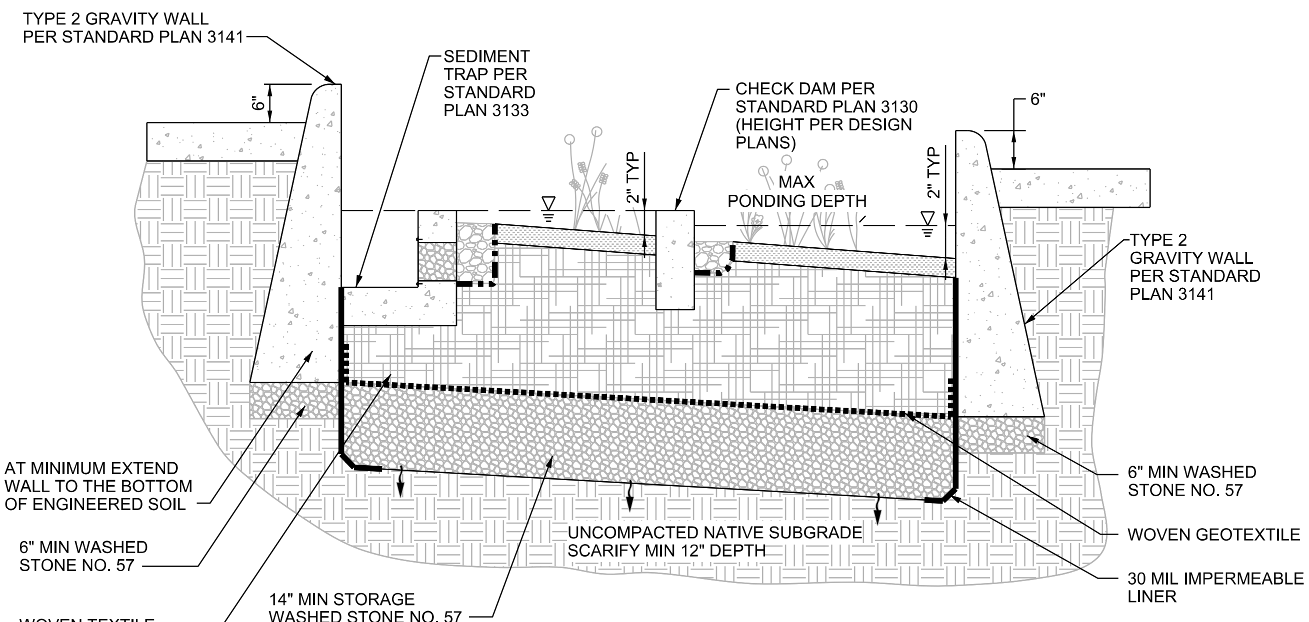
STANDARD PLAN

3101-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES



CASE B
SECTION A-A
NOT TO SCALE



CASE B
SECTION B-B
NOT TO SCALE

NOTES:

1. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
2. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
3. JOINTS BETWEEN WALLS SHALL BE SEALED PER SPPWC SECTION 303-1.8.7.
4. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
5. CHECK DAM REQUIRED IF MAX PONDING LEVEL 6" OR GREATER.
6. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
7. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
8. SEE PERMEABLE PAVERS STANDARD PLAN 3120 FOR ADDITIONAL INFORMATION.
9. USE UNDERDRAINS (CASE A) WHERE SITE SOIL INFILTRATION RATE IS LESS THAN 0.3 INCHES PER HOUR.
10. WOVEN GEOTEXTILE TO BE TYPE 20WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

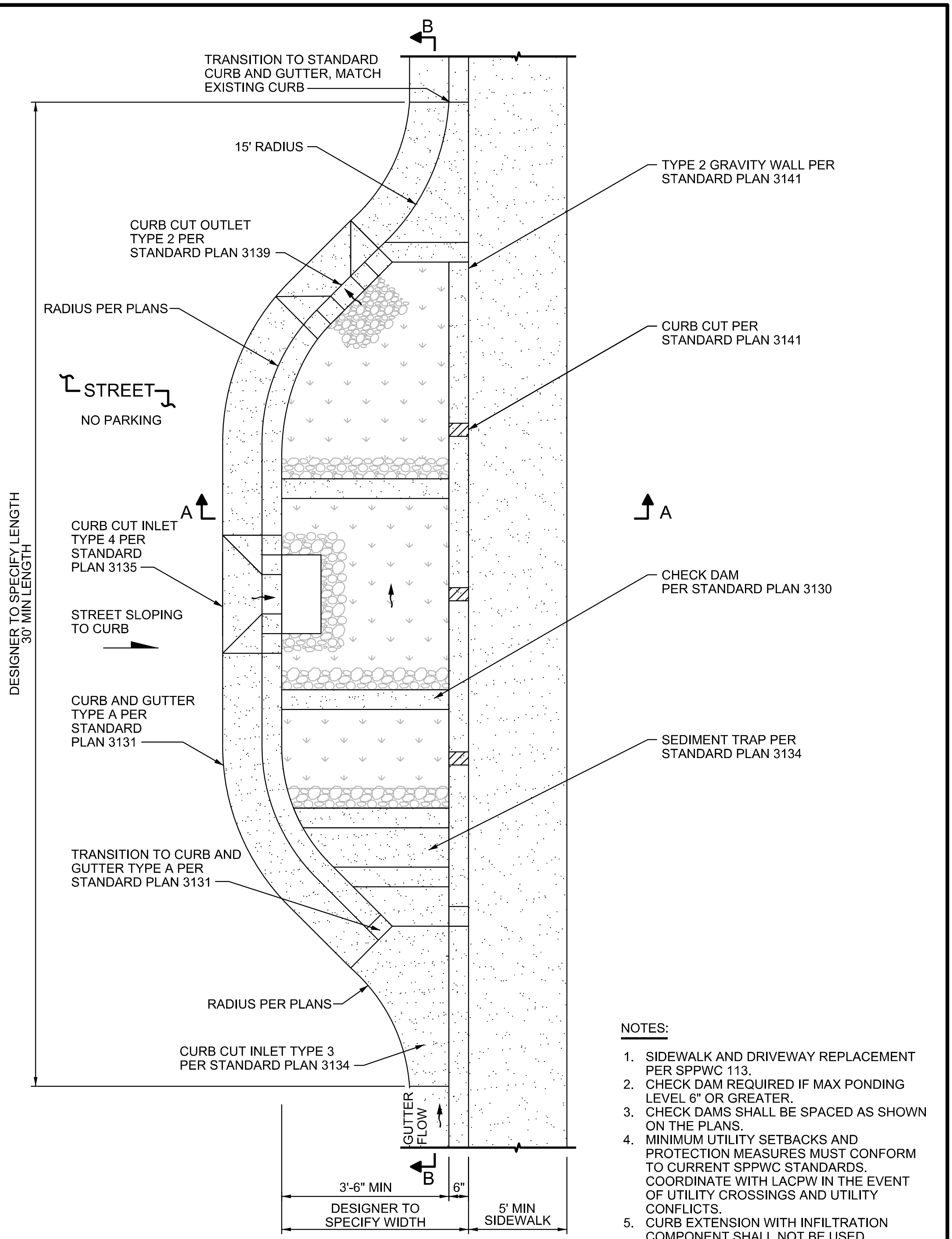
LACPW GREEN STREETS STANDARD PLANS

PLANTER WITHOUT STEP-OUT ZONE
CASE B, WITHOUT UNDERDRAIN

STANDARD PLAN

3101-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES



PLAN DETAIL

NOT TO SCALE

NOTES:

1. SIDEWALK AND DRIVEWAY REPLACEMENT PER SPPWC 113.
2. CHECK DAM REQUIRED IF MAX PONDING LEVEL 6" OR GREATER.
3. CHECK DAMS SHALL BE SPACED AS SHOWN ON THE PLANS.
4. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
5. CURB EXTENSION WITH INFILTRATION COMPONENT SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
6. PROVIDE ONE ADDITIONAL STREET SIDE INLET TYPE 4 FOR EACH 20 LINEAR FEET OF ADDITIONAL CURB EXTENSION LENGTH BEYOND 30 FT.

LACPW GREEN STREETS STANDARD PLANS

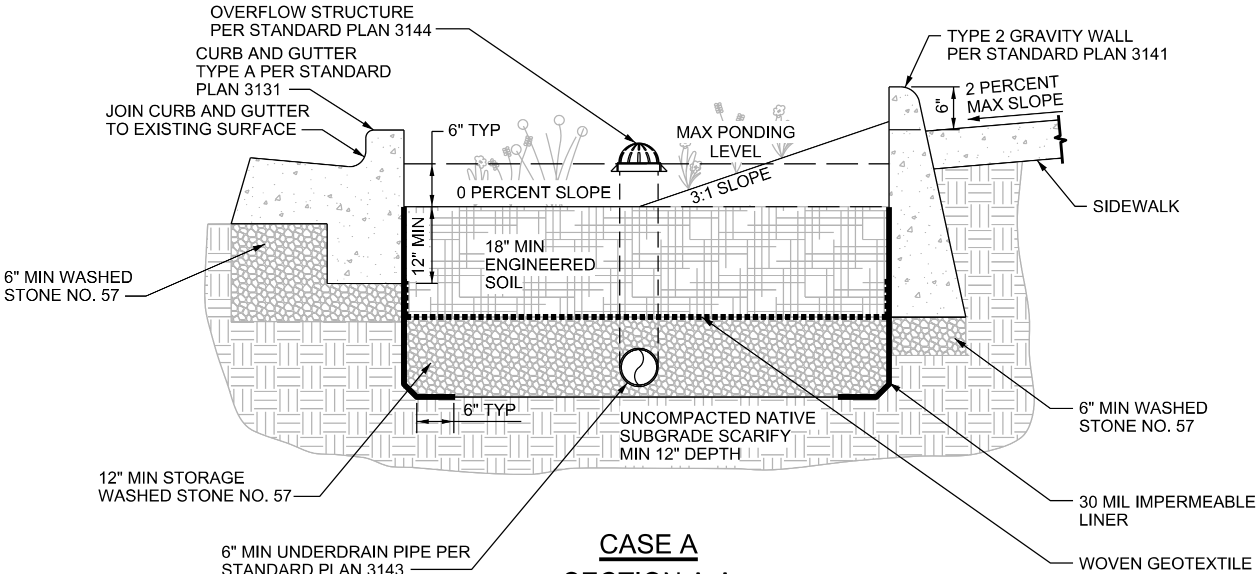
CURB EXTENSION (MID-BLOCK) PLAN VIEW

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

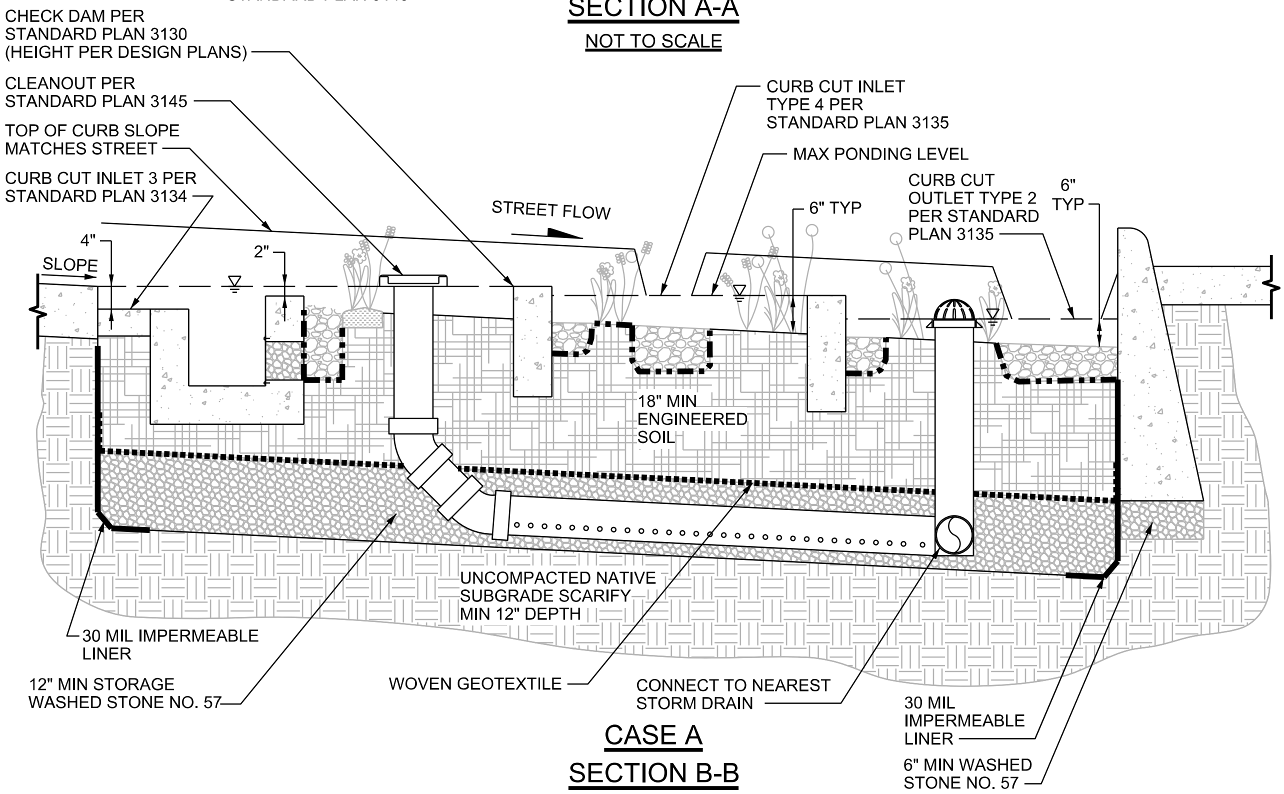
STANDARD PLAN

3102-1

SHEET 1 OF 3



CASE A
SECTION A-A
NOT TO SCALE



CASE A
SECTION B-B
NOT TO SCALE

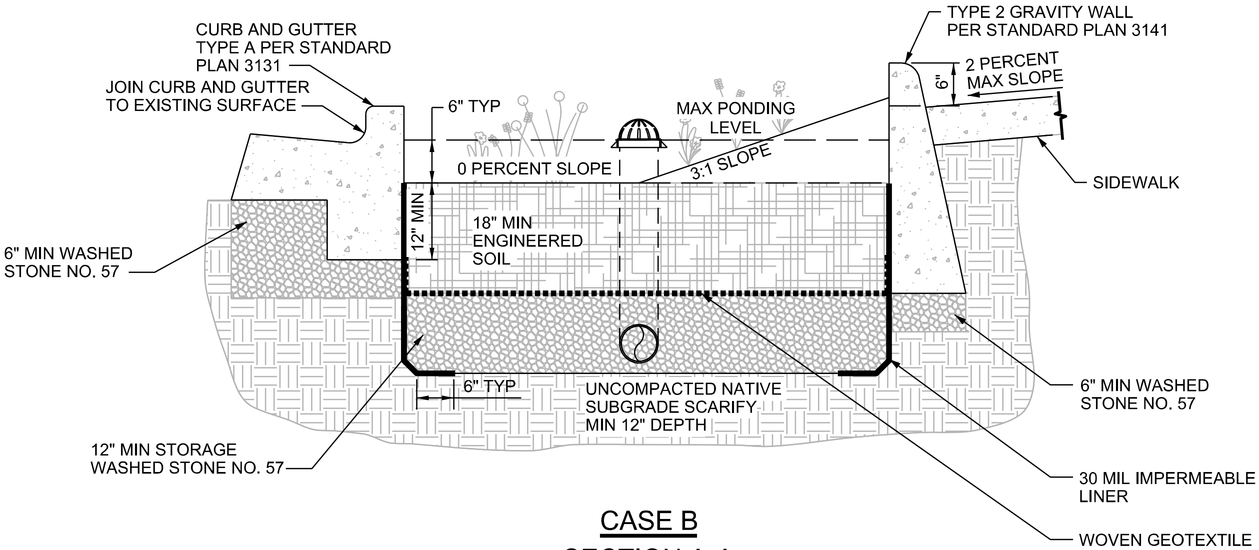
NOTES:

1. TOP OF GRAVITY WALL TO MATCH LONGITUDINAL SLOPE OF ADJACENT SURFACE AND HAVE 18 INCH MAX DEPTH TO DEEPEST POINT OF PLANTER BED SURFACE.
2. USE UNDERDRAINS "(CASE A)" WHERE SITE SOIL PERCOLATION RATE ARE LESS THAN 0.3 INCHES PER HOUR.
3. CURB EXTENSIONS WITH INFILTRATION COMPONENT SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
4. ALL CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE.
5. CURB WALLS, END WALLS, AND TRANSVERSE BRACE WALLS SHALL EACH BE POURED MONOLITHIC. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
6. ALL CURB, BRACE, AND END WALLS TO HAVE 3/4-INCH RADIUS ROUNDED CORNERS AT TOP EDGES.
7. EXPANSION JOINTS TO BE APPROVED WITH POLYSTYRENE JOINT FILLER AND TWO-PART POLYURETHANE SEALANT.
8. GEOTEXTILE FABRIC TO BE IN ACCORDANCE WITH SSPWC SECTION 300-8.
9. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
10. PLACEMENT OF GRAVEL TO BE SELF COMPACTING, COMPACT TOP SOIL TO 80-85 PERCENT RELATIVE COMPACTION, TOP SOIL TO BE PLACED IN MINIMUM OF TWO EQUAL LIFTS, IN ORDER TO MINIMIZE COMPACTION, AND EXCESSIVE SETTLEMENT.
11. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
12. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

CURB EXTENSION (MID BLOCK) CASE A, WITH UNDERDRAIN

STANDARD PLAN
3102-1

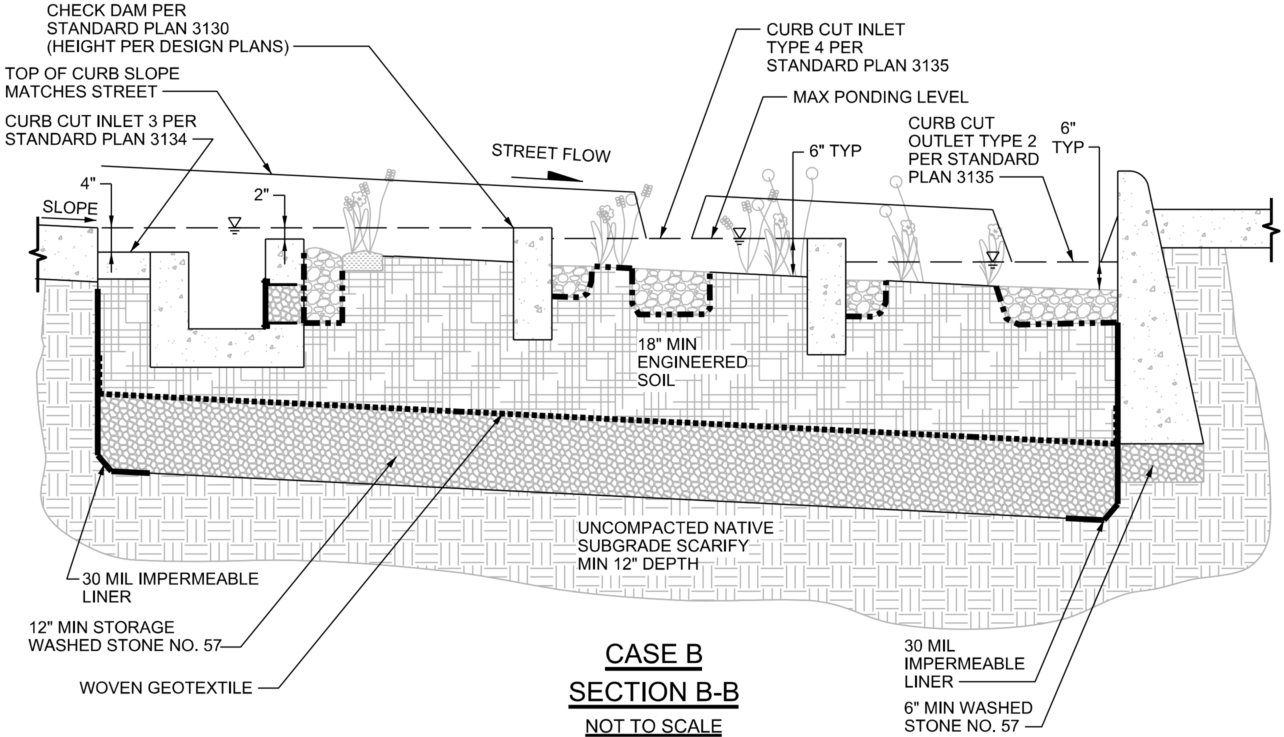
USE WITH LACPW GREEN STREETS DESIGN GUIDELINES



CASE B

SECTION A-A

NOT TO SCALE



CASE B

SECTION B-B

NOT TO SCALE

NOTES:

1. TOP OF GRAVITY WALL TO MATCH LONGITUDINAL SLOPE OF ADJACENT SURFACE AND HAVE 18 INCH MAX DEPTH TO DEEPEST POINT OF PLANTER BED SURFACE.
2. USE UNDERDRAINS "(CASE A)" WHERE SITE SOIL PERCOLATION RATE ARE LESS THAN 0.3 INCHES PER HOUR.
3. CURB EXTENSIONS WITH INFILTRATION COMPONENT SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
4. ALL CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE.
5. CURB WALLS, END WALLS, AND TRANSVERSE BRACE WALLS SHALL EACH BE POURED MONOLITHIC. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
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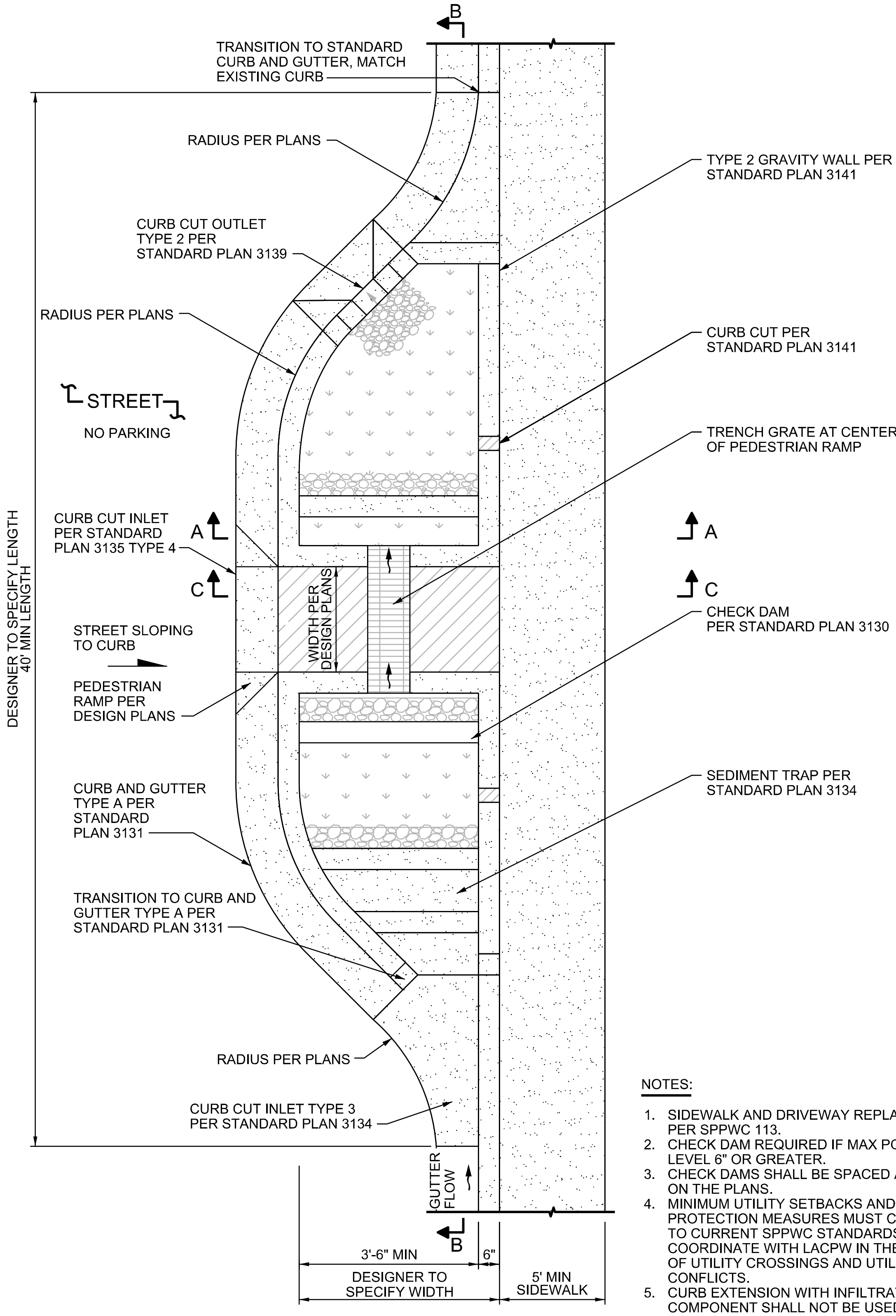
11. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
12. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

	CURB EXTENSION (MID BLOCK) CASE B, WITHOUT UNDERDRAIN	STANDARD PLAN 3102-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 3 OF 3



PLAN DETAIL

NOT TO SCALE

NOTES:

1. SIDEWALK AND DRIVEWAY REPLACEMENT PER SPPWC 113.
2. CHECK DAM REQUIRED IF MAX PONDING LEVEL 6" OR GREATER.
3. CHECK DAMS SHALL BE SPACED AS SHOWN ON THE PLANS.
4. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
5. CURB EXTENSION WITH INFILTRATION COMPONENT SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
6. PROVIDE ONE ADDITIONAL STREET SIDE INLET TYPE 4 FOR EACH 20 LINEAR FEET OF ADDITIONAL CURB EXTENSION LENGTH BEYOND 30 FT.

LACPW GREEN STREETS STANDARD PLANS

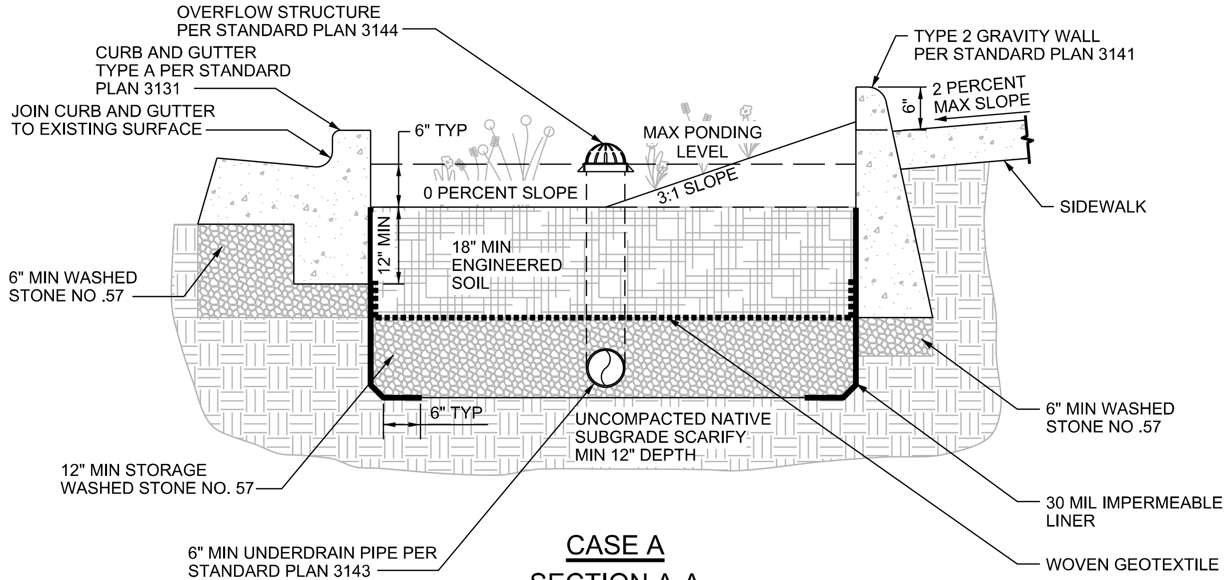
CURB EXTENSION
(MID-BLOCK WITH PEDESTRIAN RAMP)
PLAN VIEW

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

3103-1

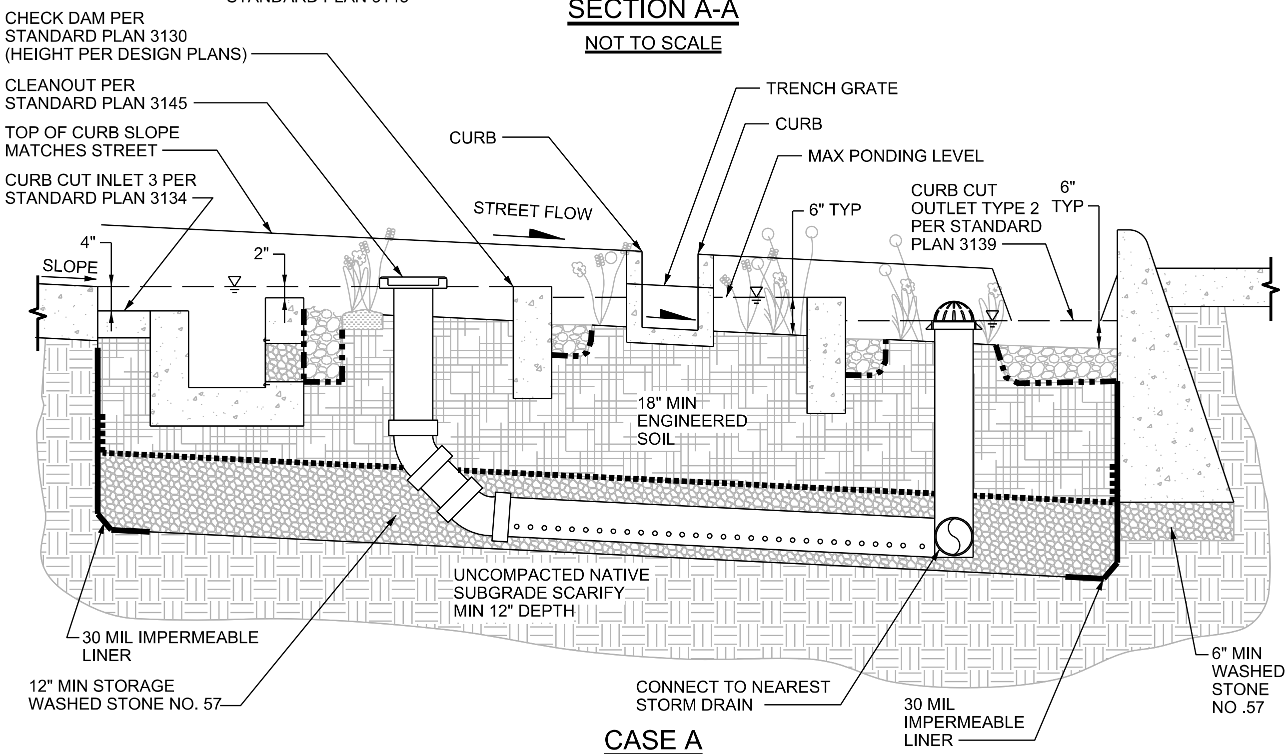
SHEET 1 OF 4



CASE A

SECTION A-A

NOT TO SCALE



CASE A

SECTION B-B

NOT TO SCALE

NOTES:

1. TOP OF GRAVITY WALL TO MATCH LONGITUDINAL SLOPE OF ADJACENT SURFACE AND HAVE 18 INCH MAX DEPTH TO DEEPEST POINT OF PLANTER BED SURFACE.
2. USE UNDERDRAINS "(CASE A)" WHERE SITE SOIL PERCOLATION RATE ARE LESS THAN 0.3 INCHES PER HOUR.
3. CURB EXTENSIONS WITH INFILTRATION COMPONENT SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
4. ALL CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE.
5. CURB WALLS, END WALLS, AND TRANSVERSE BRACE WALLS SHALL EACH BE POURED MONOLITHIC. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
6. ALL CURB, BRACE, AND END WALLS TO HAVE 3/4-INCH RADIUS ROUNDED CORNERS AT TOP EDGES.
7. EXPANSION JOINTS TO BE APPROVED WITH POLYSTYRENE JOINT FILLER AND TWO-PART POLYURETHANE SEALANT.
8. GEOTEXTILE FABRIC TO BE IN ACCORDANCE WITH SSPWC SECTION 300-8.
9. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
10. PLACEMENT OF GRAVEL TO BE SELF COMPACTING, COMPACT TOP SOIL TO 80-85 PERCENT RELATIVE COMPACTION, TOP SOIL TO BE PLACED IN MINIMUM OF TWO EQUAL LIFTS, IN ORDER TO MINIMIZE COMPACTION, AND EXCESSIVE SETTLEMENT.
11. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
12. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

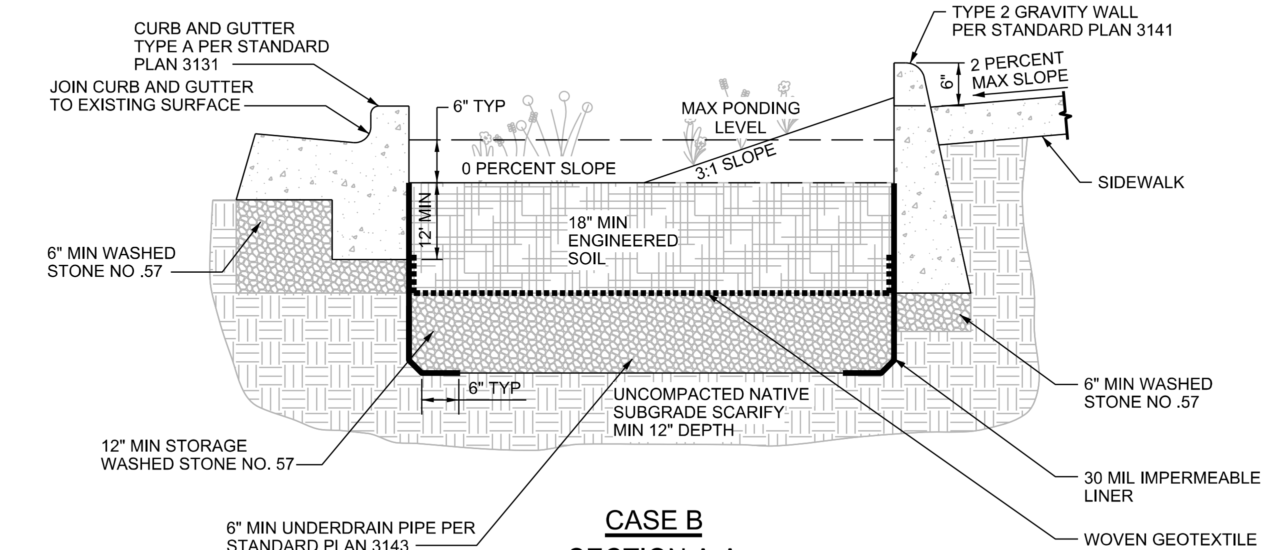
CURB EXTENSION (MID-BLOCK WITH PEDESTRIAN RAMP) CASE A, WITH UNDERDRAIN

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

3103-1

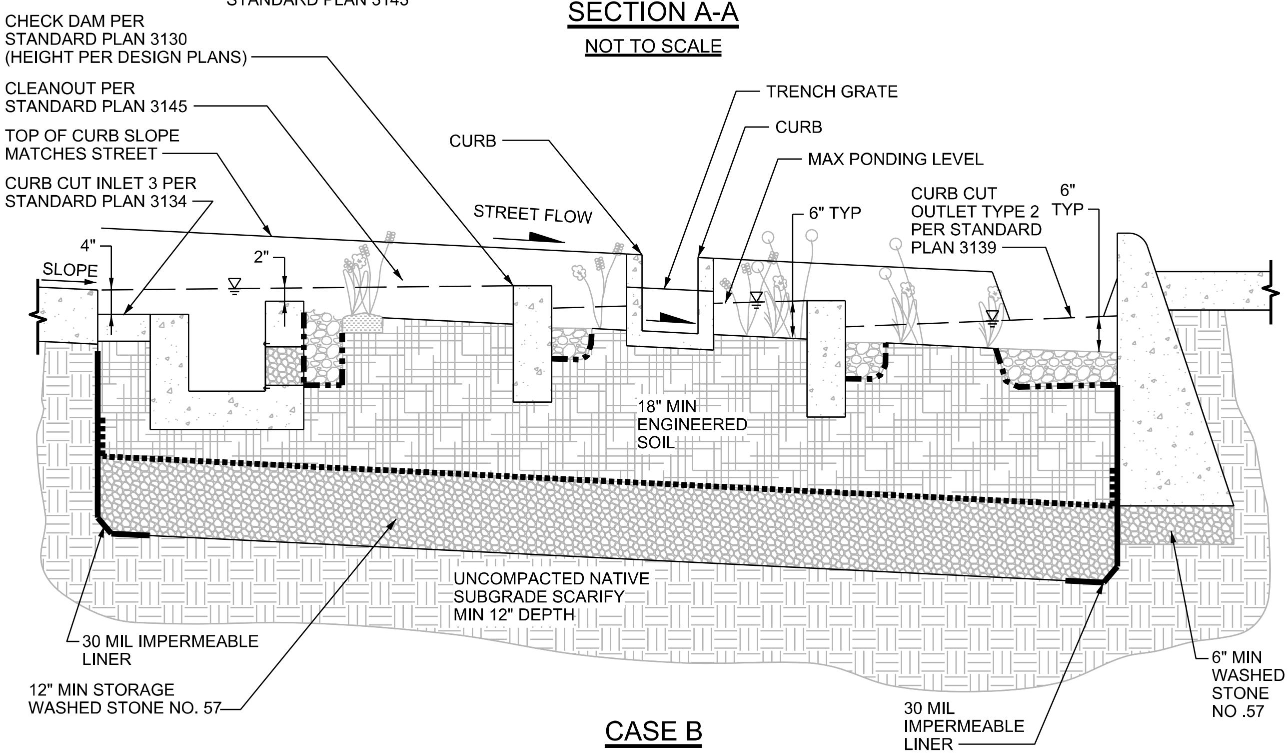
SHEET 2 OF 4



CASE B

SECTION A-A

NOT TO SCALE



CASE B

SECTION B-B

NOT TO SCALE

NOTES:

1. TOP OF GRAVITY WALL TO MATCH LONGITUDINAL SLOPE OF ADJACENT SURFACE AND HAVE 18 INCH MAX DEPTH TO DEEPEST POINT OF PLANTER BED SURFACE.
2. USE UNDERDRAINS "(CASE A)" WHERE SITE SOIL PERCOLATION RATE ARE LESS THAN 0.3 INCHES PER HOUR.
3. CURB EXTENSIONS WITH INFILTRATION COMPONENT SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
4. ALL CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE.
5. CURB WALLS, END WALLS, AND TRANSVERSE BRACE WALLS SHALL EACH BE POURED MONOLITHIC. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
6. ALL CURB, BRACE, AND END WALLS TO HAVE 3/4-INCH RADIUS ROUNDED CORNERS AT TOP EDGES.
7. EXPANSION JOINTS TO BE APPROVED WITH POLYSTYRENE JOINT FILLER AND TWO-PART POLYURETHANE SEALANT.
8. GEOTEXTILE FABRIC TO BE IN ACCORDANCE WITH SSPWC SECTION 300-8.
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10. PLACEMENT OF GRAVEL TO BE SELF COMPACTING, COMPACT TOP SOIL TO 80-85 PERCENT RELATIVE COMPACTION, TOP SOIL TO BE PLACED IN MINIMUM OF TWO EQUAL LIFTS, IN ORDER TO MINIMIZE COMPACTION, AND EXCESSIVE SETTLEMENT.
11. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
12. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

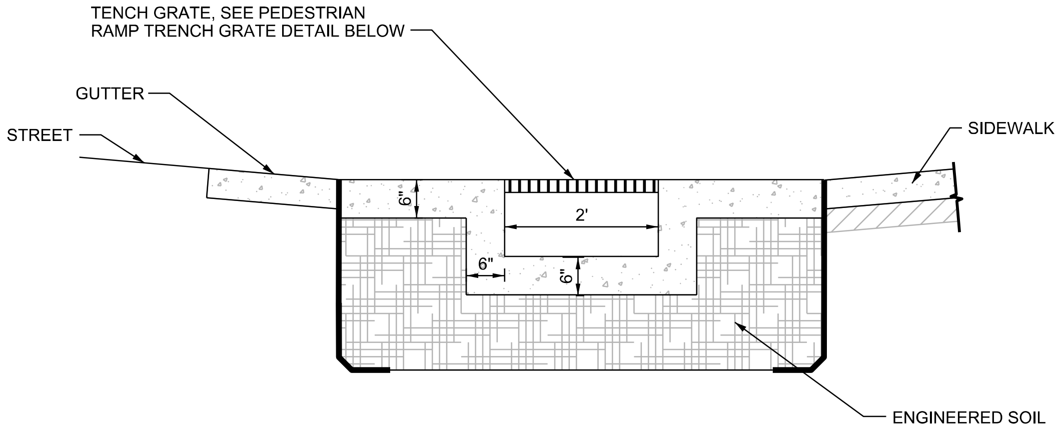
LACPW GREEN STREETS STANDARD PLANS

CURB EXTENSION
(MID-BLOCK WITH PEDESTRIAN RAMP)
CASE B, WITHOUT UNDERDRAIN

STANDARD PLAN

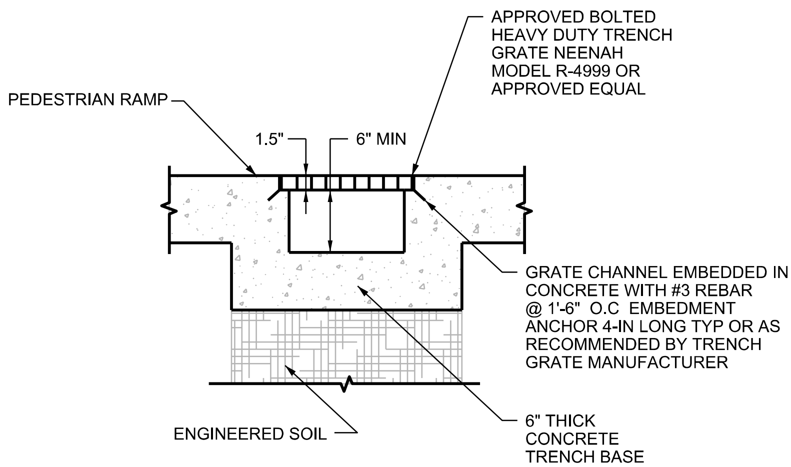
3103-1

SHEET 3 OF 4



SECTION C-C

NOT TO SCALE



PEDESTRIAN RAMP
TRENCH GRATE DETAIL

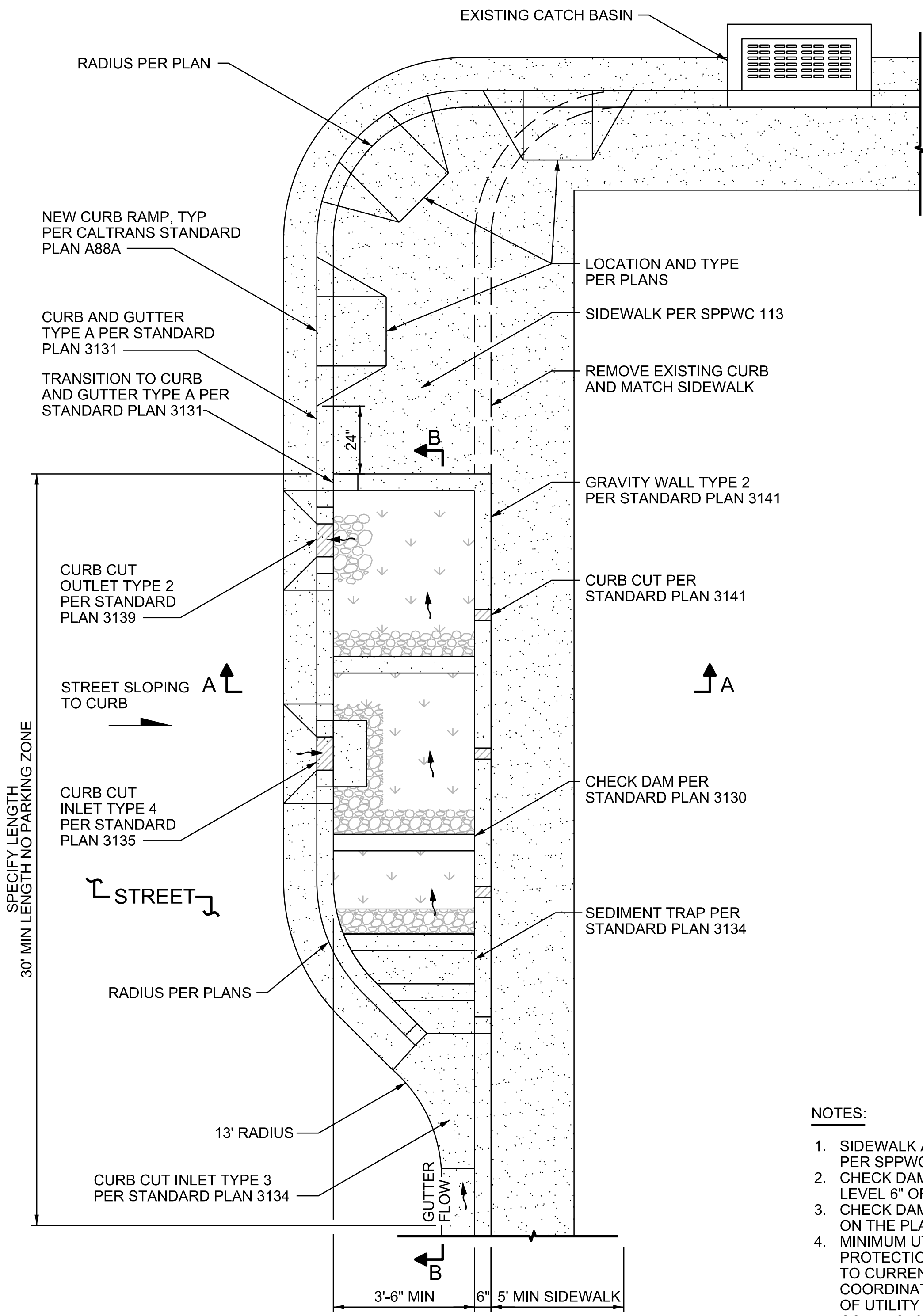
NOT TO SCALE

NOTES:

1. GUTTER DEPRESSIONS ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
2. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS, COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.

LACPW GREEN STREETS STANDARD PLANS

	CURB EXTENSION (MID-BLOCK WITH PEDESTRIAN RAMP) PEDESTRIAN CURB RAMP	STANDARD PLAN 3103-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 4 OF 4



PLAN DETAIL

NOT TO SCALE

NOTES:

1. SIDEWALK AND DRIVEWAY REPLACEMENT PER SPPWC 113.
2. CHECK DAM REQUIRED IF MAX PONDING LEVEL 6" OR GREATER.
3. CHECK DAMS SHALL BE SPACED AS SHOWN ON THE PLANS.
4. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
5. CURB EXTENSION WITH INFILTRATION COMPONENT SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
6. PROVIDE ONE ADDITIONAL STREET SIDE INLET TYPE 4 FOR EACH 20 LINEAR FEET OF ADDITIONAL CURB EXTENSION LENGTH BEYOND 30 FT.

LACPW GREEN STREETS STANDARD PLANS

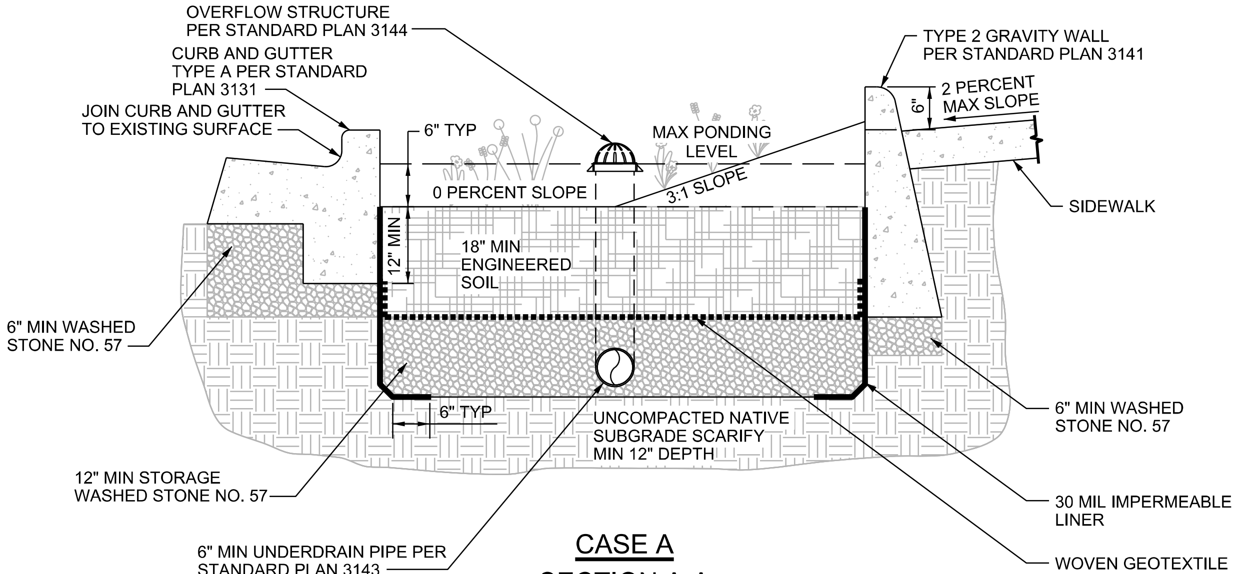
CURB EXTENSION
(CORNER)
PLAN VIEW

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

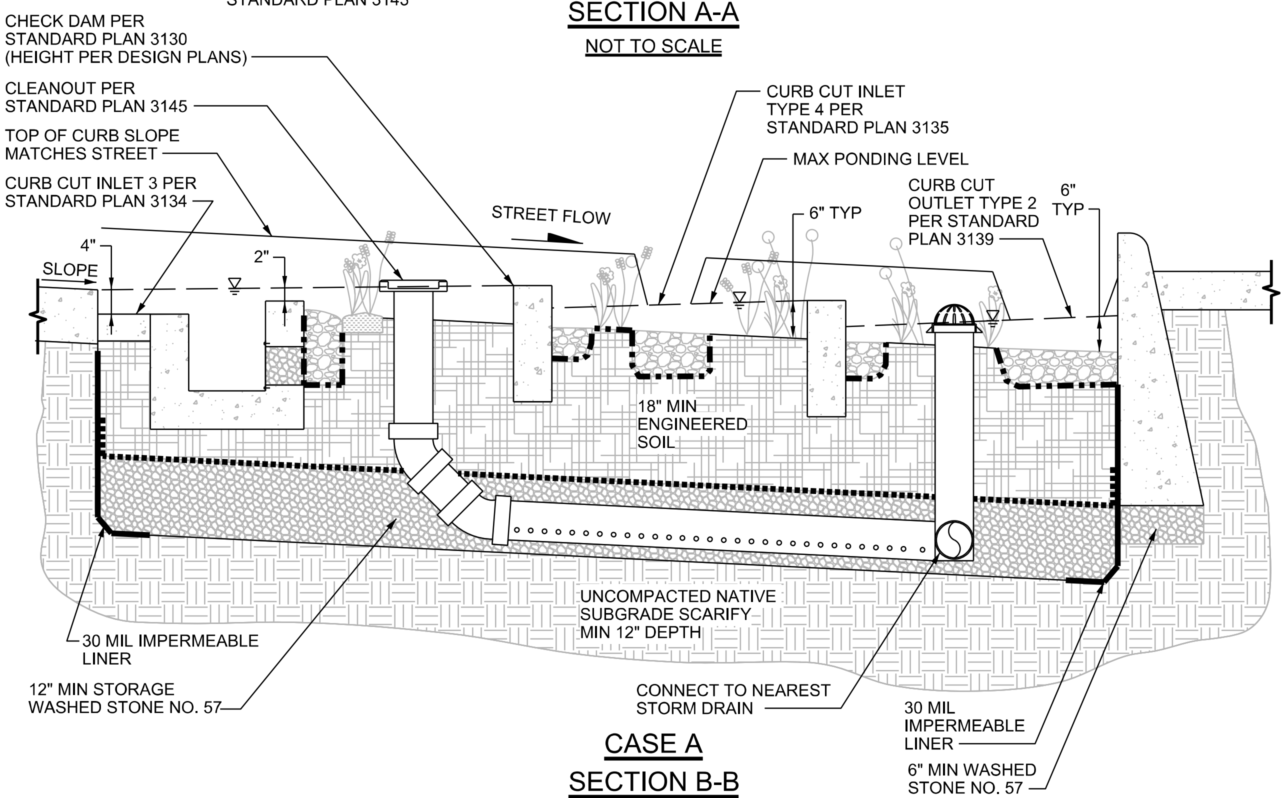
STANDARD PLAN

3104-1

SHEET 1 OF 3



CASE A
SECTION A-A
NOT TO SCALE



CASE A
SECTION B-B
NOT TO SCALE

NOTES:

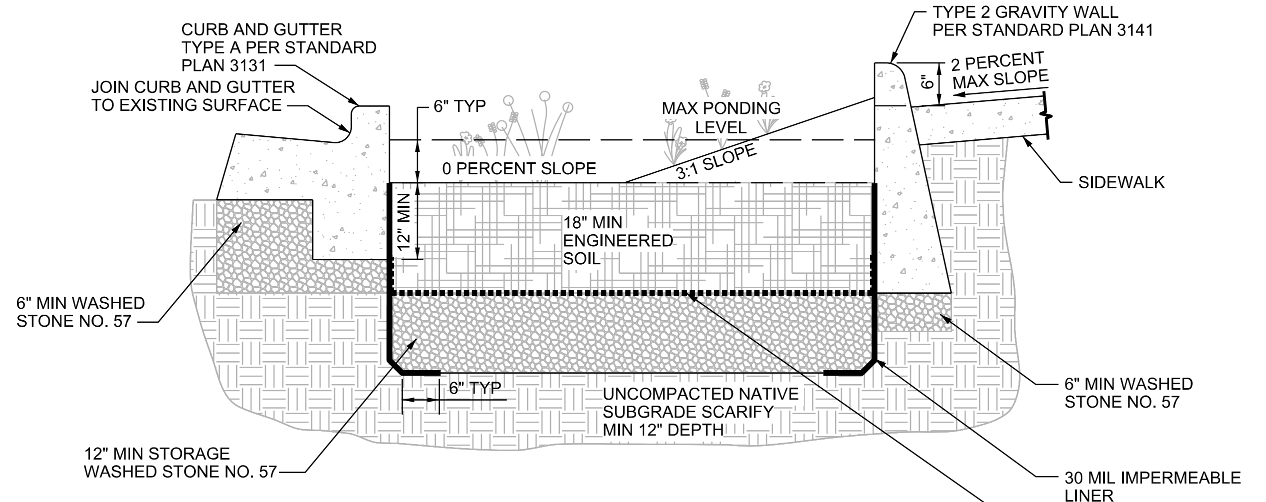
1. TOP OF GRAVITY WALL TO MATCH LONGITUDINAL SLOPE OF ADJACENT SURFACE AND HAVE 18 INCH MAX DEPTH TO DEEPEST POINT OF PLANTER BED SURFACE.
2. USE UNDERDRAINS "(CASE A)" WHERE SITE SOIL PERCOLATION RATE ARE LESS THAN 0.3 INCHES PER HOUR.
3. CURB EXTENSIONS WITH INFILTRATION COMPONENT SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
4. ALL CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE.
5. CURB WALLS, END WALLS, AND TRANSVERSE BRACE WALLS SHALL EACH BE POURED MONOLITHIC. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
6. ALL CURB, BRACE, AND END WALLS TO HAVE 3/4-INCH RADIUS ROUNDED CORNERS AT TOP EDGES.
7. EXPANSION JOINTS TO BE APPROVED WITH POLYSTYRENE JOINT FILLER AND TWO-PART POLYURETHANE SEALANT.
8. GEOTEXTILE FABRIC TO BE IN ACCORDANCE WITH SSPWC SECTION 300-8.
9. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
10. PLACEMENT OF GRAVEL TO BE SELF COMPACTING, COMPACT TOP SOIL TO 80-85 PERCENT RELATIVE COMPACTION, TOP SOIL TO BE PLACED IN MINIMUM OF TWO EQUAL LIFTS, IN ORDER TO MINIMIZE COMPACTION, AND EXCESSIVE SETTLEMENT.
11. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
12. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

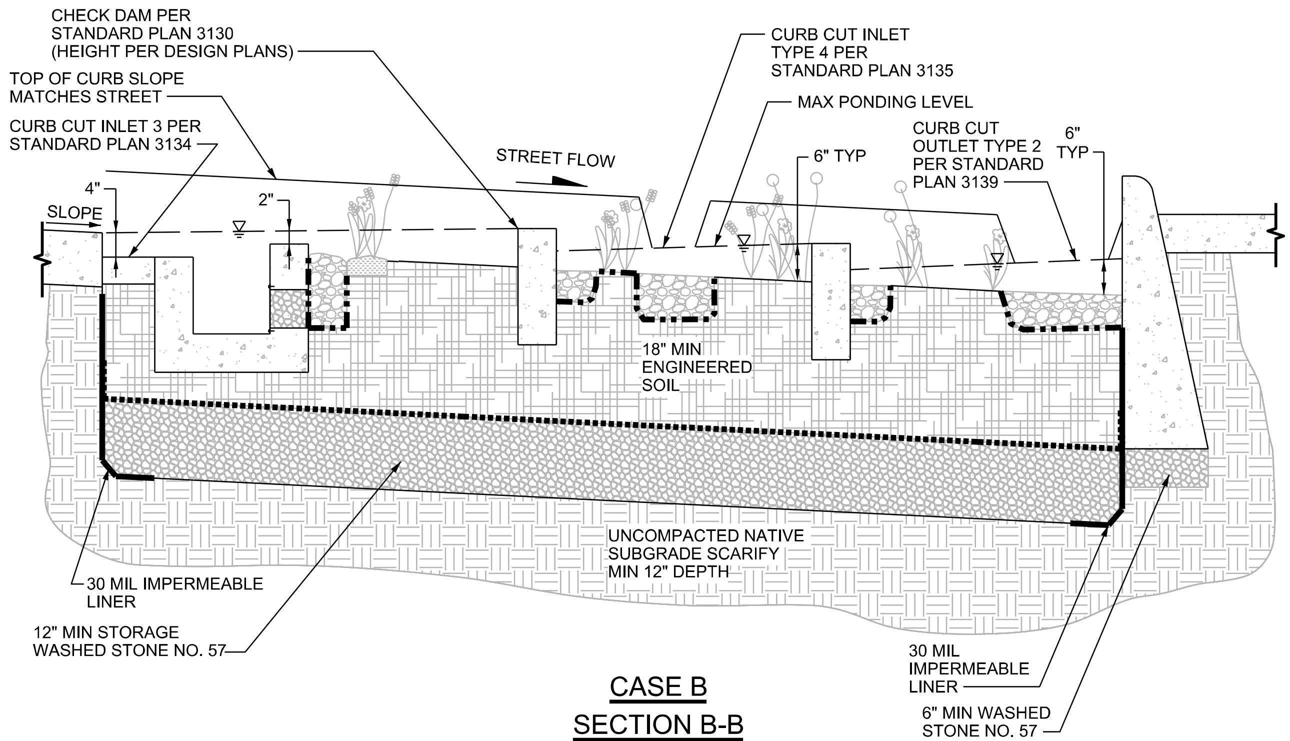
CURB EXTENSION
(MID BLOCK)
CASE A, WITH UNDERDRAIN

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN
3104-1
SHEET 2 OF 3



CASE B
SECTION A-A
NOT TO SCALE



CASE B
SECTION B-B
NOT TO SCALE

NOTES:

1. TOP OF GRAVITY WALL TO MATCH LONGITUDINAL SLOPE OF ADJACENT SURFACE AND HAVE 18 INCH MAX DEPTH TO DEEPEST POINT OF PLANTER BED SURFACE.
2. USE UNDERDRAINS "(CASE A)" WHERE SITE SOIL PERCOLATION RATE ARE LESS THAN 0.3 INCHES PER HOUR.
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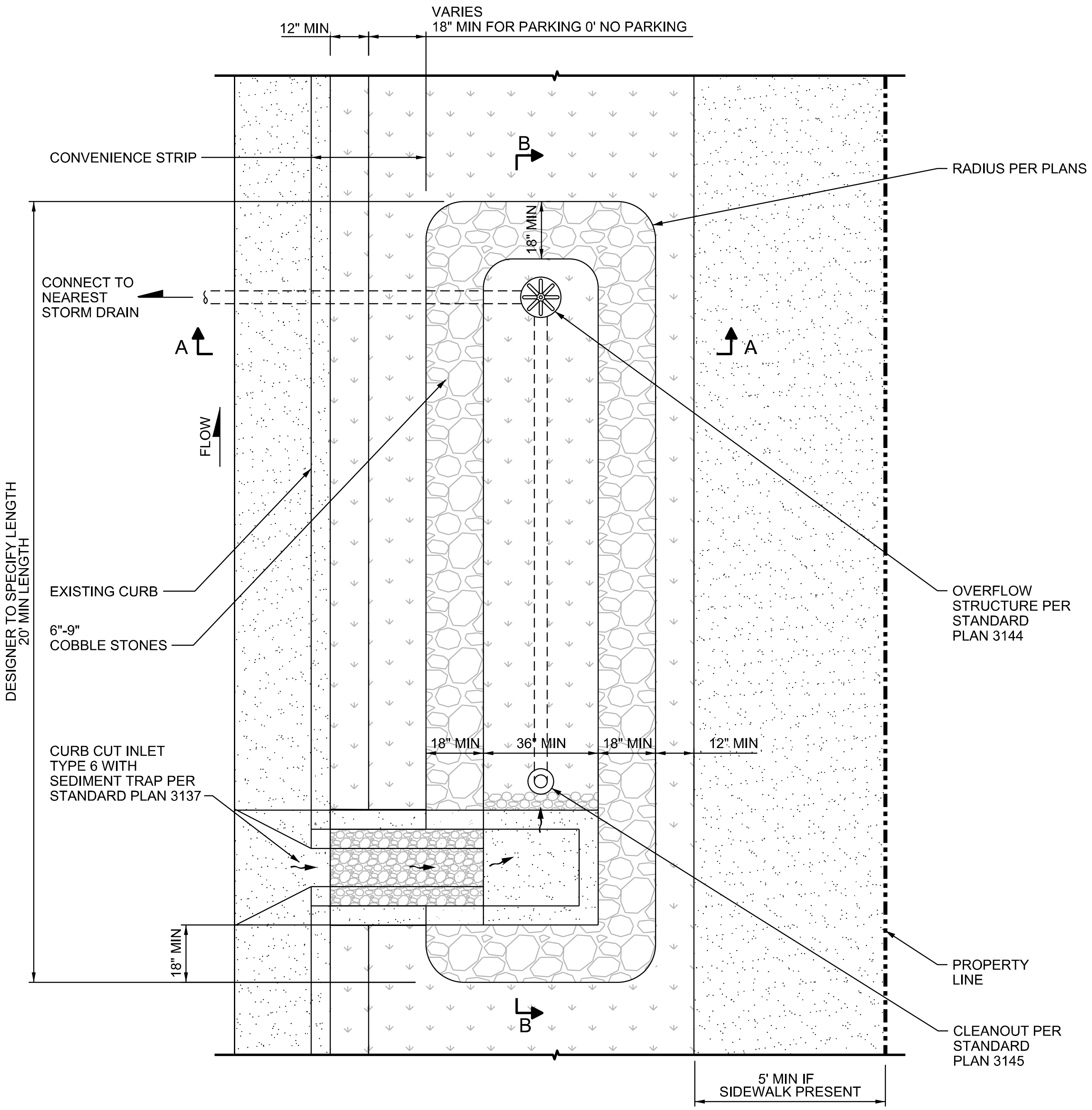
12. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

CURB EXTENSION
(MID BLOCK)
CASE B, WITHOUT UNDERDRAIN

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN
3104-1



PLAN DETAIL

NOT TO SCALE

NOTES:

1. NOT FOR USE ON PUBLIC STREETS DUE TO CLEAR ZONE REQUIREMENTS. CAN BE USED FOR PARKING AREAS OR OTHER IMPERVIOUS SURFACES.
2. IF SIDEWALK IS REMOVED, 5' MINIMUM WIDTH SHALL BE MAINTAINED.
3. REGRADE PARKWAY IF NECESSARY TO PROVIDE 2 PERCENT SLOPE FROM TOP OF CURB TO BASIN TOP OF BANK ELEVATION.
4. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.

LACPW GREEN STREETS STANDARD PLANS

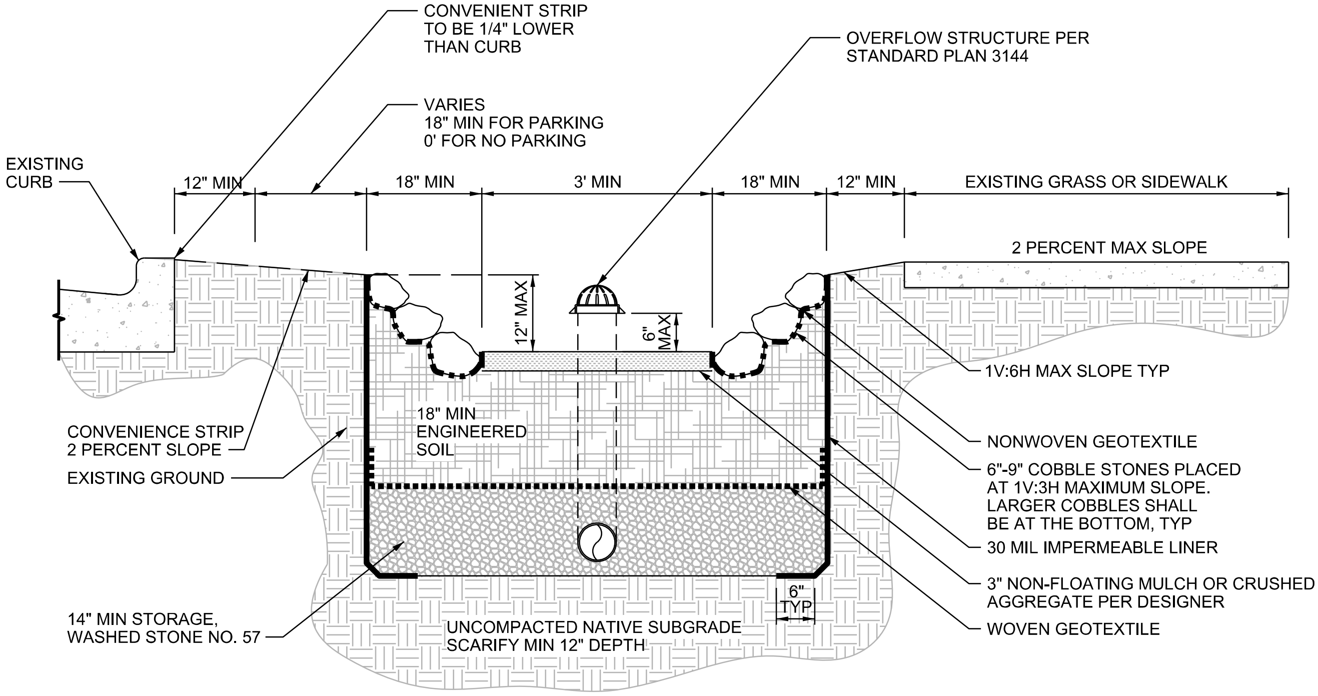
BASIN
WITH ROCK BORDER

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

3105-1

SHEET 1 OF 3



SECTION A-A

NOT TO SCALE

NOTES:

1. FOR NO PARKING OPTION, 12" CONVENIENCE STRIP REQUIRED (TYP).
2. FOR AREA WITHOUT CURB, ENSURE SURFACE ELEVATION OF EDGES OF PARKWAY STRIP (INCLUDING SURFACE TREATMENT) IS BELOW AREA AND SIDEWALK ELEVATION AND ALLOWS RUNOFF TO FLOW INTO PARKWAY AND BASIN.
3. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
4. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

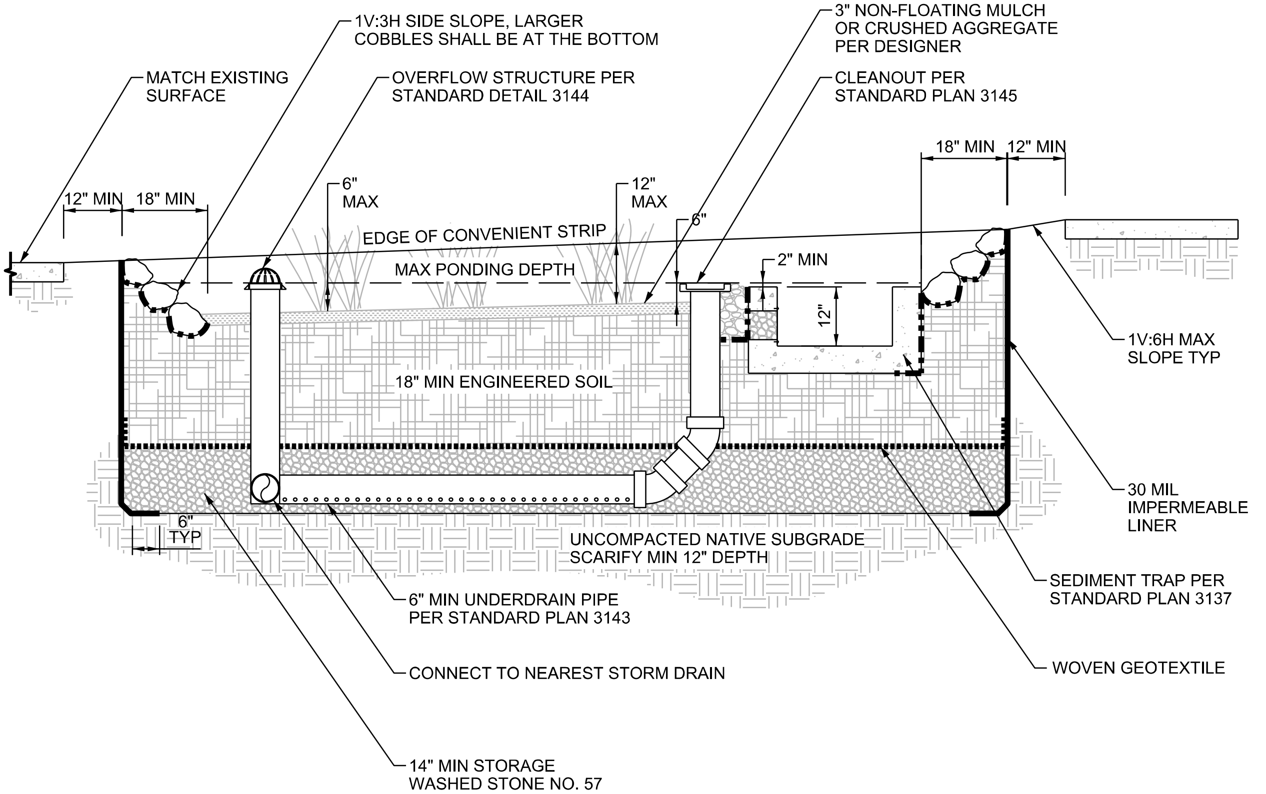
LACPW GREEN STREETS STANDARD PLANS

BASIN
WITH ROCK BORDER

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

3105-1



SECTION B-B

NOT TO SCALE

NOTES:

1. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
2. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
3. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
4. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
5. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
6. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

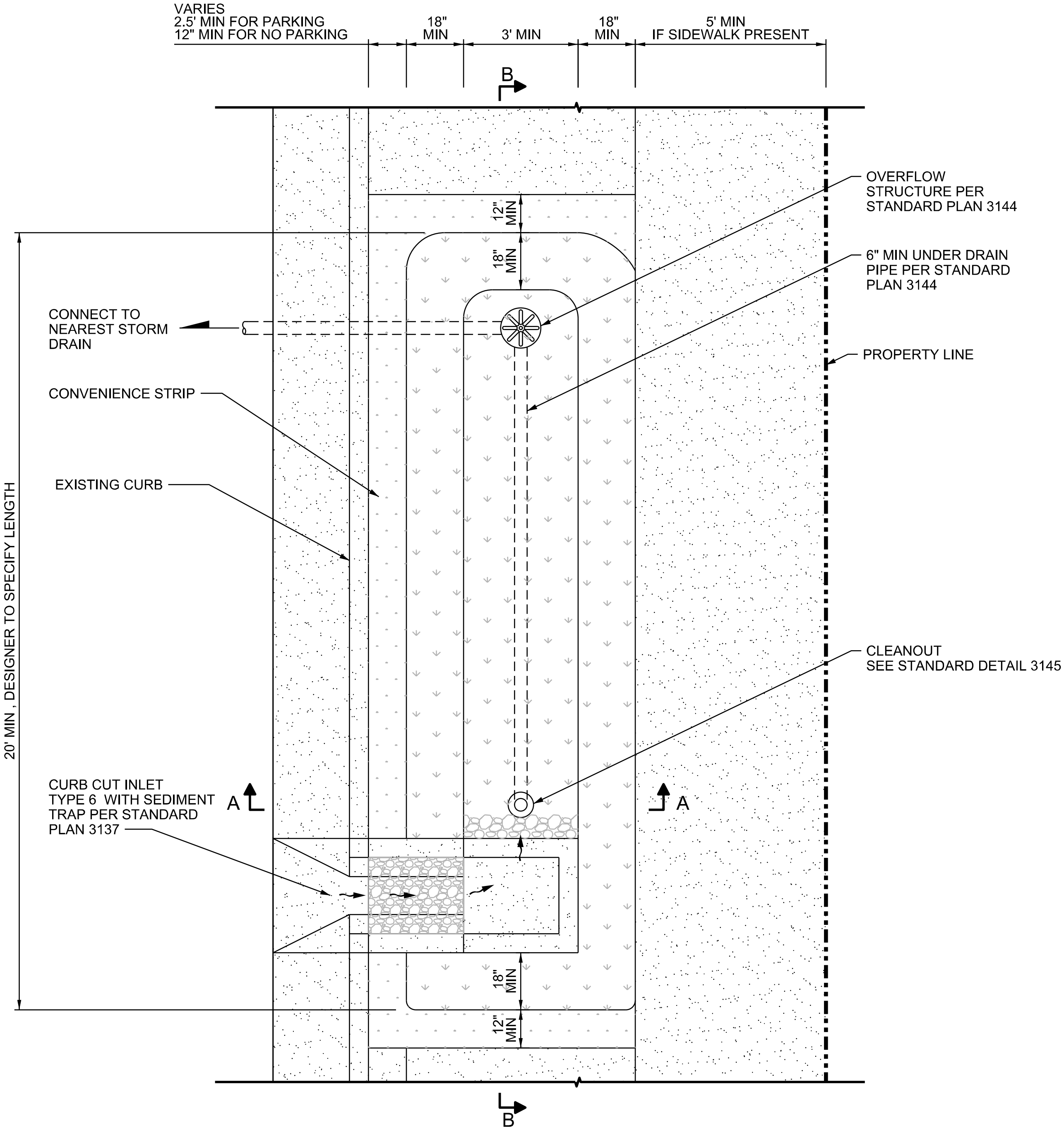
BASIN
WITH ROCK BORDER

USE WITH LACPW GREEN STREETS STANDARD GUIDELINES

STANDARD PLAN

3105-1

SHEET 3 OF 3



PLAN DETAIL

NOT TO SCALE

NOTES:

1. NOT FOR USE ON PUBLIC STREETS DUE TO CLEAR ZONE REQUIREMENTS. CAN BE USED FOR PARKING AREAS OR OTHER IMPERVIOUS SURFACES.
2. IF SIDEWALK IS REMOVED, 5' MINIMUM WIDTH SHALL BE MAINTAINED.
3. REGRADE PARKWAY IF NECESSARY TO PROVIDE 2 PERCENT SLOPE FROM TOP OF CURB TO BASIN TOP OF BANK ELEVATION.
4. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.

LACPW GREEN STREETS STANDARD PLANS

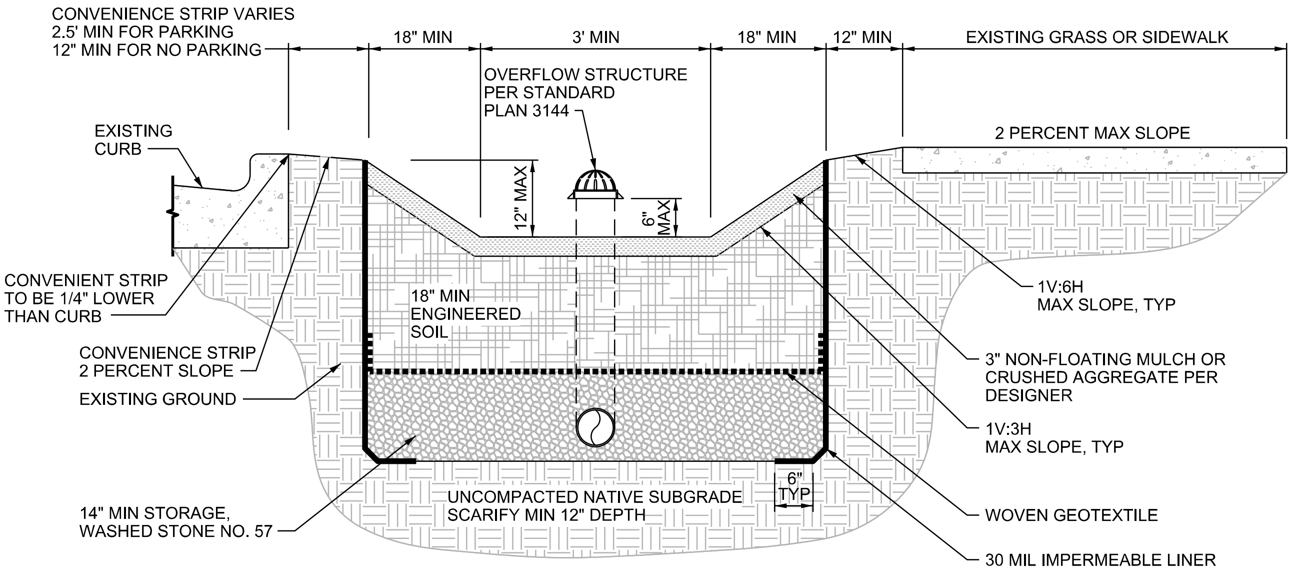
BASIN
WITHOUT ROCK BORDER

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

3106-1

SHEET 1 OF 3



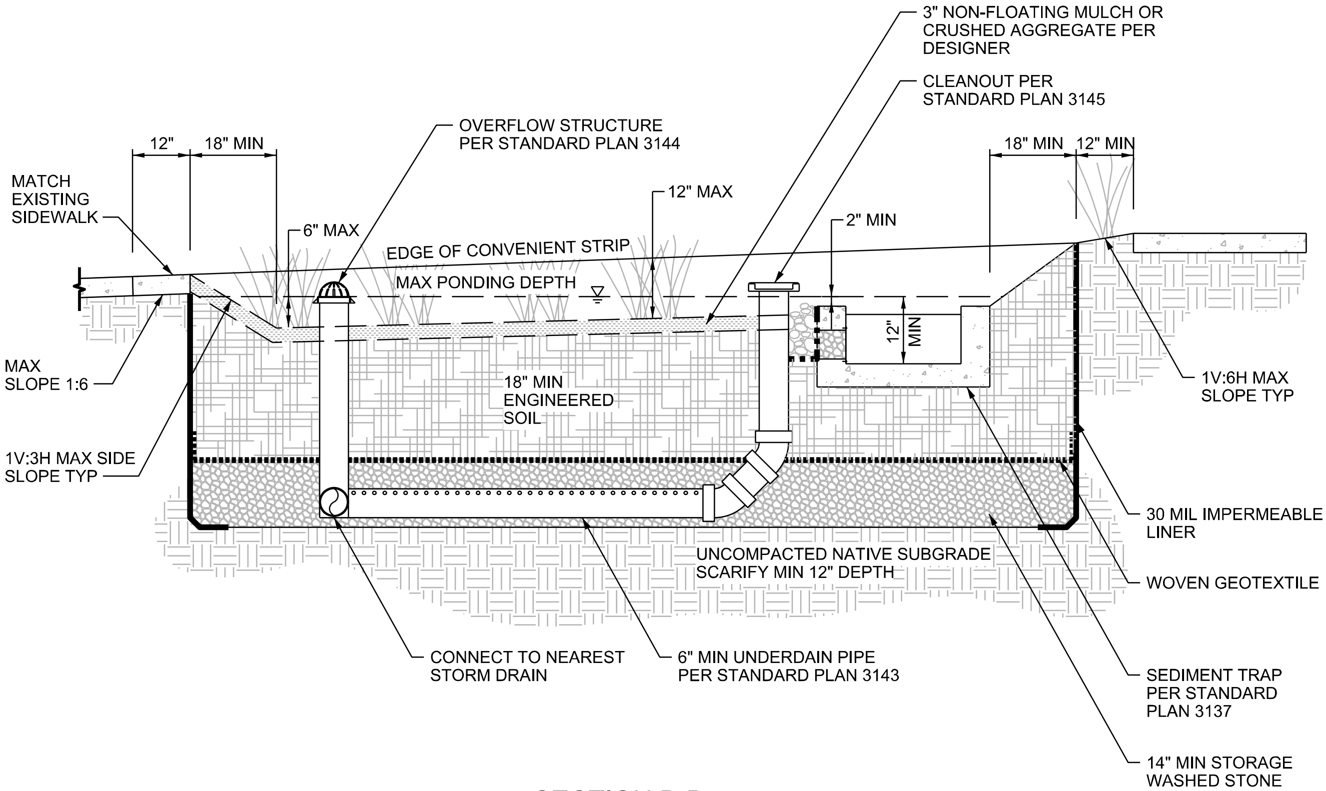
SECTION A-A

NOT TO SCALE

NOTES:

1. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
2. DESIGNER SHALL ELEVATE EXISTING SOIL TYPE/CONDITION TO ESTABLISH STABLE SIDE SLOPES.
3. FOR AREA WITHOUT CURB, ENSURE SURFACE ELEVATION OF EDGES OF PARKWAY STRIP (INCLUDING SURFACE TREATMENT) IS BELOW AREA AND SIDEWALK ELEVATION AND ALLOWS RUNOFF TO FLOW INTO PARKWAY AND BASIN.
4. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS		
	BASIN WITHOUT ROCK BORDER	STANDARD PLAN 3106-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 2 OF 3



SECTION B-B
NOT TO SCALE

NOTES:

1. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
2. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
3. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
4. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
5. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
6. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

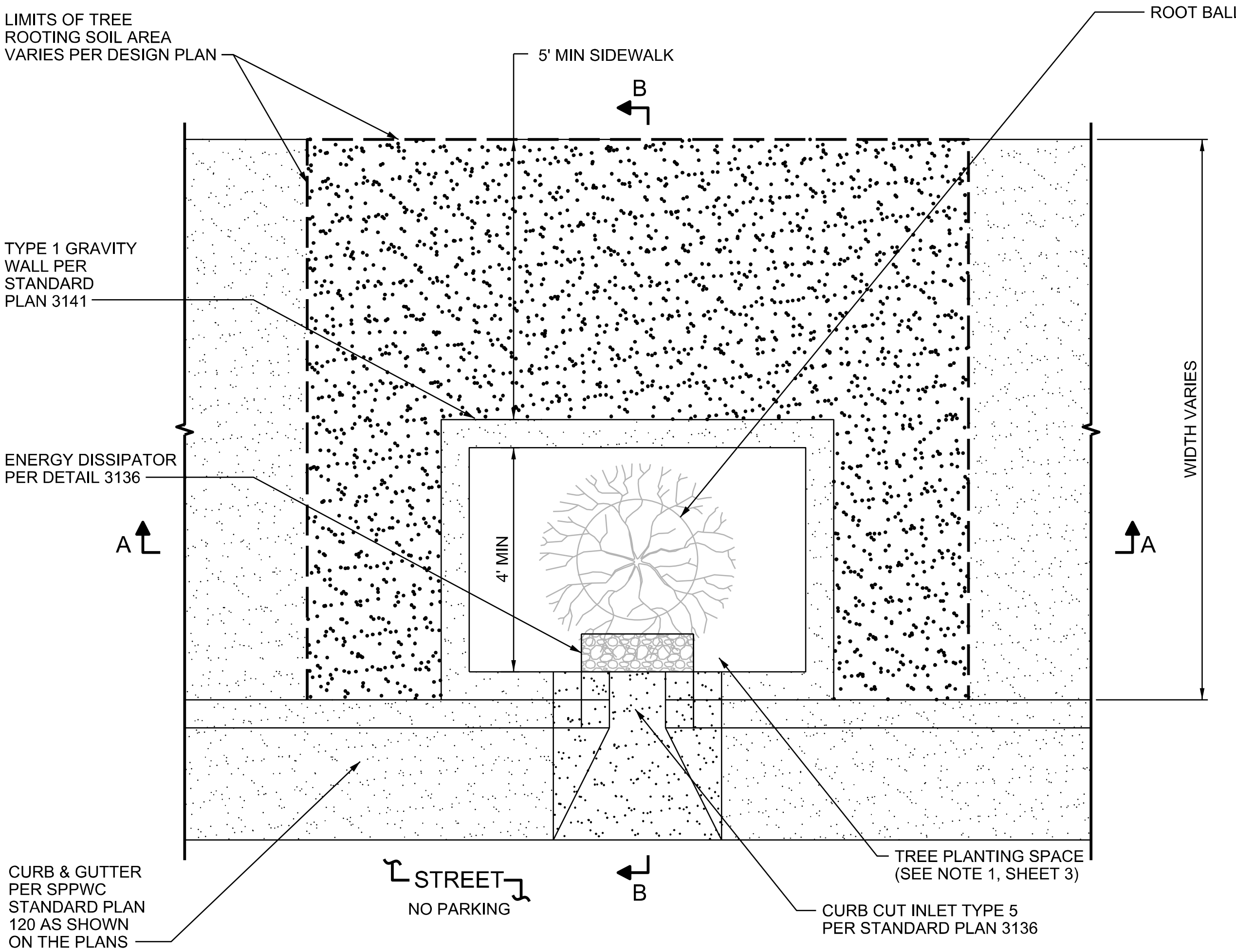
LACPW GREEN STREETS STANDARD PLANS

BASIN
WITHOUT ROCK BORDER

STANDARD PLAN
3106-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 3 OF 3



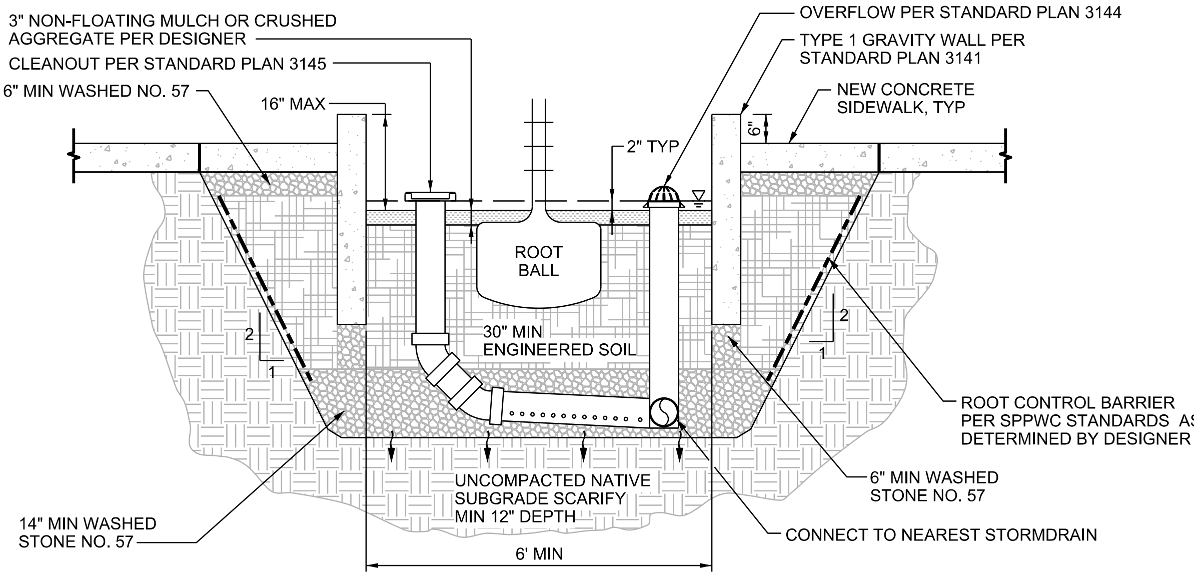
PLAN DETAIL

NOT TO SCALE

NOTES:

1. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
2. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.
3. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.
4. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT SPPWC STANDARDS.
5. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
6. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
7. TREE STAKES AND TIES TO BE SPECIFIED BY DESIGNER.

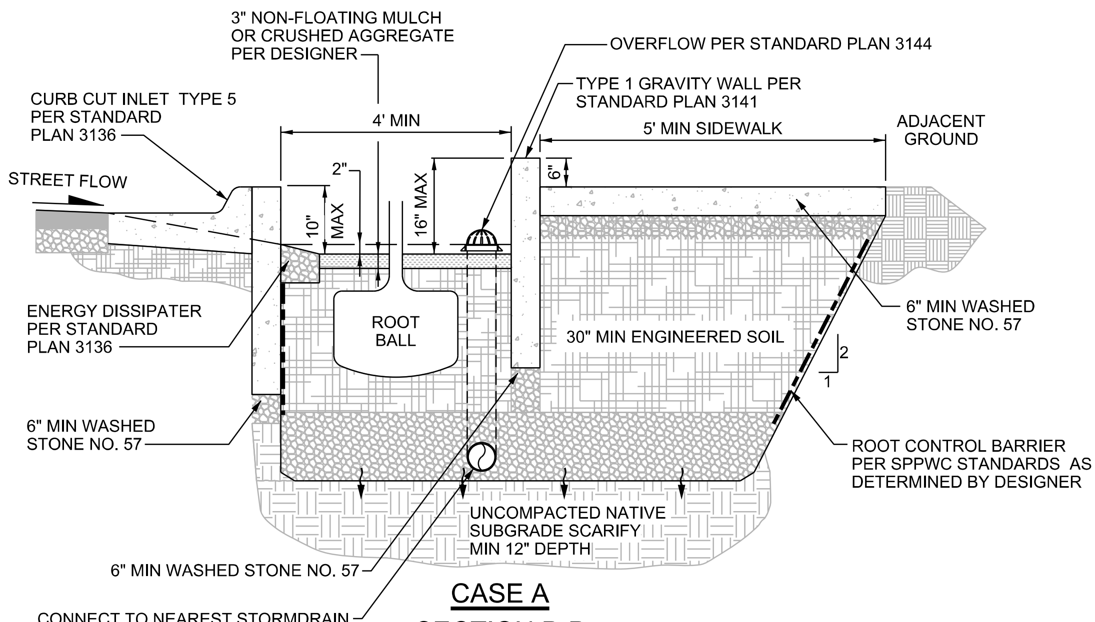
LACPW GREEN STREETS STANDARD PLANS		
	TREE WELL FILTER PLAN VIEW	STANDARD PLAN 3110-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 1 OF 3



CASE A

SECTION A-A

NOT TO SCALE



CASE A

SECTION B-B

NOT TO SCALE

NOTES:

1. MINIMUM OPEN TREE PLANTING SPACE DIMENSION 4'x6'.
2. MAXIMUM DRAINAGE AREA: 6 TIMES AREA OF THE OPEN TREE PLANTING AREA.
3. FOR SIDEWALK OVER STRUCTURAL SOIL DETAIL SEE DESIGN PLANS.
4. SEE DESIGN PLANS FOR TREE INSTALLATION REQUIREMENTS.
5. PROVIDE 18" DEEP ROOT BARRIER ON STREET SIDE OF TREE WELL AT LENGTH AS DETERMINED BY THE DESIGNER AS NECESSARY.
6. REMOVE TREE BOX FROM ROOT BALL PRIOR TO BACKFILLING.
7. TREE SIZE AND TYPE PER DESIGN PLANS.
8. STREET AND SIDEWALK IMPROVEMENTS SHALL BE ACCORDING TO LATEST EDITION OF SPPWC STANDARD.
9. INLET INVERT ELEVATION MUST BE BELOW LOWEST ADJACENT SIDEWALK ELEVATION.
10. FOR TREE WELL RETROFITS, CUT EXISTING CURB IN LOCATION OF TREE WELL CURB INLET ONLY.
11. SIDEWALK AND DRIVEWAY REPLACEMENT PER SPPWC SECTION 11.
12. TREE WELL FILTER SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
13. USE UNDERDRAINS (CASE A) WHERE SITE SOIL INFILTRATION RATE IS LESS THAN 0.3 INCHES PER HOUR.
14. TREE STAKES AND TIES TO BE SPECIFIED BY DESIGNER.

LACPW GREEN STREETS STANDARD PLANS

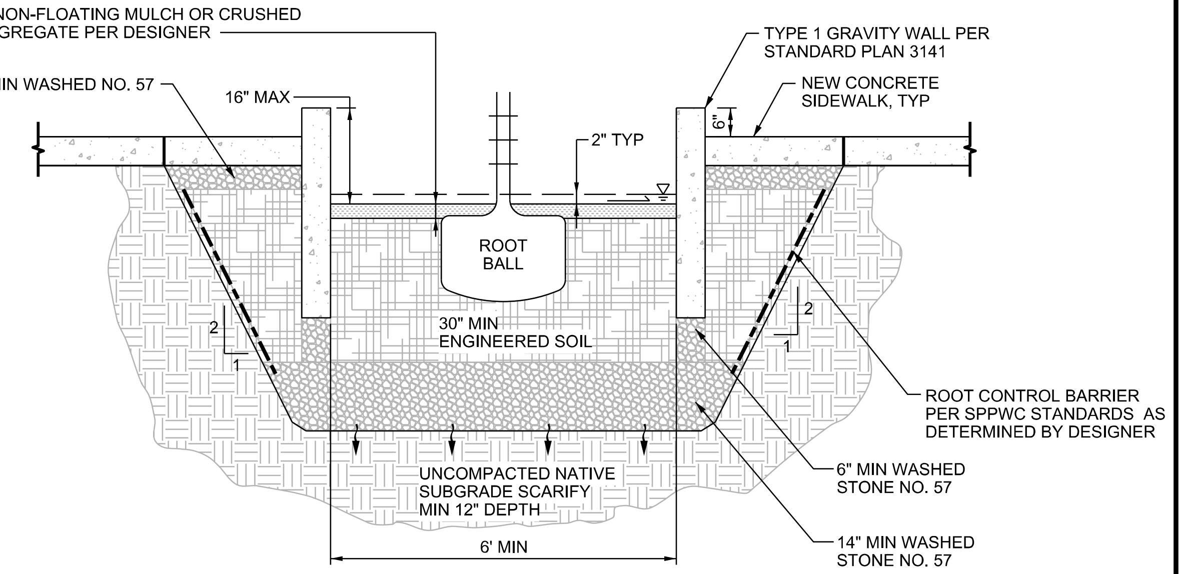
TREE WELL FILTER
CASE A, WITH UNDERDRAIN

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

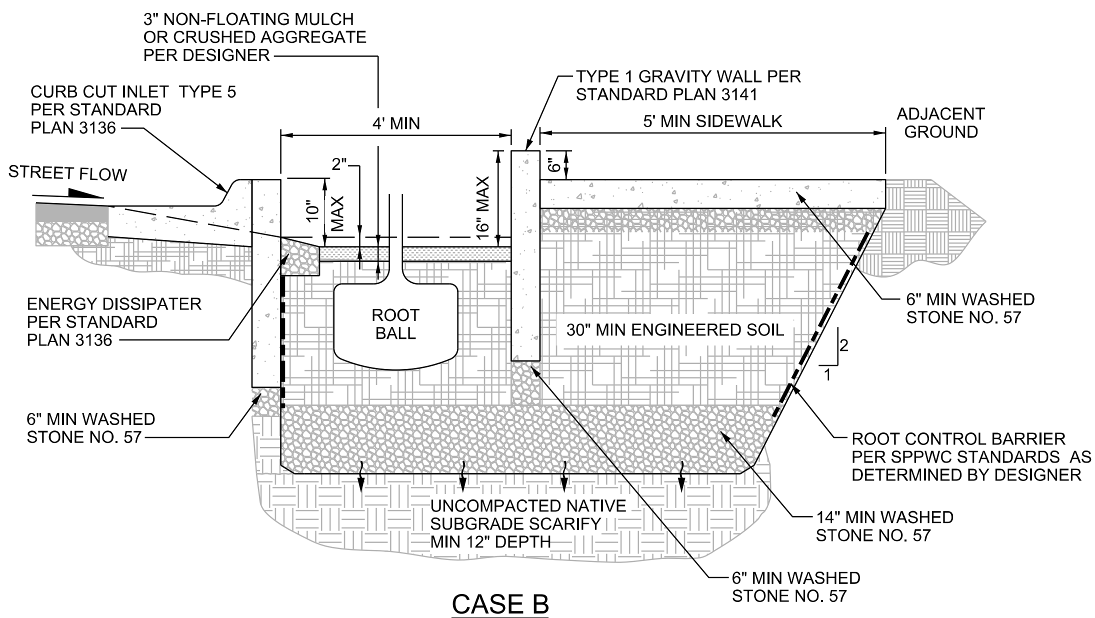
STANDARD PLAN

3110-1

SHEET 2 OF 3



CASE B
SECTION A-A
NOT TO SCALE



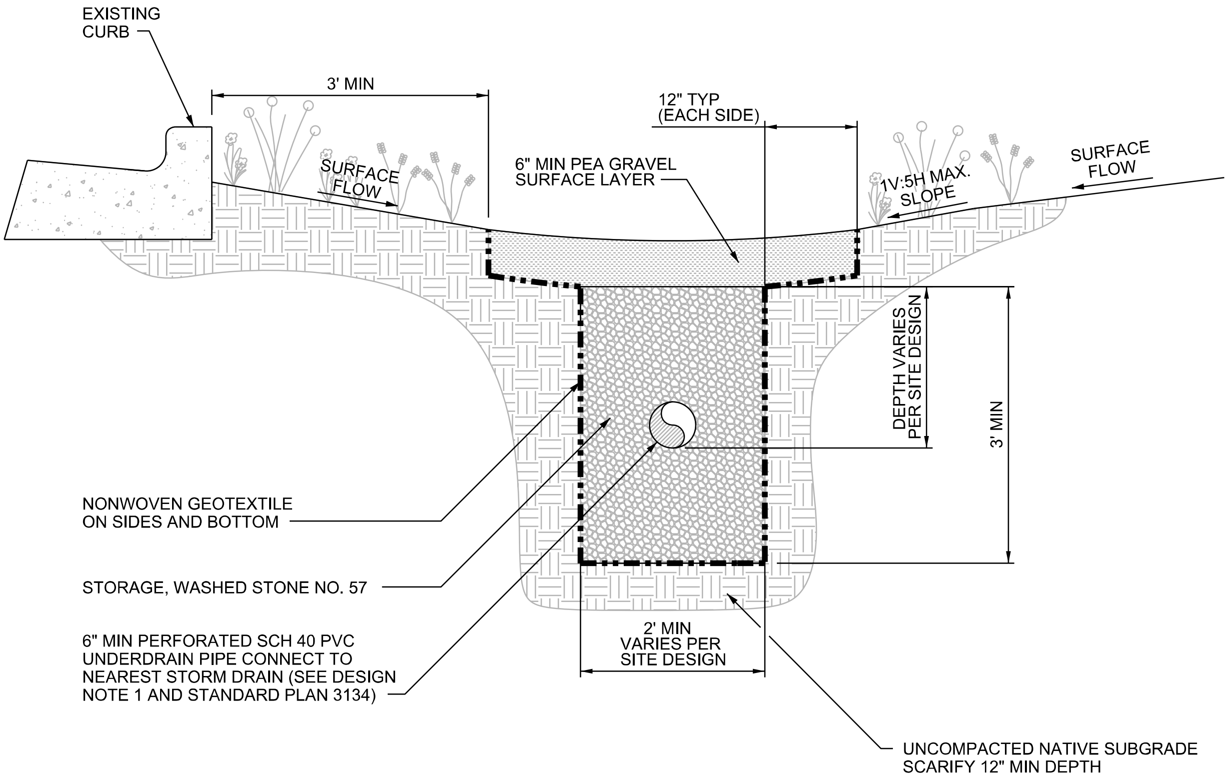
CASE B
SECTION B-B
NOT TO SCALE

NOTES:

1. MINIMUM OPEN TREE PLANTING SPACE DIMENSION 4'x6'.
2. MAXIMUM DRAINAGE AREA: 6 TIMES AREA OF THE OPEN TREE PLANTING AREA.
3. FOR SIDEWALK OVER STRUCTURAL SOIL DETAIL SEE DESIGN PLANS.
4. SEE DESIGN PLANS FOR TREE INSTALLATION REQUIREMENTS.
5. PROVIDE 18" DEEP ROOT BARRIER ON STREET SIDE OF TREE WELL AT LENGTH AS DETERMINED BY THE DESIGNER AS NECESSARY.
6. REMOVE TREE BOX FROM ROOT BALL PRIOR TO BACKFILLING.
7. TREE SIZE AND TYPE PER DESIGN PLANS.
8. STREET AND SIDEWALK IMPROVEMENTS SHALL BE ACCORDING TO LATEST EDITION OF SPPWC STANDARD.
9. INLET INVERT ELEVATION MUST BE BELOW LOWEST ADJACENT SIDEWALK ELEVATION.
10. FOR TREE WELL RETROFITS, CUT EXISTING CURB IN LOCATION OF TREE WELL CURB INLET ONLY.
11. SIDEWALK AND DRIVEWAY REPLACEMENT PER SPPWC SECTION 11.
12. TREE WELL FILTER SHALL NOT BE USED IF STREET LONGITUDINAL SLOPE EXCEEDS 15 PERCENT.
13. USE UNDERDRAINS (CASE A) WHERE SITE SOIL INFILTRATION RATE IS LESS THAN 0.3 INCHES PER HOUR.
14. TREE STAKES AND TIES TO BE SPECIFIED BY DESIGNER.

LACPW GREEN STREETS STANDARD PLANS

	TREE WELL FILTER CASE B, WITHOUT UNDERDRAIN	STANDARD PLAN 3110-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 3 OF 3



SECTION

NOT TO SCALE

NOTES:

1. INVERT ELEVATION VARIES PER SITE PLAN. SIZE AND ELEVATION OF GALLERY AND UNDERDRAIN PIPE SHALL BE DETERMINED BY DESIGNER TO RECOVER ALL STORAGE VOLUME WITHIN 48 HOURS.
2. LENGTH OF INFILTRATION GALLERY VARIES PER VOLUME REQUIRED AND SITE DESIGN.
3. PROVIDE OBSERVATION WELL PER STANDARD PLAN 3145 TO BOTTOM OF TRENCH AT LOCATIONS AS SHOWN IN SITE PLAN.
4. DURING EXCAVATION, HEAVY MACHINERY SHALL NOT DRIVE OVER EXPOSED UNDERLYING SOILS. USE TRACKED OR LOW GROUND PRESSURE VEHICLES.
5. EXCAVATE IN DRY CONDITIONS. EXCAVATE FINAL 9" TO 12" WITH TEETH OF BUCKET (DO NOT SMEAR).
6. SUBGRADE SHALL BE SCARIFIED (NOT COMPACTED) PRIOR TO PLACEMENT OF CLEAN, WASHED AGGREGATE.
7. SUBSURFACE INFILTRATION SYSTEMS ARE CONSIDERED CLASS V INJECTION WELLS AND SUBJECTED TO THE U.S. EPA UNDERGROUND INJECTION CONTROL (UIC) PROGRAM. SUBSURFACE INFILTRATION SYSTEMS MUST BE REGISTERED WITH EPA REGION IX PRIOR TO COMING ONLINE. SURFACE AREA UPSTREAM OF GALLERY SHALL STABILIZE TO MINIMIZE SOIL TRANSPORT.

LACPW GREEN STREETS STANDARD PLANS

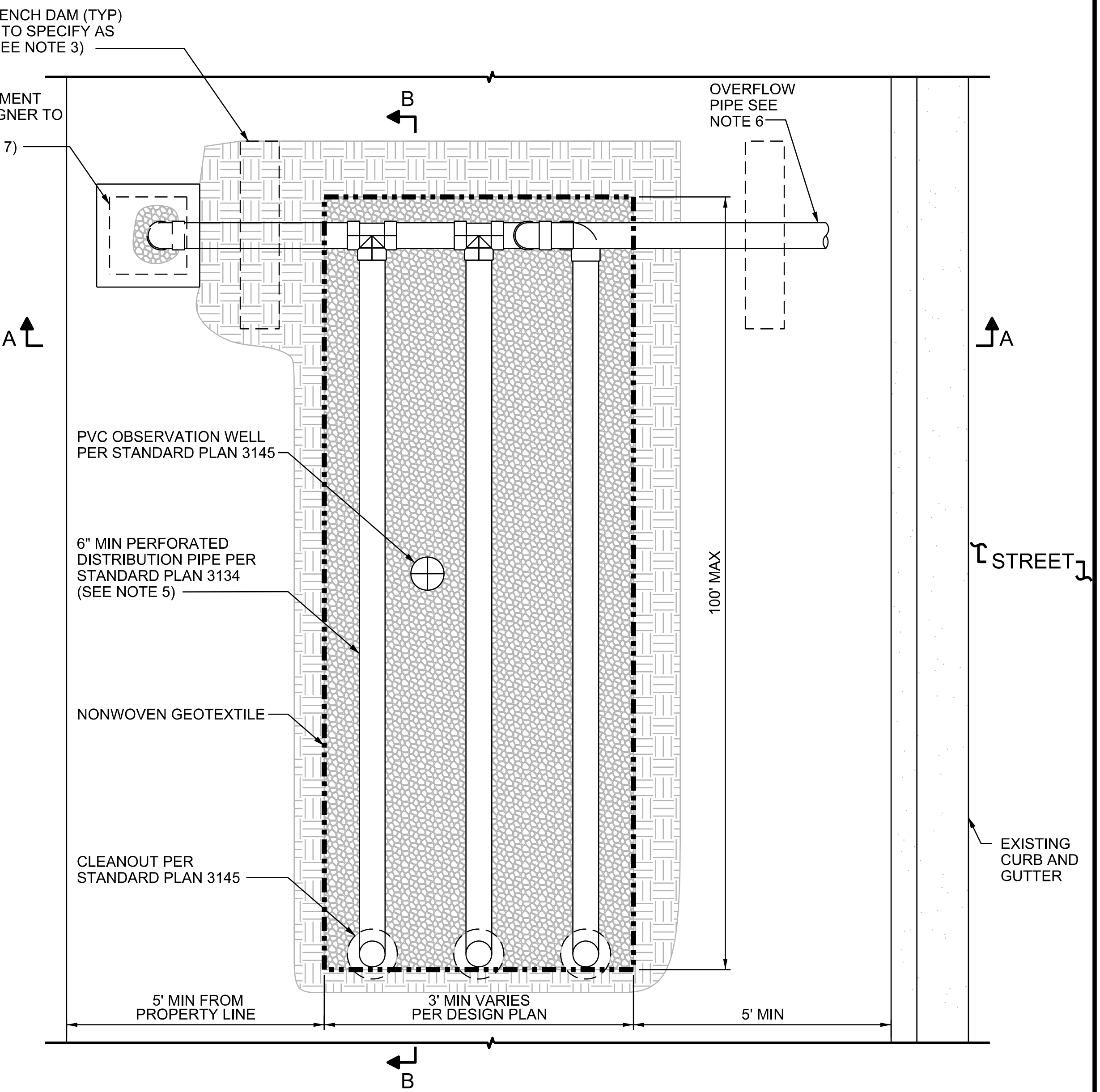
INFILTRATION GALLERY (SURFACE FLOW)

STANDARD PLAN

3112-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 1 OF 1



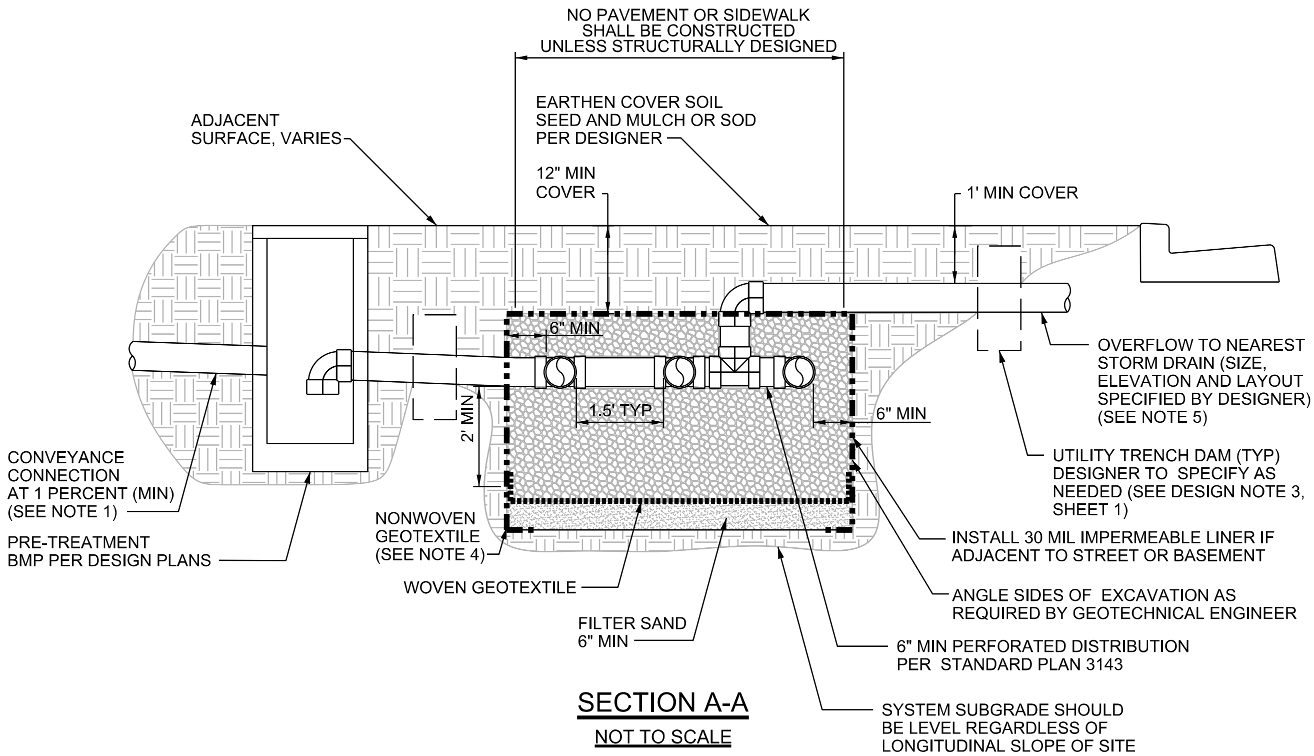
PLAN
NOT TO SCALE

DESIGN NOTES:

1. SUBSURFACE INFILTRATION SYSTEMS ARE CONSIDERED CLASS V INJECTION WELLS AND SUBJECTED TO THE U.S. EPA UNDERGROUND INJECTION CONTROL (UIC) PROGRAM. SUBSURFACE INFILTRATION SYSTEMS MUST BE REGISTERED WITH EPA REGION IX PRIOR TO COMING ONLINE.
2. FIELD-TESTED INFILTRATION RATES MUST BE AT LEAST 0.3 INCHES PER HOUR AND SUBSURFACE STORAGE DRAWDOWN TIME SHOULD NOT EXCEED 48 HOURS.
3. PROVIDE UTILITY TRENCH DAM OR EQUIVALENT MEASURE OUTSIDE OF THE INFILTRATION FACILITY AT PIPE PENETRATIONS TO PREVENT PREFERENTIAL FLOW FROM INFILTRATION GALLERY INTO UTILITY TRENCHES. DESIGNER TO PROVIDE.
4. SUBSURFACE INFILTRATION SYSTEMS ARE NOT RECOMMENDED FOR AREAS WITH VEHICULAR TRAFFIC LOADING, IN AREAS WITH KNOWN OR PRESUMED SOIL OR GROUNDWATER CONTAMINATION, OR IN AREAS WITH CURRENT OR HISTORIC INDUSTRIAL USE.
5. SUBSURFACE STORMWATER CHAMBERS MAY BE USED TO REDUCE VOLUME OF STONE AND DEPTH OF EXCAVATION NEEDED TO ACHIEVE REQUIRED STORMWATER RETENTION/DETENTION VOLUME. SEE STORM CHAMBER MANUFACTURER'S SPECIFICATIONS AND DETAILS FOR MORE INFORMATION ON MATERIAL TYPES AND DEPTHS, LAYOUT AND CROSS-SECTION.
6. ROUTE OVERFLOW PIPE TO THE NEAREST STORM DRAIN OR DOWNSTREAM BMP FOR FURTHER TREATMENT AS SHOWN ON THE SITE PLAN.
7. INCLUDE PRETREATMENT TO REMOVE SEDIMENT LOADS PRIOR TO DISCHARGE INTO SUBSURFACE SYSTEM.
8. IMPERMEABLE LINER IS REQUIRED ALONG THE STREET SIDE.

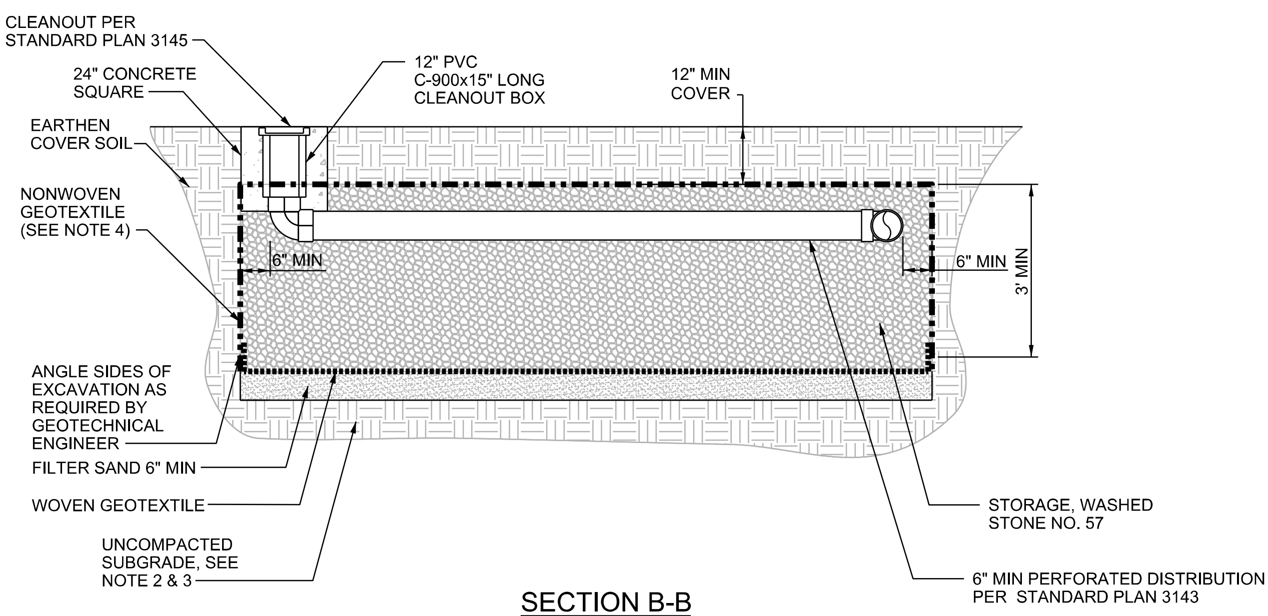
LACPW GREEN STREETS STANDARD PLANS

	INFILTRATION GALLERY (PIPED FLOW)	STANDARD PLAN 3113-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 1 OF 2



SECTION A-A

NOT TO SCALE



SECTION B-B

NOT TO SCALE

CONSTRUCTION NOTES:

1. REFER TO LA COUNTY CODES AND PUBLIC WORKS REQUIREMENTS FOR CONVEYANCE CONNECTION REQUIREMENTS.
2. AVOID COMPACTED AND DISTURBANCE OF EXISTING SOIL ADJACENT TO AND BELOW INFILTRATION FACILITIES DURING CONSTRUCTION.
3. SCARIFY SUBGRADE TO A DEPTH OF 12 INCHES (MIN) IMMEDIATELY PRIOR TO PLACEMENT OF AGGREGATE STORAGE.
4. ENTIRE BOUNDARY OF AGGREGATE STORAGE AND TOP OF AGGREGATE STORAGE SHALL BE LINED WITH A NONWOVEN GEOTEXTILE TO PREVENT MIGRATION OF ADJACENT SOILS INTO SUBSURFACE INFILTRATION SYSTEM.
5. DESIGNER SHALL VERIFY SYSTEM WILL NOT CAUSE UPSTREAM FLOODING.
6. NON-WOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
7. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

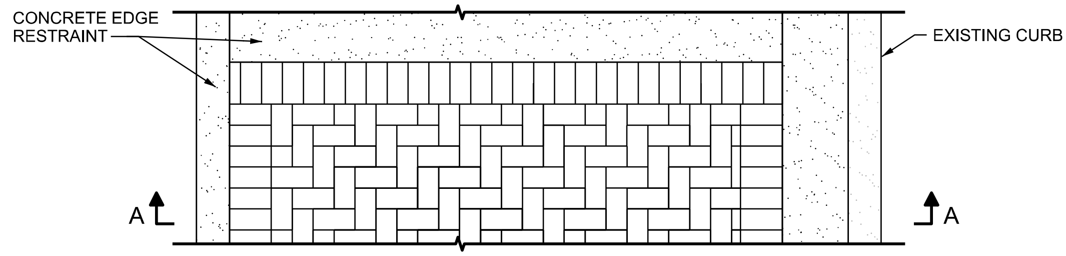
INFILTRATION GALLERY (PIPED FLOW)

STANDARD PLAN

3113-1

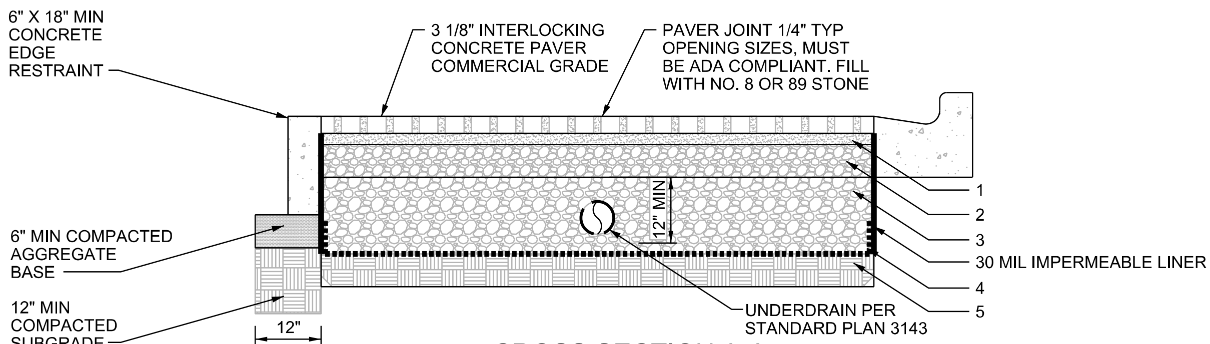
USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 2 OF 2



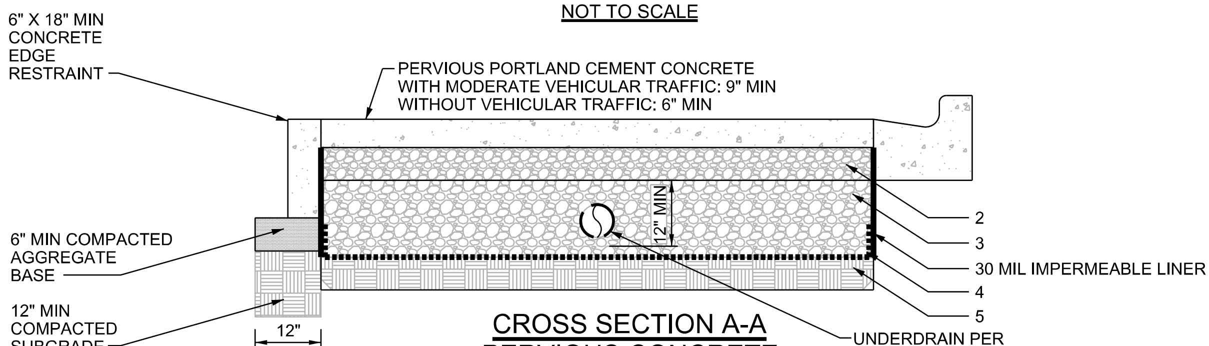
PLAN DETAIL

NOT TO SCALE



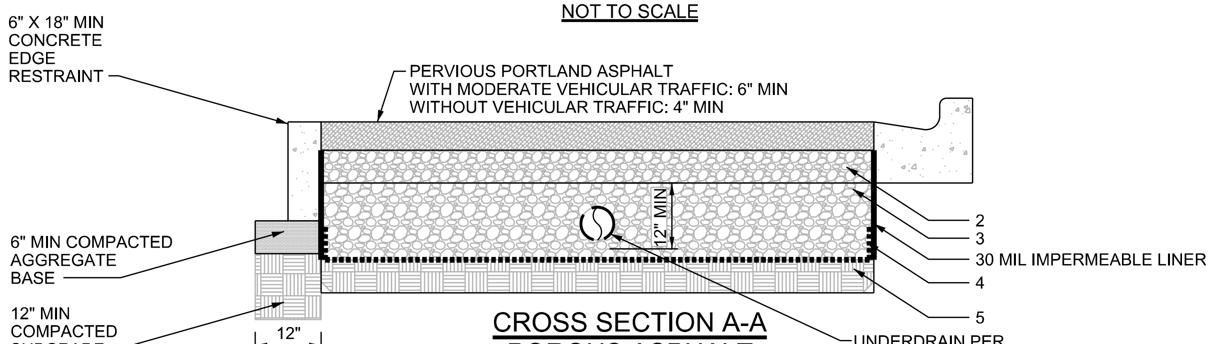
CROSS SECTION A-A INTERLOCKING PAVERS

NOT TO SCALE



CROSS SECTION A-A PERVIOUS CONCRETE

NOT TO SCALE



CROSS SECTION A-A POROUS ASPHALT

NOT TO SCALE

NOTE:

1. DESIGNER SHALL VERIFY PERMEABLE PAVEMENT SYSTEM COARSE THICKNESS MEET PROJECT VEHICLE LOADING REQUIREMENT AND INCREASE THICKNESS AS NEEDED.

TABLE 1

LAYER #	NAME	DESCRIPTION
1	BEDDING COARSE	NO. 8, OR PER MANUFACTURER RECOMMENDATION, 2"
2	BASE COARSE	WASHED STONE NO. 57, 6" MIN
3	RESEVOIR COARSE	WASHED STONE NO. 2 OR 3, 12" MIN
4	WOVEN GEOTEXTILE	TYPE 200WM PER SSPWC SECTION 213
5	SUBGRADE	SCARIFY SUBGRADE SOIL. MINIMIZE COMPACTION OF SUBGRADE SOILS, 12"

LACPW GREEN STREETS STANDARD PLANS

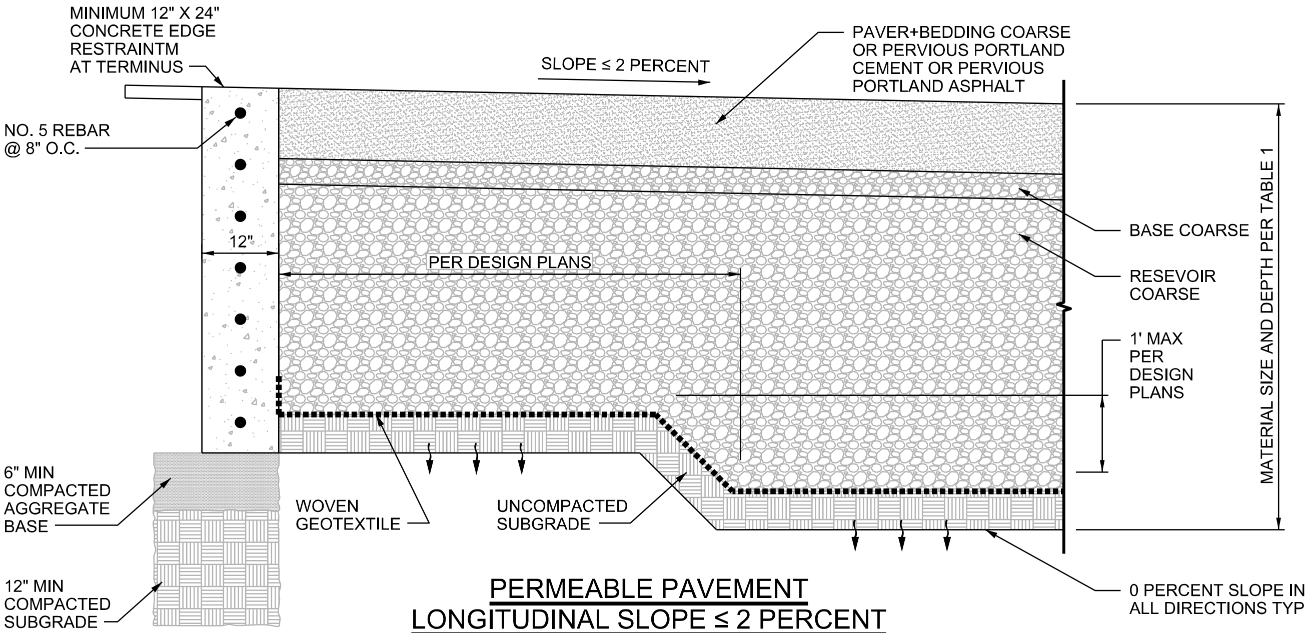
PERMEABLE PAVEMENT

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

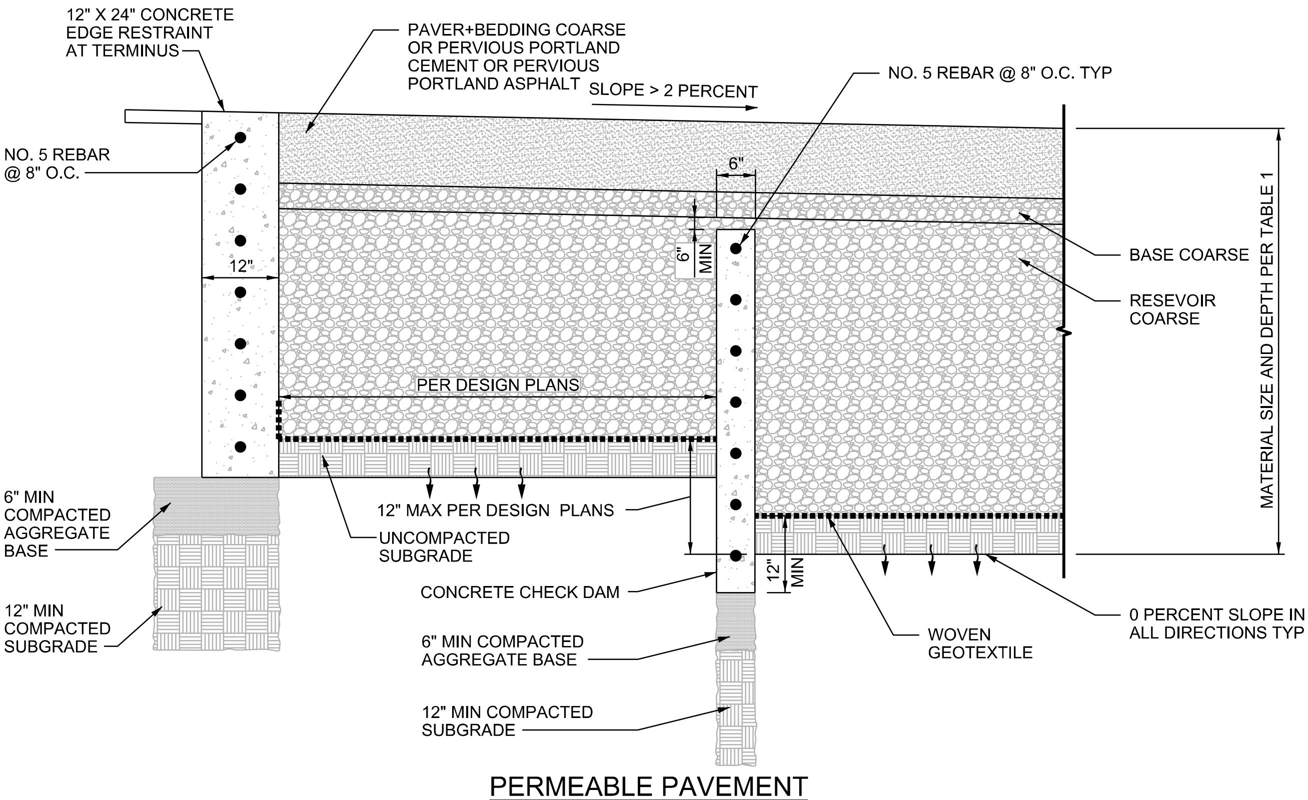
3120-1

SHEET 1 OF 3



PERMEABLE PAVEMENT
LONGITUDINAL SLOPE ≤ 2 PERCENT

NOT TO SCALE



PERMEABLE PAVEMENT
LONGITUDINAL SLOPE > 2 PERCENT

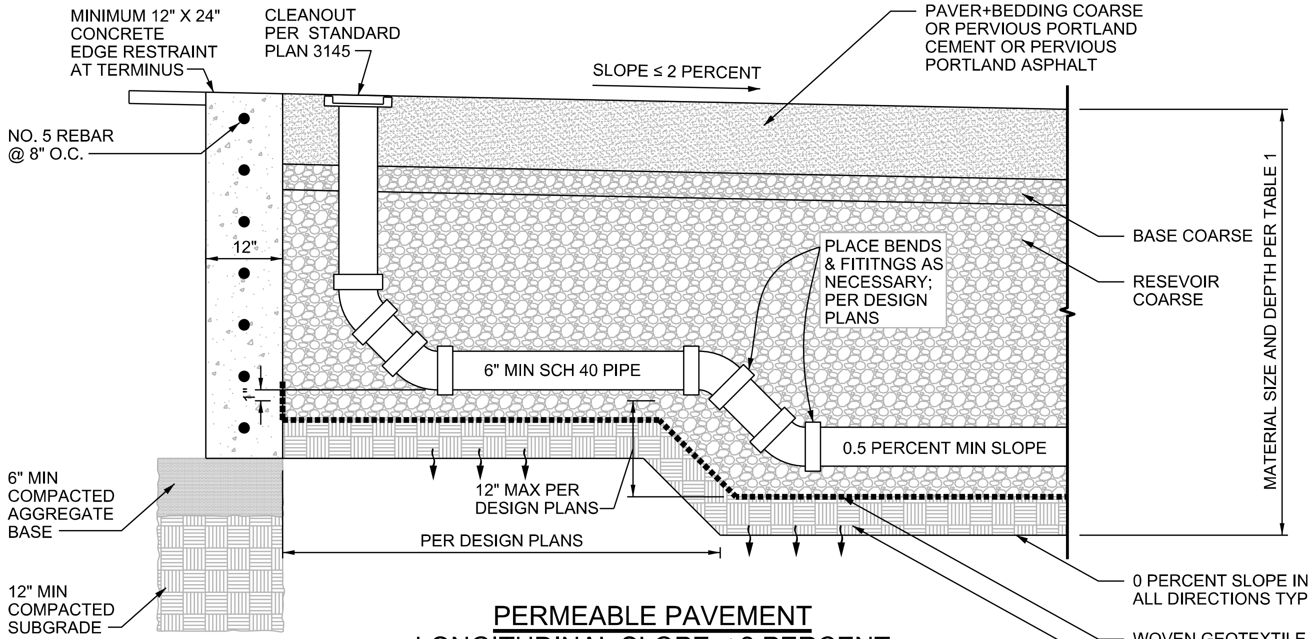
NOT TO SCALE

NOTES:

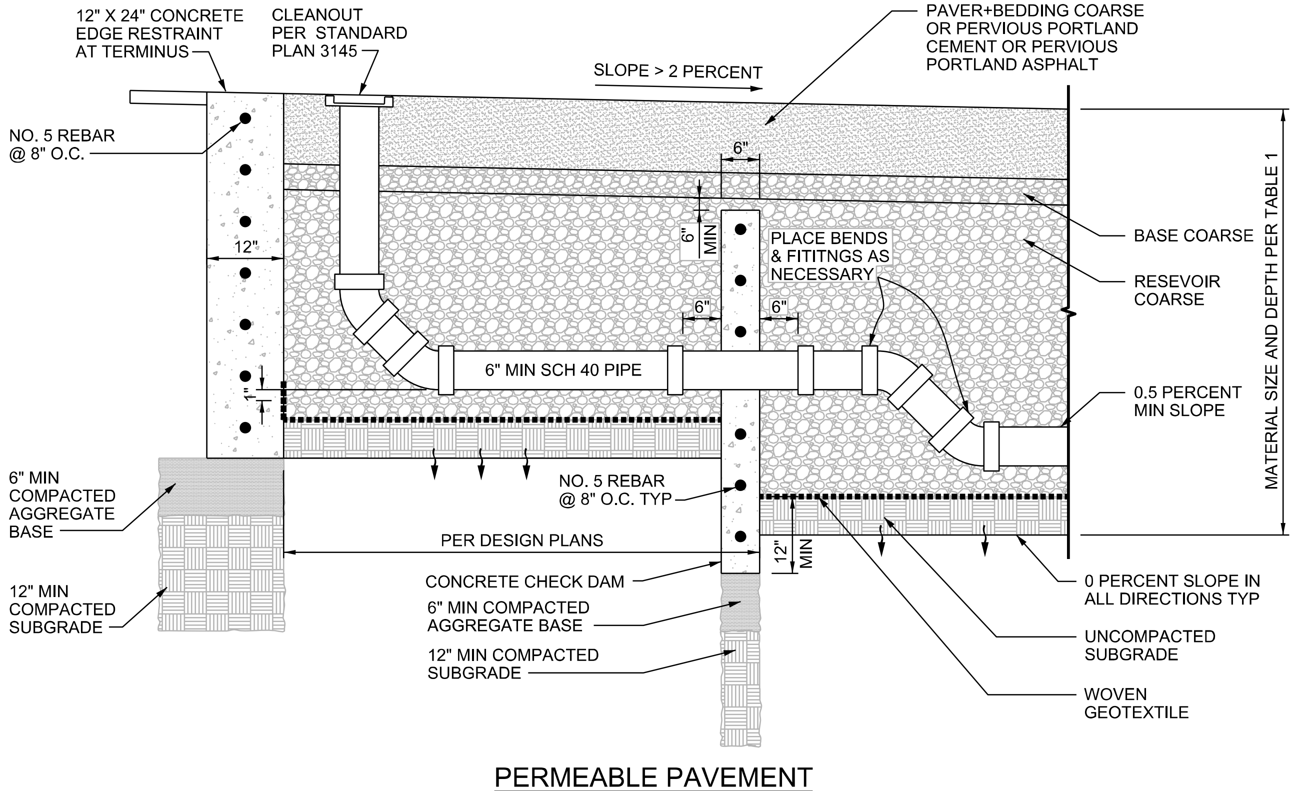
1. CHECK DAMS ARE TO BE USED FOR INSTALLATIONS WITH SURFACE SLOPES GREATER THAN 2 PERCENT.
2. SURFACE SLOPES GREATER THAN 5 PERCENT ARE NOT RECOMMENDED AND REQUIRE APPROVAL BY THE COUNTY.
3. THE PERMEABLE PAVEMENT WITHOUT UNDERDRAIN SHALL BE USED WHEN NATIVE SOIL INFILTRATION RATE IS MORE THAN 0.3 IN/HOUR.
4. EDGE RESTRAINT AT CONNECTIONS BETWEEN PERMEABLE PAVEMENT AND EXISTING ASPHALT OR CONCRETE PAVEMENT SHALL BE MINIMUM 12" WIDE X 24" DEEP WITH NO. 5 REBAR @ 8" O.C.
5. NON-WOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
6. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

	PERMEABLE PAVEMENT WITHOUT UNDERDRAIN	STANDARD PLAN 3120-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 2 OF 3



PERMEABLE PAVEMENT
LONGITUDINAL SLOPE ≤ 2 PERCENT
NOT TO SCALE



PERMEABLE PAVEMENT
LONGITUDINAL SLOPE ≤ 2 PERCENT
NOT TO SCALE

NOTES:

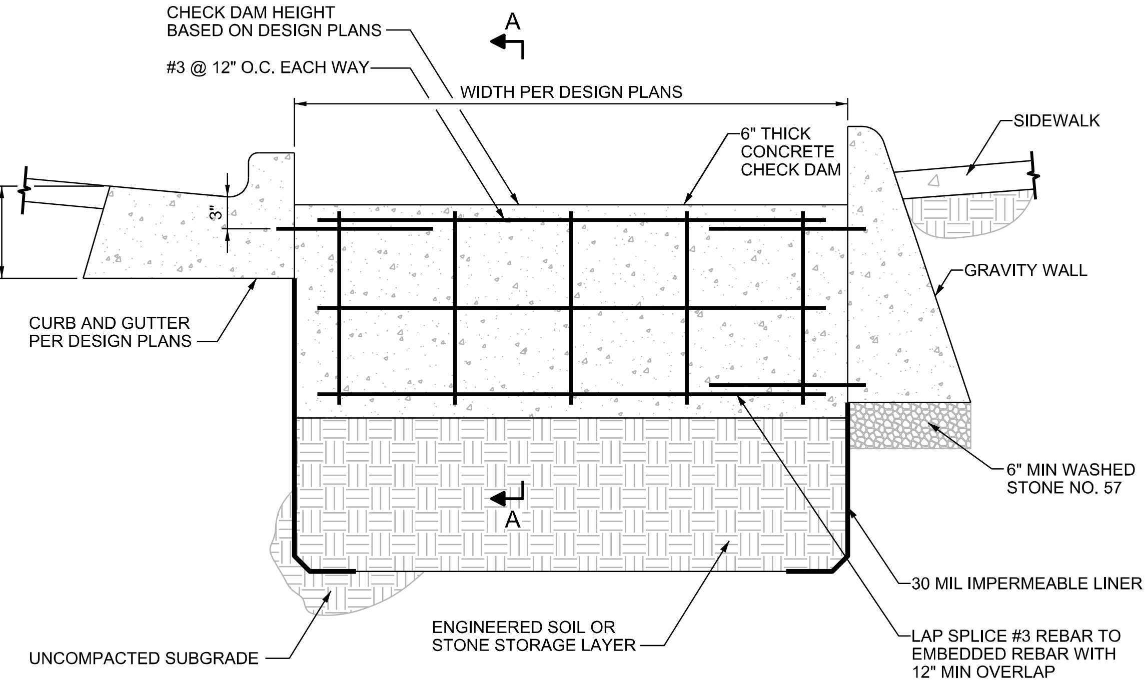
1. FIRST CLEANOUT SHALL BE PLACED AT THE MOST UPSTREAM END OF THE PERMEABLE PAVEMENT. MAXIMUM CLEANOUT SPACING SHALL BE 100-FT.
2. CHECK DAMS TO BE USED FOR INSTALLATIONS WITH SURFACE SLOPES GREATER THAN 2 PERCENT.
3. SURFACE SLOPES GREATER THAN 5 PERCENT ARE NOT RECOMMENDED AND REQUIRE APPROVAL BY THE COUNTY.
4. THE PERMEABLE PAVEMENT WITH UNDERDRAIN SHALL BE USED WHEN NATIVE SOIL INFILTRATION RATE IS LESS THAN 0.3 IN/HOUR.
5. EDGE RESTRAINT AT CONNECTIONS BETWEEN PERMEABLE PAVEMENT AND EXISTING ASPHALT OR CONCRETE PAVEMENT SHALL BE MINIMUM 12" WIDE X 24" DEEP WITH NO. 5 REBAR @ 8" O.C.
6. NON-WOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
7. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

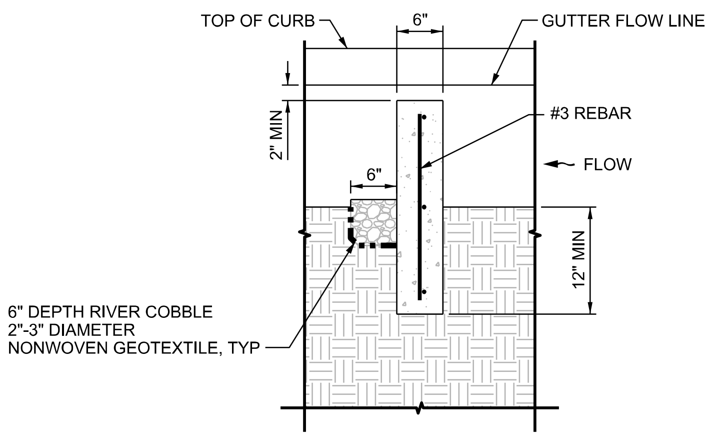
PERMEABLE PAVEMENT WITH UNDERDRAIN

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN
3120-1
SHEET 3 OF 3



SECTION
CONCRETE CHECK DAM
NOT TO SCALE



SECTION A-A
CONCRETE CHECK DAM
NOT TO SCALE

NOTES:

1. ENSURE CHECK DAM ELEVATIONS DO NOT CAUSE STORMWATER TO OVERFLOW ONTO STREET OR SIDEWALK.
2. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
3. EMBEDED REBAR 3" INTO CURB AND GRAVITY WALL.
4. FOR CHECK DAMS LONGER THAN 12', DESIGNER SHALL SPECIFY REBAR OVERLAP LENGTH.

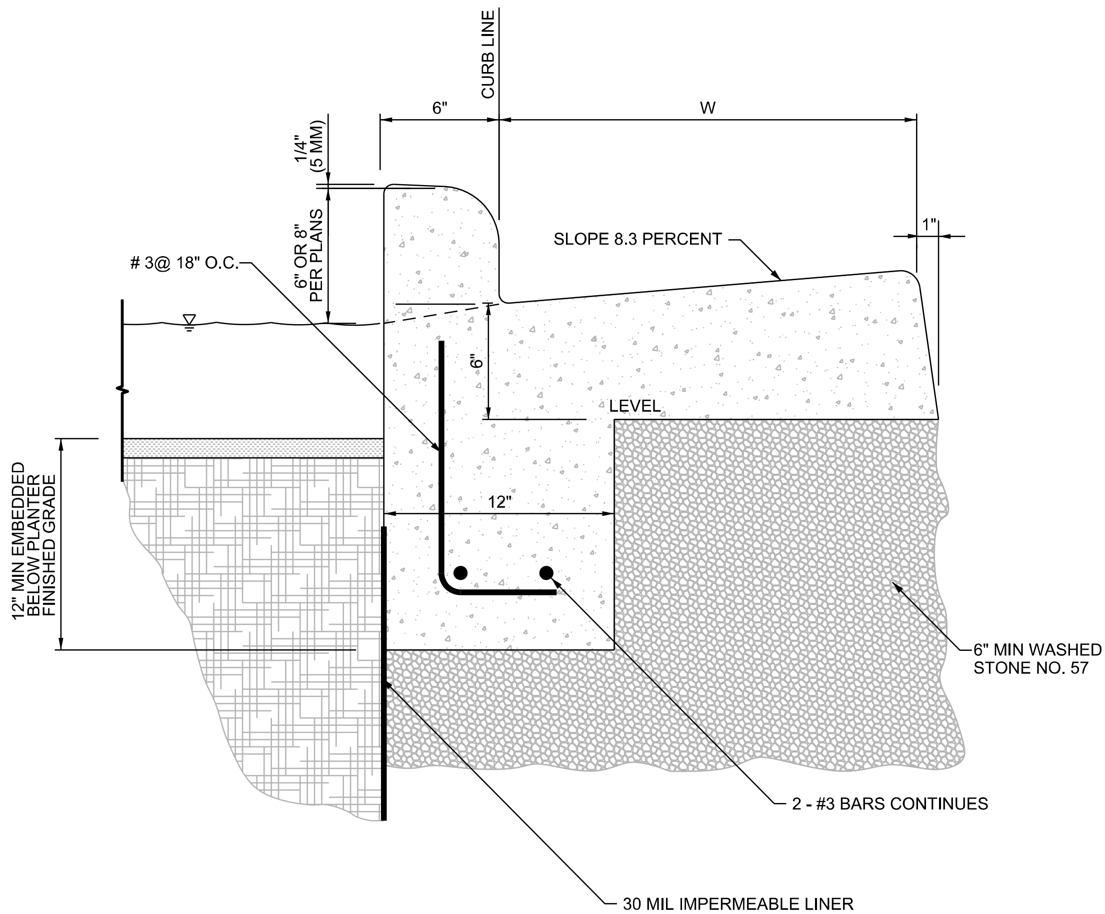
LACPW GREEN STREETS STANDARD PLANS

COMPONENTS
CHECK DAMS

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN
3130-1

SHEET 1 OF 1



SECTION
NOT TO SCALE

NOTES:

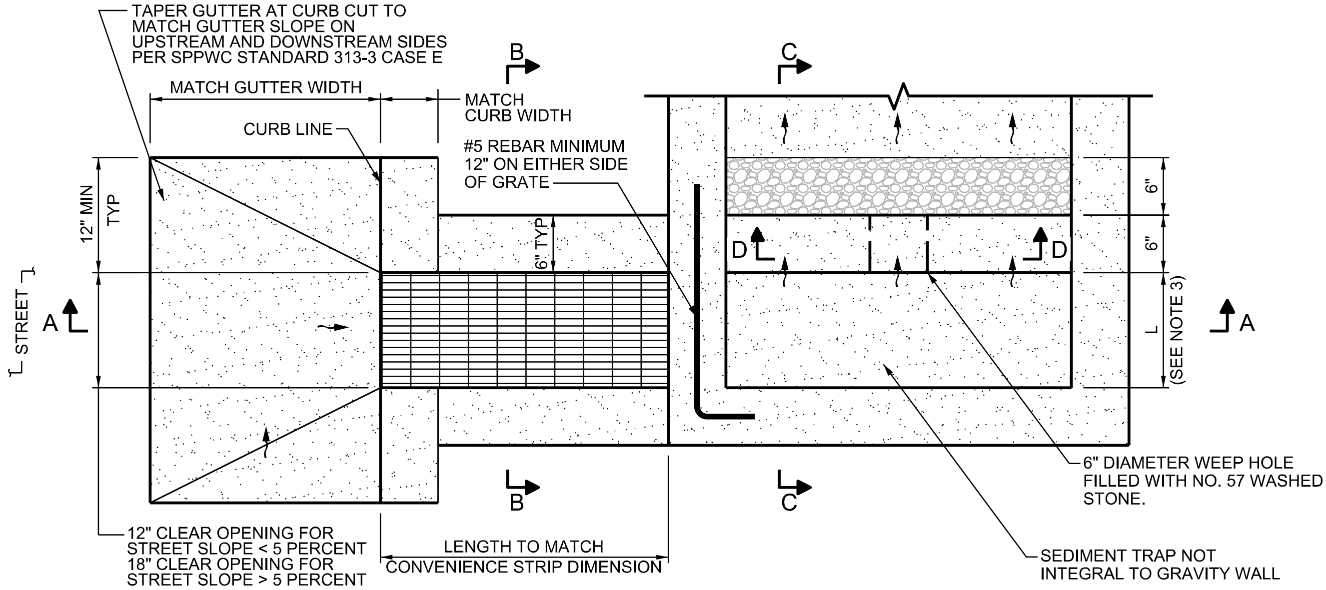
1. GUTTER WIDTH, W, IS 24" UNLESS OTHERWISE SPECIFIED.
2. CURB AND GUTTER SHALL BE CONSTRUCTED FROM PCC.
3. ALL EXPOSED CORNERS ON PCC CURBS AND GUTTERS SHALL BE ROUNDED WITH A 1/2" RADIUS.
4. CONCRETE TO BE CLASS 520-C-2500 PORTLAND CEMENT CONCRETE PER SSPWC SECTION 201.
5. CEMENT GROUT TO CONFORM TO SSPWC SECTION 202-3.2.2.
6. JOINTS BETWEEN WALLS SHALL BE SEALED PER SSPWC SECTION 303-1.8.7.

LACPW GREEN STREETS STANDARD PLANS

COMPONENTS
CURB AND GUTTER TYPE A

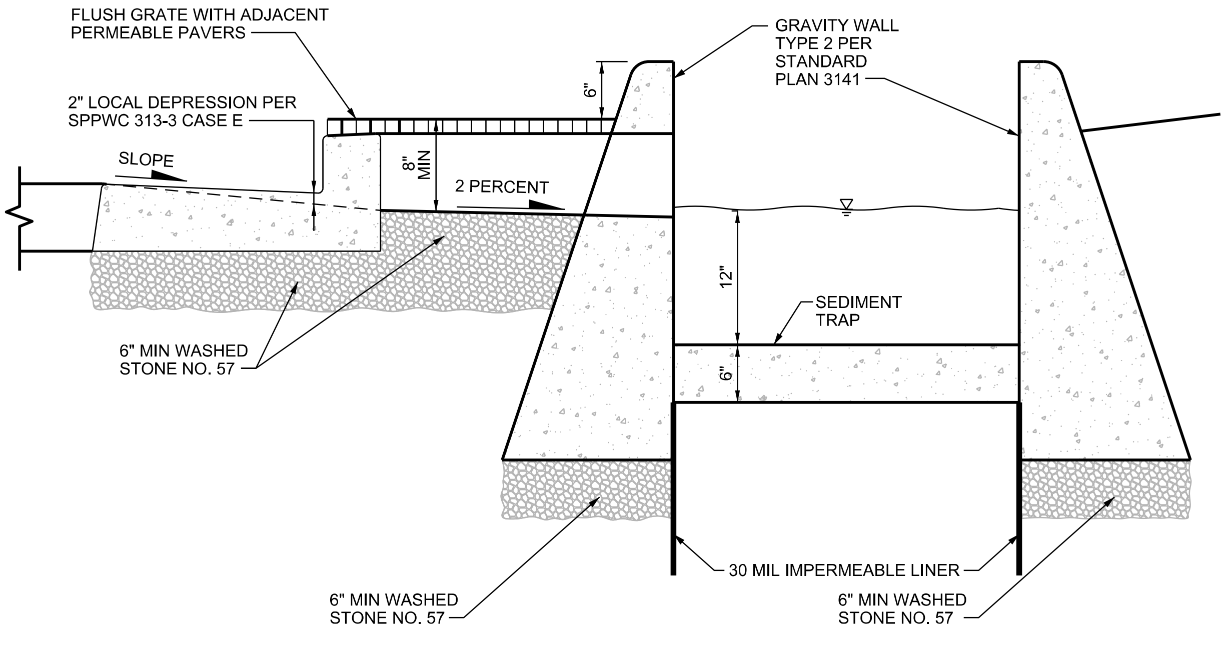
STANDARD PLAN
3131-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES



PLAN

NOT TO SCALE



SECTION A-A

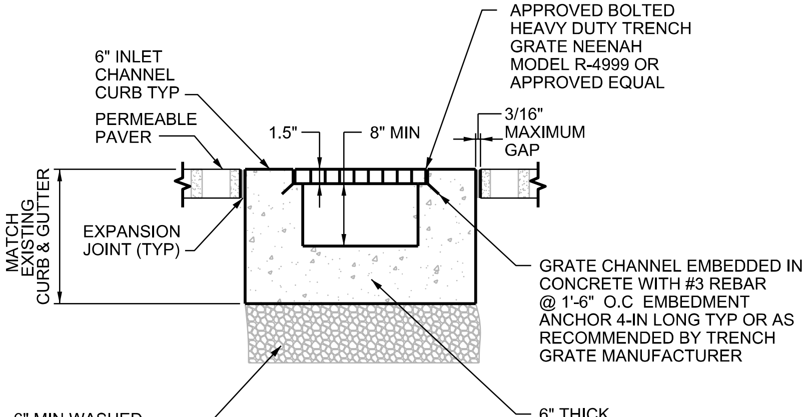
NOT TO SCALE

NOTES:

1. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
2. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT LACPW STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
3. LENGTH OF SEDIMENT TRAP, L, IS MIN OF 10 PERCENT OF TOTAL LENGTH OF BMP.

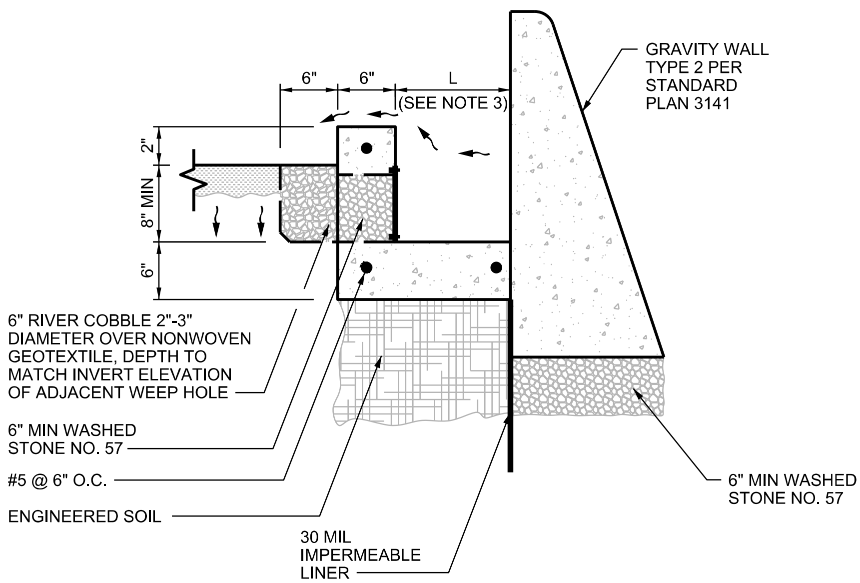
LACPW GREEN STREETS STANDARD PLANS

	COMPONENTS CURB CUT INLET TYPE 1	STANDARD PLAN 3132-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 1 OF 2



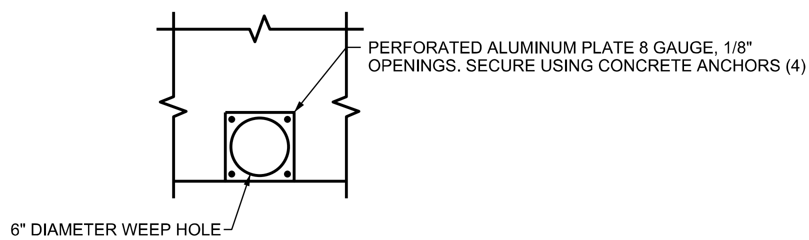
SECTION B-B

NOT TO SCALE



SECTION C-C

NOT TO SCALE



SECTION D-D

NOT TO SCALE

NOTES:

1. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
2. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT LACPW STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS.
3. LENGTH OF SEDIMENT TRAP, L, IS MIN OF 10 PERCENT OF TOTAL LENGTH OF BMP.

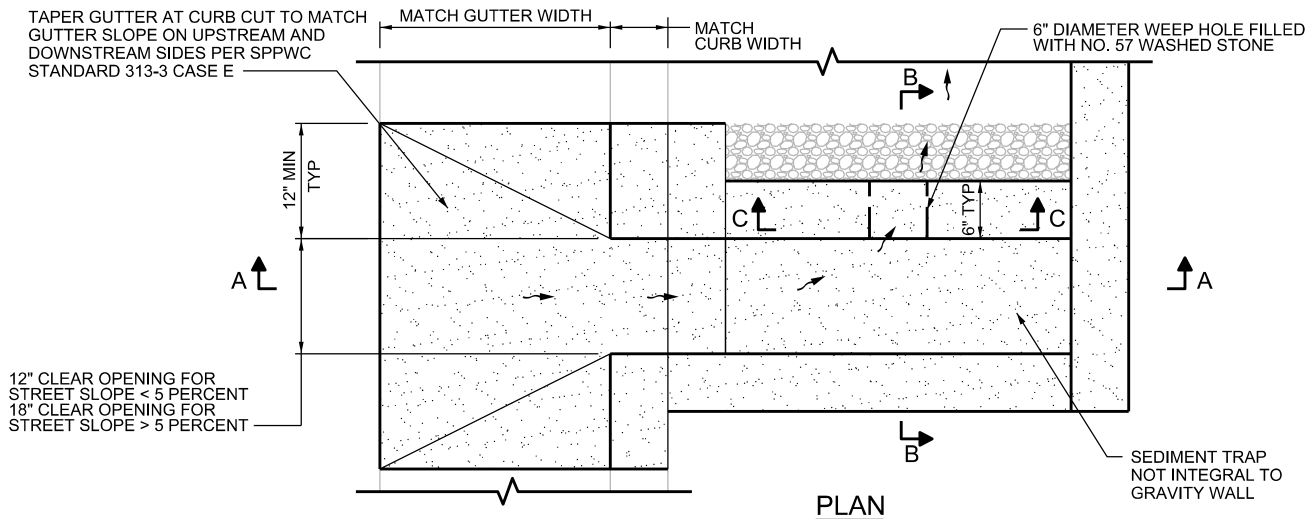
LACPW GREEN STREETS STANDARD PLANS

COMPONENTS
CURB CUT INLET TYPE 1

STANDARD PLAN
3132-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 2 OF 2



PLAN

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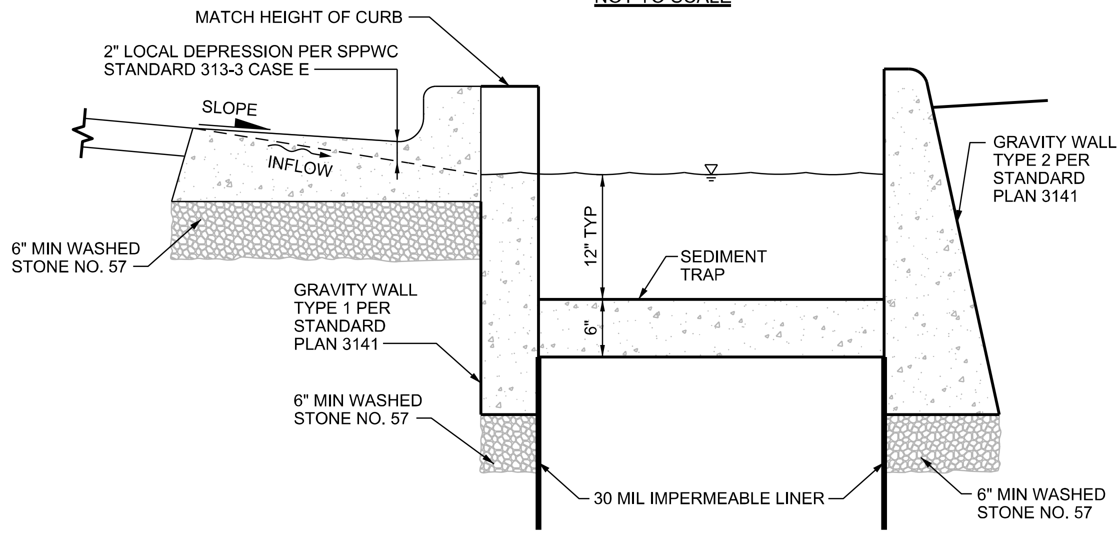
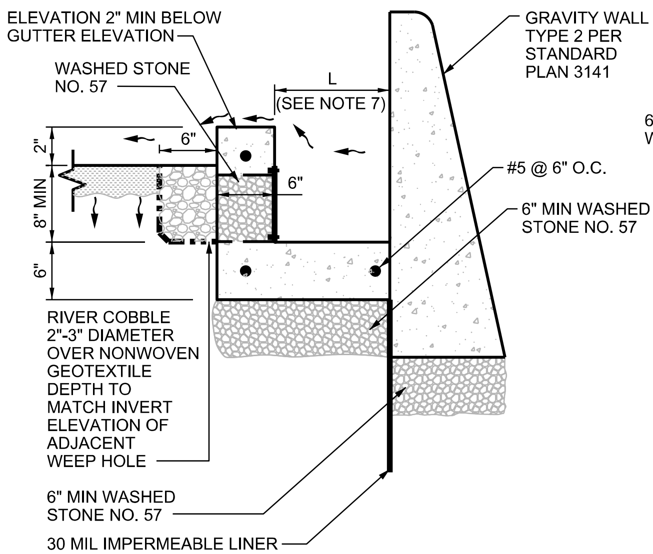


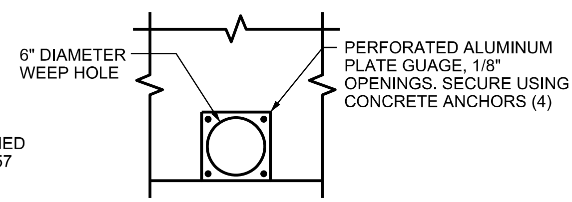
SECTION A-A

NOT TO SCALE



SECTION B-B

NOT TO SCALE



SECTION C-C

NOT TO SCALE

NOTES:

1. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO SSPWC AND APPLICABLE REQUIREMENTS OF LA COUNTY PUBLIC WORKS.
2. CONSTRUCTION FOR CURB SHALL CONFORM TO SSPWC AND APPLICABLE REQUIREMENTS FOR LA COUNTY PUBLIC WORKS.
3. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
4. MATCH GUTTER SLOPE UPSTREAM AND DOWNSTREAM OF CURB CUT SLOPE SIMILAR TO INLET DETAIL UNLESS MODIFYING GUTTER.
5. GUTTER DEPRESSION STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
6. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
7. LENGTH OF SEDIMENT TRAP, L, IS MIN OF 10 PERCENT OF TOTAL LENGTH OF BMP.

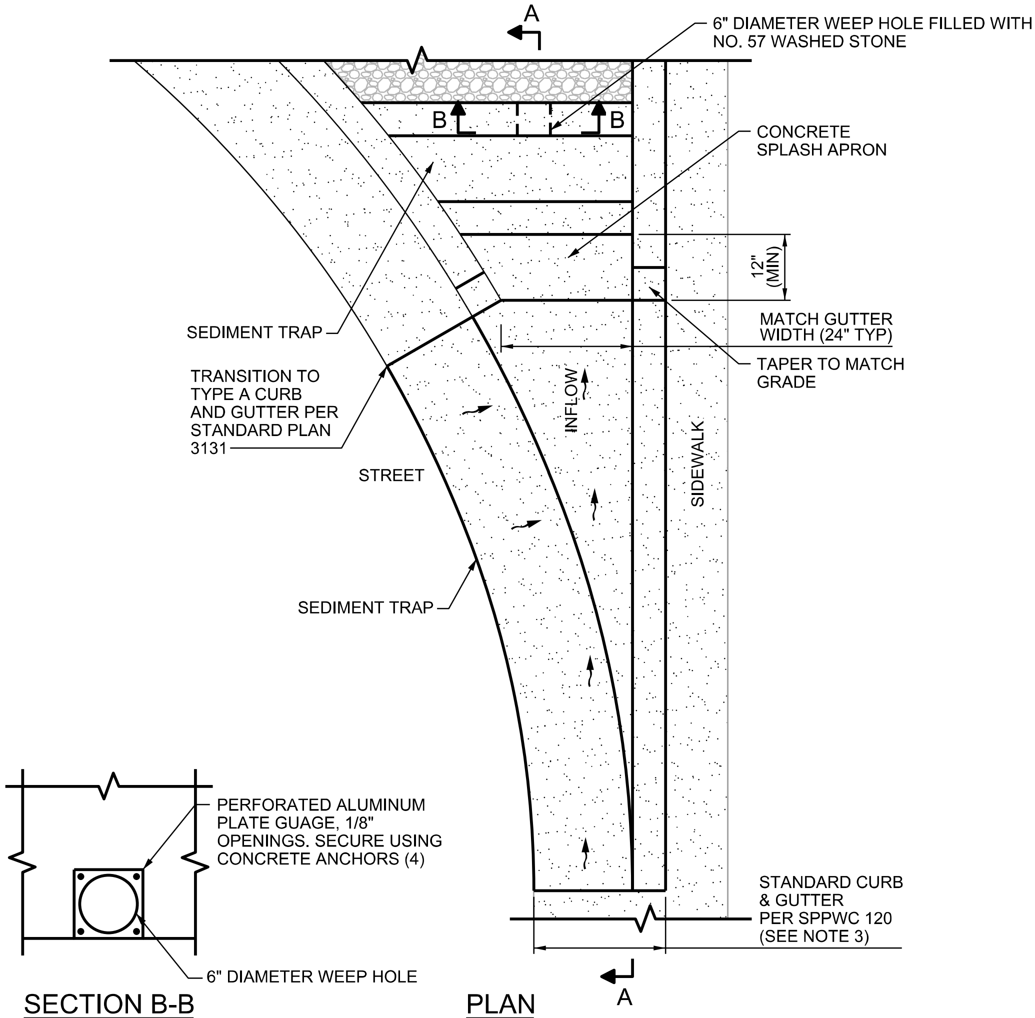
LACPW GREEN STREETS STANDARD PLANS

COMPONENTS CURB CUT INLET TYPE 2

STANDARD PLAN 3133-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 1 OF 1

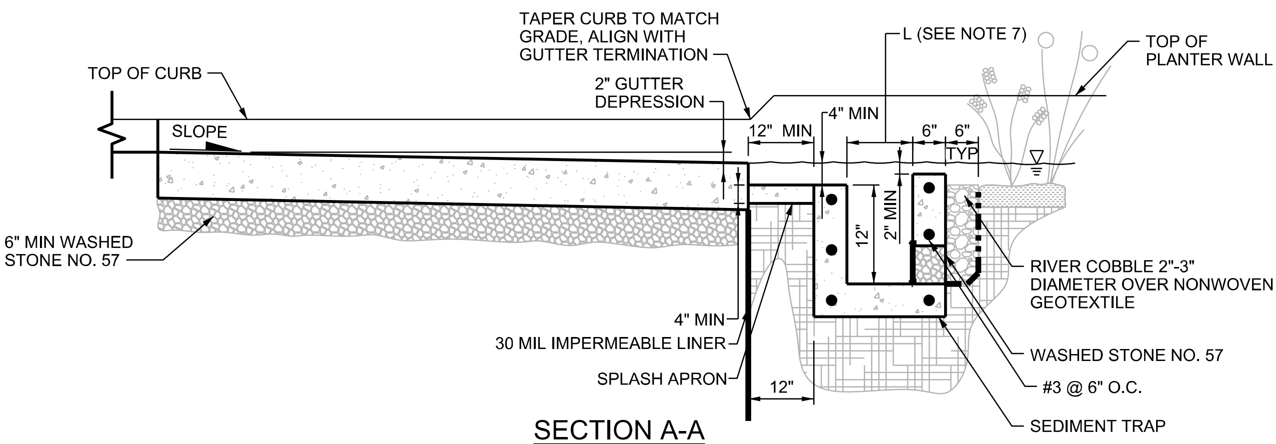


SECTION B-B

NOT TO SCALE

PLAN

NOT TO SCALE



SECTION A-A

NOT TO SCALE

NOTES:

1. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO APPLICABLE REQUIREMENTS OF LA COUNTY PUBLIC WORKS.
2. CONSTRUCTION FOR CURB CUTS SHALL CONFORM TO SSPWC AND APPLICABLE REQUIREMENTS FOR LA COUNTY PUBLIC WORKS.
3. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
4. MATCH GUTTER SLOPE UPSTREAM AND DOWNSTREAM OF CURB CUT SLOPE SIMILAR TO INLET DETAIL UNLESS MODIFYING GUTTER.
5. GUTTER DEPRESSION STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
6. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND REPLACEMENT TO FOLLOW SECTION 300-8.
7. LENGTH OF SEDIMENT TRAP, L, IS MIN OF 10 PERCENT OF TOTAL LENGTH OF BMP.

LACPW GREEN STREETS STANDARD PLANS

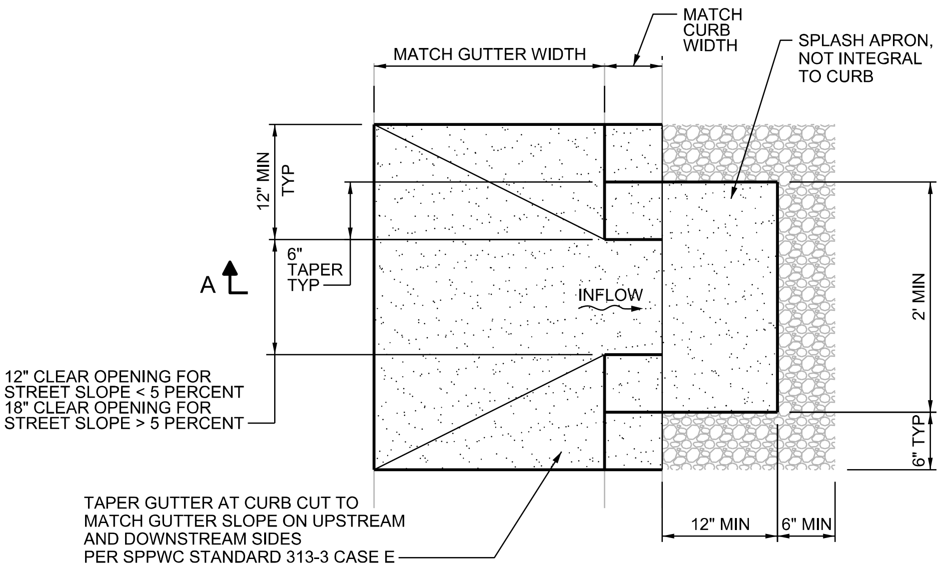
COMPONENTS
CURB CUT INLET TYPE 3

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

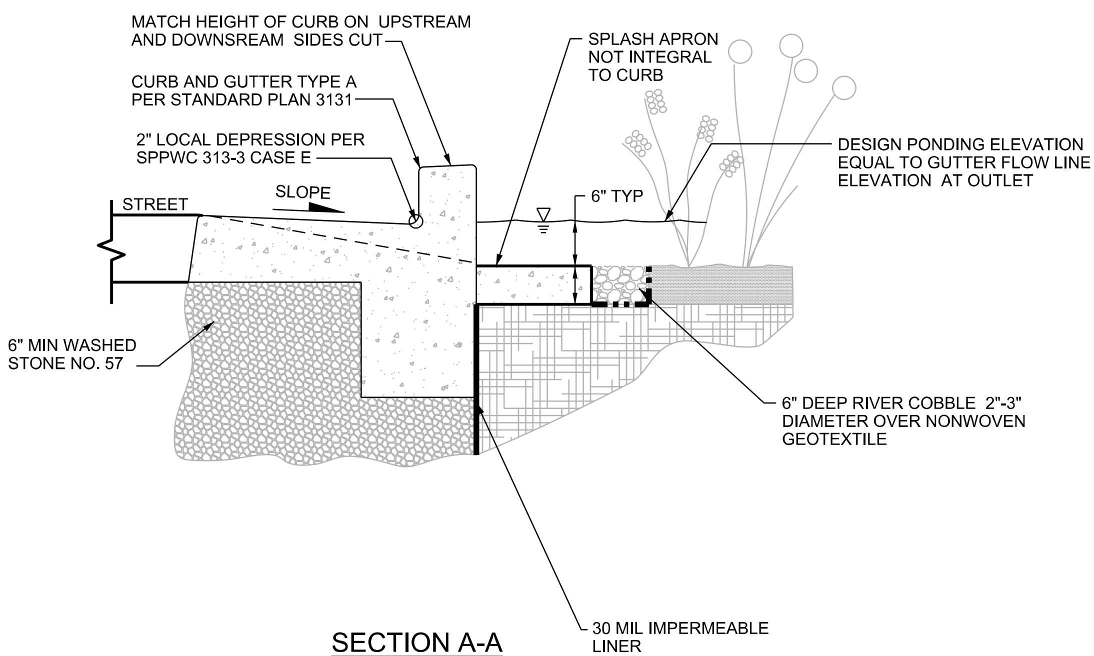
3134-1

SHEET 1 OF 1



PLAN

NOT TO SCALE



SECTION A-A

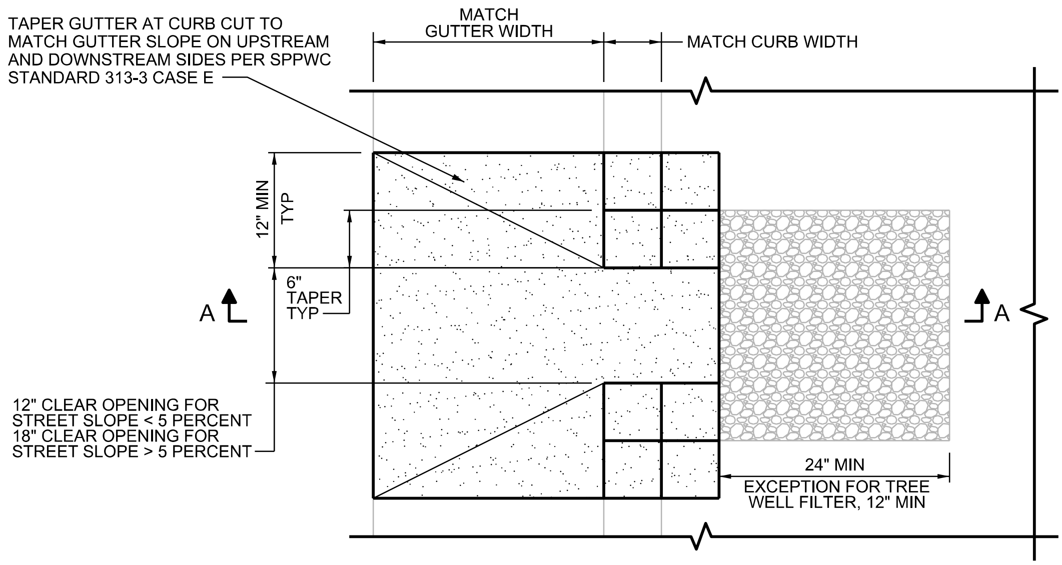
NOT TO SCALE

NOTES:

1. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO APPLICABLE REQUIREMENTS OF LA COUNTY PUBLIC WORKS.
2. CONSTRUCTION FOR CURB CUTS SHALL CONFORM TO SSPWC AND APPLICABLE REQUIREMENTS FOR LA COUNTY PUBLIC WORKS.
3. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
4. MATCH GUTTER SLOPE UPSTREAM AND DOWNSTREAM OF CURB CUT SLOPE SIMILAR TO INLET DETAIL UNLESS MODIFYING GUTTER.
5. GUTTER DEPRESSION STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
6. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

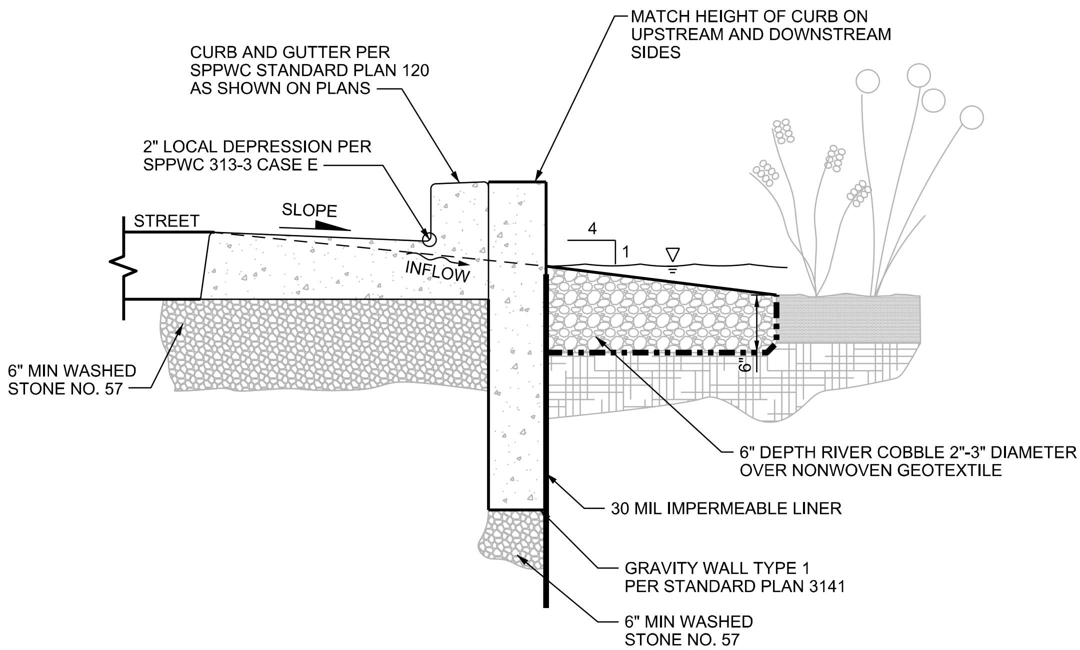
LACPW GREEN STREETS STANDARD PLANS

	COMPONENTS CURB CUT INLET TYPE 4	STANDARD PLAN 3135-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 1 OF 1



PLAN

NOT TO SCALE



SECTION A-A

NOT TO SCALE

NOTES:

1. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO APPLICABLE REQUIREMENTS OF LA COUNTY PUBLIC WORKS.
2. CONSTRUCTION FOR CURB SHALL CONFORM TO SSPWC AND APPLICABLE REQUIREMENTS FOR LA COUNTY PUBLIC WORKS.
3. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
4. MATCH GUTTER SLOPE UPSTREAM AND DOWNSTREAM OF CURB CUT SLOPE SIMILAR TO INLET DETAIL UNLESS MODIFYING GUTTER.
5. GUTTER DEPRESSION STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
6. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

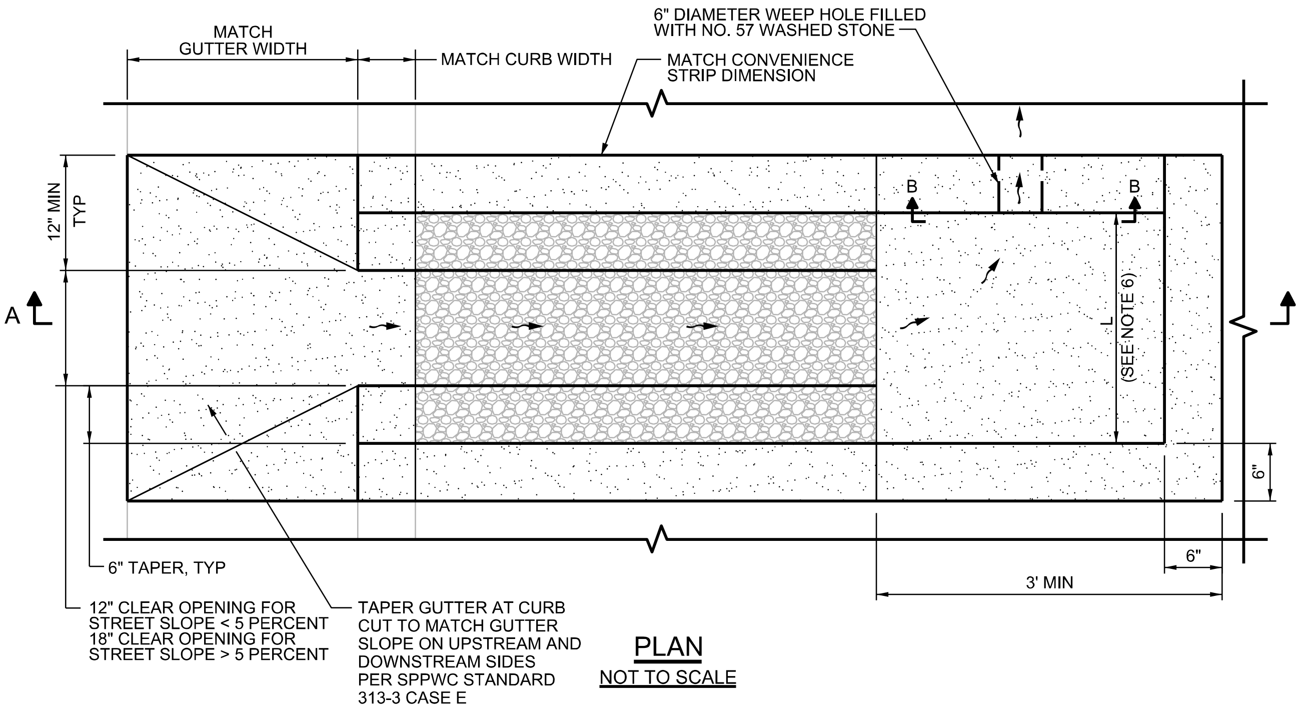
COMPONENTS
CURB CUT INLET TYPE 5

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

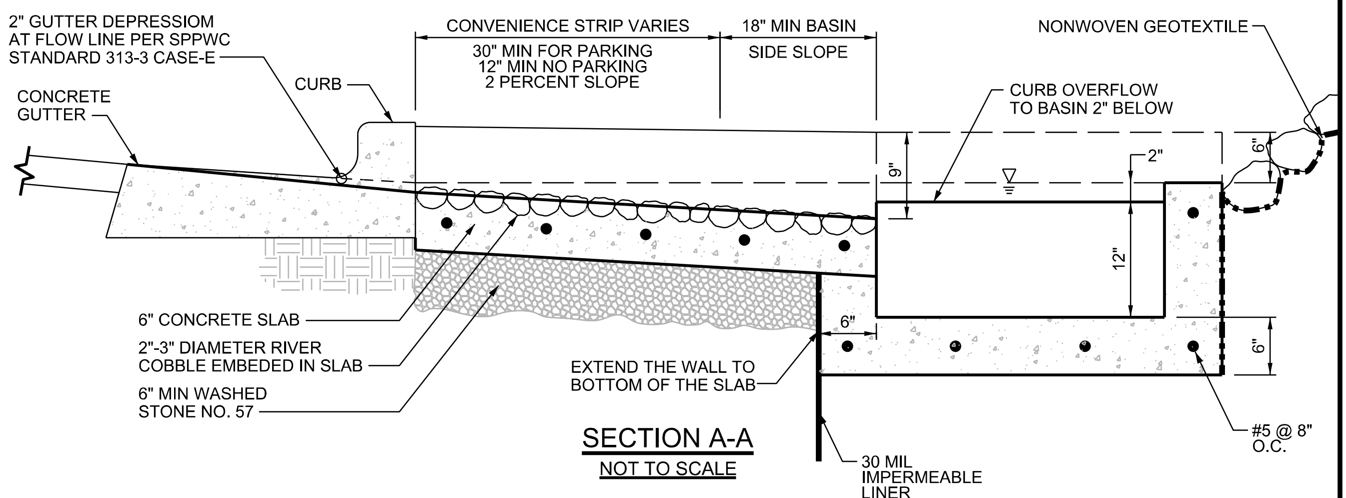
STANDARD PLAN

3136-1

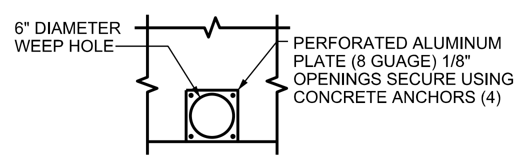
SHEET 1 OF 1



PLAN
NOT TO SCALE



SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE

NOTES:

1. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO SSPWC AND APPLICABLE REQUIREMENTS OF LA COUNTY PUBLIC WORKS.
2. BOND NEW CURB AND CUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
3. MATCH GUTTER SLOPE UPSTREAM AND DOWNSTREAM OF CURB CUT SLOPE SIMILAR TO INLET DETAIL UNLESS MODIFYING GUTTER.
4. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
5. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
6. LENGTH OF SEDIMENT TRAP L, IS MIN OF 10 PERCENT OF TOTAL LENGTH OF BMP.

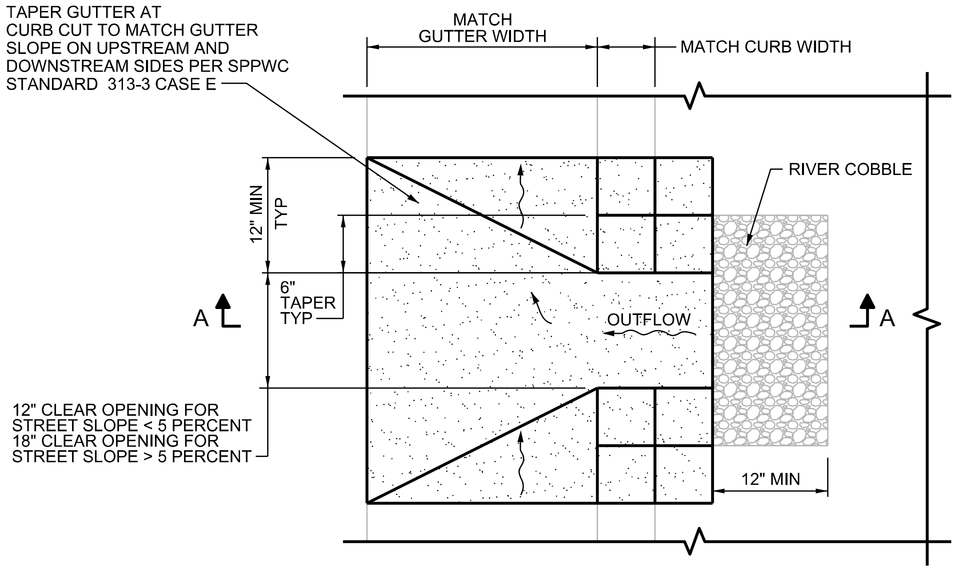
LACPW GREEN STREETS STANDARD PLANS

COMPONENTS
CURB CUT INLET TYPE 6

STANDARD PLAN 3137-1

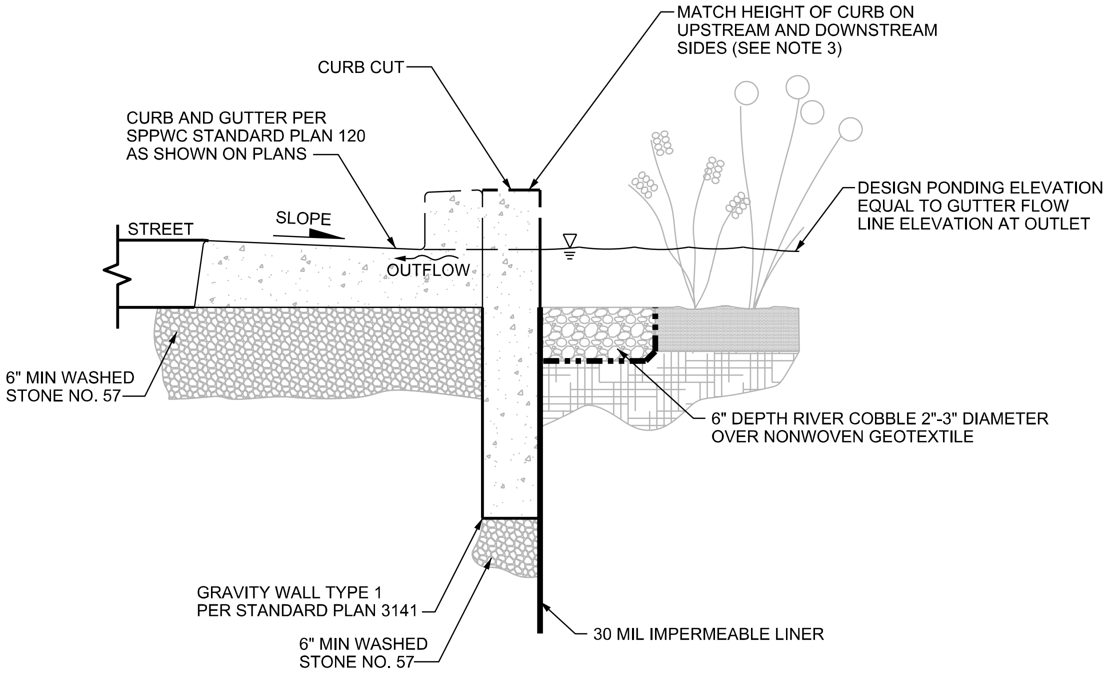
USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 1 OF 1



PLAN

NOT TO SCALE



SECTION A-A

NOT TO SCALE

NOTES:

1. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO APPLICABLE REQUIREMENTS OF LA COUNTY PUBLIC WORKS.
2. CONSTRUCTION FOR CURB CUTS SHALL CONFORM TO SSPWC AND APPLICABLE REQUIREMENTS FOR LA COUNTY PUBLIC WORKS.
3. BOND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
4. MATCH GUTTER SLOPE UPSTREAM AND DOWNSTREAM OF CURB CUT SLOPE SIMILAR TO INLET DETAIL UNLESS MODIFYING GUTTER.
5. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8 .

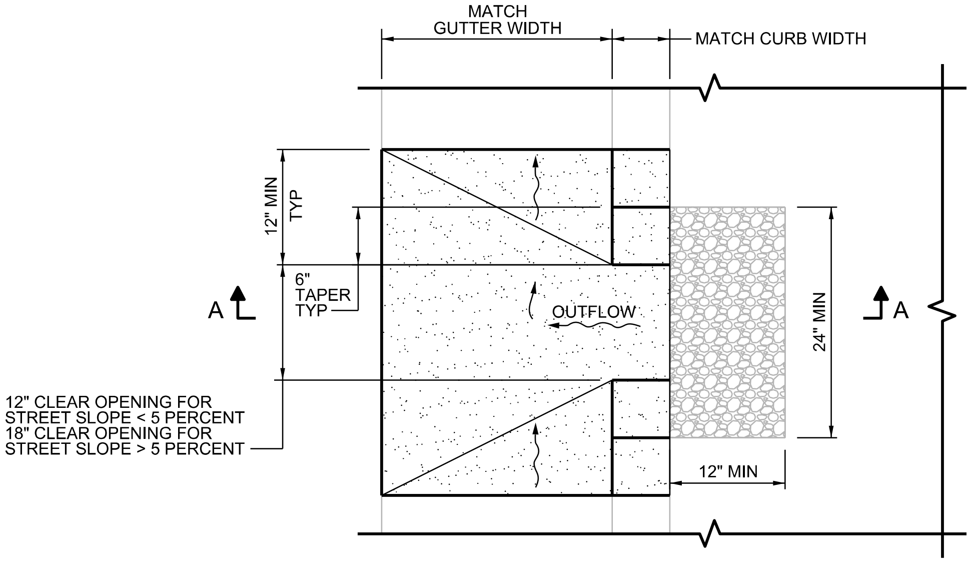
LACPW GREEN STREETS STANDARD PLANS

COMPONENTS
CURB CUT OUTLET TYPE 1

STANDARD PLAN 3138-1

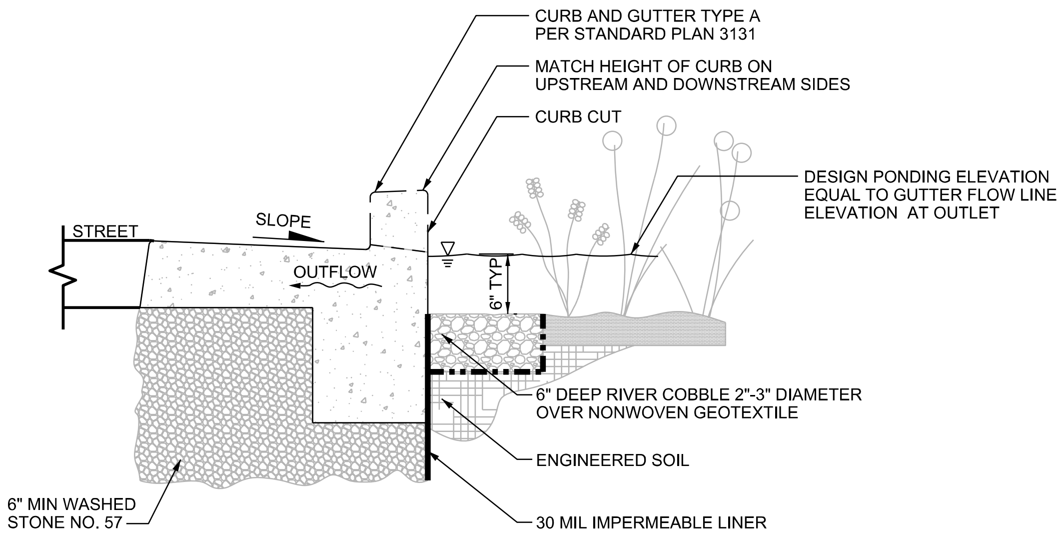
USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 1 OF 1



PLAN

NOT TO SCALE



SECTION A-A

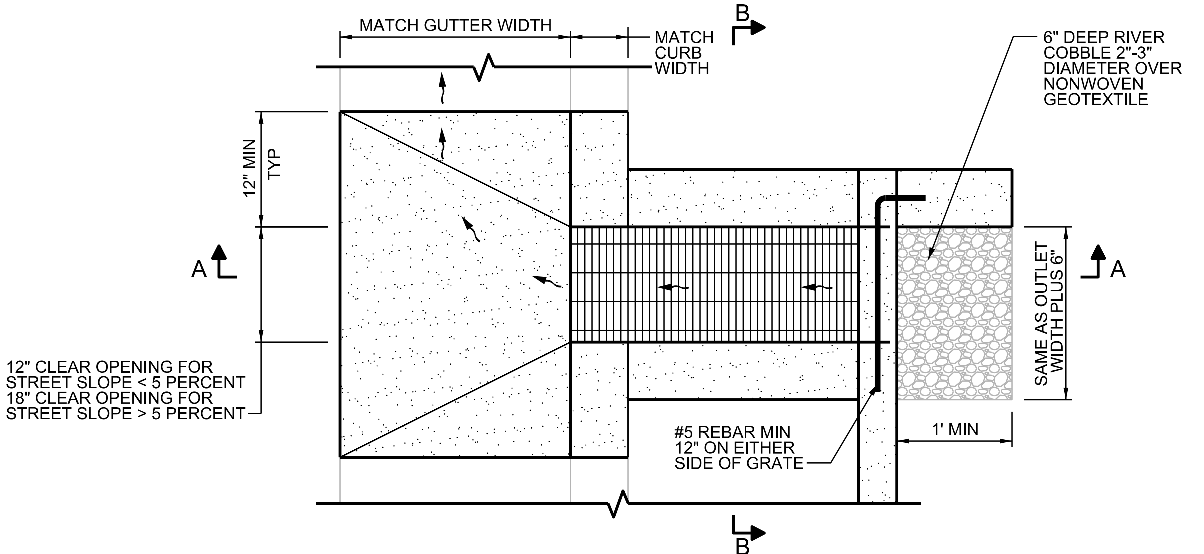
NOT TO SCALE

NOTES:

1. ALL MATERIAL AND WORKMANSHIP FOR CURB CUTS SHALL CONFORM TO APPLICABLE REQUIREMENTS OF LA COUNTY PUBLIC WORKS.
2. CONSTRUCTION FOR CURB CUTS SHALL CONFORM TO SSPWC AND APPLICABLE REQUIREMENTS FOR LA COUNTY PUBLIC WORKS.
3. BOUND NEW CURB AND GUTTER TO EXISTING CURB AND GUTTER WITH EPOXY AND DOWEL CONNECTION.
4. MATCH GUTTER SLOPE UPSTREAM AND DOWNSTREAM OF CURB CUT SLOPE SIMILAR TO INLET DETAIL UNLESS MODIFYING GUTTER.
5. GUTTER DEPRESSION STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED.
6. NONWOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.

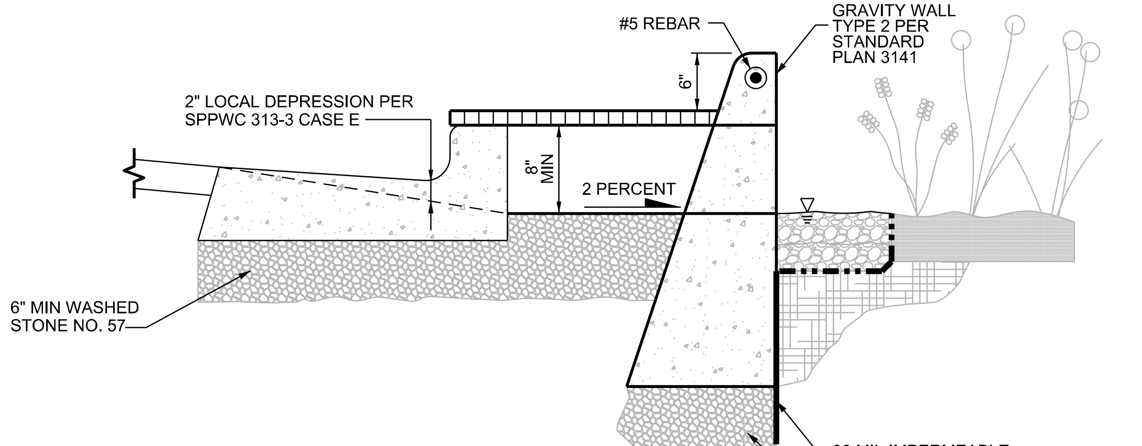
LACPW GREEN STREETS STANDARD PLANS

	COMPONENTS CURB CUT OULET TYPE 2	STANDARD PLAN 3139-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 1 OF 1



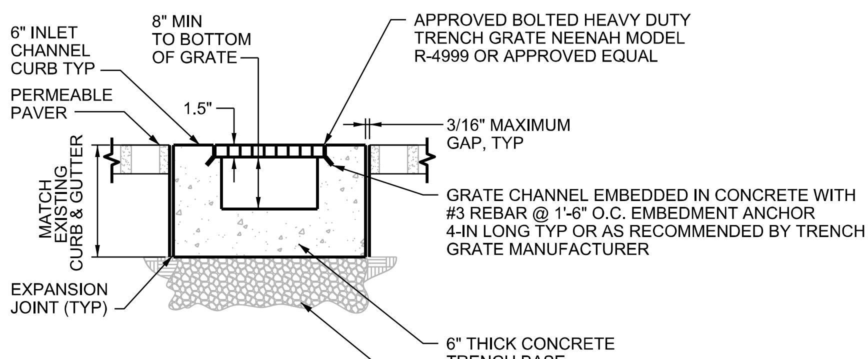
PLAN

NOT TO SCALE



SECTION A-A

NOT TO SCALE



SECTION B-B

NOT TO SCALE

NOTES:

1. GUTTER DEPRESSION ON STREETS THAT HAVE OR POTENTIALLY WILL HAVE BIKE LANES SHOULD BE AVOIDED
2. MINIMUM UTILITY SETBACKS AND PROTECTION MEASURES MUST CONFORM TO CURRENT LACPW STANDARDS. COORDINATE WITH LACPW IN THE EVENT OF UTILITY CROSSINGS AND UTILITY CONFLICTS

LACPW GREEN STREETS STANDARD PLANS

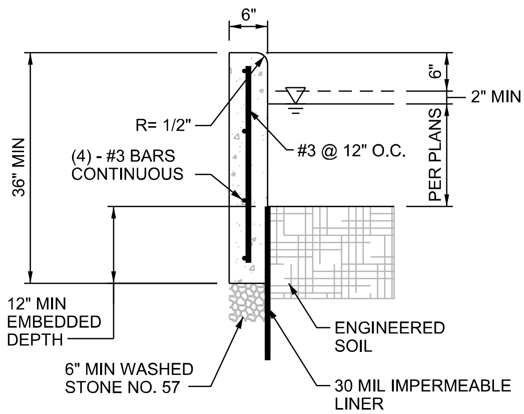
COMPONENTS
CURB CUT OUTLET TYPE 3

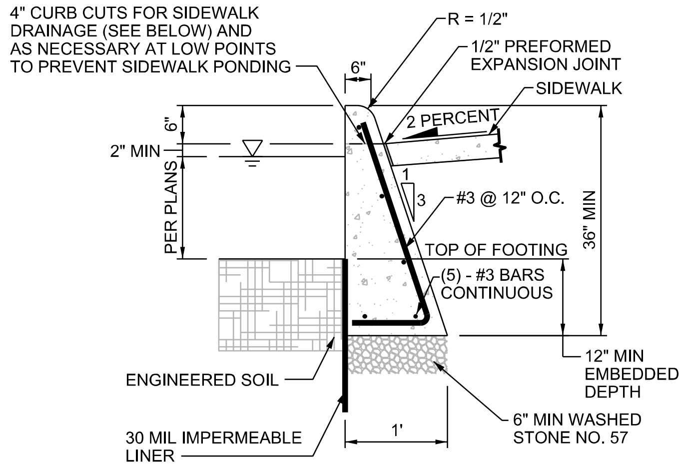
USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

STANDARD PLAN

3140-1

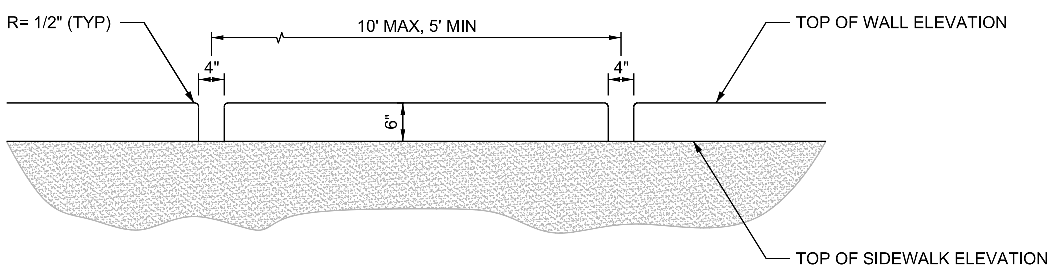
SHEET 1 OF 1





TYPE 1 GRAVITY WALL
NOT TO SCALE

TYPE 2 GRAVITY WALL
NOT TO SCALE



CURB CUT
NOT TO SCALE

NOTES:

1. OTHER EQUIVALENT WALL DESIGN MAY BE ALLOWED. THE DESIGNER SHALL INCLUDE PROJECT- SPECIFIC DETAILS, STRUCTURAL CALCULATIONS, AND GEOTECHNICAL RECOMMENDATIONS WITH DESIGN PLAN SUBMITTAL.
2. SEAL IMPERMEABLE LINER TO ADJACENT IMPROVEMENTS AND EDGE RESTRAINTS PER STANDARD PLAN 3142.

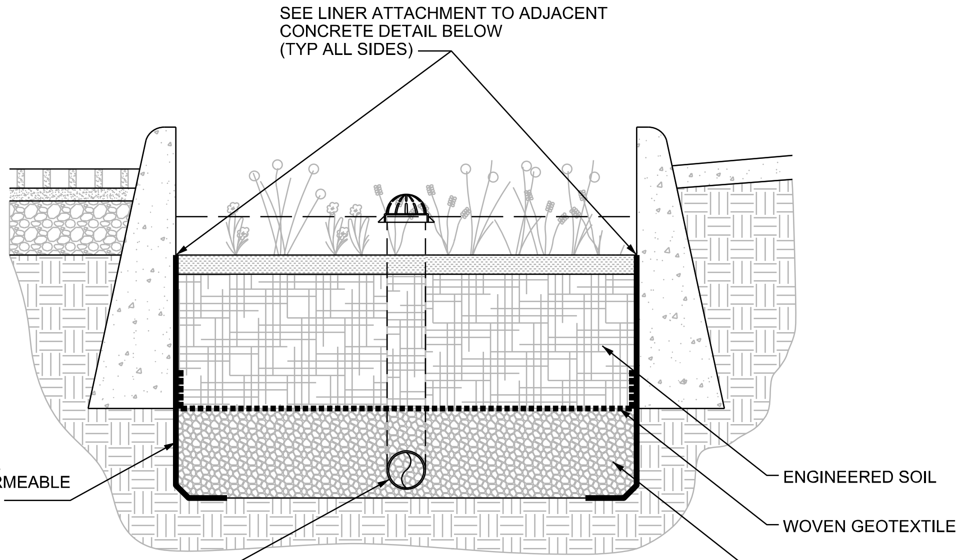
LACPW GREEN STREETS STANDARD PLANS

COMPONENTS
GRAVITY WALL AND CURB CUT

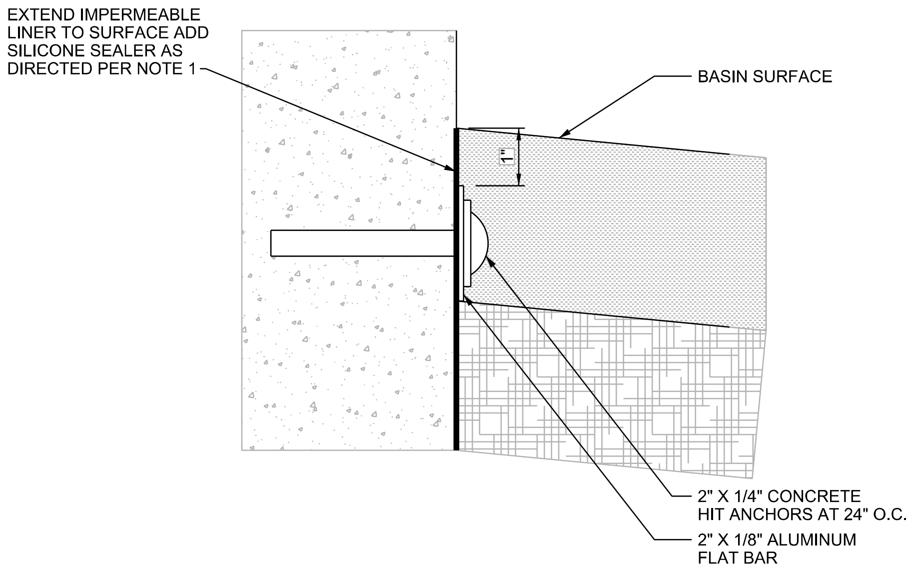
STANDARD PLAN
3141-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 1 OF 1



TYPICAL BIOFILTRATION BASIN SECTION



LINER ATTACHMENT TO ADJACENT CONCRETE DETAIL

NOTES:

1. ON CLEAN CONCRETE SURFACE, ADHERE LINER TO CONCRETE WITH SILICONE SEALANT OR EQUIVALENT PER MANUFACTURER RECOMMENDATIONS TO TOP 1/2" OF LINER.
2. SECURE LINER TO CONCRETE WITH 2" ALUMINUM OR STAINLESS STEEL FLAT BAR AS DIRECTED PER PLAN.
3. AS AN ALTERNATIVE, HIT ANCHORS CAN BE SUBSTITUTED WITH STAINLESS STEEL ANCHORS AT 24" O.C. OR POWDER ACTUATED FASTENERS AT 12" O.C.
4. TRIM EXCESS LINER TO BE FLUSH WITH SURFACE ELEVATION.
5. CONTRACTOR MEANS AND METHODS SHOULD AVOID/MINIMIZE WRINKLES TO THE LINER.
6. NON-WOVEN GEOTEXTILE TO BE TYPE 250N PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOW SECTION 300-8.
7. WOVEN GEOTEXTILE TO BE TYPE 200WM PER SSPWC SECTION 213 AND PLACEMENT TO FOLLOWE SECTION 300-8.

LACPW GREEN STREETS STANDARD PLANS

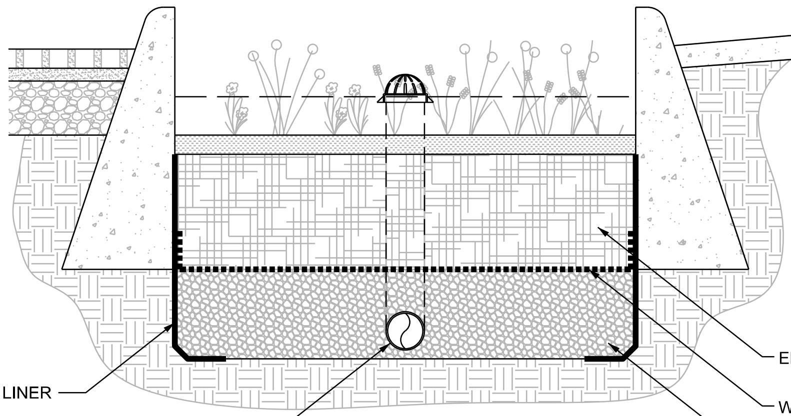
COMPONENTS
IMPERMEABLE LINER CONNECTION DETAIL

STANDARD PLAN

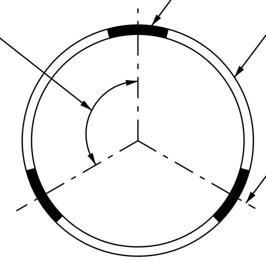
3142-1

USE WITH LACPW GREEN STREETS DESIGN GUIDELINES

SHEET 1 OF 1



TYPICAL BIOFILTRATION
BASIN SECTION



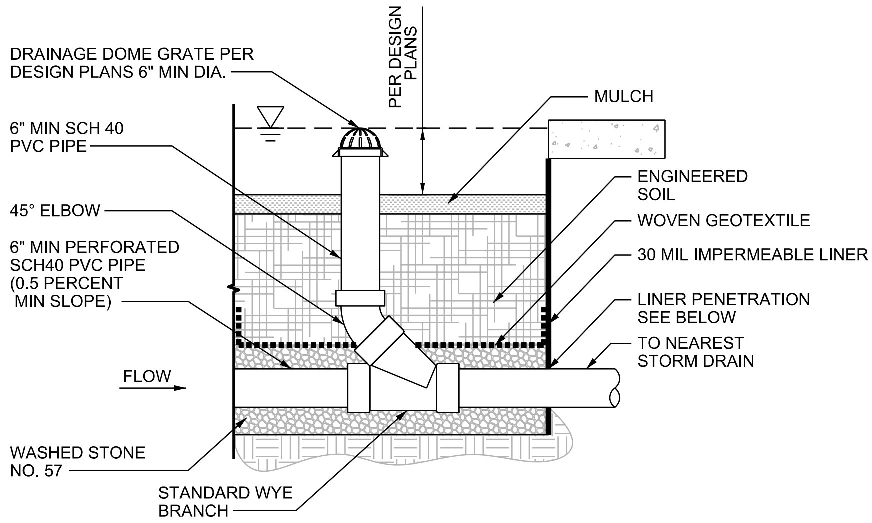
DETAIL
SLOTTED UNDERDRAIN PIPE

NOTES:

1. SET CROWN OF UNDERDRAIN PIPE MINIMUM 2" BELOW BOTTOM OF CHOKING COARSE.
2. LONGITUDINAL SLOPE OF UNDERDRAIN PIPE SHALL BE 0.5 PERCENT MINIMUM.
3. UNDERDRAIN PIPE SHALL BE SLOTTED SCH 40 PVC PIPE OR SUBSTITUTE MATERIAL PER DESIGNER SPECIFICATION APPROVED BY LACPW. SINGLE WALL AND DUAL WALL CORRUGATED HDPE PIPE (AASHTO M252 AND M295 TYPE C,S, AND D) ARE NOT ACCEPTABLE.
4. UNDERDRAIN PIPE SHALL BE SLOTTED TYPE, MEASURING 0.032 INCH WIDE (MAX), SPACED AT 0.25 INCH (MIN), AND PROVIDING A MINIMUM INLET AREA OF 5.0 SQUARE INCH PER LINEAR FOOT OF PIPE.
5. SLOTS SHALL BE ORIENTED PERPENDICULAR TO LONG AXIS OF PIPE, AND EVENLY SPACED AROUND CIRCUMFERENCE AND LENGTH OF PIPE.

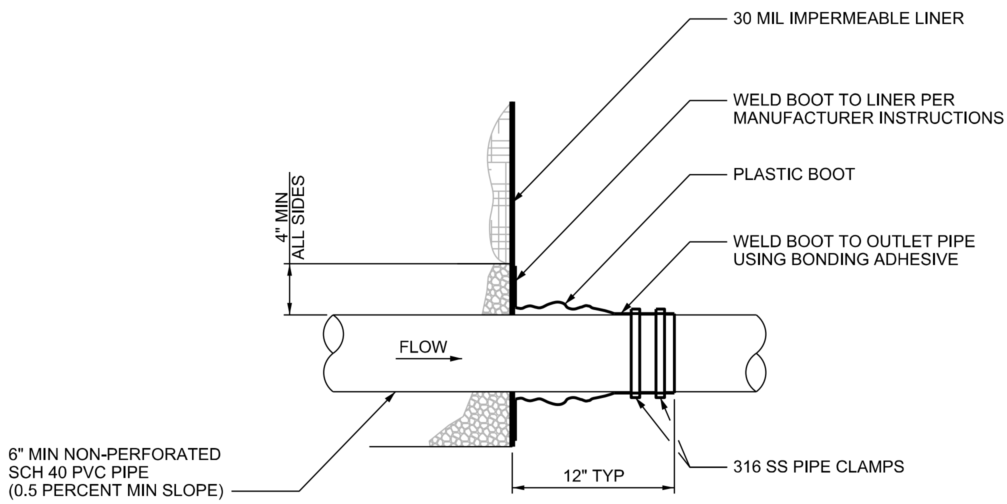
LACPW GREEN STREETS STANDARD PLANS

	COMPONENTS UNDERDRAIN PIPE	STANDARD PLAN 3143-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 1 OF 1



OVERFLOW STRUCTURE

NOT TO SCALE



LINER PENETRATION

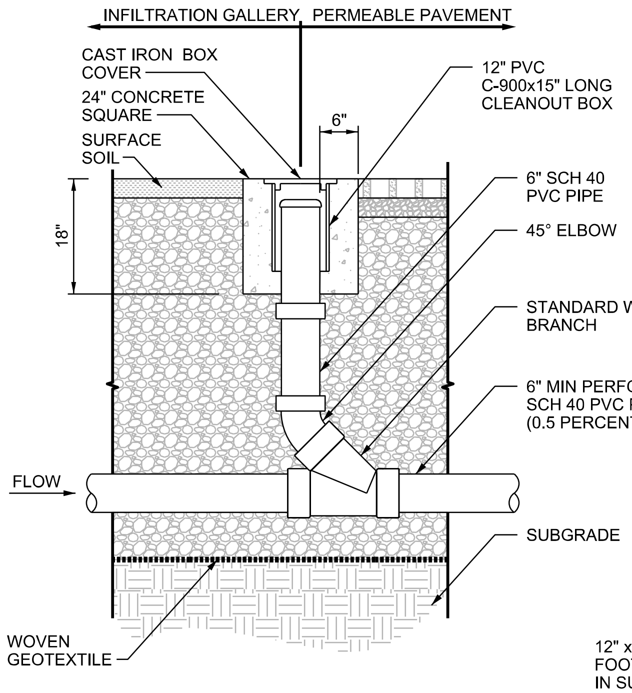
NOT TO SCALE

NOTES:

1. ALL MATERIAL AND WORKMANSHIP SHALL CONFORM TO APPLICABLE REQUIREMENTS OF LA COUNTY PUBLIC WORKS.
2. PROVIDE GRATE ELEVATION ON PLANS.
3. SIZE OF GRATE SHALL MATCH SIZE OF RISER, BE REMOVABLE FOR MAINTENANCE ACCESS, AND BE BOLTED IN PLACE OR OUTFITTED WITH TAMPER-RESISTANT LOCKING MECHANISM. MAXIMUM GRATE OPENING SHALL BE 2"
4. LINER PENETRATION MATERIALS, MEANS AND METHODS TO BE SPECIFIED PER PROJECT SPECIFIC DESIGN PLANS AND SPECIFICATIONS.
5. DESIGNER SHALL DETERMINE SIZE AND ELEVATION OF OVERFLOW TO AVOID STREET OR PROPERTY FLOODING IN THE DRAINAGE AREA.

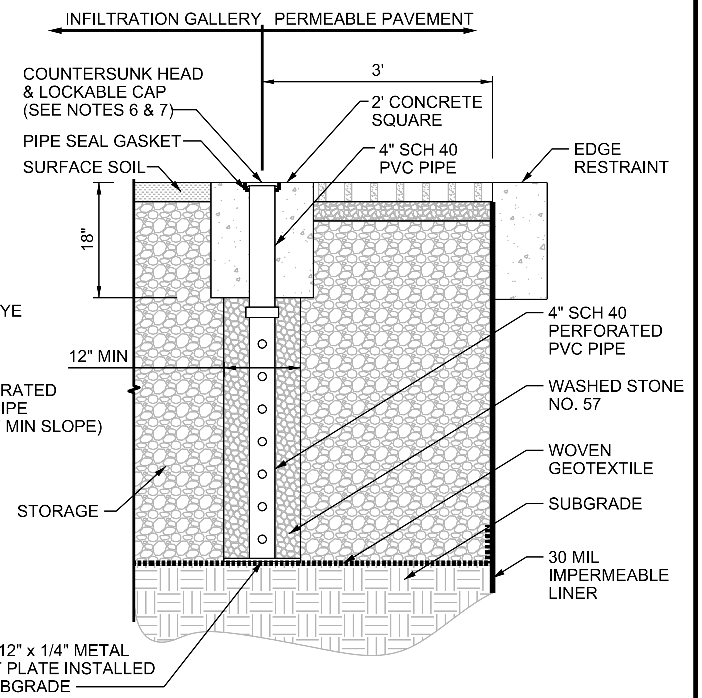
LACPW GREEN STREETS STANDARD PLANS

	COMPONENTS OVERFLOW STRUCTURE	STANDARD PLAN 3144-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 1 OF 1



PERMEABLE PAVEMENT & INFLITRATION GALLERY CLEANOUT

NOT TO SCALE



PERMEABLE PAVEMENT & INFLITRATION GALLERY OBSERVATION WELL

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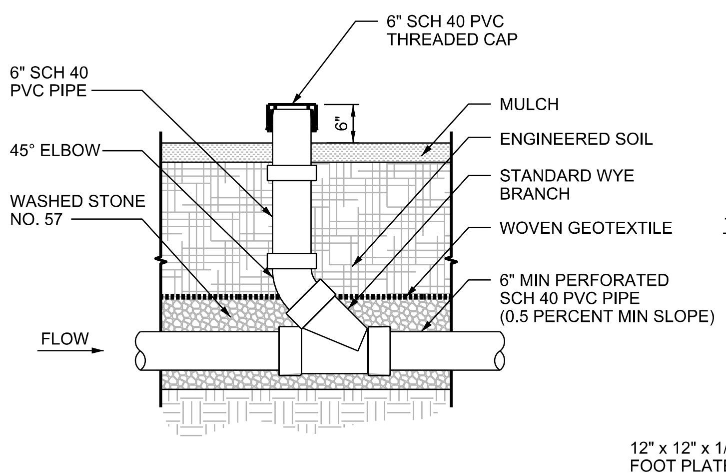

BIORETENTION CLEANOUT

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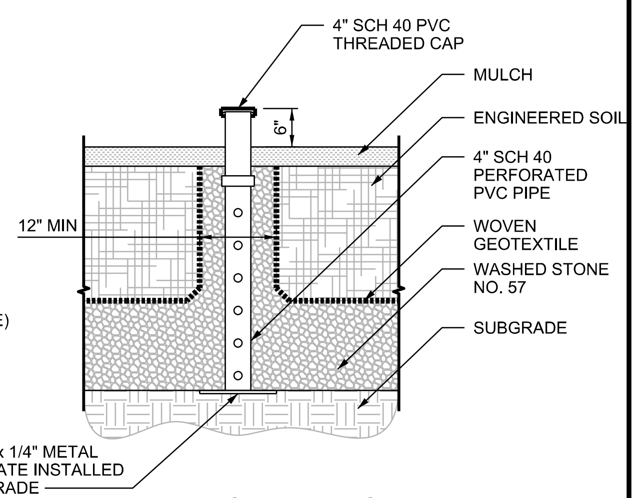

BIORETENTION OBSERVATION WELL

NOT TO SCALE

NOTES:

1. RECOMMENDED MAX CLEANOUT SPACING = 100-FT O.C.
2. PLACE OBSERVATION WELLS STATEGICALLY TO MEASURE BMP PERFORMANCE PER DESIGNER.
3. FIELD CUT PAVERS AS NECESSARY FOR PLACEMENT OF CONCRETE SQUARE.
4. CONCRETE APRONS ARE RECOMMNDED TO BE INSTALLED AROUND CLEANOUTS AND OBSERVATION WELLS SUBJECT TO VEHHICULAR LOADING; PER DESIGN PLANS.
5. FOR AREAS SUBJECT TO VEHICULAR TRAFFIC, LOCKABLE CAPS SHALL BE BRASS AND RATED FOR HS-20 LOADING.
6. LOCKABLE CAPS SHALL BE MOUNTED FLUSH TO GRADE.
7. SEE STANDARD PLANS 3112 AND 3113 FOR INFILTRATION GALLERY DETAIL. SEE STANDARD PLAN 3120 FOR PERMEABLE PAVEMENT DETAIL.

LACPW GREEN STREETS STANDARD PLANS		
	COMPONENTS CLEANOUTS AND OBSERVATION WELLS	STANDARD PLAN 3145-1
	USE WITH LACPW GREEN STREETS DESIGN GUIDELINES	SHEET 1 OF 1

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SECTION 03100
BIORETENTION SOIL

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This specification includes furnishing and installation of engineered soil mix for bioretention areas, (planters, curb extensions, basins, and tree well filter) constructed in LA County.

B. Work consists of furnishing and installing Bioretention Soils in accordance with this specification, the Construction Drawings (Drawings), LACPW Green Streets Standard Plans and Design Guidelines, pertinent References, and local, state, and federal requirements.

C. Associated LACPW Green Streets Standard Plans:
1. 3100 – Planter With Step Out Zone
2. 3101 – Planter Without Step Out Zone
3. 3102 – Curb Extension (Mid-Block)
4. 3103 – Curb Extension (Mid-Block with Pedestrian Ramp)
5. 3104 – Curb Extension (Corner)
6. 3104 – Basin With Rock Border
7. 3105 – Basin Without Rock Border
8. 3110 – Tree Well Filter

1.02 REFERENCES

A. LACPW Green Streets Standard Plans and Design Guidelines

B. Latest Edition of Standard Specifications for Public Works Construction (“Greenbook”).

C. Administrative Manual County of Los Angeles Department of Public Works Geotechnical and Material Engineering Division, GS200.1, Guidelines For Design, Investigation, and Reporting Low Impact Development Stormwater Infiltration

D. County of Los Angeles Department of Public Works Low Impact Development Standards Manual, February 2014

E. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO T194, Standard Method of Test for Determination of Organic Matter in Soils by Wet Combustion

F. ASTM International:
1. ATM D 3385, Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer
2. ASTM D 4542, Standard Test Method for Pore Water Extraction and Determination of the Soluble Salt Content of Soils by Refractometer
3. ASTM D 4972, Standard Test Method for pH of Soils

1.03 SUBMITTALS

A. Submittals shall be made in accordance with this specification and the requirements of the project Drawings and Contract Documents.

B. Submit the following for review and approval prior to shipment of materials to the Site:
   1. Written documentation from manufacturers or suppliers for all materials to be furnished under this Section. Include description of origin and composition of the materials.
   2. Material test results including native soils and engineered soils infiltration rate. Source quality control test results.
   3. Samples of proposed materials.

1.04 QUALITY ASSURANCE

A. Contractor shall retain the services of an approved independent soil testing firm to perform testing of the native soils beneath the engineered soil/stone system and the engineered soil mix as specified in this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials in a manner to prevent damage and deterioration.

B. Engineered soil mix and mulch shall be delivered to the Site using clean equipment, and separately stockpiled in areas approved by the Engineer. Adequately protect to preserve the materials' fitness and quality.

C. Coordinate delivery and installation schedule to minimize interference with adjacent construction.

1.06 PROJECT CONDITIONS

A. Conform to the specifications in this Section and specified References (Section 1.02) for required environmental conditions for construction work, including site moisture conditions and ambient temperature.

B. Existing site conditions impacting the work are indicated on the Drawings.

1.07 SCHEDULING

A. Coordinate furnishing and placement of specified materials with related construction work specified on the Drawings and in other referenced specification sections.

1.08 DRAINAGE

A. Bioretention BMPs shall be designed to drain below the engineered soil in less than 48 hours and completely drain in less than 96 hours. The intention is that soils must be allowed to dry out periodically in order to restore hydraulic capacity needed to receive flows from subsequent storms, maintain infiltration rates, maintain adequate soil oxygen levels for healthy soil biota and vegetation, and to provide proper soil conditions for biodegradation and retention of pollutants.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Proposed materials and sources of supply shall be tested and approved by the Owner and Engineer as specified, prior to use of the materials in the construction.

B. The independent testing firm shall sample and analyze proposed engineered soil mix as specified in this Section.

C. Tests on amended soil shall be performed once per location for pH and organic content. Tests for remaining parameters are required for every 500 cubic yards of soil mix, and at a minimum once per location.

2.02 ENGINEERED SOIL MIX

A. The planting media placed in the cell should achieve a long-term, in-place infiltration rate of at least 5 inches per hour. Higher infiltration rates of up to 12 inches per hour are permissible. Bioretention soil shall retain sufficient moisture to support vigorous plant growth.

B. Planting media should consist of 60 to 80% fine sand and 20 to 40% compost.

C. Sand should be free of wood, waste, coating such as clay, stone dust, carbonate, etc. or any other deleterious material. All aggregate passing the No. 200 sieve size should be non-plastic. Sand for bioretention should be analyzed by an accredited lab using #200, #100, #40, #30, #16, #8, #4, and 3/8 sieves (ASTM D 422 or as approved by the local permitting authority) and meet the following gradation (Note: all sands complying with ASTM C33 for fine aggregate comply with the gradation requirements provided in Table 1):

Table 1. Sand Texture Specifications

	Percent Passing by Weight	
Sieve Size ASTM D422	**Minimum**	**Maximum**
3 /8 inch	**100**	**100**
No. 4	**90**	**100**
No. 8	**70**	**100**
No. 16	**40**	**95**
No. 30	**15**	**70**
No. 40	**5**	**55**
No. 110	**0**	**15**
No. 200	**0**	**5**

Note: The gradation of the sand component of the media is believed to be a major factor in the hydraulic conductivity of the media mix. If the desired hydraulic conductivity of the media cannot be achieved within the specified proportions of sand and compost (#2), then it may be necessary to utilize sand at the coarser end of the range specified in above (“minimum” column).

D. Compost should be a well decomposed, stable, weed free organic matter source derived from waste materials including yard debris, wood wastes, or other organic materials not including manure or biosolids meeting standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program). Compost quality should be verified via a lab analysis to be:

- Feedstock materials shall be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
- Organic matter: 35-75% dry weight basis.

- Carbon and Nitrogen Ratio: 15:1 < C:N < 25:1
- Maturity/Stability: shall have dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120 F) upon delivery or rewetting is not acceptable.
- Toxicity: any one of the following measures is sufficient to indicate non-toxicity:
  - NH4:NH3 < 3
  - Ammonium < 500 ppm, dry weight basis
  - Seed Germination > 80% of control
  - Plant trials > 80% of control
  - Solvita® > 5 index value
- Nutrient content:
  - Total Nitrogen content 0.9% or above preferred
  - Total Boron should be <80 ppm, soluble boron < 2.5 ppm
- Salinity: < 6.0 mmhos/cm
- pH between 6.5 and 8 (may vary with plant palette)
- Compost for bioretention should be analyzed by an accredited lab using #200, ¼ inch, ½ inch, and 1 inch sieves (ASTM D 422) and meet the gradation described in Table 2:

Table 2. Compost Texture Specifications

	Percent Passing by Weight	
Sieve Size ASTM D422	**Minimum**	**Maximum**
1 inch	**99**	**100**
½ inch	**90**	**100**
¼ inch	**40**	**90**
#200	**2**	**10**

Tests should be sufficiently recent to represent the actual material that is anticipated to be delivered to the site. If processes or sources used by the supplier have changed significantly since the most recent testing, new tests should be requested.
Note: the gradation of compost used in bioretention media is believed to play an important role in the saturated hydraulic conductivity of the media. To achieve a higher saturated hydraulic conductivity, it may be necessary to utilize compost at the coarser end of this range ("minimum" column). The percent passing the #200 sieve (fines) is believed to be the most important factor in hydraulic conductivity.
In addition, a coarser compost mix provides more heterogeneity of the bioretention media, which is believed to be advantageous for more rapid development of soil structure needed to support health biological processes. This may be an advantage for plant establishment with lower nutrient and water input.

E. Bioretention soils not meeting the above criteria shall be evaluated on a case by case basis. Alternative bioretention soil shall meet the following specification: "Soils for bioretention facilities shall be sufficiently permeable to infiltrate runoff at a minimum rate of 5 inches per hour during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation." The following steps shall be followed by the Permittees to verify that alternative soil mixes meet the specification:

- Submittals – The applicant must submit to the Permittee for approval:
  - A sample of mixed bioretention soil.
  - Certification from the soil supplier or an accredited laboratory that the bioretention soil meets the requirements of this specification.
  - Certification from an accredited geotechnical testing laboratory that the bioretention soil

has an infiltration rate of between 5 and 12 inches per hour.
    - Organic content test results of mixed bioretention soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, “Loss-On-Ignition Organic Matter Method”.
    - Organic Grain size analysis results of mixed bioretention soil performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.
    - A description of the equipment and methods used to mix the sand and compost to produce the bioretention soil.
- The name of the testing laboratory(s) and the following information:
    - Contact person(s)
    - Address(s)
    - Phone contact(s)
    - email address(s)
    - Qualifications of laboratory(s), and personnel including date of current
    - Certification by STA, ASTM, or approved equal.
- Bioretention soils shall be analyzed by an accredited lab using #200, and 1/2” inch sieves (ASTM D 422 or as approved by municipality), and meet the gradation described in Table 3).

Table 3. Alternative Bioretention Soil Texture Specifications

	Percent Passing by Weight	
Sieve Size ASTM D422	**Minimum**	**Maximum**
½ inch	97	100
200	2	5

- Bioretention soils shall be analyzed by an accredited geotechnical lab for the following tests:
    - Moisture – density relationships (compaction tests) shall be conducted on bioretention soil. Bioretention soil for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
    - Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.

F. Engineered soil mix shall not be incorporated into the Work until it is has been approved by the Engineer.

2.03 MULCH

A. Mulch shall be non-floating and consist of finely shredded (double shredded) CA hardwood mulch, or equivalent material, and shall be well mixed and homogenous, uniform in color and free of foreign material, chemical or organic impurities, and viable plant seeds. Mulch shall meet the following criteria:
1. 90% of material passing the 1/2-inch screen.
2. Organic Content: 35% to 65% (dry weight basis).
3. pH: 6.0 to 8.0 (as determined using ASTM D 4972).

PART 3 - EXECUTION

3.01 PREPARATION

A. Erosion and sediment control measures shall be implemented to protect construction areas in accordance with local, state, and federal requirements and permits.

B. Prior to placing the storage stone and engineered soil, the bottom of the excavation (below the bottom of the storage stone and engineered soil mix) shall be roto-tilled or excavated to a minimum depth of 24 inches to alleviate any compaction of the native soils. Remove any roots or other foreign materials and smooth the surface of the existing soils. Any substitute method must be approved by the Engineer prior to use. Any ponded water shall be removed from the bottom of the facility and the soil shall be friable before loosening.

C. Install storage stone, underdrain if specified, and geotextile and impermeable liner as shown on the Drawings and Standard Plans.

3.02 PLACEMENT OF ENGINEERED SOIL MIX

A. Engineered soil shall be thoroughly mixed and tested prior to placement.

B. Place engineered soil mix to the depth and limits indicated on the Drawings. Installation of engineered soil mix shall be completed in a manner that will ensure preservation of the infiltrative capacity of the underlying soils. The moisture content of the soil shall be low enough to prevent clumping and compaction during placement.

C. No heavy equipment shall be used within 10 feet of the limits of bioretention BMPs before, during, or after placement of the engineered soil mix.

D. The engineered soil mix shall be placed in horizontal layers not to exceed six inches loose depth, and wetted and drained, or compacted with a small water-filled landscape roller, to fully consolidate and reduce the potential for additional settling.

E. Uniformly grade engineered soil mix to achieve a smooth surface, free of irregular surface changes. Do not over-work or excessively compact the soil mix. Grade to cross-sections, thickness and elevations indicated on the Drawings. Settling of soil by walking on surface and working with hand equipment is acceptable.

3.04 PLACEMENT OF MULCH

A. Place non-floating mulch on top of completed engineered soil mix and around vegetation plantings to a uniform depth of three to four inches as indicated on the Drawings. Place to the full limits of each bioretention area and stormwater planter as indicated.

B. Where possible, do not allow mulch to touch plant foliage.

3.05 MAINTENANCE AND PROTECTION

A. Remove all debris from within the limits of the constructed bioretention BMP.

B. Protect the constructed areas from erosion and keep free from accumulation of debris. Divert post-construction stormwater runoff around the areas until vegetative cover has been established.

C. Damage to the constructed areas shall be fully repaired and approved by the Engineer.

+++ END OF SECTION 03100 +++

SECTION 3120
PERMEABLE PAVEMENT

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This specification covers furnishing, installing, testing, and protecting until final acceptance permeable pavement systems in LA County comprised of heavy duty concrete pavers with bedding course and permeable joint material, permeable asphalt, or porous concrete, and a base course and reservoir course each consisting of open graded aggregates, and an edge restraint consisting of existing or cast-in-place concrete.

B. Work consists of furnishing and installing a Permeable Pavement System in accordance with this specification, the Construction Drawings (Drawings), LACPW Green Streets Standard Plans and Design Guidelines, pertinent References, and local, state, and federal requirements.

C. Associated LACPW Green Streets Standard Plan:
   1. 3120 – Permeable Pavement

1.02 REFERENCES

A. LACPW Green Streets Standard Plans and Design Guidelines.

B. Latest Edition of Standard Specifications for Public Works Construction (“Greenbook”).

C. Administrative Manual County of Los Angeles Department of Public Works Geotechnical and Material Engineering Division, GS200.1, Guidelines For Design, Investigation, and Reporting Low Impact Development Stormwater Infiltration

D. County of Los Angeles Department of Public Works Low Impact Development Standards Manual, February 2014

E. US Department of Transportation Federal Highway Administration
   1. FHWA-HIF-15-009 Porous Asphalt Pavements with Stone Reservoirs
   2. FHWA-HIF-13-006 Pervious Concrete

F. American Concrete Institute (ACI).
   1. SPEC-522.1-20: Specification for Construction of Pervious Concrete Pavement
   2. SPEC-522.1-13 Specification for Pervious Concrete Pavement
   3. PRC-325.12-02: Guide for Design of Jointed Concrete Pavements for Streets and Local Roads (Reapproved 2019)
   4. PRC-325.14-17: Guide for Design and Proportioning of Concrete Mixtures for Pavements

G. American Association of State Highway and Transportation Officials (AASHTO)
   1. GDPS-4-M Guide for Design of Pavement Structures

H. American Society of Civil Engineers (ASCE)
   1. ASCE 58-10 Structural Design of Interlocking Concrete Pavement for Municipal Streets and Roadways

I. American Society for Testing and Materials (ASTM)

1. ASTM C-29 Bulk Density ("Unit Weight") and Voids in Aggregate
2. ASTM C-94 Standard Specification for Ready Mixed Concrete
3. ASTM C-131 Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
4. ASTM C-136 Sieve Analysis of Fine and Course Grained Aggregates
5. ASTM C-140 Sampling and Testing Concrete Masonry Units and Related Units
6. ASTM C-936 Solid Concrete Interlocking Paving Units
7. ASTM C-979 Pigments for Integrally Colored Concrete
8. ASTM C-1645 Freeze-thaw and De-icing Salt Durability of Solid Interlocking Paving Units
9. ASTM D-448 Standard Classification for Sizes of Aggregates for Road and Bridge Construction
10. ASTM D-698 Laboratory Compaction Characteristics of Soil Using Standard Effort
11. ASTM D-1557 Laboratory Compaction Characteristics of Soil Using Modified Effort
12. ASTM D-1883 CBR (California Bearing Ratio) of Laboratory Compacted Soils
13. ASTM D-2488 Description and Identification of Soils (Visual-Manual Procedure)
14. ASTM D-3034 Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
15. ASTM D-3350 Polyethylene Plastic Pipe and Fittings Materials
16. ASTM D-4873 Identification, Storage and Handling of Geosynthetic Rolls and Samples
17. ASTM D-6928 Resistance of Course Aggregates to Degradation by Abrasion in the Micro-Deval Apparatus
18. ASTM C1688, Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete.
19. ASTM C1701, Standard Test Method for Infiltration Rate of In Place Pervious Concrete.
20. ASTM C1747, Standard Test Method for Determining Potential Resistance to Degradation of Pervious Concrete by Impact and Abrasion.
21. ASTM C1754, Standard Test Method for Density and Void Content of Hardened Pervious Concrete.
22. AASHTO T 269-11/ASTM D3203M-11 Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
23. AASHTO T 331-13/ASTM D6857M-11 Standard Test Method for Maximum Specific Gravity and Density of Bituminous Paving Mixtures Using Automatic Vacuum Sealing Method
24. AASHTO T 305-09/ASTM D6390-11 Standard Test Method for Determination of Draindown Characteristics in Uncompacted Asphalt Mixtures
25. ASTM D7064M-08(2013) Standard Practice for Open-Graded Friction Course (OGFC) Mix Design (Cantabro test)

J. Interlocking Concrete Pavement Institute (ICPI)

1. Permeable Interlocking Concrete Pavement manual (latest edition)
2. Permeable Design Pro software for hydrologic and structural design
3. Tech Spec Technical Bulletins.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with this specification and the requirements of the project Drawings and Contract Documents.

B. Submit the following for review and approval prior to shipment of materials to the Site:
   1. Manufacturer's (or installation subcontractor's) drawings and details: Indicate perimeter conditions, junction with other materials, expansion and control joints, paver or pavement layout, patterns, color arrangement, and installation and setting details. Indicate layout, pattern, and relationship of paving joints to fixtures and structures.
   2. Design mix for permeable asphalt (each type/layer) and porous concrete including density and void content.
   3. Expected traffic load and structural design calculations for the permeable pavement system.
   4. Contractor shall submit to the Owner for approval, and retain for the balance of the project, a minimum of four full size samples of each paver or pavement type/size/thickness/color/finish specified; the samples shall represent the range of shape, texture and color permitted for the respective type. Concrete Color(s) will be selected by Owner from Manufacturer's standard colors.
   5. Minimum 3-pound samples of base, reservoir, joint filler, and bedding aggregate materials.
   6. Sieve analysis of aggregates for permeable asphalt, porous concrete, and base, reservoir, joint filler, and bedding stone materials.
   7. Test results for soil subgrade, including in-place density test reports, soil classification, in-situ infiltration rate, and suitability for the intended project.
   8. Manufacturer's or supplier's product data sheets (including specifications) for each type of paver or pavement material.
   9. Certification (including sieve analysis test results) from suppliers for all materials.
   10. Test results from an independent testing laboratory showing compliance to ASTM standards.
   11. Stone bedding, base, and reservoir material test results (actual material used at the site; provide a minimum of three tests per delivery): Gradation (see tables in Part 2 – Products): Micro Deval (degradation of less than 8% as per ASTM D-6938): Percent of angular and sub-angular particles (greater than 90%). Do not use rounded river gravel; LA Abrasion <40 as per ASTM C-131: minimum CBR of 80% as per ASTM D-1883. Material not meeting these requirements shall not be used.
   12. Geosynthetics: name of manufacturer; product type; product grade; lot number; and physical dimensions.
   13. Manufacturer's Material Safety Data Sheets for the safe handling of the specified materials and products.
   14. Written documentation of installation subcontractor's qualifications as specified in subsection 1.04.
   15. Written Method Statement and Quality Control Plan that describes material staging and flow, installation sequencing, and installation procedures, including representative reporting forms that ensure conformance to the Specifications.

1.04 QUALITY ASSURANCE

A. Manufacturer or supplier shall be a firm specializing in the manufacture of interlocking pavers or supplying permeable pavement materials of the type specified.

B. Contractor shall submit a list of five (5) previously constructed similar (same surface) permeable pavement projects with the bid to be qualified. Contractor shall be located in the state of CA. Contact names, emails, and telephone numbers shall be listed for each project with date of completion.

C. Installation shall be performed by the Contractor (or a subcontractor) with experience in installing permeable pavement of the type specified on projects of similar size and scope.

D. For Permeable Paver projects, the Contractor will hold a current certificate from the Interlocking Concrete Pavement Institute (ICPI), Accredited Paver Installation Company (APIC) Program and a site foreman with a PICP Technician Certificate shall be on-site for the entire paver system installation.

E. For porous concrete projects at least one National Ready Mixed Concrete Association (NRMCA) certified Pervious Concrete Craftsman must be employed and on site, overseeing each placement crew during all concrete placement, or no less than three NRMCA Certified Pervious Concrete Installers, must be employed and on site working as members of each placement crew during all concrete placement, unless otherwise specified. The minimum number of certified individuals must be present on each concrete placement, including the test panel placements, and a certified individual must be in charge of the placement crew and procedures

F. Contractor will hold a mandatory pre-construction meeting with Engineer, Owner, and affected sub-trades accessing the work area to review method statement and quality control plan and communicate to all parties a work flow that is most desirable to meet the construction schedule as set forth by the Contractor.

G. The Contractor shall verify with the bid they have the necessary equipment, and is sufficiently familiar with its operation, to properly conduct the work.

H. Field Construction Mock-Ups:
   1. After material samples are approved and prior to starting permeable pavement installation, a mock-up area shall be constructed. At least 48 hours prior to constructing the mock-up area, submit written notification to the Owner and Engineer.
   2. The mock-up area shall be minimum 10-foot by 20-foot dimension and constructed as required in this Section. Mock-up area shall show joint sizes, lines, laying pattern, color, and texture.
   3. The completed mock-up area shall be used as the standard of workmanship for the Project. Consideration will be given with regard to differences in age of materials from time of mock-up construction to time of actual product delivery.
   4. Subject to acceptance by Engineer, mock-up may be retained as part of finished work. If mock-up is not retained, Contractor shall remove and properly dispose of materials offsite.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver concrete pavers in manufacturer’s original, unopened, undamaged container packaging with identification tags intact on each paver bundle. Pavers shall be in steel banded, plastic banded, or plastic wrapped cubes suitable for unloading by forklift or clamp lift. Unload pavers as recommended by the manufacturer to prevent damage to the products.

B. Concrete unit pavers shall be visually inspected by the Contractor upon delivery to the Site. All units shall be sound and free of defects that would interfere with the proper placing of pavers or impair the strength and quality of the construction. Minor cracks or chipping resulting from standard methods of handling in shipment and delivery may be acceptable as determined by the Owner and Engineer. Products that fail to conform to material specifications shall be rejected as determined by the Owner and Engineer.

C. Store pavers in protected area such that they are kept free from mud, dirt, and other foreign materials. Contractor shall protect all materials from damage or contamination due to jobsite conditions and in accordance with manufacturer's recommendations. Damaged or contaminated materials shall not be incorporated into the work.

D. Handle and transport aggregates to avoid segregation, contamination, and degradation. Keep different materials sufficiently separated as to prevent mixing. Do not dump or store one material on top of another unless it is part of the installation process. Cover material with waterproof covering to prevent exposure to rainfall or removal by wind – secure the covering in place.

E. Permeable asphalt mix shall be transported in clean vehicles with tight, smooth dump beds that have been sprayed with a non-petroleum release agent or soap solution to prevent the mixture from adhering to the dump beds. Mineral filler, fine aggregate, slag dust, and similar materials shall not be used to dust truck beds. The open graded mix shall be covered during transport to protect the mix from weather and to minimize mix cooling and prevent lumps. Long hauls, particularly those in excess of 25 miles may result in separation of the mix and its rejection, and are not recommended.

F. For porous concrete begin mixing immediately after cement has been added to aggregates. Batch and mix in compliance with ASTM C94/C94M, except that discharge shall be completed within 60 minutes of the introduction of mixture water or aggregate to the cement. Increase time to 120 minutes when using a hydration-stabilizing admixture. Additional water may be added on site, but the fresh density must still meet project requirements after water addition.

G. Coordinate delivery and installation schedule to minimize interference with adjacent construction.

1.06 PROJECT CONDITIONS

A. Permeable paver system elements shall not be installed during rain.

B. Conform to the specifications in this Section and specified References (Section 1.02) for required environmental conditions for construction work, including site moisture conditions and ambient temperature.

C. Existing site conditions impacting the work are indicated on the Drawings.

1.07 DESIGN

A. Three elements are evaluated when determining the required thickness of the layers of the permeable pavement system: 1) site considerations to ensure that the site is acceptable; 2) hydrologic design to ensure the underlying native soils and pavement meet the potential stormwater runoff demands; and 3) structural design to ensure that the pavement withstands the anticipated traffic loading.

B. Structural Design of Interlocking Concrete Pavement systems shall follow the design procedures outlined in ICPI Tech Spec 4 or equivalent approach.

C. Structural design for permeable asphalt pavements shall follow standard AASHTO 93 design procedures or equivalent approach.

D. Structural design of porous concrete shall follow ACI, AASHTO, and/or American Concrete Pavement Association design procedures or equivalent approach.

1.08 MAINTENANCE

A. If installing pavers, furnish 10 percent of total surface area of additional paver material for use by Owner for future maintenance and repair. Pavers shall be from the same production run as installed materials. Store paver materials in Owner designated location.

B. Contractor is responsible for minimizing the amount of stormwater runoff entering the system until fully completed.

C. Contractor is responsible for minimizing the sediment entering the system and maintaining the permeable pavement system until final approval and acceptance of the work.

PART 2 – PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Proposed materials and sources of supply shall be tested and approved by the Owner and Engineer as specified, prior to use of the materials in the construction.

2.02 PAVING UNITS

A. Paving Units shall be commercial permeable interlocking concrete paver units, Aqualine manufactured by Belgard or approved equal, conforming to the following specifications.

1. Material Standard: Comply with ASTM C 936.
2. Color Pigment Material Standard: Comply with ASTM C 979.
3. 80 mm thickness
5. Measured length or width of test specimens shall not differ by more than +/- 0.063 inch, while measured thickness shall not differ by more than +/- 0.125 inch.
6. Average compressive strength of 8,000 psi (55 MPa) with no individual unit under 7,200 psi (50 MPa) when tested in accordance with ASTM C-140.
7. Average absorption of 5% with no unit greater than 7% when tested in accordance with ASTM C-140.
8. Where freeze-thaw testing is required, the average mass loss of all specimens tested shall not be greater than (A) 225 g/m2 when subject to 28 freeze thaw cycles, or (b) 500 g/m2 when subject to 49 freeze thaw cycles. Testing shall be conducted using a 3% saline solution in according to ASTM C-1645.

B. Permeable Asphalt Pavement shall consist of a mixture of aggregates, bituminous binder material including polymer modified asphalt, fibers, mineral filler, anti-strip additives, and other optional additives as specified under Caltrans 2018 Standard Specifications Section 39 "Asphalt Concrete."

1. Asphalt Surfaces: Use Open Graded Friction Course (OGFC) per Caltrans 2018 Standard Specifications Section 39 as the non-structural wearing course for permeable asphalt paving.

2. Permeable Asphalt Base: Use Asphalt Treated Permeable Base (ATPB) per Caltrans 2018 Standard Specifications Section 29 as the structural layer for permeable asphalt pavement. No modification to existing standard specifications is required.

3. Additives: additives such as cellulose or mineral filler, or anti-strip additives, if used, shall be listed in the Job Mix Formula, and approved by the Engineer.

C. Porous Concrete shall be a mixture of cementitious materials, water, coarse aggregate, and possibly admixtures, with minimal or no fines as specified in ACI 522.1-13.

D. Product substitutions may be allowed if approved by the Owner and Engineer.

E. Materials shall be manufactured to produce a solid homogeneous matrix in the produced unit. All pavers to be placed within a continuous area (e.g. one street) shall be from the same production run.

2.02 JOINT FILLER, BEDDING, BASE AND RESERVOIR STONE

A. Joint Filler and Bedding: Gradation shall conform to size number 8 coarse aggregate as defined in Table 800.1 and summarized in the following table. Clean, non-plastic aggregate, free from deleterious or foreign matter, manufactured from crushed rock. Size number 89 or number 9 coarse aggregate may be used for narrow joints if approved by the Engineer. Micro Deval Degradation of less than 8% as per ASTM D-6938. Percent of angular and sub-angular particles greater than 90%. Do not use rounded river gravel. LA Abrasion <40 as per ASTM C-131, minimum CBR of 80% as per ASTM D-1883. All aggregates shall have equal to or less than 2% passing the No. 200 (0.075 mm) sieve.

Sieve Size	Percent Passing, by Weight
1/2 inch	100
3/8 inch	85 - 100
No. 4	10 – 30
No. 8	0 - 10
No. 16	0 - 5

B. Base: Gradation shall conform to size number 57 coarse aggregate as defined in Table 800.1 and summarized in the following table. Clean, non-plastic aggregate, free from deleterious or foreign matter, manufactured from crushed rock. Micro Deval Degradation of less than 8% as per ASTM D-6938. Percent of angular and sub-angular particles greater than 90%. Do not use rounded river gravel. LA Abrasion <40 as per ASTM C-131, minimum CBR of 80% as per ASTM D-1883. All aggregates shall have equal to or less than 2% passing the No. 200 (0.075 mm) sieve.

Sieve Size	Percent Passing, by Weight
1 1/2 inch	100
1 inch	95 - 100
1/2 inch	25 – 60
No. 4	0 – 10
No. 8	0 – 5

C. Reservoir: Gradation shall conform to size number 3 coarse aggregate as defined in Table 800.1 and summarized in the following table. Clean, non-plastic aggregate, free from deleterious or foreign matter, manufactured from crushed rock. Micro Deval Degradation of less than 8% as per ASTM D-6938. Percent of angular and sub-angular particles greater than 90%. Do not use rounded river gravel. LA Abrasion <40 as per ASTM C-131, minimum CBR of 80% as per ASTM D-1883. All aggregates shall have equal to or less than 2% passing the No. 200 (0.075 mm) sieve.

Sieve Size	Percent Passing, by Weight
2 1/2 inch	100
2 inch	90 - 100
1 1/2 inch	35 – 70
1 inch	0 – 15
1/2 inch	0 – 5

2.03 EDGE RESTRAINTS

A. Edge restraints shall consist of existing concrete or granite curb (good condition and capable of restraining the paver system) or new concrete curb as indicated on the Drawings and specified below.

B. Materials for cast-in-place concrete (including concrete mix design, reinforcement, and expansion joint filler) shall conform to the requirements outlined in other specification sections.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to commencement of any work, the Contractor shall conduct a pre-construction meeting with the Owner, Designer, and affected sub-trades. The pre-construction meeting should, at a minimum, verify:
   1. The location of the Mock Up area.
   2. The site layout conforms to the Site Plan. In particular, the location and elevation of discharge points (if any) of the Horizontal Drainage Pipes.
   3. The excavation work conforms to the specified lines and elevations. Subgrade shall be trimmed to within 0 and ½ in of the specified grades. The surface of the prepared Subgrade shall not deviate by more than 3/8 in from the bottom edge of a 10-foot straight edge laid in any direction.
   4. The condition of the subgrade, in particular that the surface infiltration (where desired) has not been adversely impacted by the excavation work. Where compaction is desired, that the compaction densities have been met.
   5. Locations of curbs, grade beams, utility structures, light standards, tree wells or any other protrusions as applicable to the project.
   6. The details of the site's 'Erosion and Sediment Control Plan'.
   7. Panel Installation Drawings for the Geosynthetics, in particular the location of any protrusions through the Membrane Liner where boots are required.

B. Prior to installing the permeable pavement system, the bottom of the excavation (below the bottom of reservoir coarse) shall be scarified to a minimum depth of 12 inches to alleviate any compaction of the native soils. Remove any roots or other foreign materials and smooth the surface of the existing soils. Any ponded water shall be removed from the bottom of the facility and the soil shall be friable before loosening.

C. Install geotextile, impermeable liner, and underdrain, if applicable, as shown on the Drawings and Standard Plans.

D. The Contractor is responsible for soil and materials testing and quality assurance inspection during earthwork and subgrade preparation and is responsible for quality control and system performance. Contractor shall perform all quality control testing or inspection necessary to satisfy the Owner and Engineer with the condition of the Subgrade prior to commencement of the work including infiltration testing to verify the subgrade has not been adversely impacted.

E. Where deficiencies or inconsistencies are identified, the Contractor shall notify the Owner in writing. The Contractor will not proceed with the work until the Owner has verified that the deficiencies or inconsistencies have been addressed.

3.02 USING EXISTING CURB FOR EDGE RESTRAINTS

A. In those areas using existing curb, sawcut curb, driveways, or sidewalk for edge restraints, the edge restraint shall be prepared by the Contractor.

B. Any cuts shall be completed in a continuous and straight line leaving a uniform vertical edge restraint surface adjacent to the paver system.

C. Material adjacent to the edge restraint shall be carefully removed by the Contractor so the existing edge restraint is not damaged. Once the existing material adjacent to the curb has been removed by the Contractor, and the permeable pavement system is ready to be installed, the Contractor shall request that the Owner inspect the edge restraint. The pavement system shall not be installed until the edge restraint is inspected and approved for use by the Owner. The Contractor shall be responsible for repairing or replacing, to the satisfaction of the Owner, any edge restraint damaged by the Contractor.

3.03 INSTALLATION OF EDGE RESTRAINTS

A. Edge restraint shall be provided along the perimeter of paving as specified on the Drawings. The face of the edge restraint, where it abuts pavers, shall be vertical.

B. All concrete edge restraints shall be constructed to dimensions and level specified on the Drawings and shall be supported on a compacted base not less than 6 inches thick.

C. Concrete used for the construction of edge restraints shall be in accordance with SSPWC, latest edition.

D. Once the curb has been installed by the Contractor, and the permeable pavement system is ready to be installed, the Contractor shall request that the Owner inspect the edge restraint. The paver system shall not be installed until the edge restraint is inspected and approved by the Owner.

3.04 INSTALLATION OF BASE AND RESERVOIR COURSES

A. Keep area where pavement is to be constructed free from sediment during the entire job. Any materials contaminated with sediment shall be removed and replaced with clean material.

B. The subgrade soils shall be properly prepared and accepted by the project Geotechnical Engineer prior to reservoir course installation. The subgrade soils shall also have an acceptable moisture content and not excess moisture from groundwater or a recent storm event. The Contractor shall perform required dewatering prior to reservoir course installation.

C. Install geotextile and impermeable liner on the bottom and sides of the paver system as shown on the Drawings and Standard Plans and/or as specified by the Engineer during construction. Provide a minimum 1-foot overlap at all joints.

D. Install the Reservoir Course and Base Course at the thicknesses, compaction rates, surface tolerances, and elevations shown on the Drawings.

1. Place and spread the first layer of Reservoir without displacing or damaging the Geosynthetics (if used). To prevent damage, tracked or heavy vehicles must not be used to spread the initial Reservoir layer.
2. The aggregate should be spread and compacted in uniform layers not exceeding 6-inch loose thickness. Compaction is performed using either a 10 T (10 ton) vibratory roller or a minimum 13,500 lbs. of centrifugal force reversible vibratory plate compactor. For each lift, make at least two passes in the vibratory mode and at least two passes in the static mode – continue compaction until there is visible movement in the materials.
3. At the specified elevation(s), install the Horizontal Underdrain Pipes, if applicable, in accordance with the Standard Plan and manufacturer's recommendations. Ensure the Pipes are properly sloped. Care must be taken not to damage Horizontal Drain Pipes during subsequent aggregate installation.
4. Final surface tolerance of stone courses should be plus or minus 1 inch over a 10-foot straight edge laid in any direction.

5. Attention will be paid to providing proper compaction near curbs, grade beams, concrete collars around utility structures, lights standards, tree wells, building edges and other protrusions as applicable to the project. In areas not accessible to large compaction equipment, compact to specified density with mechanical tampers (jumping jacks).

E. Before commencing the placing of the Bedding Course for pavers, or permeable asphalt or porous concrete, the base shall be inspected and accepted by the Owner and Engineer.

3.05 INSTALLATION OF BEDDING COURSE, CONCRETE PAVERS AND PERMEABLE JOINT MATERIAL

A. Spread the Bedding Course evenly over the Base Course and screed to a nominal 2-inch thickness. Do not use the bedding material to fill depressions in the Base Course surface.

B. The Contractor shall roll the Bedding Course using either an approved mechanical spreader (e.g., an asphalt paver) or using screed rails and boards.

C. Moisten and lightly compact the Bedding Course using a Plate Compactor. Surface tolerances shall be 3/8 inch over a 10-foot straight edge.

D. Loose screed the bedding course.

E. Ensure that Concrete Pavers are free of foreign material before installation. Concrete Pavers shall be inspected for color distribution and all chipped, damaged or discolored Concrete Pavers shall be replaced. Initiation of Concrete Paver placement shall be deemed to represent acceptance of the pavers.

F. Lay the type of Concrete Pavers in the pattern(s) as shown on the Drawings. Maintain straight pattern lines.

G. Paving units shall be installed from a minimum of three (3) bundles for hand installations, six (6) bundles for mechanical installations, simultaneously to ensure color blending.

H. Joints between the individual Concrete Pavers shall be maintained according to the spacer bars.

I. Fill gaps at the edges of the paved area with cut pavers or edge units. Do not install cut pavers smaller than one-third of a whole paver along edges subject to vehicular traffic – trim two pavers to fit.

J. Cut pavers using a masonry saw. Upon completion of cutting, the area must be swept clean of all debris to facilitate inspection and to ensure the Concrete Pavers are not damaged during compaction.

K. Using a low amplitude plate compactor capable of at least 5,000 lbs. (22 kN) compaction at a frequency of 75 Hz –100 Hz, compact and seat the Concrete Pavers into the Bedding Course.

L. The pavers shall be compacted to achieve consolidation of the Bedding Course and brought to level and profile by not less than three passes. Initial compaction should proceed as closely as possible following the installation of the paving units and prior to the acceptance of any traffic or application of Permeable Joint Material.

M. Any units that are damaged during compaction shall be immediately removed and replaced.

N. Apply a dressing of Permeable Joint Material to the surface and sweep into the joints and voids. Fill joints and voids, and then sweep off excess material before vibrating the material down into the joints using a plate compactor. This will require at least two or three passes with the compactor.

O. All work to within 3 feet (1 m) of the laying face must be left fully compacted at the end of each day. Cover the laying face with plastic sheets overnight if not closed with cut and compacted pavers.

P. Sweep off excess aggregate when the job is complete. Wash dust or particles from the paver surface.

3.06 INSTALATION OF PERMEABLE ASPHALT

A. Place the asphalt using self-propelled paving equipment with an activated screed or strike-off assembly capable of being heated if necessary, and capable of spreading and finishing the mixture without segregation. Track pavers are required unless otherwise directed by the Engineer.

B. The use of water to cool the pavement is prohibited.

C. Place lifts no more than 24 hours after each previous lift to minimize the use of tack coats. Tack coats will only be allowed if approved by the Engineer.

D. The finished surface shall be of a uniform texture and evenness, and shall not show any indication of tearing, shoving, or pulling of the pavement during placement.

E. Roll the asphalt using a two-axle tandem roller when it is cool enough to withstand the roller without displacement of the asphalt, and using rollers sufficient to compact the asphalt without crushing the aggregate or compromising the required void content and infiltration rates.

F. The number, mass (weight), and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. Generally, one breakdown roller will be needed for each paver used in the spreading operation.

G. Breakdown rolling shall occur when the mix temperature is between 275 and 325°F. Intermediate rolling shall occur when the mix temperature is between 200 and 275°F. Finish rolling shall occur when the mix temperature is between 150 and 200°F.

H. Unless otherwise specified by the Engineer, the longitudinal joints shall be rolled first. Next, the Contractor shall begin rolling at the low side of the pavement and shall proceed toward the center or high side with lapped rolling parallel to the centerline.

I. Roll until all roller marks are gone however avoid excessive rolling which could reduce the infiltration capabilities of the asphalt.

J. To prevent adhesion of the mixture to the rolls, rolls shall be kept moist with clean water or water mixed with very small quantities of detergent or other approved materials. Excess liquid will not be permitted.

K. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot or lightly oiled hand tampers, smoothing irons or with mechanical tampers. On depressed areas, either a trench roller or cleated compression strips may be used under the roller to transmit compression to the depressed area.

L. Rollers will not be stopped or parked on the freshly placed mixture; Foot-traffic shall not be allowed on fresh asphalt for at least 24-hours.

M. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture. The mixture shall be compacted to conform to the surrounding area with segregation. Any area showing deficiencies shall be replaced at the Contractor's expense.

N. Joints between old and new pavements or between successive days work shall be made to ensure a thorough and continuous bond between the old and new mixtures. Whenever the spreading process is interrupted long enough for the mixture to attain its initial stability, the paver shall be removed from the mat and a joint constructed.

O. Butt joints shall be formed by cutting the pavement in a vertical plane at right angles to the centerline, at locations approved by the Engineer. The Engineer will determine locations by using a straightedge at least 16 feet long. The butt joint shall be thoroughly coated with Type RS-1 emulsified asphalt just prior to depositing the pavement mixture when paving resumes.

P. Tapered joints shall not be allowed. Longitudinal joints that have become cold shall be coated with Type RS-1 emulsified asphalt before the adjacent mat is placed. If directed by the Engineer, joints shall be cut back to a clean vertical edge prior to applying the Type RS-1 emulsified asphalt.

Q. Minimum times prior to opening pavement to traffic are as follows:
    1. After pavement has been permitted to cool to below 100 °F for all traffic,
    2. 24 hours for pedestrian traffic, and
    3. As directed by Engineer for vehicular traffic.

R. The Contractor shall protect the permeable asphalt from severe weather conditions and contamination by dust, dirt, mud or other fine grained material or sediment. The asphalt shall be protected by an approved method from the time of placement until final acceptance of the project. Any damage to the permeable asphalt caused by the contractor’s equipment shall be repaired by the contractor at no cost to the owner. Any portion of the permeable asphalt that becomes contaminated to the extent that drainage is reduced or inhibited shall be removed and replaced at no expense to the County.

3.07 INSTALLATION OF POROUS CONCRETE

A. Porous concrete shall be mixed, delivered, installed, tested, and protected in accordance with all requirements as provided in ACI 522.1-13, Specification for Pervious Concrete Pavement. Traffic will not be allowed on the surface until the specified design compressive strength has been verified by testing.

B. The Contractor shall protect the porous concrete from severe weather conditions and contamination by dust, dirt, mud or other fine grained material or sediment. The concrete shall be protected by an approved method from the time of placement until final acceptance of the project. Any damage to the porous concrete caused by the contractor’s equipment shall be repaired by the contractor at no cost to the owner. Any portion of the porous concrete that becomes contaminated to the extent that drainage is reduced or inhibited shall be removed and replaced at no expense to the County.

3.08 TESTING AND QUALITY ASSURANCE/QUALITY CONTROL

A. Contractor testing in accordance with the Drawings, these specification requirements, and referenced test methods shall include:
    1. Subgrade smoothness, moisture content, organic content, density, CBR, and in-situ infiltration rate.
    2. Bedding, Filler, Base, and Reservoir stone smoothness, gradation, Micro Deval Degradation, percent of angular and sub-angular particles, LA Abrasion, and CBR.
    3. Permeable asphalt in-place base and surface course smoothness, thickness, void content, unit weight, and in-situ water infiltration rate.

4. Porous concrete initial and 28-day smoothness, void content, unit weight, compressive strength, and in-situ water infiltration rate.
5. Unless modified in the project Drawings, testing shall be performed for each 500 square feet of surface area.

B. Quality Assurance – The Owner may engage inspection and testing services, including independent laboratories, to provide quality assurance and testing services during construction. This does not relieve the Contractor from securing the necessary construction quality control testing.

C. Quality assurance should include as a minimum verification with the Owner that the Contractor's quality control plan and testing are adequate. Quality assurance shall also include observation of construction for general compliance with design drawings and project specifications.

D. The Contractor shall engage only qualified and experienced technicians and engineers to perform testing services.

E. Repair or remove and replace unacceptable work, as directed by the Engineer, at the Contractor's cost.

3.09 AS-BUILT CONSTRUCTION TOLERANCES

A. Final inspection shall be conducted to verify conformance to the drawings after removal of excess aggregate. All pavements shall be finished to lines and levels to ensure positive drainage at all drainage outlets and channels.

B. The final surface elevations shall not deviate more than +/- 1/4 inch in any direction under a 10-foot-long straight edge. The Contractor shall provide a 10-feet long professional grade level to check deviation.

C. Where the permeable pavement system is adjacent to the concrete edge restraint at the same level the elevation of the pavers shall not deviate more than +/- 1/8 inch.

D. Lippage shall be no greater than 1/8-inch difference in height between adjacent pavers.

E. Bond lines for the pavers shall be +/- ½ inch over a 50-foot string line.

F. The actual measured infiltration rate of the completed permeable pavement system shall be at least 6 inches per hour.

3.10 MAINTENANCE AND PROTECTION

A. Remove all sediment and debris from within the limits of the constructed permeable pavement system. Ensure all adjacent soil areas are vegetated and stabilized.

B. Protect the constructed areas from erosion and keep free from accumulation of debris. Divert post-construction stormwater runoff around the areas until final completion.

C. For concrete paver projects, the Contractor shall return to the site after 12 months from the completion of the work and conduct an inspection of the PICP System with the Owner and Manufacturer in accordance with the "PICP System Maintenance Checklist". The Contractor shall provide the following remedial work, as required, as part of the original bid and with no additional compensation: fill paver joints with stones; replace broken or cracked pavers; re-level settled pavers to specified elevations; and re-align pavers to straighten bond lines. This work shall include removing the paver system to at least the base layer to re-level areas.

+++ END OF SECTION 3120 +++