REMOVING BARRIERS TO
LOW IMPACT
DEVELOPMENT
IN LOCAL & STATE
CODEx
LESSONS LEARNED AND TIPS AND TRICKS
California Stormwater Quality Association
- Daniel Apt, CPESC, CPSWQ; Michael Baker International
- Darla Inglis, PhD; Central Coast Low Impact Development Initiative
- Wayne Carlson, AICP, LEED AP; AHBL, Inc.
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
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
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.
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.

- 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
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.
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.

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.
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!
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
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 was an identified requirement 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.
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.
### Gap Analysis

<table>
<thead>
<tr>
<th>Objective</th>
<th>Code Reference and Summary of Existing Standards</th>
<th>Impediment / Opportunity to improve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect Vegetation and Cardiovascular Trees</td>
<td>2019 California Green Building Code Appendix D: Nonresidential Commercial Trees: On-site trees shall be selected and planted consistent with the provisions of the following:</td>
<td>For projects requiring design review, the reviewer shall determine whether the plan allocates the minimum amount of vegetation removal to create the buildable site. Other application types or exceptions may apply design review findings. The City adopts the California Green Building Code which encourages a variety of tree species, including at least 90% native. Native vegetation on property or new vegetation shall be consistent with this chapter. The City requires the planting of native trees on new developments.</td>
</tr>
</tbody>
</table>

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

---

[City of Municipal Landscape Gap Analysis Tool]
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.
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.
Discussion of opportunities to disconnect rooftop runoff from a permittee’s public stormwater system.
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.
Continued discussion of the questions that identify opportunities to integrate green stormwater practices into local cluster development standards.
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.
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.
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.
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.
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.
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.
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
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.
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.
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.
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
Maintaining consistency with adopted plans was an important element of our work.
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.
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 slide 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.
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
This slide depicts curb bulb outs. In addition to the stormwater benefits of these designs, these facilities can also provide important traffic calming functions.
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.
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.
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).
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.
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.
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.
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.