

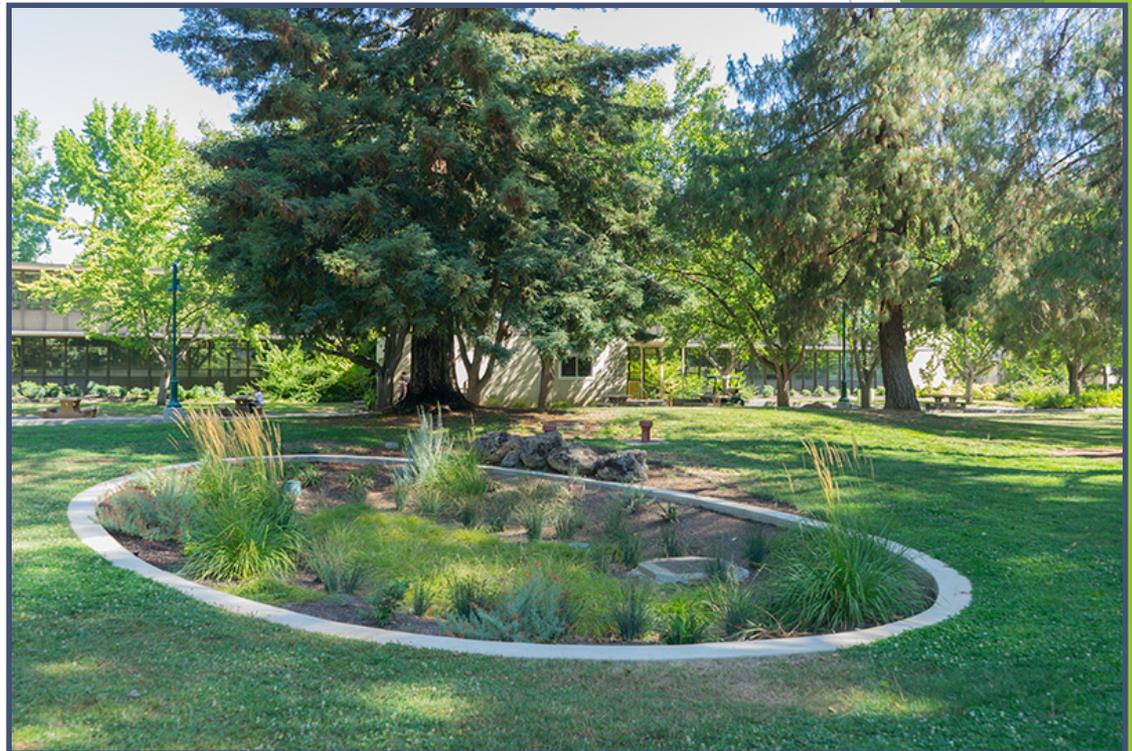
# Retrofitting Sacramento State Campus with Low Impact Development Stormwater Control Measures: A Local Project with Regional Intent

Kevin Murphy, P.E.  
Joel Shinneman, EIT  
OWP at Sacramento State



# Project Highlights

- ▶ Setting
- ▶ Incentives and Opportunities
- ▶ LID Palette
- ▶ Retrofit Stories
- ▶ Performance
- ▶ Outreach



# Setting

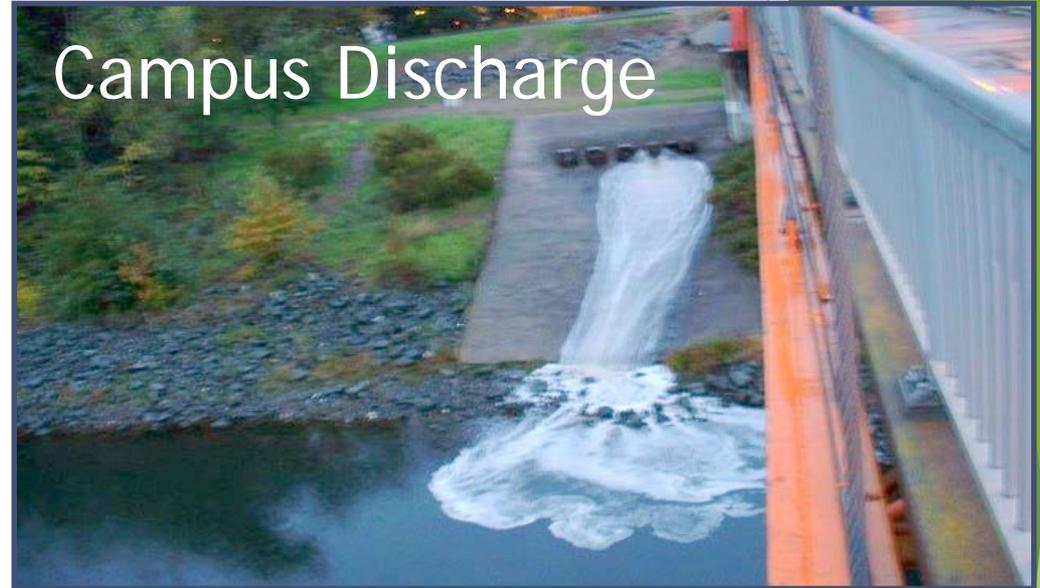


# Setting



American River

# Setting



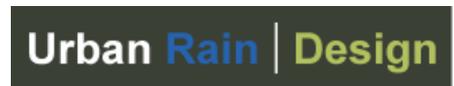
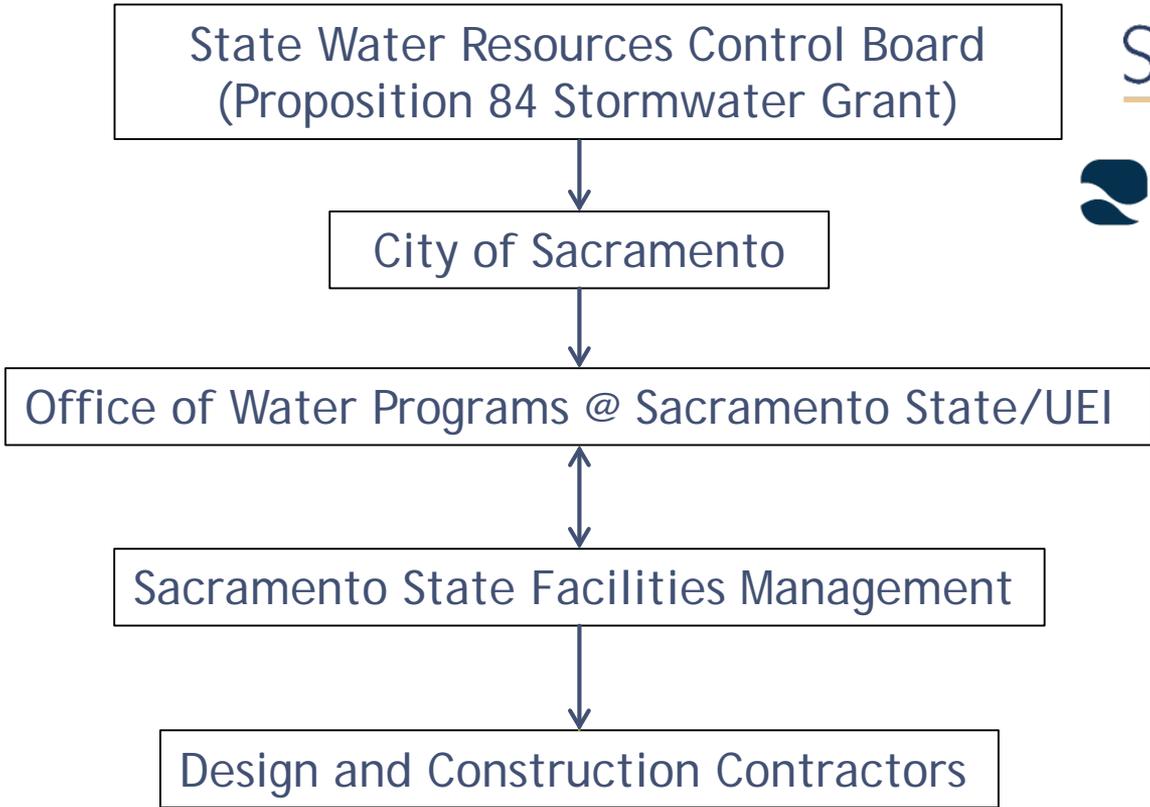
# Incentives and Opportunities

- ▶ Sac State
  - ▶ Phase II Permit
  - ▶ 20 year Master Plan
  - ▶ Living Lab Vision
- ▶ State Water Board
  - ▶ Prop. 84 Stormwater Grant Program: LID
- ▶ Sacramento Stormwater Quality Partnership
  - ▶ Phase I Permit
  - ▶ New LID Standards

# Incentives and Opportunities



- Dry Creek Conservancy
- American Basin Council of Watersheds
- County of Sacramento



# Incentives and Opportunities: Local and Regional Benefits

- ▶ Water Quality & Environmental
  - ▶ Protect river's beneficial uses
  - ▶ Comply with stormwater permits
- ▶ Water Supply
  - ▶ Recharge groundwater
  - ▶ Reduce irrigation
- ▶ Community
  - ▶ Improve campus aesthetics/connectivity
  - ▶ Support campus education and research
  - ▶ Create a regional demonstration site
  - ▶ Foster watershed-scale alliances

# LID Palette: Sites



# LID Palette: Sites



# LID Palette: Parking Lots

## ► Bioretention Planters



# LID Palette: Parking Lots

- Bioretention planters



# LID Palette: Parking Lots

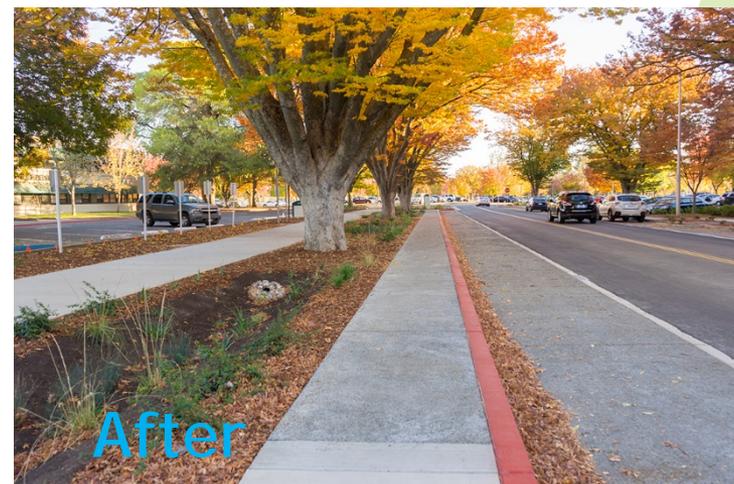
- Curb cuts, Infiltrating bioswale



Curb cuts

# LID Palette: Streets

## ► Green Street



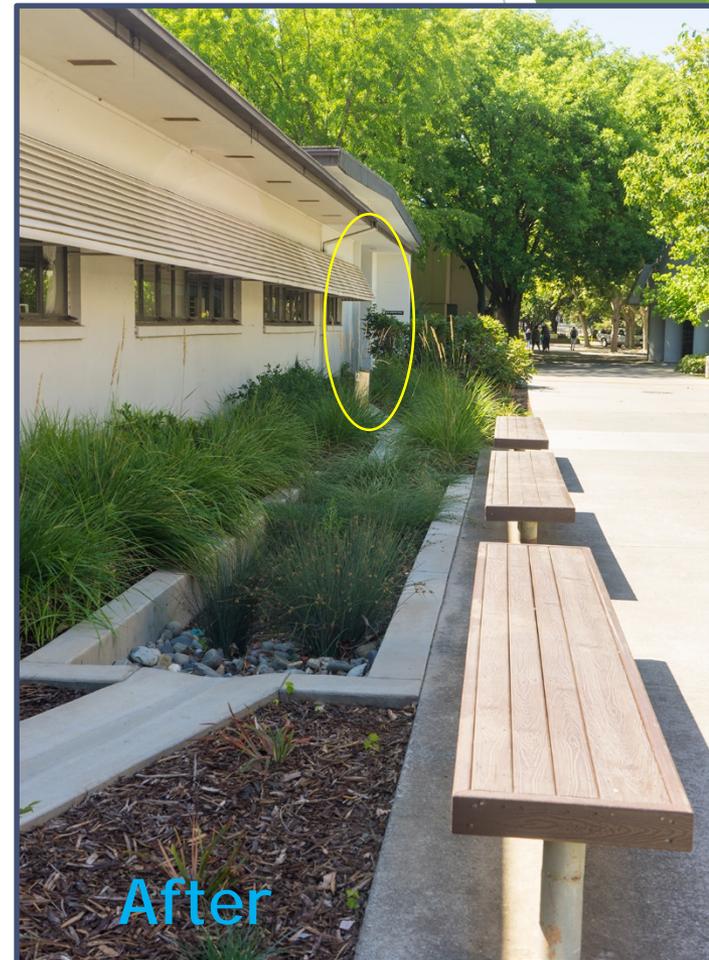
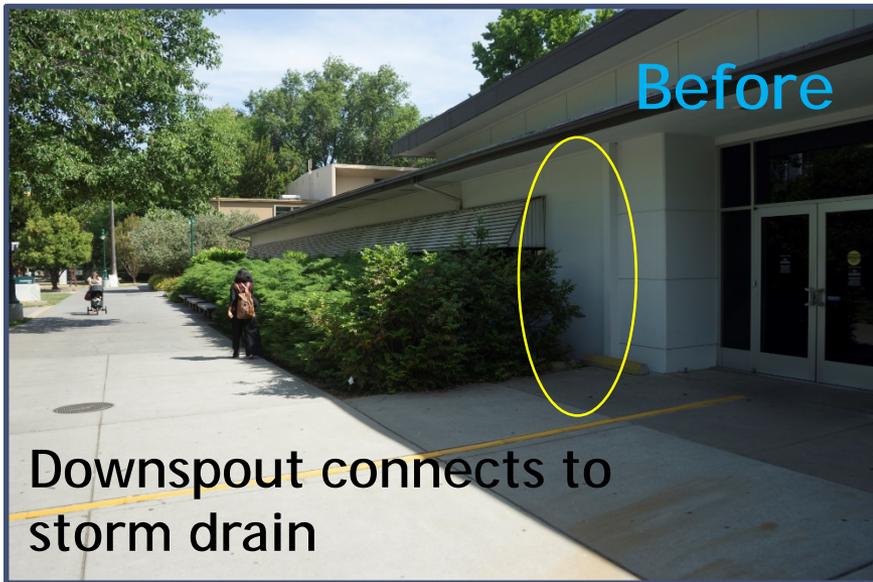
# LID Palette: Streets

- Curb cuts, rain gardens



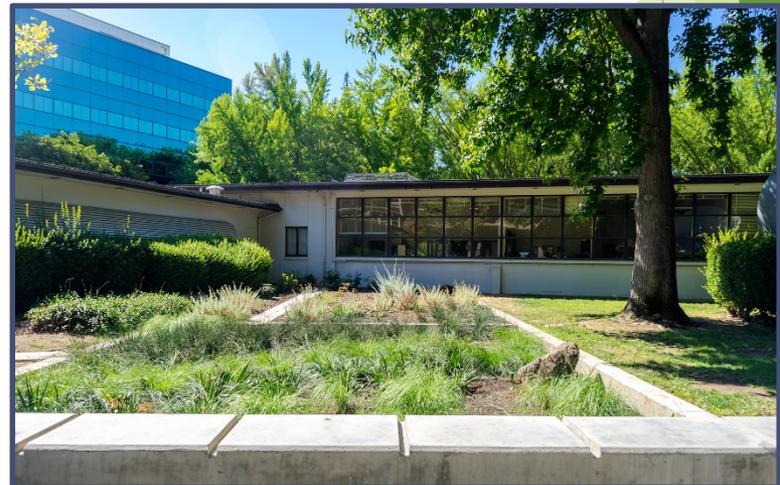
# LID Palette: Roof Tops

- Downspout Disconnect, Flow-Through Planter



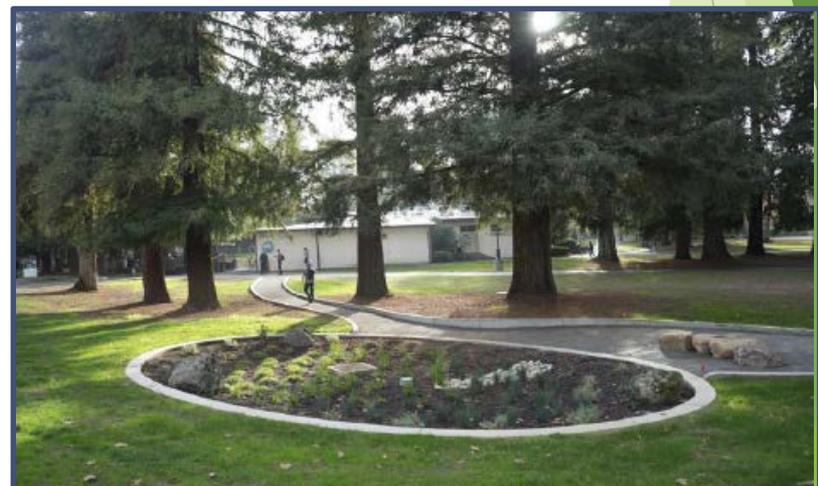
# LID Palette: Roof Tops

- Downspout Disconnect, Rain Gardens, Porous Pavement

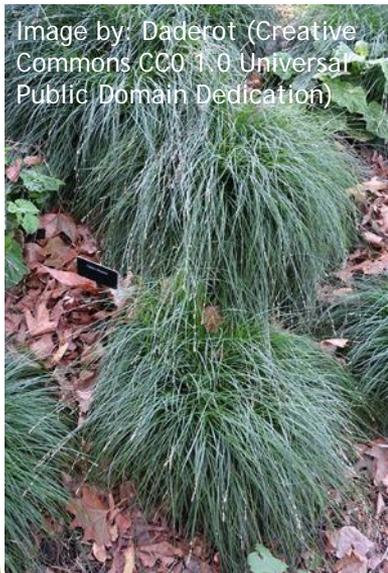


# LID Palette: Existing Landscape

- Raised inlets, Rain gardens, Porous pavement



# LID Palette: Plants



# Retrofit Stories

- ▶ Preserving existing infrastructure
- ▶ Improving the landscaping
- ▶ Integrating porous pavement into streets
- ▶ Building next to a structure
- ▶ **Compatibility with future site plans**
- ▶ Underground surprises
- ▶ **Changing conventional construction practices**
- ▶ **Fitting into existing drainage system**
- ▶ **Minimizing the loss of parking stalls**
- ▶ **Fitting into existing topography**
- ▶ Imperfections in existing grades
- ▶ Infiltration issues
- ▶ Making lawns greener
- ▶ **Saving trees**

# Retrofit Stories

- ▶ Compatibility with Future Site Plans
  - ▶ Campus 20 year Master Plan



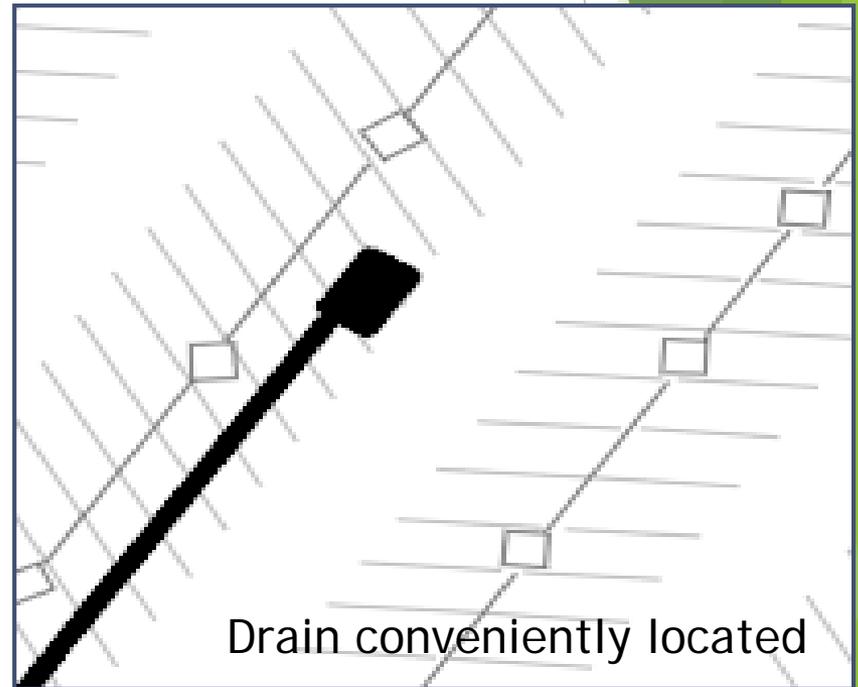
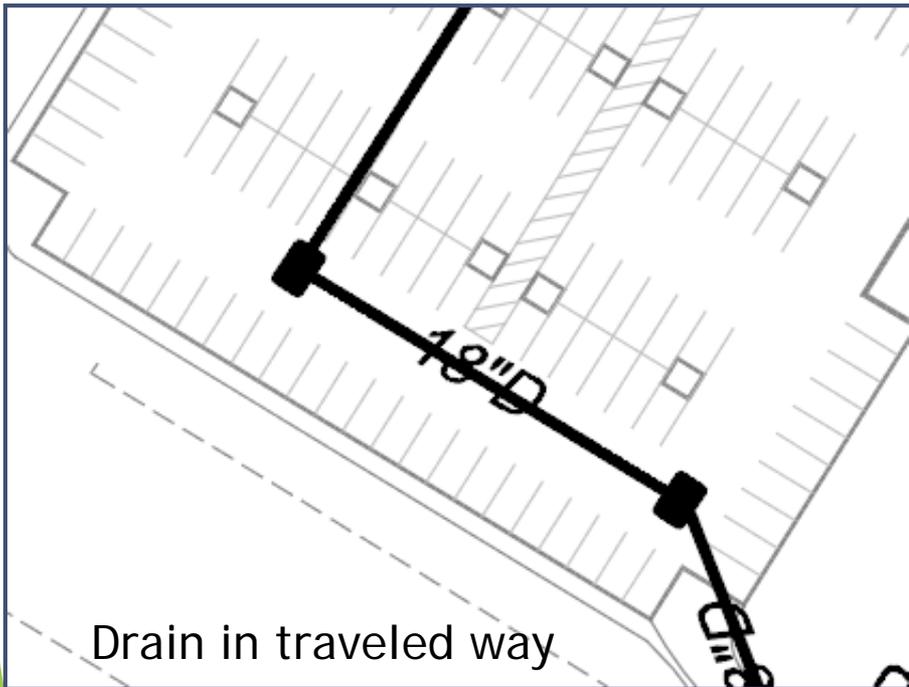
# Retrofit Stories

- ▶ Changing conventional construction practices
  - ▶ Keep heavy equipment off



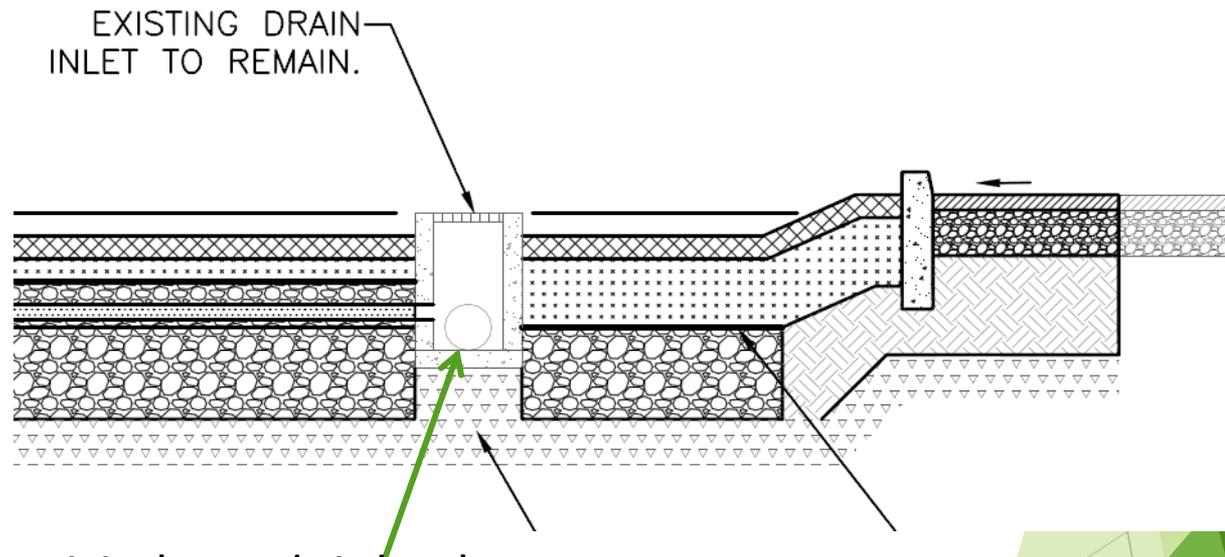
# Retrofit Stories

- ▶ Fitting into the existing drainage system
  - ▶ Horizontal



# Retrofit Stories

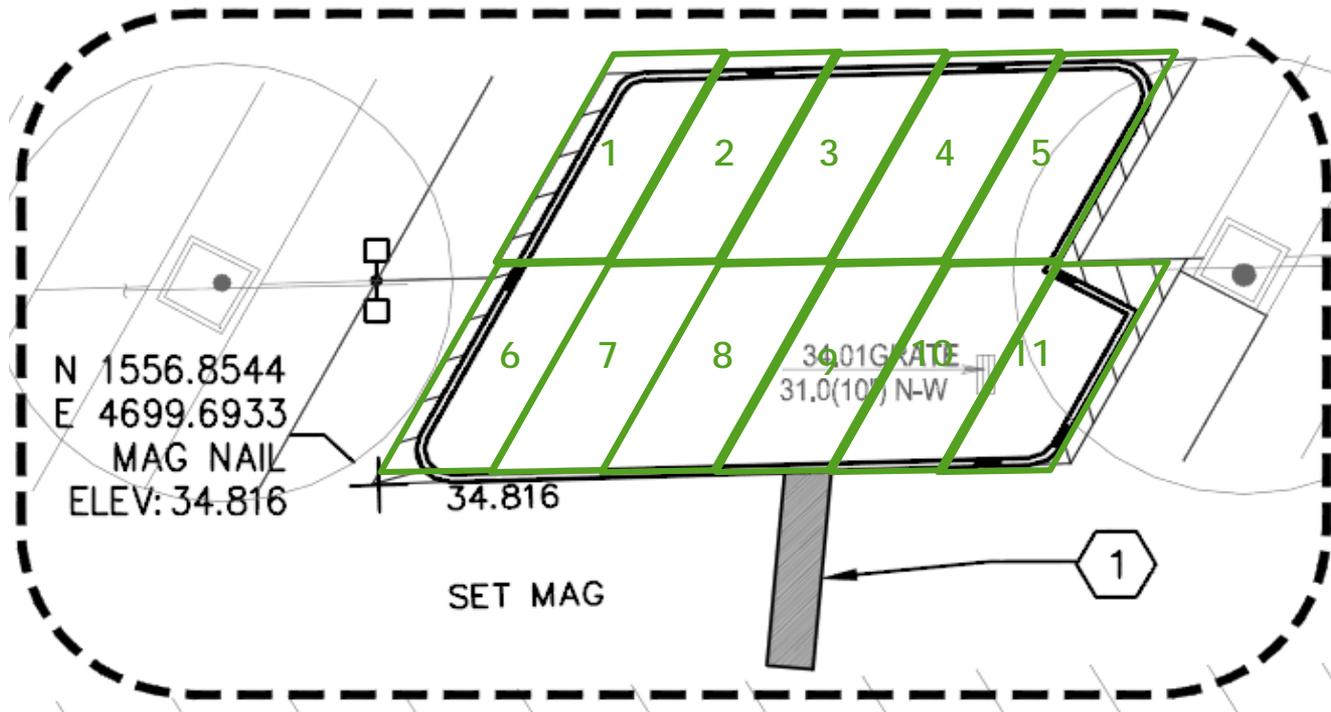
- ▶ Fitting into the existing drainage system
  - ▶ Vertical



Existing pipe invert to be maintained  
(can limit depth of bioretention media)

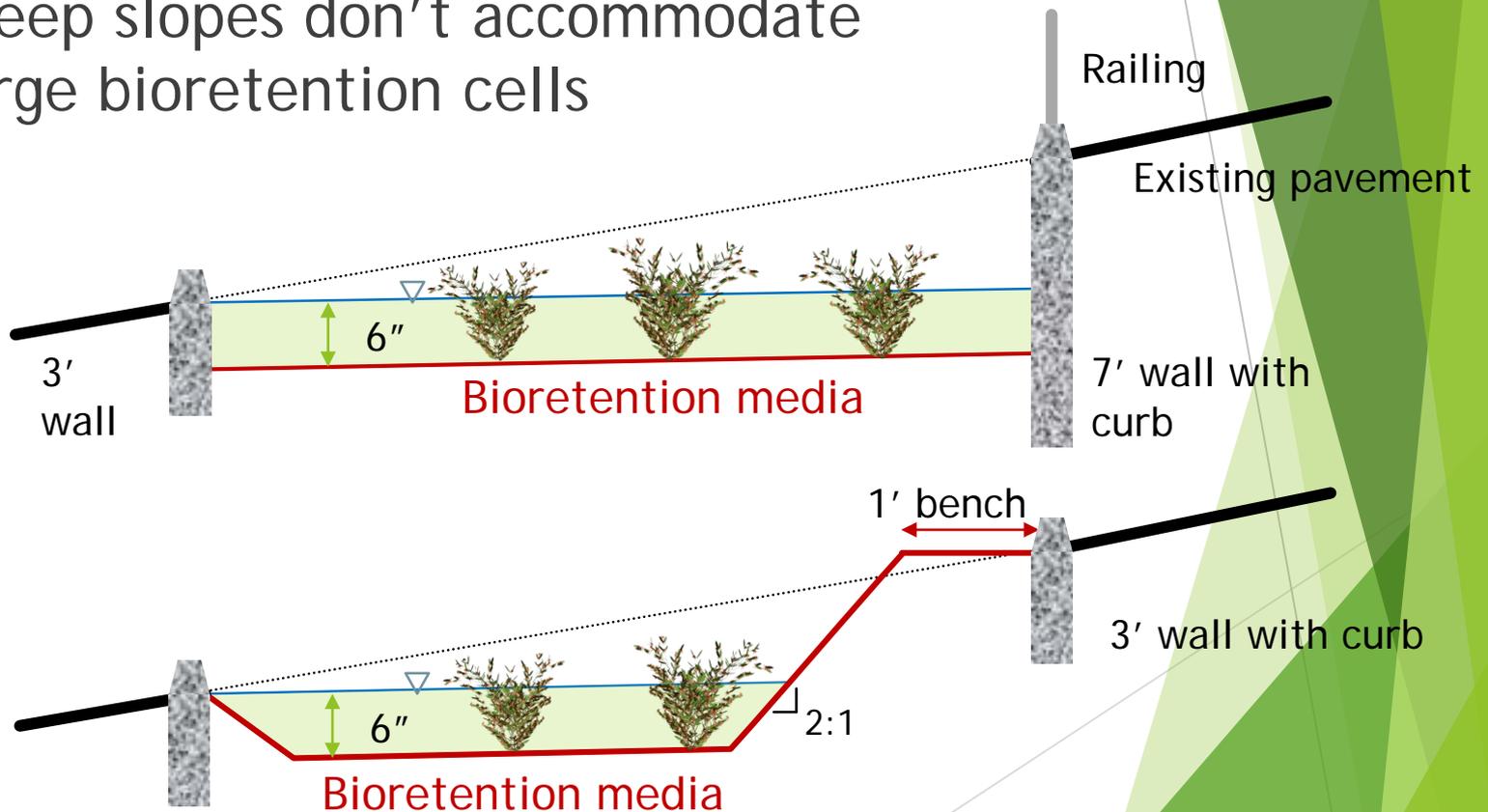
# Retrofit Stories

- ▶ Minimizing loss of parking stalls
  - ▶ A-symmetric geometry



# Retrofit Stories

- ▶ Fitting into existing topography
  - ▶ Steep slopes don't accommodate large bioretention cells



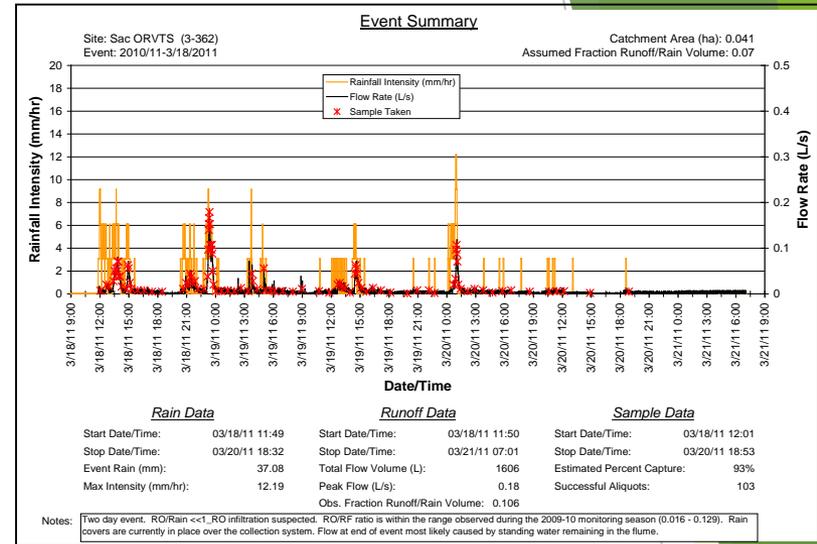
# Retrofit Stories

- ▶ Saving trees



# Performance

- ▶ Measure Flows
- ▶ Analyze Water Quality
- ▶ Data Evaluation



# Education and Outreach

## Low Impact Development (LID) Stormwater Management

### Parking Lot 7 South Bioretention Planter

Bioretention planters are depressed landscapes into which runoff is directed and allowed to pond, filter, and infiltrate. They consist of a few inches of parking depth underlain by a layer of coarse-graded soils (amendment soil) and then a layer of gravel storage. The ponding zone allows for temporary storage of runoff and promotes infiltration into the bioretention soils.

A raised drain line is provided within the planter to serve as an overflow discharge path in case the runoff exceeds the planter's design capacity. The overflow inlet is connected to the existing storm drain system.

**Campus Map LID Locations**

TAKE THE TOUR WITH OUR WEB APP [www.lid.csus.edu](http://www.lid.csus.edu)

**Vegetation used at this site**  
This planter includes vegetation that was specifically selected to summer during periods of drought and still tolerate temporary inundation during the rainy season. The plants promote water infiltration and therefore can't cause runoff volume reductions.

Take the self-guided walking tour with your mobile device, or a virtual tour by desktop:  
[www.owp.csus.edu/lid](http://www.owp.csus.edu/lid)

## SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS STEM Lecture Series

### Stormwater as a Resource: Sustainable Projects at Sacramento State

*John Johnston, P.E., Ph.D.*  
Professor, Civil Engineering  
California State University, Sacramento

*Maureen Kerner, P.E.*  
Office of Water Programs  
California State University, Sacramento

[www.csus.edu/stem](http://www.csus.edu/stem)

Free Community Lecture → Free Parking (Display Permit on Back of Card)  
**Thursday, February 18, 2016 × 6 p.m.**  
**University Union, Redwood Room**

**SACRAMENTO STATE**  
Center for STEM Excellence



The State Journal A2 | News

## Sustainability to boost water collecting efforts with drain

### LID project plans to redirect rain from campus to river

By *Allyssa Garcia* **Staff Writer**

Sustainability at Sacramento State is working with the LID project to reduce 499,000 cubic feet of runoff per year. The project is designed to filter the amount of runoff from campus to the American River. Stormwater is captured at planting and discharge. The project includes an extensive education and outreach campaign for stakeholders.

Sacramento resident Kristina Dutton, the sustainability and operations manager for Sacramento State, said the LID project is a good example of how to reduce runoff.

**SACRAMENTO STATE**  
Office of Water Programs

Water Programs SACRAMENTO STATE

**Campus LID**

Low Impact Development Stormwater Management at Sacramento State

Capturing Stormwater

0 Items

- Home
- Operator Training
- Research
- Stormwater Training
- Campus LID Project
  - Construction Log December 7, 2015
  - Regional LID Conference November 4, 2015
  - Construction Log September 25, 2015
  - Construction Log August 25, 2015
  - Construction Log August 11, 2015
- Upcoming Events
- About
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# Special Thanks



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<https://www.owp.csus.edu/lid/>

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