






Elmer Avenue, Los Angeles
Source: Central Coast LID



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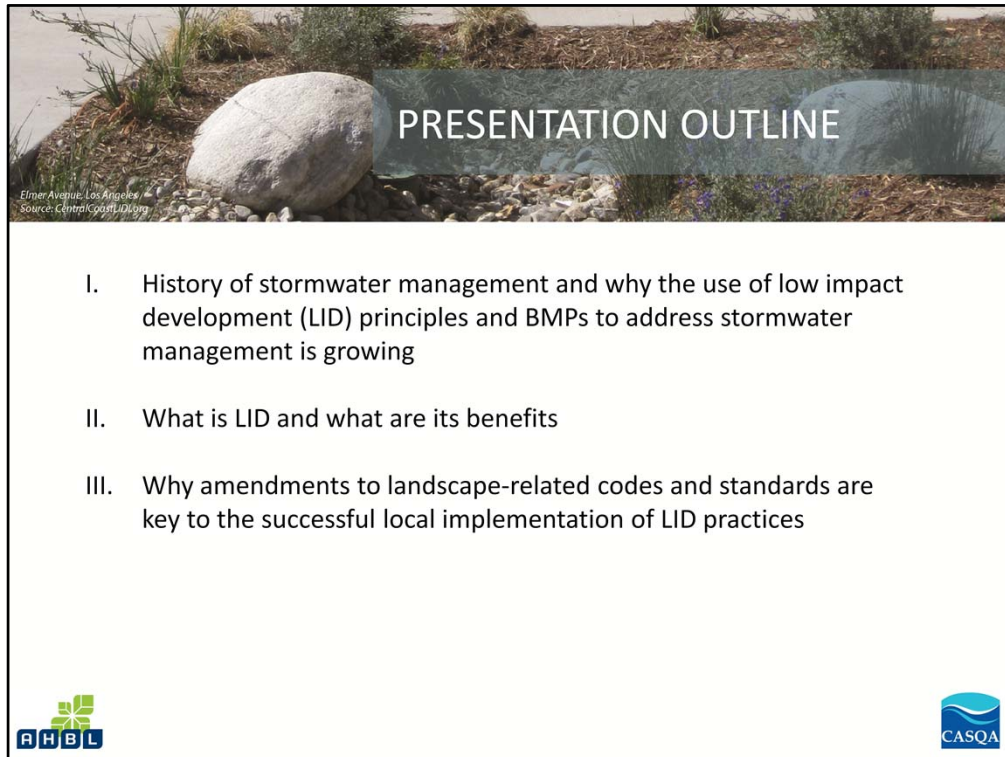




PURPOSE OF TRAINING

- Discuss where to look within municipal codes when attempting to remove barriers to the integration of LID in local development controls
- Provide resources and tips related to the successful integration of LID into local codes and enforceable standards
- Share lessons learned from CASQA's Prop 84 Removing Barriers to Low Impact Development in Local and State Codes grant project





The slide features a header image of a dry riverbed with a large rock and sparse vegetation. A semi-transparent dark blue box with the title "PRESENTATION OUTLINE" is overlaid on the image. Below the image is a white box containing a three-point outline. At the bottom left is the AHB L logo, and at the bottom right is the CASQA logo.


PRESENTATION OUTLINE

Elmer Avenue, Los Angeles
Source: Central City Connections

- I. History of stormwater management and why the use of low impact development (LID) principles and BMPs to address stormwater management is growing
- II. What is LID and what are its benefits
- III. Why amendments to landscape-related codes and standards are key to the successful local implementation of LID practices

AHB L



CASQA

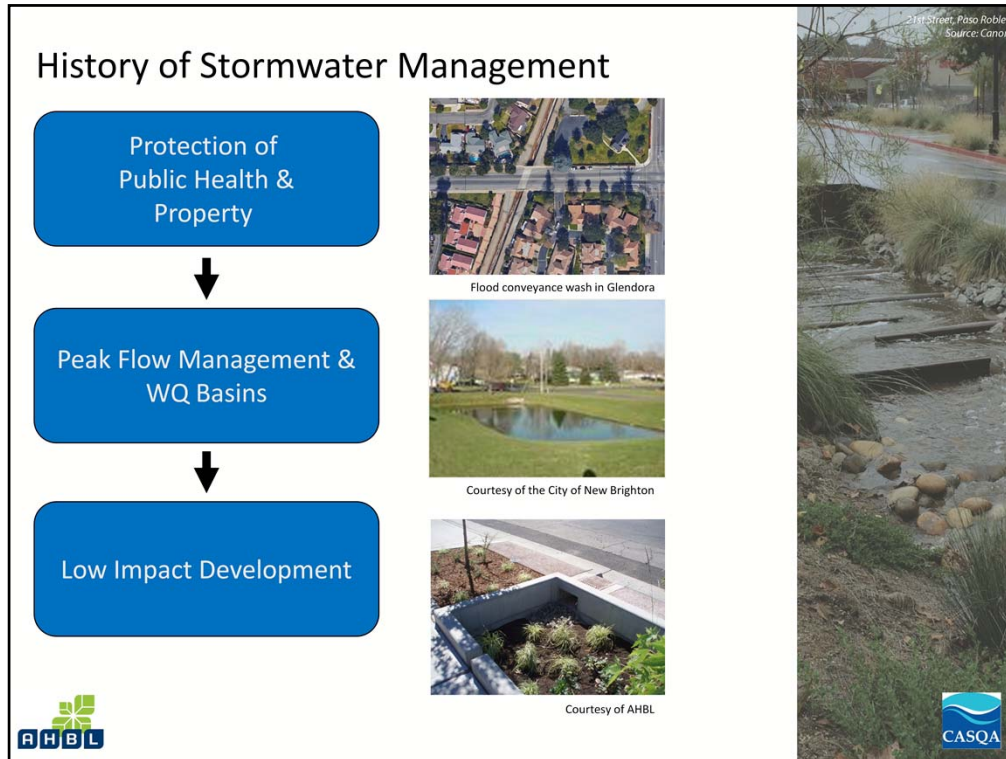


PRESENTATION OUTLINE

Elmer Avenue, Los Angeles
Source: Central Coast LID.org

- IV. Presentation of opportunities to integrate LID into local codes and engineering design manuals as illustrated by our work with the participants of CASQA's Prop 84 Removing Barriers to LID in Local and State Codes project
- V. Presentation of tips and lessons learned from various codes updates and tools to aid you with your work



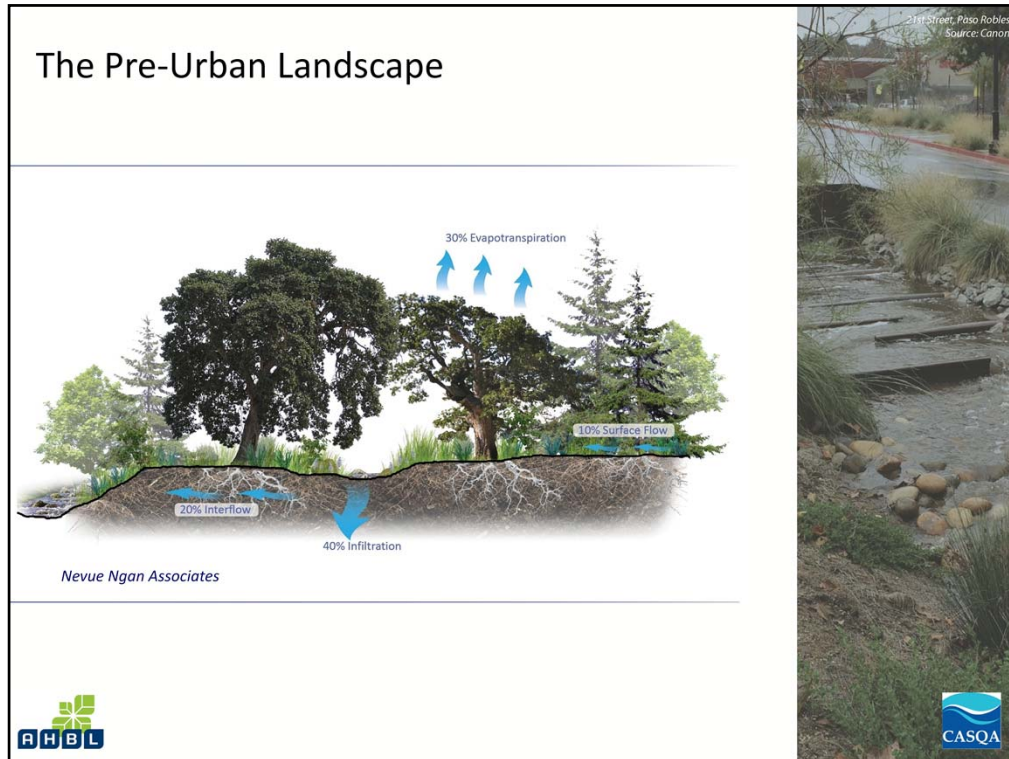


The next couple of slides regarding the history of stormwater management and the role of LID will be familiar to the practitioners watching this webcast, but may be new to some of the elected officials that may be watching.

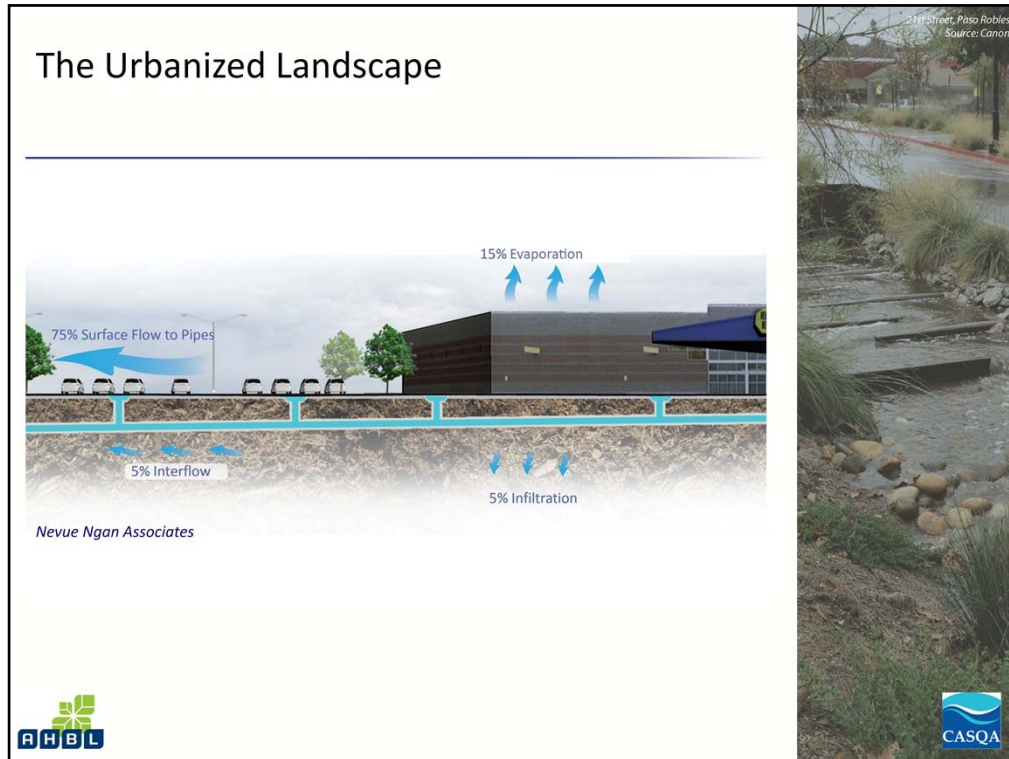
Historically, we have addressed stormwater runoff due to urbanization under categories of protection of public health (diseases borne by SW) and flood control.

We've learned that these conventional practices such as collecting and conveying stormwater through pipes, ditches, vaults, and detention ponds do not replicate natural drainage patterns.


Moreover, these practices are inadequate to address water quality issues and are not environmentally, socially, or economically sustainable. Perhaps most importantly with the draught is that these techniques are wasteful of a valuable resource.



Pre-developed or pre-urban landscape typically has little runoff. Hydrologic processes of infiltration, interflow, and evapotranspiration are permitted to naturally occur.





The urbanized landscape, however, diminishes the occurrence of these natural processes and results in greater downstream flows.



WHAT IS LID AND WHAT ARE ITS BENEFITS?

- Mimics natural hydrologic processes such as infiltration, storage, and evapotranspiration
- Use of small scale, on-site practices that are decentralized throughout the project site
- Focus on capture, treat, retain small storm events



This is where LID has emerged as the next evolution of stormwater management.

Not to replace conventional techniques but to improve how we manage stormwater to provides multiple environmental and community benefits.

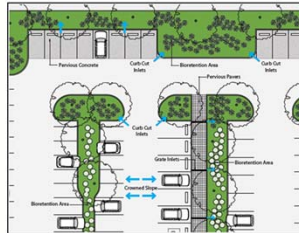
In LID, the non-structural practices are as important if not more so than the structural. The more you can reduce the amount of runoff generated, the less you have to control with structural practices.

It is very common to see a site design where the road, building, sidewalks, etc. have been designed without thinking using LID principles and the designer is then left to fit in structural facilities to address all the runoff.

Hard to communicate the importance of site design for technical feasibility and cost savings.

LID is a Comprehensive Design Approach

1. Site Design Measures are engineered systems to address remaining runoff.
Example: reduce impervious surface
2. Runoff Reduction Measures decrease the amount of runoff leaving the site through “soft” design.
Example: route stormwater to landscaping
3. Structural Control Measures are engineered systems to address remaining runoff.
 - Bioretention
 - Rain barrels, Cisterns
 - Green Roofs
 - Permeable Pavements
 - Infiltration basins
 - Constructed wetlands



Site Design, Runoff Reduction, and Structural Controls work together

Use of site design and runoff reduction measures will influence the need or sizing of engineered structural controls and therefore, influence project cost and ability to comply with requirements

LID is a Comprehensive Design Approach

A good LID design begins early in the project planning process where LID design principles can be integrated.

Site Design and Runoff
Reduction Measures

+


Structural
Controls

=

Overall
Successful
Design



Ability to integrate Site Design principles will depend on the project (e.g., redevelopment vs. new development)






WHY AMEND CODES?

- Use of LID BMPs and principles often requires both stormwater and land use approvals.
- Municipal codes will often include standards that discourage or even preclude the use of LID site design practices and structural BMPs.
- It's required under the Statewide NPDES Phase II Municipal Stormwater Permit and several other Phase I Municipal Stormwater Permits throughout the State.







WHY FOCUS ON LANDSCAPE-RELATED CODES?

Elmer Avenue, Los Angeles
Source: Central Coast LID.org

Bioretention, the workhorse of LID best management practices, is a landscape-based stormwater management practice.

Landscaping is a requirement for most development proposals and the dual use of landscaping for stormwater and aesthetic purposes is desired by applicants and municipalities alike.



Integrating standards to minimize disturbance to the hydrologic cycle will likely result in amended language that will permeate a very, very broad number of codes and standards.

Each City and County has a code structure that is unique and that grew organically from challenges that were faced locally.

As a result, the discussion that follows will include the topics that you will want to address as you integrate LID into your local codes and enforceable standards.



WHY FOCUS ON LANDSCAPE-RELATED CODES?

Landscaping requirements are found in a variety of codes including:

- Landscape chapters
- Parking design chapters and standard drawings
- Subdivision and cluster design chapters
- Zoning codes for individual zoning districts
- Street and right-of-way improvement standards
- Standard plans and specifications

Therefore significant opportunity for the dual use of these landscape areas for stormwater management is currently being unmet!






CODE AMENDMENTS TO FACILITATE COMPLIANCE WITH MS4 PERMITS

Elmer Avenue, Los Angeles
Source: Central City Connections

Landscape-related code amendments occur in a variety of locations within a municipality's code structure. The following code areas were the emphasis of our integration of LID principles and BMPs within landscape-related codes:

- Landscape Code and Water-Efficient Landscape Code Amendments
- Bioretention Plant Lists and Technical Specifications
- Bioretention Planting Design
- Clustering/PUD Provisions
- Parking Lot Design





WHY FOCUS ON LANDSCAPE-RELATED CODES?

The preparation of a gap and impediment analysis is a good way to uncover provisions in local development controls that discourage or preclude the use of LID practices. Identifying gaps and opportunities to integrate LID into landscape-related codes was an identified requirement in the Statewide Phase II Permit.

A H B L

CASQA

The preparation of a gap and impediment analysis is the best way to uncover provisions in local development controls that discourage or preclude the use of LID practices.

Identifying gaps and opportunities to integrate LID into landscape-related codes using the gap analysis template that was referenced in the Statewide Phase II Permit.

The tool was created for the Region 3 permittees to provide a framework to analyze an entire municipal code. Many of the identified opportunities and impediments were found in three general areas:

- Landscape-related codes
- Street standards
- Stormwater management control ordinances

These findings led the State Water Board to direct Phase II permittees to focus their efforts on landscape-related codes.



The gap analysis on the subsequent slides reflects the emphasis on analyzing landscape-related codes and enforceable standards.

WHY FOCUS ON LANDSCAPE-RELATED CODES?

The tool that was referenced in the Permit was created by members of this team for the Region 3 Water Board to provide a framework to analyze an entire municipal code. However, many of the identified opportunities and impediments were found in three general areas:

- Landscape-related codes
- Street standards
- Stormwater management control ordinances

To that end, the Statewide Phase II Permit emphasized the evaluation of landscape related codes and stormwater control ordinances in the Permit. The following slides step through the use of the gap analysis tool.

The preparation of a gap and impediment analysis is the best way to uncover provisions in local development controls that discourage or preclude the use of LID practices.

Identifying gaps and opportunities to integrate LID into landscape-related codes using the gap analysis template that was referenced in the Statewide Phase II Permit.




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The gap analysis on the subsequent slides reflects the emphasis on analyzing landscape-related codes and enforceable standards.

Gap Analysis

City of _____ MUNICIPAL LANDSCAPE GAP ANALYSIS TOOL		
<div> <div>  <div> Central Coast Low Impact Development Initiative Dustin Hight, P.E. http://centralcoastlidi.org </div> </div> <div>  <div> AHBL, Inc. Wayne Carlson 208.688.3014 www.ahbl.com </div> </div> </div>		
Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(1) VEGETATION CONSERVATION (a) Do regulations require or encourage the preservation of natural vegetation at development sites? 	§17.07.100 Design review. B. Scope of Design Review. review and approval shall be directed to the following considerations: 2. The extent to which the site plan attains the minimum amount of grading and/or removal of trees and vegetation in creating a building site, including access drives and off-street parking areas; 2013 California Green Building Code Appendix A4 Residential Voluntary Measures A4.106.3 Landscape Design. Post construction landscape designs shall accomplish one or more of the following: 1. Areas disrupted during construction are restored to be consistent with native vegetation species and patterns. 3. Utilize at least 75 percent native California or drought tolerant plant and tree species appropriate for the climate zone region. 2013 California Green Building Code Appendix A5 Nonresidential Voluntary Measures A5.304.7 Previously developed sites. On previously developed or graded sites, restore or protect at least 50 percent of the site area with adaptive and/or noninvasive vegetation. Projects complying with Section A5.106.3, Item 3 may apply vegetated roof surface to this calculation if the roof plants meet the definition of adaptive and noninvasive.	For projects requiring design review, the review shall consider whether the plan attains the minimum amount of vegetation removal to create the building site. Other application types generally do not require the same findings. The City also adopts the California Green Building code which encourages as a voluntary measure the utilization of at least 75% native vegetation for landscape design and at least 50% of previously developed sites is restored with native vegetation. An opportunity exists to use vegetation retention findings similar to §17.07.100.B.2 for uses/project types that do not require design review.

Discussion of vegetation and soil conservation and the reasons why it is important for minimizing hydromodification

Gap Analysis

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(b) If forests or specimen trees are present at development sites, must some of the stand be preserved? **	§17.07.100 Design review. B Scope of Design Review. Where design review is prescribed for a use or structure by the zoning regulations, review and approval shall be directed to the following considerations: 2. The extent to which the site plan attains the minimum amount of grading and/or removal of trees and vegetation in creating a building site, including access drives and off-street parking areas;	For projects requiring design review, the review shall consider whether the plan attains the minimum amount of vegetation removal to create the building site. These requirements are not specific to any particular tree species or stand of trees, only that the disturbance be the minimum amount to create the building site. Moreover, the requirements only apply to proposals that require design review. An opportunity exists to prioritize the preservation of specimen trees at development sites.
(c) If there is a stream buffer ordinance in the municipality, does the ordinance specify that at least part of the stream buffer be maintained with native vegetation?		A stream buffer ordinance is already under consideration.
(2) OPEN SPACE MANAGEMENT		
(a) Are mechanisms in place to manage open space in perpetuity?	§17.05.141 Open space for multifamily development. 4. All required open space shall be permanently controlled and maintained by either the owner of the property or by an incorporated nonprofit homeowners' association. Open space shall remain fully usable, with no obstructions over ground level space except for devices to enhance its usability. 6. The city may, as a condition of approval, require the applicant to employ any appropriate method(s) to ensure the permanent status and maintenance of open space.	Mechanisms are in place for the management of open spaces for multi-family development types. The same mechanisms are not codified for open spaces/landscape areas that may be required for other development types. An opportunity exists to adopt language that would provide mechanisms to manage open space in perpetuity for areas not associated with multi-family development projects.



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Discussion of the need for tools to ensure that open spaces that are conserved as a result of project approval are managed and maintained consistent with the conditions of project approval. This includes things like maintenance agreements, covenants, and other tools.

Gap Analysis

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(b) Are open space areas required to be consolidated into larger units?		The City's design review process results in the creation of open spaces configured into larger units. No gap between the LID goals and the City's code.
(c) Does a minimum percentage of open space have to be managed in a natural condition?		The code is silent to this topic. Where open spaces exist that are currently in a natural condition, there is an opportunity to establish provisions to encourage the management of open space in a natural condition.
(d) Are allowed uses in open space areas defined? **		The code is silent. An opportunity exists to add language that would allow stormwater management practices to occur within open space areas as long as the intended use for the open space (e.g., recreation, passive enjoyment, etc.) is not compromised.
(e) Can open space be managed by a third party using land trusts or conservation easements?	§17.05.141 Open space for multifamily development. 4. All required open space shall be permanently controlled and maintained by either the owner of the property or by an incorporated nonprofit homeowners' association. Open space shall remain fully usable, with no obstructions over ground level space except for devices to enhance its usability. 6. The city may, as a condition of approval, require the applicant to employ any appropriate method(s) to ensure the permanent status and maintenance of open space.	Mechanisms are in place for the management of open spaces through "appropriate method(s)" for multifamily development types. The same mechanisms are not codified for open spaces that may be required for other development types. No gap between the LID goals and the City's code.




Page 3



Discussion of the need for tools to ensure that open spaces that are conserved as a result of project approval are managed and maintained consistent with the conditions of project approval. This includes things like maintenance agreements, covenants, and other tools.

Gap Analysis

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(3) Rooftop Runoff		
(a) Can rooftop runoff be discharged to yard areas?		Rooftop runoff can be discharged to yard areas. No gap between the LID goals and the City's code. However, opportunity exists to more fully encourage the practice rather than merely allowing it.
(b) Do current grading or drainage requirements allow for temporary ponding of stormwater on front yards or rooftops? 	2010 California Green Building Code Chapter 4 Residential Mandatory Measures 4.106.3 Grading and paving. Construction plans shall indicate how the site grading or drainage system will manage all surface water flows to keep water from entering buildings. Examples of method to manage surface water include, but are not limited to, the following: 1. Swales 2. Water collection and disposal system 3. French drains 4. Water retention gardens 5. Other water measures which keep surface water away from buildings and aid in groundwater recharge. 2010 California Green Building Code Chapter 5 Nonresidential Mandatory Measures 5.106.10 Grading and paving. Construction plans shall indicate how the site grading or drainage system will manage all surface water flows to keep water from entering buildings. Examples of method to manage surface water include, but are not limited to, the following: 1. Swales 2. Water collection and disposal system 3. French drains 4. Water retention gardens 5. Other water measures which keep surface water away from buildings and aid in groundwater recharge.	The City adopts the California Green Building Code which allows temporary ponding of stormwater as a method of managing surface water. No gap between the LID goals and the City's code.



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Discussion of opportunities to disconnect rooftop runoff from a permittee's public stormwater system.

Gap Analysis

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(c) Are vegetated roofs allowed? Do criteria exist to allow designers to receive credit for landscaping, stormwater, etc. for the use of vegetated roofs? **	2010 California Green Building Code Appendix A4 Residential Voluntary Measures A4.106.6 Vegetated roof. Install a vegetated roof for at least 50 percent of the roof area. Vegetated roof shall comply with requirements for roof gardens and landscaped roofs in the California Building Code, Chapter 15 and Chapter 16.	Vegetated roofs are allowed under the California Green Building Code. However, incentives for their use in other portions of the code (e.g., landscaping, stormwater, etc.) are not present. No gap between the LID goals and the City's code. However, an opportunity may exist to encourage vegetated roofs through zoning incentives such as relief from coverage requirements or other standards.
(4) OPEN SPACE / CLUSTER DESIGN REQUIREMENTS		
(a) Does your municipality have open space/cluster design regulations?	§17.07.080 Planned developments. Central to the purpose of a planned development is the concept of group or clustering buildings that result in smaller private open spaces, consolidated common open space, and less-costly improvements.	No gap between the LID goals and the City's code.



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Discussion of opportunities to cluster developments to preserve drainage ways and provide areas for the use of green stormwater infrastructure practices. Many communities are doing this through local hillside development codes, planned unit development chapters, and conservation subdivision standards.

Gap Analysis

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(b) Is land conservation or impervious cover reduction a major goal or objective of the open space/cluster design regulations?	§17.07.080 Planned developments.	Planned Developments require a significant amount of open space (40 percent). Land conservation and impervious surface coverage limitations are not explicitly the rationale for the requirements although such benefits will typically accrue from a Planned Development. No gap between the LID goals and the City's code. However, an opportunity exists to acknowledge that land conservation and impervious cover limitations are important findings for the approval of a Planned Development.
(c) Are the entitlement criteria for open space/cluster design more stringent than for standard subdivision design?	§17.07.080 Planned developments.	The criteria for the approval of Planned Developments are reasonable and consistent with the deviations from standard code requirements requested by applicants. No gap between the LID goals and the City's code.
(d) Are flexible site design criteria available for developers that utilize open space/cluster design options (setbacks, road widths, lot sizes)?	§17.07.080 B.2 Waiver of Development Standards. Exceptions to the frontage, lot area, lot width, lot depth, ground coverage, yard size, parking, and loading requirements of the zoning district, and exceptions to the improvement standards and specifications may be granted in accordance with subsection (C) of this section.	No gap between the LID goals and the City's code.

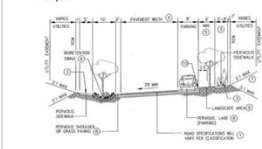
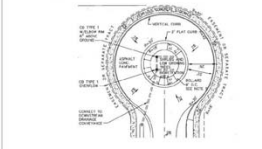


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Continued discussion of the questions that identify opportunities to integrate green stormwater practices into local cluster development standards.

Gap Analysis

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(5) STREET STANDARDS		
<p>(a) Do adopted street sections allow for open treatment and conveyance of stormwater within landscape strips?</p> 		<p>The City is currently preparing standard plans for streets. Open treatment and conveyance of stormwater is not depicted in the current draft designs.</p> <p>An opportunity exists to adopt street standards that allow for treatment and conveyance of stormwater within landscape strips.</p>
<p>(b) Can a landscape island be created within the cul-de-sac?</p> 		<p>The City is currently preparing standard plans for streets. Open treatment and conveyance of stormwater is not depicted in the current draft designs.</p> <p>An opportunity exists to adopt street standards that provide designs which integrate landscape areas into the terminus of the cul-de-sac.</p>




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There are significant opportunities to integrate green stormwater infrastructure practices into linear transportation projects. These opportunities are discussed more fully in the slides that follow. Suffice to say, there were many opportunities to integrate landscape-based LID practices into local street standards.

Gap Analysis

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(5) Parking Lot Runoff: (a) Is a minimum percentage of a parking lot required to be landscaped? **	§17.05.110 Landscaping and screening D. Parking Lot Landscaping. A screening device shall be required along all interior property lines from all off-street parking spaces abutting a residential use. Said screening shall be not less than six feet in height. All off-street parking areas having four or more spaces shall be provided with screening and landscaping according to the following standards: 1. Parking lots located within 20 feet of a street right-of-way shall be screened from the street by a landscaped strip of not less than five feet in width 2. One tree shall be provided for every eight parking spaces, except that parking areas of five or more spaces shall also require at least one tree. Said tree shall be planted in a tree-well measuring at least four feet by four.....	No gap between the LID goals and the City's code.
(b) Is the use of bioretention islands and other stormwater practices allowed within landscaped areas and/or setbacks? ** 	§17.05.110 D Parking Lot Landscaping All planters and tree wells shall be enclosed by a curb composed of concrete or other durable material not less than six inches in height, as measured from the top of the existing adjacent street curb, or, where no curb exists, as measured from the average cross-section elevation.	The enclosure of the landscape areas with a six inch curb is an impediment to the use of parking lot bioretention without area drains and pipe. However, the City has approved parking lot bioretention designs for the parking lot located at the northwest corner of 11th Street and L Street. Although the code language does not support the use of bioretention designs within parking lot areas, the City has supported the practice. Opportunities exist to make this process easier for applicants by including standard details within the Standard Plans so that designers do not have to prepare a design anew with each project.



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We identified many opportunities to integrate LID practices into parking lot designs. These opportunities included specifications on a minimum amount of landscaping for a parking lot and its appurtenant circulation, the use or prohibition of compact parking spaces, and details for parking lot landscape islands.

Gap Analysis

Objective	Code Reference and Summary of Existing Standards	Impediment / Opportunity to Improve
(c) Does your design manual specify required designs that would preclude the ability to use parking lot landscaped areas for bioretention? **	<p>§17.05.110.D Parking Lot Landscaping</p> <p>All planters and tree wells shall be enclosed by a curb composed of concrete or other durable material not less than six inches in height, as measured from the top of the existing adjacent street curb, or, where no curb exists, as measured from the average cross-section elevation.</p>	<p>The enclosure of the landscape areas with a six inch curb is an impediment to the use of parking lot bioretention without area drains and pipe. However, the City has approved parking lot bioretention designs for the parking lot located at the northwest corner of 11th Street and L Street.</p> <p>Although the code language does not support the use of bioretention designs within parking lot areas, the City has supported the practice. Opportunities exist to make this process easier for applicants by including standard details within the Standard Plans so that designers do not have to prepare a design anew with each project.</p>



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Continued discussion of parking lot landscaping and opportunities to use these resources for green stormwater infrastructure.

Gap Analysis

While it is important to look at impediments throughout an entire municipal code structure, we often found that amendments to local water efficient landscape ordinances were a useful way to integrate LID design considerations into a municipality's landscape codes.

Traditional landscape codes were good and useful regulations for describing the quantity of landscaping that a municipality desired and the spatial preference for its placement (e.g., buffer, within parking, etc.). Many landscape chapters in municipal codes deferred to a water efficient landscape ordinance for guidance on the design of the landscaping.



Ongoing discussion of gaps and opportunities to integrate LID into landscape related codes using the gap analysis template that was referenced in the Statewide Phase II Permit.

Gap Analysis

While local water efficient landscape ordinances may have spelled out requirements for turf coverage, water efficient landscape plantings, and irrigation design, references were seldom made to plantings for bioretention facilities.

The timing of Governor Brown's Executive Order modifying the State Water Efficient Landscape Ordinance allowed us to leverage the changes that local municipalities were making to their WELOs while making simultaneous provisions for LID.



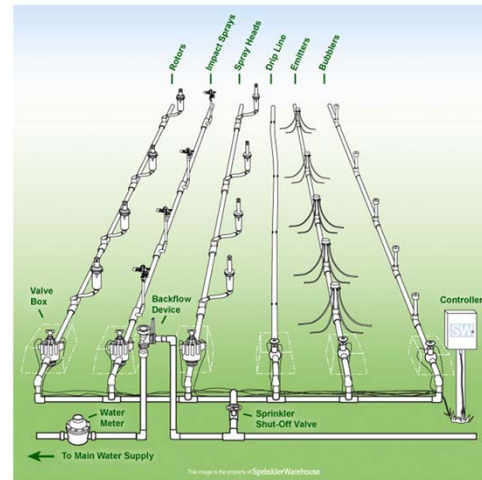
Ongoing discussion of gaps and opportunities to integrate LID into landscape related codes using the gap analysis template that was referenced in the Statewide Phase II Permit.

Traditional Landscape and Water Efficient Landscape Codes

CHAPTER 10.24 WATER EFFICIENT LANDSCAPE DESIGN REQUIREMENTS

Sections:

- 10.24.010: Purpose
- 10.24.020: Applicability
- 10.24.030: Definitions
- 10.24.040: Landscape and Irrigation Plan Contents
- 10.24.050: Landscape and Irrigation Design
- 10.24.060: Stormwater Management
- 10.24.070: Landscape and Irrigation Maintenance



Source: Sprinkler Warehouse



Most municipalities did a good job of specifying the quantity of landscaping that was required and general preferences for where it was to be located (e.g., buffers, park tracts, etc.). Design criteria for plant specification and irrigation was most often found in a municipality's water-efficient landscape chapter.

Design criteria for landscape-based stormwater management practices is suitable for inclusion in a water-efficient landscape chapter because these practices are water-efficient by design.

Most codes were silent to the opportunity to use landscape areas for passive uses and stormwater practices. Opportunities existed in most municipalities to make clear that landscaping could be used for buffering/screening, parking lot landscaping, or aesthetic purposes as well as for landscape based stormwater management practices.

This text shows language integrated into a water efficient landscape chapter.

Key issues include:

- Determining the type of landscaping to retain or recreate
- Establishing native soil preservation
- Allowing multiple use of landscaping for landscape-based stormwater management practices

Traditional Landscape and Water Efficient Landscape Codes – Example Code Language

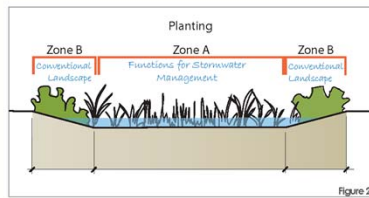
10.24.060: Stormwater Management: Landscape-related stormwater management practices can reduce runoff and improve water quality when properly designed and constructed. The following standards apply to the design of landscape areas used as bioretention facilities:

- A. Facility Sizing.** Bioretention facilities shall be designed to manage stormwater from the drainage management area. Sizing shall be in accordance with the City's stormwater permit and as codified elsewhere in the Municipal Code.
- B. Plant Selection.** Plants used in bioretention facilities shall be selected for tolerance to both periodic inundation, as well as prolonged dry periods. Plants shall be non-invasive and should be native to the region whenever possible, so as to reduce the demand for excessive irrigation and pesticide/herbicide application. A list of suitable plant species is on file with the Department of Planning and Economic Development. Plants shall be selected according to the surface grade and the incidence of periodic surface water inundation. Plants selected for Zone A should tolerate periodic surface water inundation as well as seasonal dry periods. Plants selected for Zone B should tolerate the planting on side slopes and surface water runoff.



Bioretention Planting Selection

Our project plant list resources focused on plantings appropriate for Zone A. Zone B can be planted from your municipality's existing plant list.



Important to use native vegetation to maximize success and longevity.

Depending on the location of the bioretention facility, the plant selection may need to be hardy enough to withstand trampling.

Jury is still out on ability of trees to survive/thrive ponding related to bioretention designs.



Other benefits include:

- Aesthetics
- Habitat
- Treatment
- Air Pollution
- Carbon Sequestration
- Reduces Heat Island

Traditional Landscape and Water Efficient Landscape Codes – Example Code Language

10.24.060: Stormwater Management (*continued*):

- C. **Hydrozone Grouping and Irrigation.** Installed plants within rain gardens and other bioretention facilities shall be grouped into hydrozones based on similar water usage. During plant establishment, temporary irrigation shall use separate valves for each hydrozone. All irrigation shall be removed or disconnected from the bioretention facility at the end of plant establishment.
- D. **Planter Edge and Curb Design.** Bioretention facilities are intended to receive and treat stormwater runoff. Edge treatments shall be designed not to impede sheet flow from surrounding areas. See design details contained in the City's Standard Drawings.



Traditional Landscape and Water Efficient Landscape Codes – Example Code Language

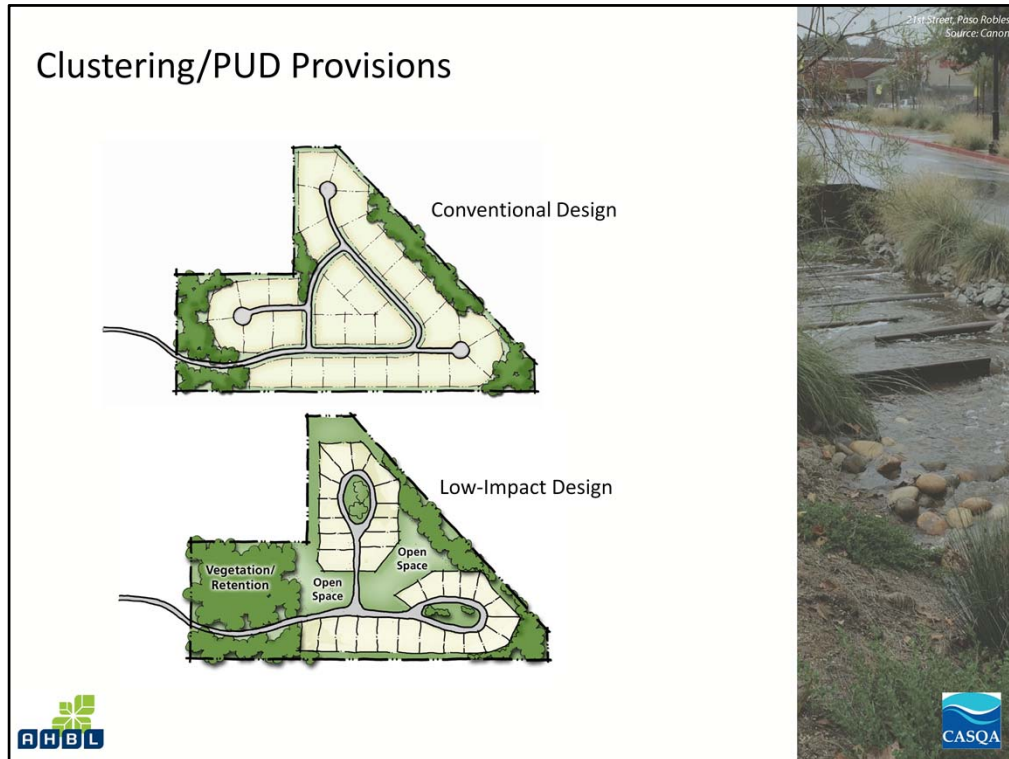
10.24.060: Stormwater Management (continued):

- E. **Compost.** Compost application, quantity, and composition for bioretention facilities shall be as specified in the design details contained in the City's Standard Drawings.



Courtesy of AHBL





The gap analyses also identified opportunities to integrate low impact development practices into cluster designs.



Opportunities to integrate LID into parking lot designs were identified in most of the Round 1 participants. Round 1 municipalities required anywhere between 2 and 20 percent of the parking lot and circulation area to be landscaped. The typical range was between 5 and 8 percent. Modifications to the quantitative requirement for landscaping around the perimeter of a parking lot or within internal parking lot areas was generally not modified.

However, most municipalities had design details requiring parking lot landscaping that would be “planted up” like an island with barrier curb around the edges. Irrigation was also typically required for this design.

We prepared amendments to these details that included parking lot landscaping that would be concave thereby allowing it to accept runoff from the parking areas. The barrier curb was either retained and modified to include curb inlets or eliminated altogether and replaced with wheel stops.

These design solutions were widely popular since parking lot landscaping is already required as a means of softening the appearance of vast expanses of asphalt.

The practice of using internal parking lot landscaping for stormwater management is an excellent solution for new construction where feasible. For retrofits, it can be a bit more challenging. Typically, parking lots are designed to drain to drive isles so that there is not ponding in the area where people are entering/exiting their cars. Catch basins are located in the driveways to collect the drainage for disposal downstream.

Rather than fully reconstructing a parking lot so that it drains to the landscape areas, some retrofit designs have included the following:

1. Sawcut the asphalt parking lot
2. Lay small runs of pipe between the existing catch basin and the newly concave landscape area
3. Patch parking lot

Integrating Drainage Facilities into Required Parking Lot Landscaping



Integrating Drainage Facilities into Rights-of-Way




Google Maps: Southgate Neighborhood Retrofit – Corner of Miramonte Avenue and Madrono Avenue, Palo Alto



Our gap analysis identified the design of new and the retrofit of existing streets as an opportunity to meet post construction requirements through the use of low impact development techniques.


Many permittees viewed these opportunities as the single greatest way to improve water quality while dealing with other infrastructure needs. The following slides describe opportunities that were identified by the project participants to integrate LID into public rights-of-way. The slides also describe some of the planning considerations that were important to the designs that were ultimately settled on.



GREEN COMPLETE STREETS

Elmer Avenue, Los Angeles
Source: Central City Connections

Integrating green infrastructure principles within the urban rights-of-way can help to reduce flooding, protect natural waterbodies and provide a safer, healthier and more aesthetically pleasing environment for all users including drivers, pedestrians and bicyclists.



Source: Google Maps, Bricknell Avenue, Santa Monica




Important planning and design considerations include:

- Awareness of, and attempt to, separate various wet and dry utilities from LID/stormwater management practices where feasible;
- Concerns regarding placement of trees in bioretention areas.
- Maintaining existing rights-of-way widths even where impervious surface reductions (e.g., narrower streets) are pursued so that adequate space is maintained to address all current and future needs;
- Consideration of travel widths within street classifications where and as appropriate to maintain public safety, mobility and other uses;
- Avoiding excessive use of pervious surfaces to avoid high O&M costs and structural issues associated with inappropriate application;
- Considering options for local, collector, minor and major arterial street classifications; and
- Providing specificity for street standard dimensions but also flexibility as need by the designer to achieve compliance and address site conditions.



GREEN COMPLETE STREETS

Fundamental to Green Complete Street design is optimizing the use of landscape elements that are already required for conventional street design. Typical required landscape elements within streets include landscape planting strips, boulevard plantings, and medians employed to provide pedestrian, bicyclist, and vehicular benefits as well as aesthetic, habitat, air quality, urban heat island, and stormwater management value.



Source: Caltrans, San Pablo Avenue, El Cerrito



GREEN COMPLETE STREETS

We put together a summary paper and user guide to our work that describes why the participants emphasized bioretention over permeable pavement and other LID practices and some of the considerations that influenced the design of the street standards.

This document can be found on the California LID Portal:

<http://www.CaliforniaLID.org>



GREEN COMPLETE STREETS

Several communities had agreements with local transit providers to ensure that the construction of new streets and major retrofits of existing rights-of-way were complete streets that accommodated multiple modes of travel.

Monterey Bay Area

COMPLETE STREETS GUIDEBOOK



Adopted August 2013



Maintaining consistency with adopted plans was an important element of our work.

Landscape Strip Design Alternatives

Consider alternatives to traditional landscape strips by replacing lawn and street trees with bioretention in landscape swales or planter boxes between the curb and sidewalk

Landscape strip alternative: Bioretention swale

Conventional Design



LID Design



This slide, and the ones that follow, depict opportunities to integration LID practices within street designs. This slide shows a street-side bioretention facility where the facility was designed to retain the mature trees along the street. This is a retrofit project where parking was sacrificed on one side of the street.

Landscape Strip Design Alternatives

Consider alternatives to traditional landscape strips by replacing lawn and street trees with bioretention in landscape swales or planter boxes between the curb and sidewalk

Landscape strip alternative: Bioretention planter box



Los Angeles



This slide shows a bioretention planter box. Consider this the same as a bioretention swale, but with a more urban feel to it. Because it is put in a box, the need for side slopes are not present. These facilities take up less width, but are more expensive. This example is a detail from the City of Los Angeles. It was inspired by a similar detail from the City of Portland. Context is important when considering designs for street side bioretention. This particular design is appropriate for a downtown setting, but would look out of place and be an expensive design for streets serving lower density single-family developments.

In-Street Bioretention

Consider street section design alternatives depicting street-side and in-street bioretention (e.g., lanes sloped to median, lanes sloped to one side of street, curb bulb outs, lanes crowned, etc.)

In-street bioretention: Medians



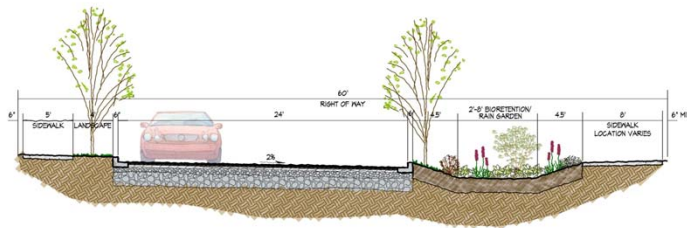
Consider integrating bioretention into all road classifications. Many communities concentrate the integration of bioretention facilities into the lowest classification local roads. Bioretention can be successfully integrated into the street sections for collector and arterial roads as well.

This slide depicts bioretention being used as the boulevard landscaping for the required median in Downey.

In-Street Bioretention

Consider street section design alternatives depicting street-side and in-street bioretention (e.g., lanes sloped to median, lanes sloped to one side of street, curb bulb outs, lanes crowned, etc.)

In-street bioretention: Lanes sloped to one side of the street



In-Street Bioretention

Consider street section design alternatives depicting street-side and in-street bioretention (e.g., lanes sloped to median, lanes sloped to one side of street, curb bulb outs, lanes crowned, etc.)

In-street bioretention: Curb bulb outs



This slide depicts curb bulb outs. In addition to the stormwater benefits of these designs, these facilities can also provide important traffic calming functions.

Pedestrian Safety for Crossing Bioretention Facilities

Include pedestrian considerations in design specifications to ensure public safety (e.g., people walking from their parked car to a sidewalk with a bioretention area in between)



Include pedestrian considerations in design specifications to ensure public safety (e.g., people walking from their parked car to a sidewalk with a bioretention area in between).


Planting Design for Bioretention Facilities

Ensure that planting recommendations for trees, shrubs, and groundcover consider technical design considerations as well as costs and benefits related to climate/drought; costs of irrigation; wind tolerance; operations and maintenance; public safety; and community aesthetics



Google Maps: Southgate Neighborhood Retrofit – Corner of Miramonte Avenue and Castilleja Avenue, Palo Alto







STORMWATER CONTROL LANGUAGE

Elmer Avenue, Los Angeles
Source: Central Coast Union

One of the more consistent gaps we found during our review of city and county codes were opportunities to improve the enforceable mechanism to implement the post construction requirements in the permit. Many permittees did not have a connection between the thresholds for new and redevelopment and the requirements for permanent stormwater controls.

Assistance within this topic area included the preparation and/or amendment of local storm drainage chapters as well as the preparation of alternative compliance language for proposals that cannot meet the post construction requirements on-site.



Stormwater Management Municipal Code Chapter

Chapter 5 URBAN STORMWATER QUALITY MANAGEMENT

- 8-5-1: TITLE:
- 8-5-2: PURPOSE AND INTENT:
- 8-5-3: DEFINITIONS:
- 8-5-4: AUTHORITY FOR ADMINISTRATION AND ENFORCEMENT:
- 8-5-5: CONSTRUCTION AND APPLICATION:
- 8-5-6: ULTIMATE RESPONSIBILITY OF DISCHARGER:
- 8-5-7: PROHIBITION OF NONSTORMWATER DISCHARGE TO THE PUBLIC STORM DRAIN SYSTEM; EXEMPTIONS:
- 8-5-8: OPERATING FACILITIES OR ACTIVITIES:
- 8-5-9: CONSTRUCTION SITES:
- 8-5-10: POSTCONSTRUCTION:
- [8-5-10-1: REGULATED PROJECTS:](#)
- [8-5-10-2: MINIMUM PERFORMANCE REQUIREMENTS:](#)
- [8-5-10-3: ALTERNATIVE COMPLIANCE:](#)
- 8-5-11: CLEANUP AND NOTIFICATION REQUIREMENTS:
- 8-5-12: INSPECTIONS:
- 8-5-13: ENFORCEMENT AND PENALTIES:
- 8-5-14: CONFLICT WITH OTHER LAWS:
- 8-5-15: PENALTIES:



LID is implemented through the Post Construction Requirements

To ensure that LID is implemented, language was added to require regulated new and redevelopment projects to use LID practices. While the triggers or thresholds for new and redevelopment projects were identified in local codes, the design of the stormwater practices was included within the municipality's stormwater design manual.

All of the examples in this presentation, and all of others on the project, are included on the project portal.

Stormwater Management Municipal Code Chapter

8-5-10: POSTCONSTRUCTION:

The primary objective of these Post-Construction Stormwater Management Requirements (hereinafter, Post-Construction Requirements) is to ensure the reduction of pollutant discharges to the Maximum Extent Practicable and preventing stormwater discharges from causing or contributing to a violation of receiving water quality standards in all applicable development projects that require approvals and/or permits issued by the City.

Property owners or operators shall ensure long term operation and maintenance of postconstruction stormwater runoff control mechanisms, such as retention basins, dry wells and other measures described in 40 CFR 122.34(b)(5)(iii).



Stormwater Management Municipal Code Chapter

8-5-10-1: REGULATED PROJECTS:

Regulated Projects include all New Development or Redevelopment projects that create and/or replace >2,500 square feet of impervious surface (collectively over the entire project site)

A. Regulated Projects include

B. Regulated Projects do not include

8-5-10-2: MINIMUM PERFORMANCE REQUIREMENTS:

A. Performance Requirement No. 1: Site Design and Runoff Reduction

B. Performance Requirement No. 2: Water Quality Treatment

C. Performance Requirement No. 3: Runoff Retention

D. Performance Requirement No. 4: Peak Management

E. Performance Requirement No. 5: Special Circumstances




These types of amendments were provided to ensure that project applicants understood the types of new and redevelopment projects that would trigger the performance requirements and the performance requirements that were connected to various projects. While the triggers or thresholds for new and redevelopment projects were identified in local codes, the design of the stormwater practices was included within the municipality's stormwater design manual.

Stormwater Management Municipal Code Chapter

8-5-10-3: ALTERNATIVE COMPLIANCE:



Alternative Compliance refers to Water Quality Treatment, Runoff Retention and Peak Management Performance Requirements that are achieved off-site through mechanisms such as developer fee-in-lieu arrangements and/or use of regional facilities. Alternative Compliance may be allowed under circumstances of technical infeasibility identified in the Stormwater Management Manual, or equivalent as approved by the director.



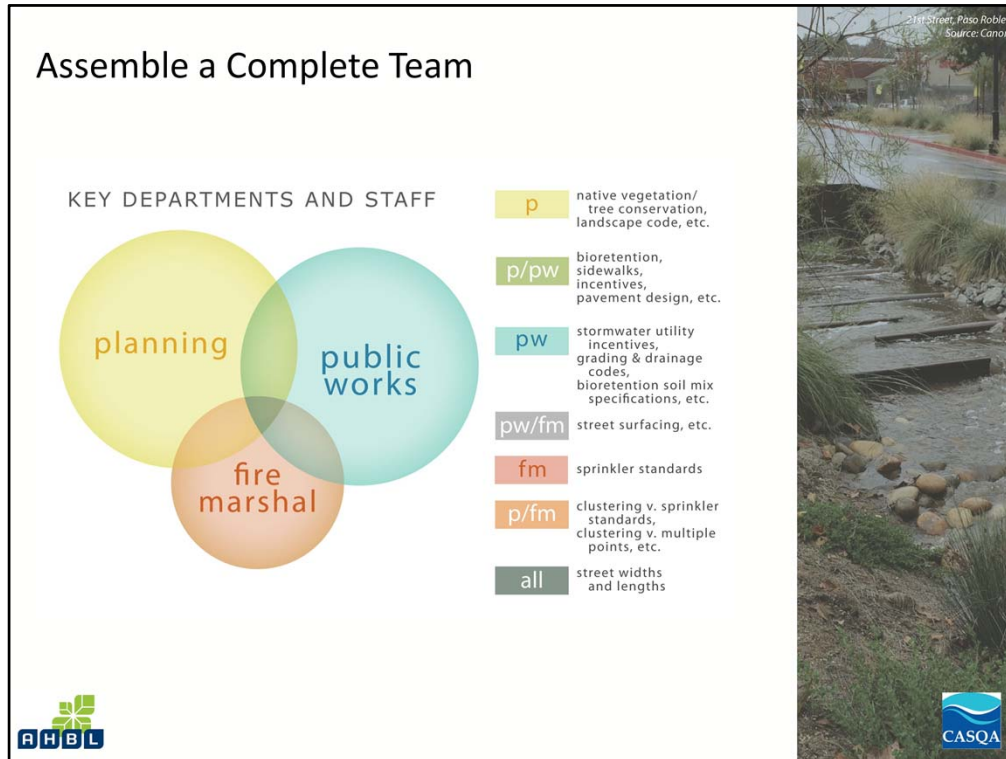


ADOPTION PHASE SCHEDULE, TIPS AND RESOURCES

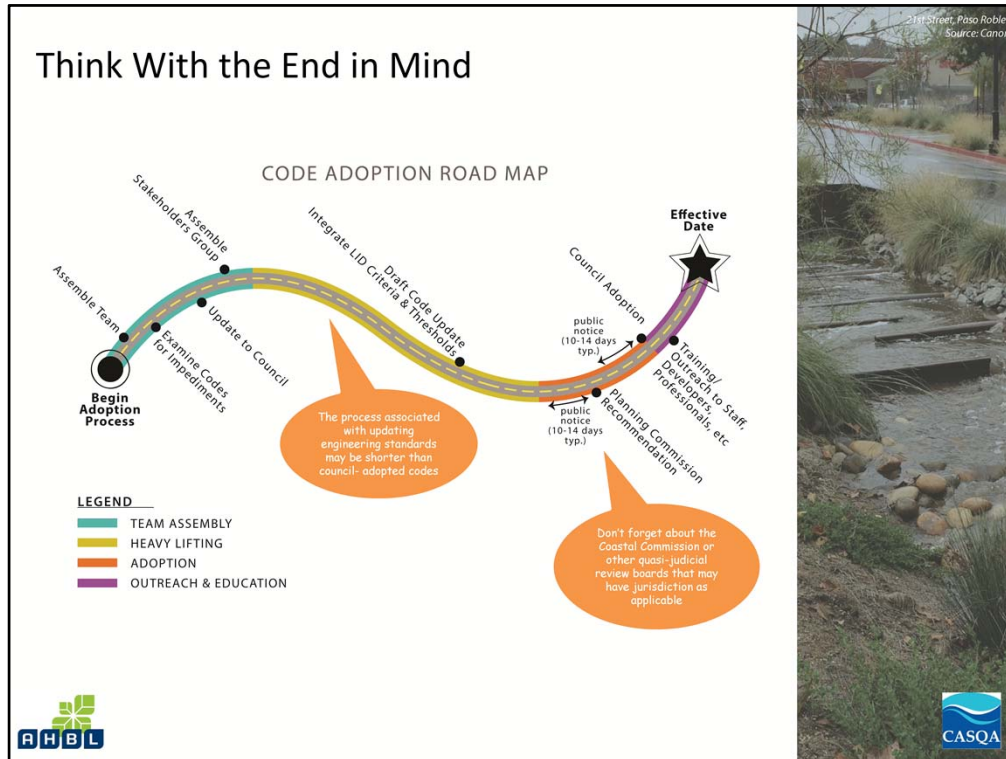
The following slides document some of the tips that that the CASQA team learned related to taking the LID code amendments through the adoption finish line.



When considering adoption, it is always important to think with the end in mind. The following slides represent key lessons and tips to guide you through the adoption phase.



We like to call this the “group hug” slide and it is important because most development standards have at least two departments that will share an interest in the outcome of the potential amendments. Understanding the relationships between departments and their interest in various amendments to codes and standards will provide for better written standards and less headache during the adoption phase.



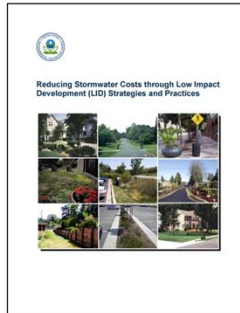
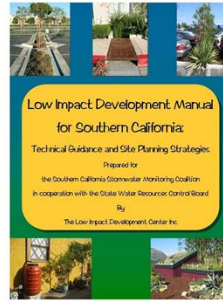
As you develop an adoption schedule, you will want to make sure that you leave adequate time for:

- Review of existing codes
- Early input by stakeholders and other members of the public
- Preparation of code amendments and/or new code sections
- Public review
- Adoption


Collect White Papers & Staff Reports

When properly used, white papers, technical documents, and well written staff reports can allay concerns over new methods of managing stormwater thereby easing the adoption process.

White papers and other technical documents can be excellent sources for the findings of fact that legislative bodies make when adopting new ordinances.



We have found that technical reports and white papers are excellent resources for making local decision makers more comfortable with the changes to codes and standards. Cost studies and other evaluations of the economic impact to the municipality for long-term maintenance of LID practices are typically the most desired resources.



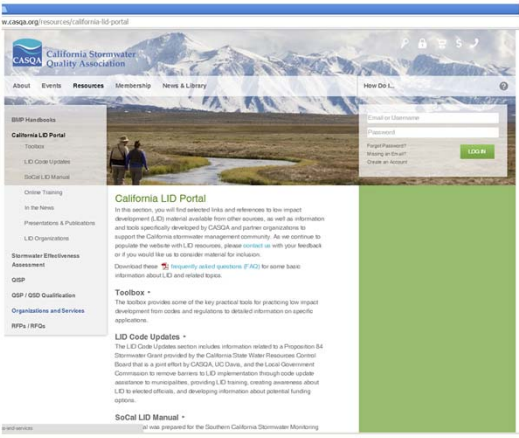
Elmer Avenue, Los Angeles
Source: Central Coast LID.org



RESOURCES

CASQA LID Portal

- Toolbox containing case studies and technical assistance resources
- LID Code Updates – Gap analysis template tools and examples of code updates
- Online Training
- Presentations & Publications
- Gap analysis templates and instructions

★ Examples of code language and drawings prepared for first round participants can be found at:
<http://www.CaliforniaLID.org>



Finally, there are a variety of resources from local cities and counties that have already done what you are considering doing.

The California LID Portal contains all of the resources from this project as well as the work of many other municipalities. Bookmark this site because there are updates occurring all of the time.

Thank you.