

DISCUSSIONS ON LOW IMPACT DEVELOPMENT BIOSWALES AND BIORETENTION

4:00 - 4:45

INTRODUCTION:
TIM SMITH

NEW BIOSWALE REGULATIONS:
STEPHANIE GAINES

BIORETENTION DESIGN BMP'S:
JIM KUHLEN

4:45-5:30

BANNOCK STREET PILOT PROJECT:
MERRILL TAYLOR

HARBOR DRIVE PROJECT CASE STUDY:
MARTY POIRIER

SCE PROJECT CASE STUDY:
MIKE SULLIVAN

5:30-6:00

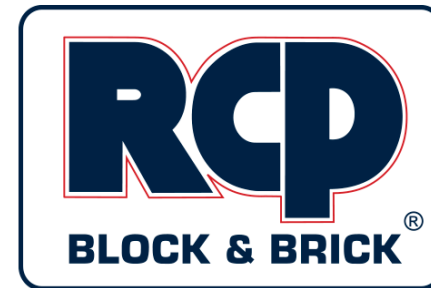
QUESTIONS AND COMMENTS
PANELISTS AND AUDIENCE PARTICIPATION

6:00-7:00

SOCIAL NETWORKING HOUR



THANK YOU TO THE FOLLOWING EVENT SPONSORS:



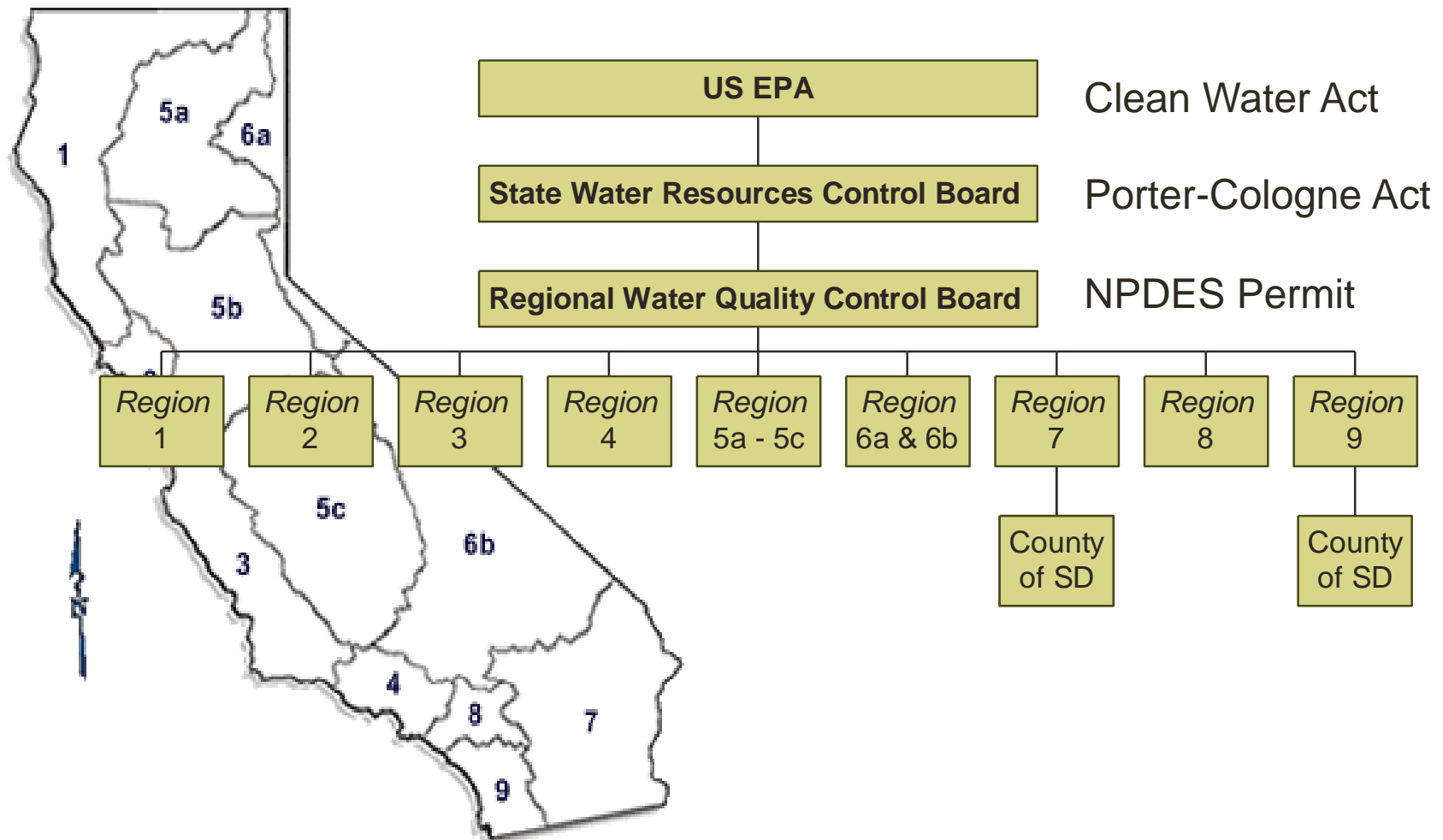
Municipal Stormwater Permit

Update & Timeline

Presented by Stephanie Gaines
County of San Diego
Watershed Protection Program

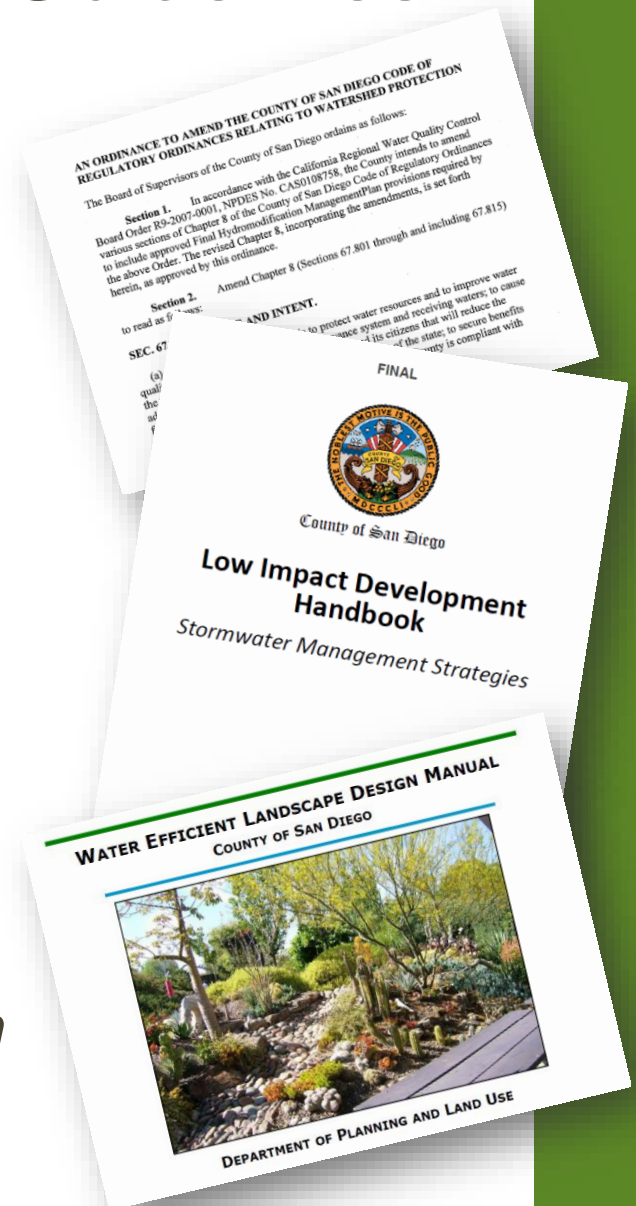


Regulatory Framework



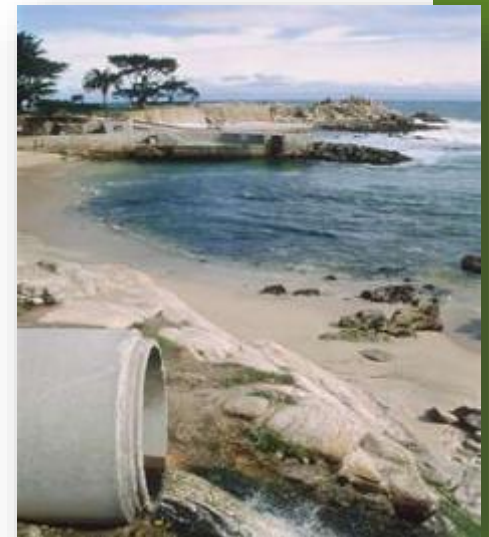
County Regulations and Guidelines

- Watershed Protection Ordinance (WPO)
- Landscape Ordinance & Water Efficient Landscape Design Manual (WELDM)
- LID Handbook and Fact Sheets
- Best Management Practice (BMP) Design Manual
 - *Standard Urban Stormwater Mitigation Plan (SUSMP)*



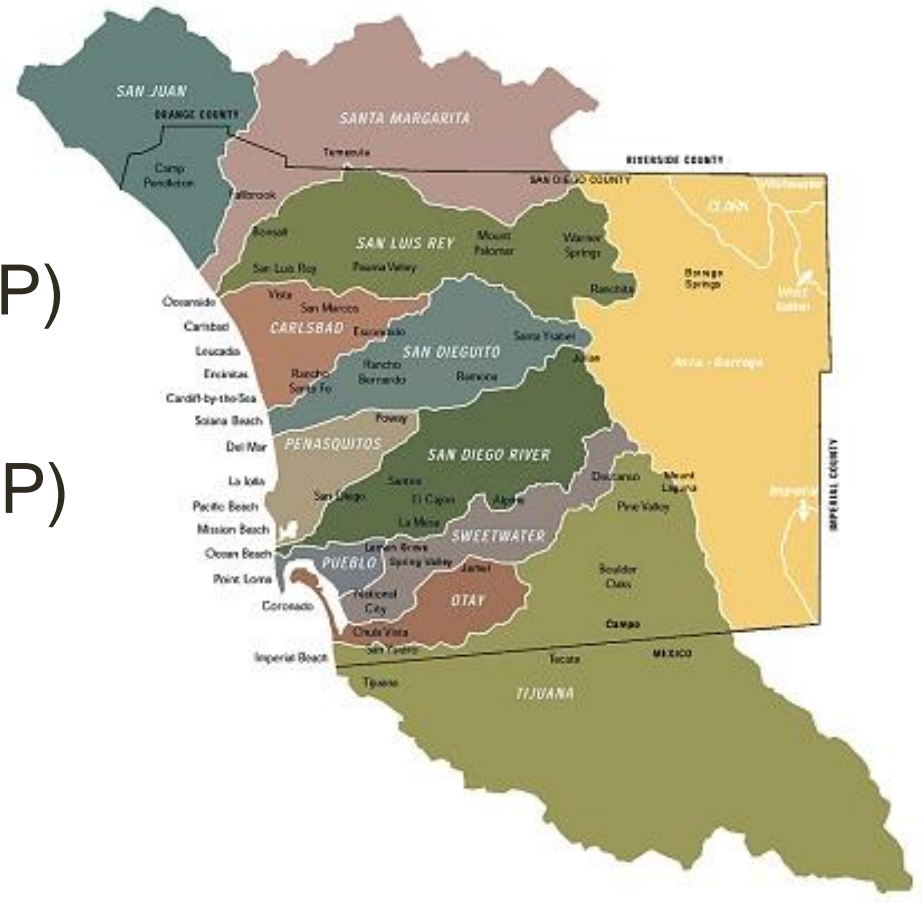
Municipal Storm Drains

- Municipal **Separate** Storm Sewer System = MS4
- Not Connected!



New Requirements

- Water Quality Improvement Plan (WQIP)
- Jurisdictional Runoff Management Plan (JRMP)
- Best Management Practice (BMP) Design Manual
- **New Requirements & Prohibitions**



New Development Regulations



Development Planning

- Priority Development Project Categories
- **Retention**
- Hydromodification
- Alternative Compliance

Priority Development Projects (PDPs)

Categories	Previous Permit	2013 Permit
Residential	>10-units	10,000 sq. ft.
Commercial, Industrial	>1 acre	10,000 sq. ft.
Driveways	Exempt	Added: 5,000 sq. ft.



Section E.3.b.(1)

New PDP Exemptions

- New Sidewalks, Bike Lanes, Trails using LID
- Redevelop Alleys, Roadways as “Green Streets”

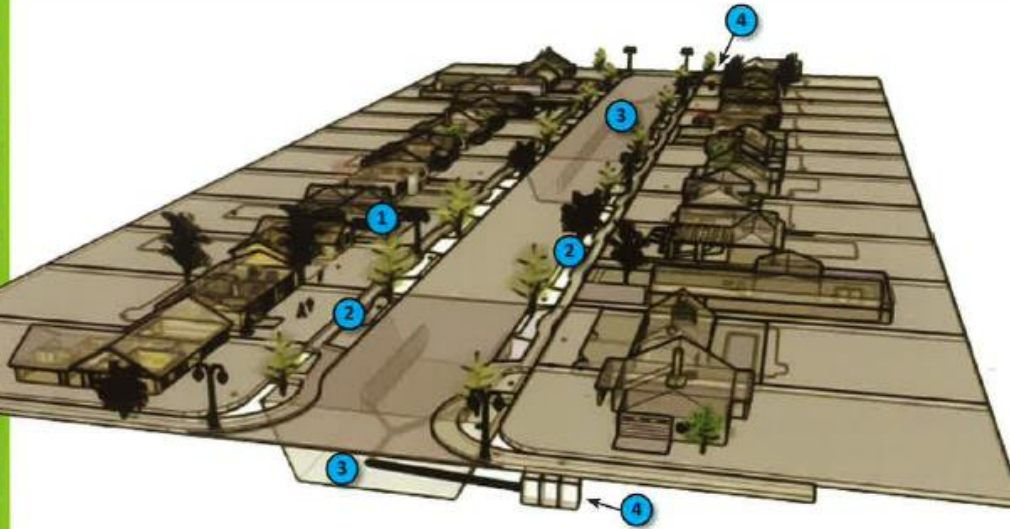


Green Street Example: Elmer Avenue



Example: Elmer Avenue & Paseo

RIGHT-OF-WAY & STREET RETROFIT



HIGHLIGHTS

- Demonstrates Low Impact Development strategies on public lands
- Reduces pollution that is sent to the Los Angeles River from urban runoff
- Captures and treats runoff from 40 acres of residential landuse
- Annually deposits 16 acre-feet of groundwater recharge
- The first block in Los Angeles with street lights off the grid.

1. SOLAR STREET LIGHTING

The lights are powered by solar panels and use LED technology to save 1,730 kW of power each year.



2. PARKWAY BIO-SWALES

The parkway bio-swale uses plants and soil to capture urban runoff, breakdown pollutants and provide habitat for animals.



3. INFILTRATION GALLERY

The two underground infiltration galleries capture runoff from the upstream landuses. The galleries are capable of infiltrating 6,575 gallons of water every five minutes for groundwater recharge.



4. CATCH BASINS

The two catch basins (one on each end of the block) divert water from the street to the infiltration galleries. They reduce pollutants from entering the infiltration galleries by settling out sediments and filtering trash.

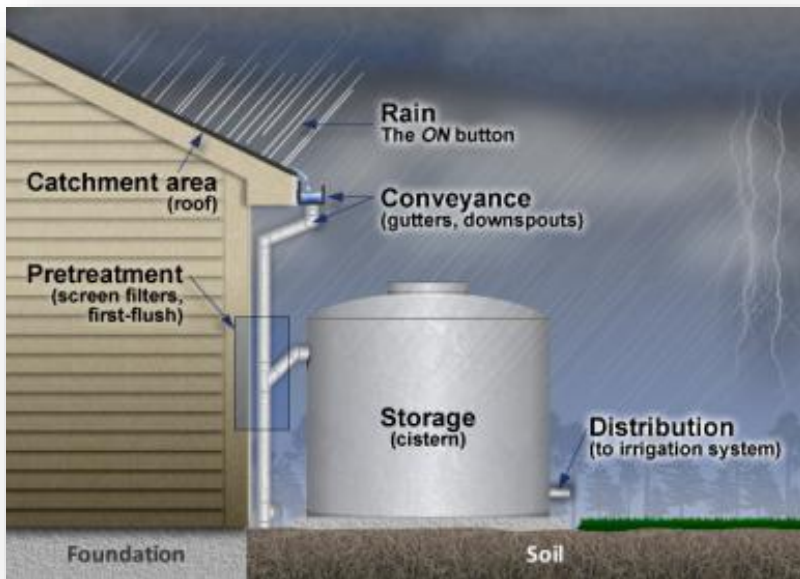


Example: Elmer Avenue & Paseo



New Retention Standard

- PDP to Retain 85th % storm event
- Retain: Intercept, Store, Infiltrate, Evaporate



Non-Stormwater Discharges



Offsite Alternative Compliance

Jurisdictional Alternative Compliance Program

- Determine Greater Water Quality Benefit
- Program(s) May Allow Implementation or In-lieu Fee
- Voluntary Agreement Between Jurisdiction/Developer
- Built Within 4 Years Of First PDP Occupancy



Regional Example: South Los Angeles Wetlands



Distributed Example: Marsh Park



Public-Private Partnerships

Private Investment in Stormwater Management



Sustainable Landscapes Program

- Prop 84 IRWM Grant Project
- Turf Replacement
- Resource Management
 - “Conservation, Permeability, Retention”
 - “New Norm”



Resources



project clean water

Project Clean Water website:

www.projectcleanwater.org



***County of San Diego
Watershed Protection Program:***

<http://www.sandiegocounty.gov/dpw/watersheds.html>



Stephanie Gaines

Stephanie.Gaines@sdcounty.ca.gov

858-694-3493

Jim Kuhlken

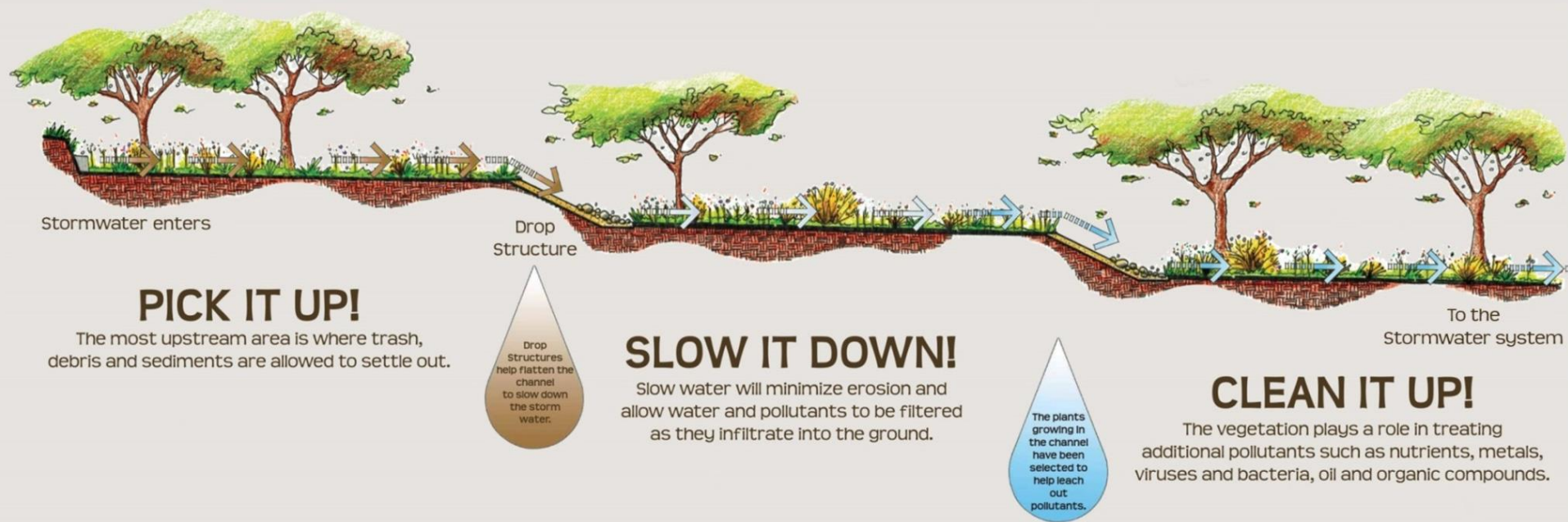
Principal of the Landscape Architecture Division

RICK ENGINEERING COMPANY

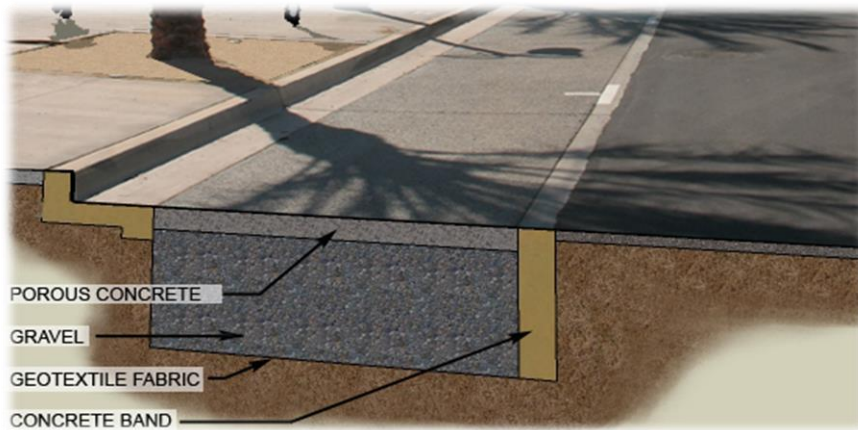
(RICK) is a full-service, multi-disciplinary planning, design, and engineering firm with more than 60 years of local San Diego experience.



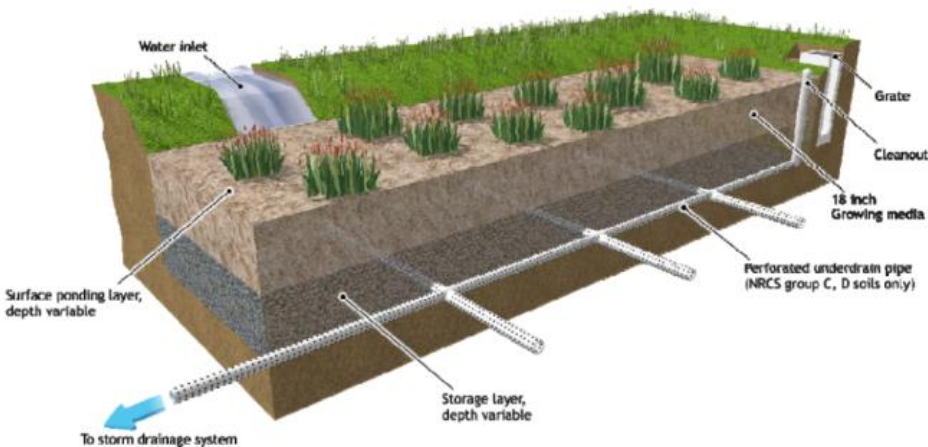
DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS
BIORETENTION DESIGN BMP



DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS
BIORETENTION DESIGN BMP



Pervious Pavement

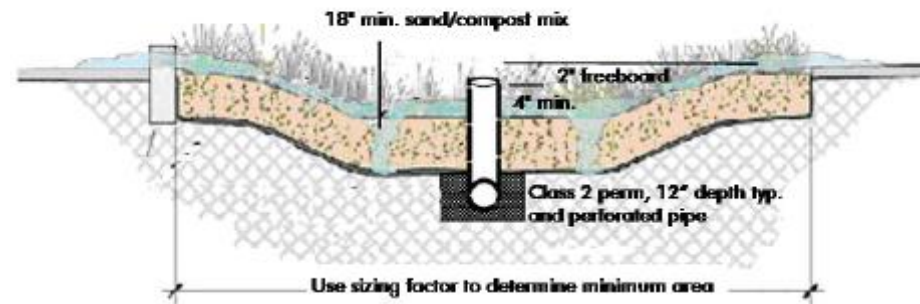


BMP Sizing Calculator Methodology "Bioretention" Facility
(treatment plus flow control)



Figure 1-6. Cistern with Bioretention BMP Example Illustration

"Cistern with Bioretention" or "Bioretention Plus Cistern"
(treatment-only or treatment plus flow control)



Countywide Model SUSMP "Bioretention" Facility
(treatment-only)

Bioretention with Flow Control



Bioretention in Island



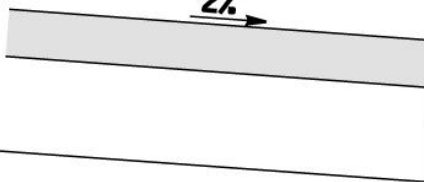
Bioretention with Infiltration



Bioretention in Hardscape



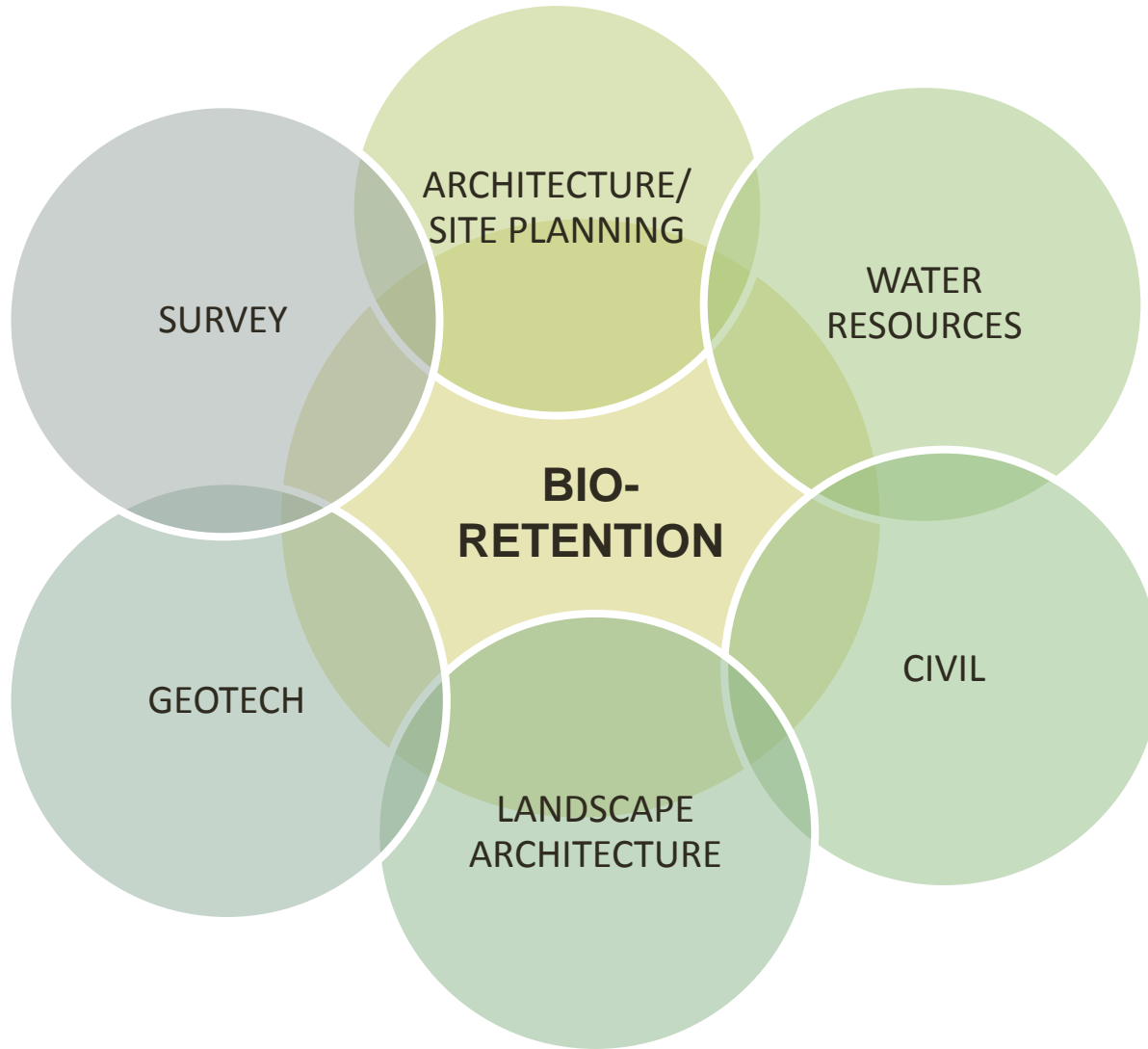
DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS
BIORETENTION DESIGN BMP



Bioretention Basin Plan

DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS
BIORETENTION DESIGN BMP

MULTI-DISCIPLINE SITE



DISCUSSIONS ON LOW IMPACT DEVELOPMENT SOLUTIONS
BIORETENTION DESIGN BMP

COMMON ISSUES, PITFALLS & SOLUTIONS

What have we learned?

Soil Type

- ~~70% Sand~~
- ~~30% Compost/Sandy Loam~~

Soil Replacement

- long term, in place infiltration rate of at least 5 inch per hour
- ~~Compact 85% - 90%~~
- Appropriate plant material
- Separate irrigation



COMMON ISSUES, PITFALLS & SOLUTIONS

What was developed?

Soil Type (by weight)

- 65% Sand
- 20% Sandy Loam
- 15% Compost

Soil Placement

- long term, in place infiltration rate of at least 5 inch per hour (for Flow-Based design)
- Six (6) to twelve (12) inch lifts and lightly watered. No mechanical compaction.
- Appropriate plant material
- Separate irrigation



OPERATIONS & MAINTENANCE

Routine Landscape Maintenance

- Trash removal
- Vegetation pruning
- Mulch replenishment (~annually)
- Visual inspections of inlets/outlets/surface ponding

Storm Water Maintenance Agreements

- Run with the land, between owner (i.e. – HOA, POA, etc.) and public agency

Annual Verification of Treatment Control BMPs (TC-BMPs)

- Notice from City for sign-off that inspection and maintenance has occurred
- Enforcement if not installed or maintained adequately

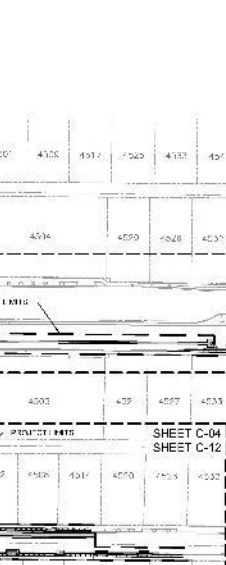
Load Reductions Through LID Green Streets: Bannock Ave

Merrill Taylor, P.E.

Goals of the Project

- MS4 Compliance
- Pollutant Reduction
 - Bacteria
 - Metals
 - Nutrients
 - Toxicity
 - Turbidity
- Pilot Project
 - Gather valuable information for standardizing LID practices within the City of San Diego
- Streetscape Enhancement



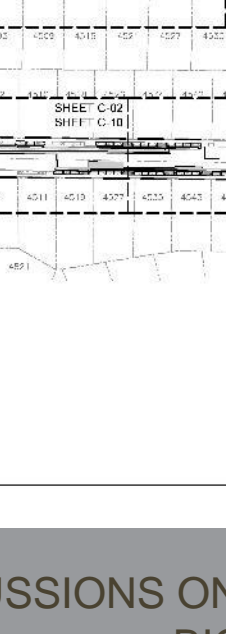


NC01-8

- 1 FOR IT IMPROVEMENT PLANS, SEE 5 FTS COMBUSING 00.
- 2 FOR INTERNAL INFORMATION, SEE 5 FTS COMBUSING 012.
- 3 FOR INFORMATION PLAN AND FOR IT, SEE 5 FTS COMBUSING 012.
- 4 FOR TEMPORARY TRAFFIC CONTROL INFORMATION, SEE 5 FTS COMBUSING 012.

ANTHONY
THREE PHASES
IN TWO
CITY
CLINT. AND
-ALL

Difficult (Hardscape):



Difficult (Trees):

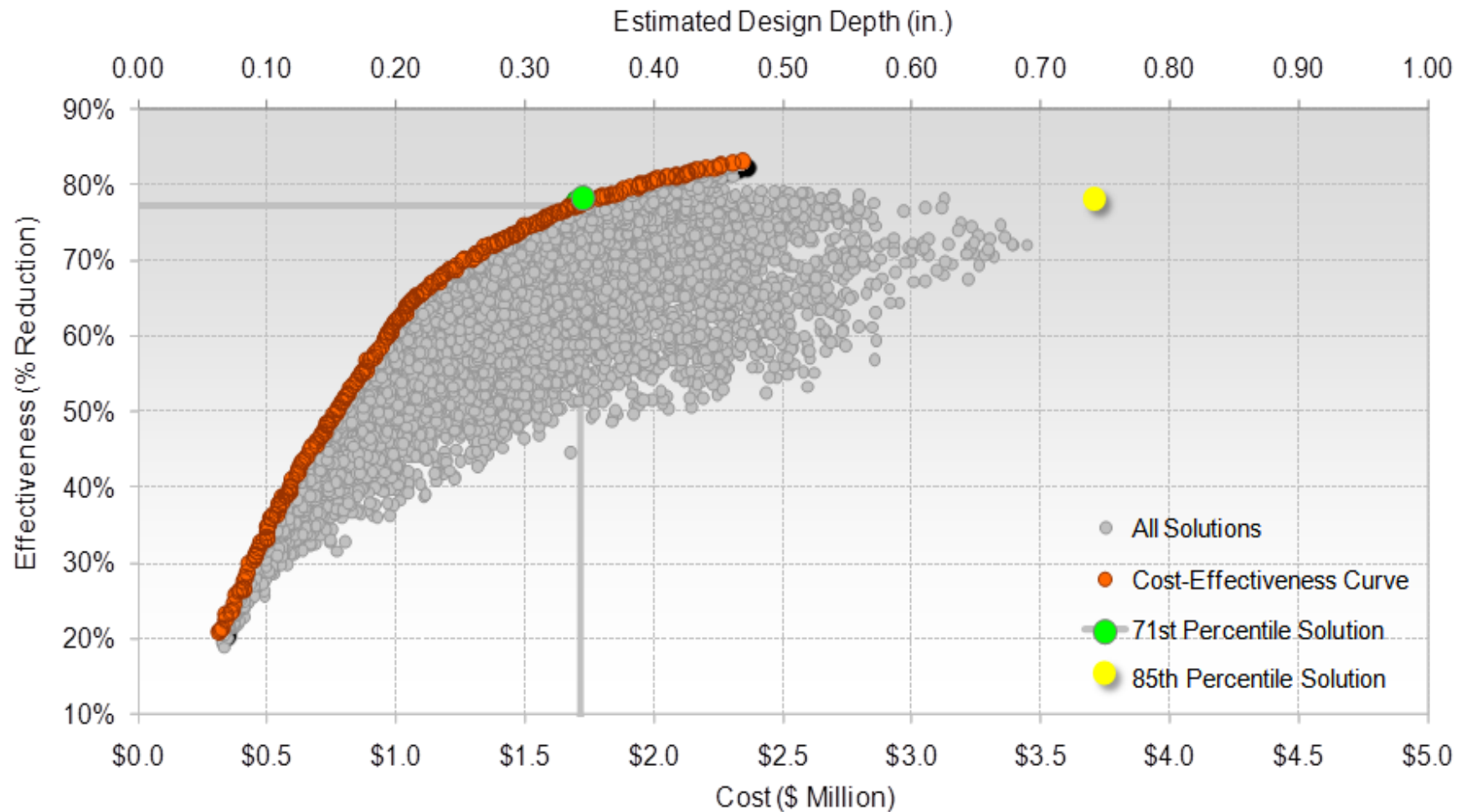


A photograph of a residential street scene. A large, mature tree with a thick, gnarled trunk stands prominently on the sidewalk. The tree's branches spread out over the road and sidewalk. A white car is parked on the street near the tree. In the background, there are houses and other trees. The sky is overcast.

-03
C.
X
6-17327
NO. 200
RECEIVED
FAC. CH. 20
01
DEPT. OF
3-D
TOTAL

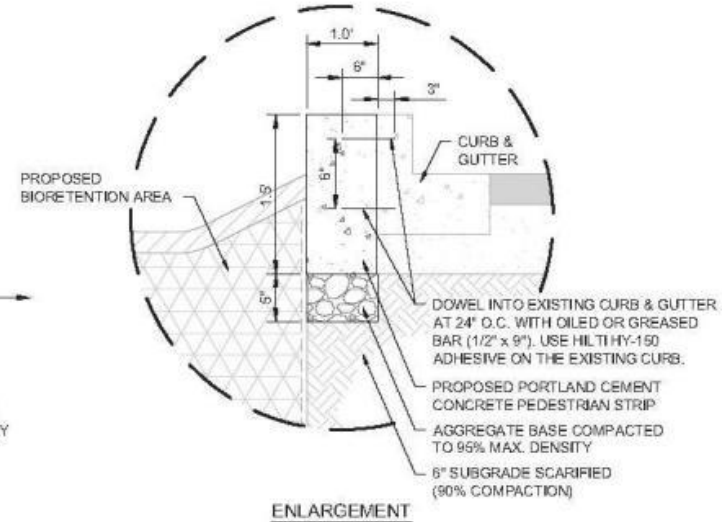
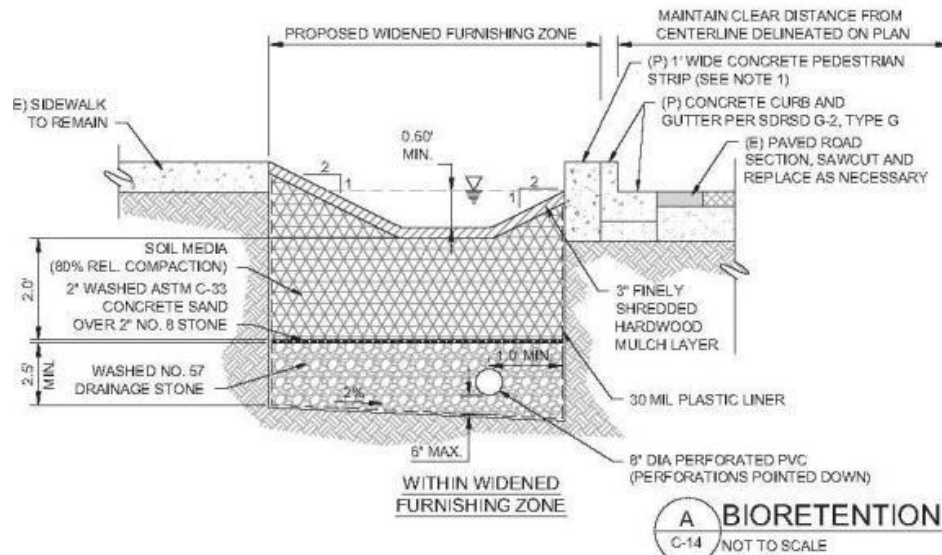
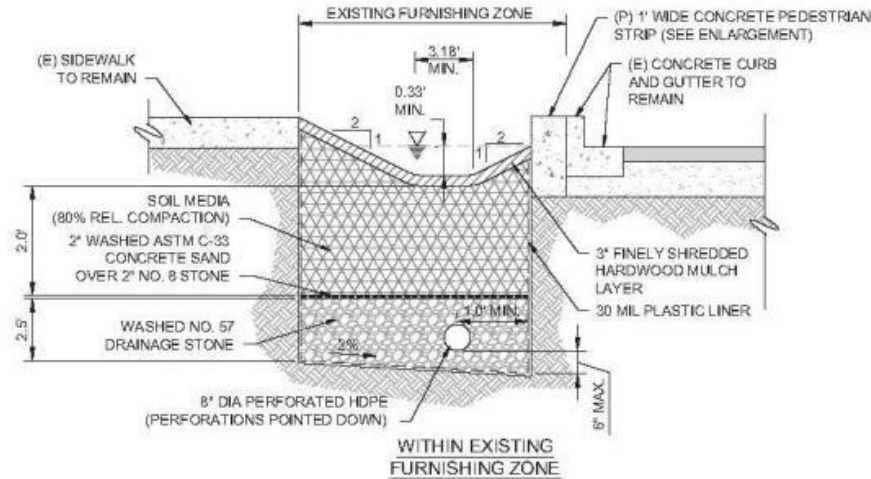
BIOSWALES AND BIORETENTION

WORKSHOP, April 30, 2015



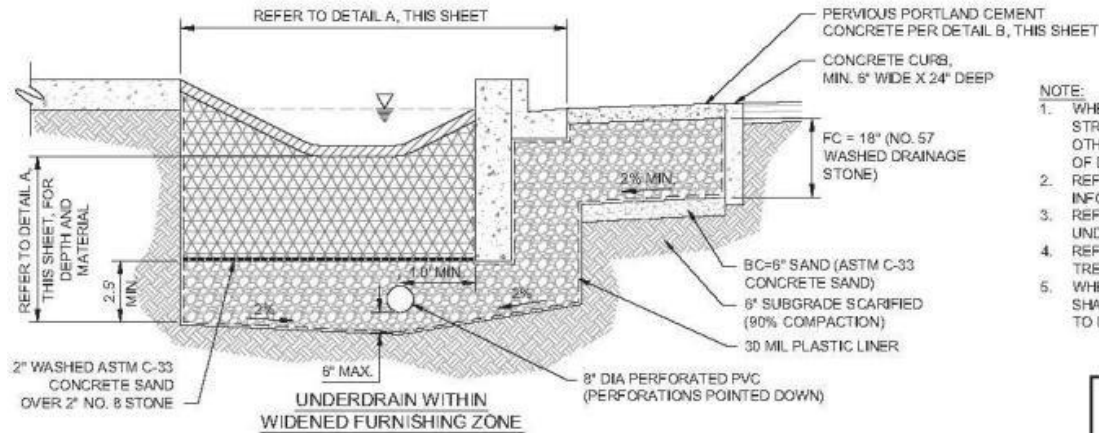
DISCUSSIONS ON LOW IMPACT DEVELOPMENT
BIOSWALES AND BIORETENTION

WORKSHOP, April 30, 2015



NOTE:

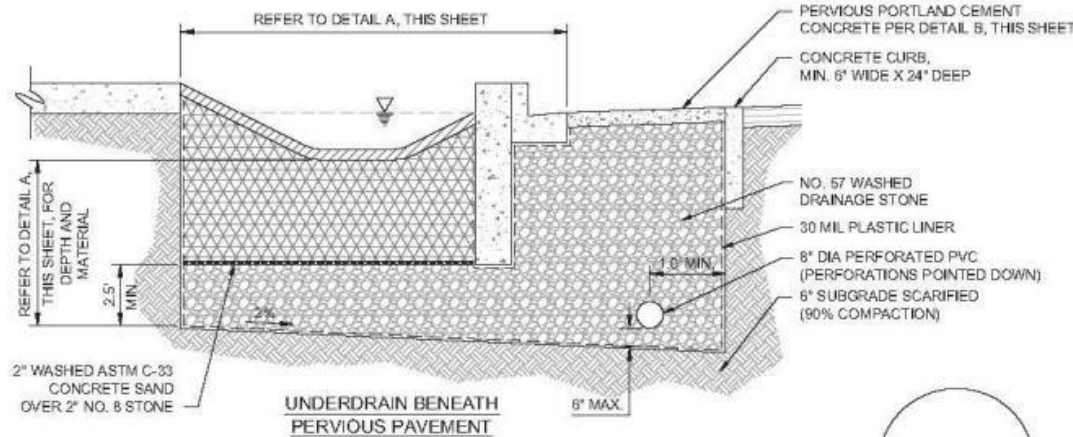
1. WHERE APPLICABLE, POUR PROPOSED 1' WIDE CONCRETE PEDESTRIAN STRIP MONOLITHICALLY WITH THE PROPOSED CURB AND GUTTER. OTHERWISE, DOWEL INTO EXISTING AS SHOWN ABOVE.
2. REFER TO HORIZONTAL CONTROL PLANS FOR HORIZONTAL CONTROL INFORMATION.
3. REFER TO UNDERDRAIN PLANS FOR INVERT ELEVATIONS OF UNDERDRAINS.
4. REFER TO DETAIL C, THIS SHEET, FOR UNDERDRAIN WITHIN A COMMON TRENCH.
5. WHERE A PIPE IS REQUIRED TO PENETRATE THE LINER, THE LINER SHALL BE CUT TO SLIDE THE PIPE THROUGH. TO SEAL THE LINER REFER TO DETAIL C, SHEET C-15 FOR TYPICAL PIPE SEALANT DETAIL.



NOTE:

1. WHERE APPLICABLE, POUR PROPOSED 1' WIDE CONCRETE PEDESTRIAN STRIP MONOLITHICALLY WITH THE PROPOSED CURB AND GUTTER. OTHERWISE, DOWEL INTO EXISTING AS SHOWN IN THE ENLARGEMENT OF DETAIL A, THIS SHEET.
2. REFER TO HORIZONTAL CONTROL PLANS FOR HORIZONTAL CONTROL INFORMATION.
3. REFER TO UNDERDRAIN PLANS FOR INVERT ELEVATIONS OF UNDERDRAINS.
4. REFER TO DETAIL C, THIS SHEET, FOR UNDERDRAIN WITHIN A COMMON TRENCH.
5. WHERE A PIPE IS REQUIRED TO PENETRATE THE LINER, THE LINER SHALL BE CUT TO SLIDE THE PIPE THROUGH. TO SEAL THE LINER REFER TO DETAIL C, SHEET C-15 FOR TYPICAL PIPE SEALANT DETAIL.

C-14



C
COMMON TRENCH
C-14 NOT TO SCALE

RESERVE FOR
ENGINEER OF REC

PLANS PREPARED BY:



TETRA TECH, INC.

9444 Balboa Avenue, Suite 215
San Diego, CA 92123
(858) 268-5746 - phone, (858) 268-5809 - fax

**BANNOCK AVENUE
STREETSCAPE ENHANCEMENTS
DETAILS**

CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 17 OF 33 SHEETS				WBS NO. B-10027	
APPROVED	DATE			SUBMITTED BY	
FOR CITY ENGINEER				PROJECT MANAGER	
DESCRIPTION	APPROVED	DATE	FILMED	CHECKED BY	
ORIGINAL	JOA/XX			PROJECT ENGINEER	
				CONTROL CERTIFICATION	
				234-1701	
				LAMBERT COORDINATES	
CONTRACTOR	DATE STARTED			36701-17-D	
INSPECTOR	DATE COMPLETED				

Landscape Selection Form

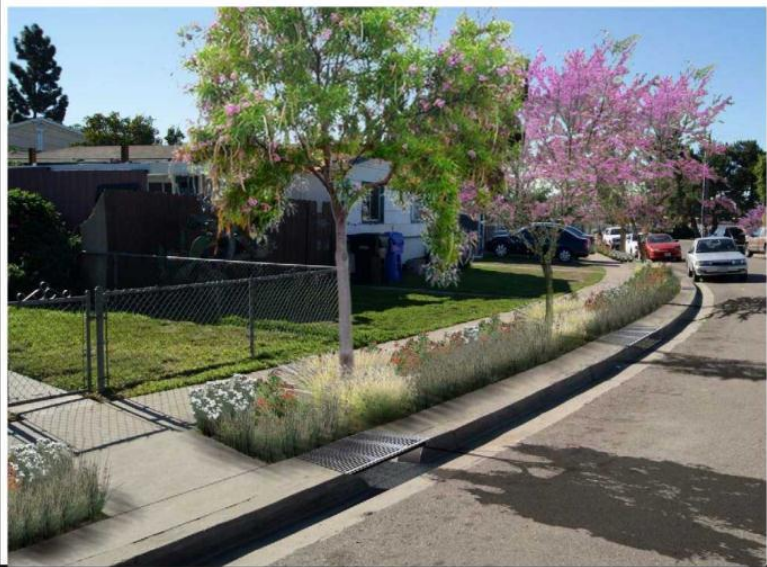
Use this form to select plants for the parkway in front of your home. You may submit by mail or email by April 23, 2012. Selections cannot be made by phone.

Mailing Instructions: Please select only one plant from each of the three categories (trees, shrubs, and ornamental grasses) on the back of this form by checking the box next to each. Mail the completed form to:

Andrea Demich, City of San Diego
9370 Chesapeake Dr, Suite 100
San Diego, CA 92123

Email Instructions: Send an email to ademich@sandiego.gov with "Landscape Selection" in the subject line. In the email, include your full name, street address, and one selection from each of the three categories on the back of this form (trees, shrubs, and ornamental grasses).

This rendering gives an idea of how the landscaping will look once the project is complete. This rendering displays the Desert Willow, Western Redbud, Common Yarrow, Deer Grass, California Fuchsia, and California Grey Rush.



Trees

☐

Desert Willow (*Chilopsis Linearis*)

Mature Height: 35 feet/Diameter: 25 feet


☐

Western Redbud (*Ceris Occidentalis*)

Mature Height: 25 feet / Diameter: 25 feet



OR

Shrubs

☐

Common Yarrow

(*Achillea Millefolium*)

Mature Height: 2 feet


☐

California Fuchsia

(*Epilobium Californica*)

Mature Height: 2-3 feet



OR

Ornamental Grasses

☐

California Gray Rush (*Juncus Patens*)

Mature Height: 2 feet


☐

Deer Grass (*Muhlenbergia Rigens*)

Mature Height: 3-4 feet



OR

Name: _____

Sign: _____ Date: _____

Email: _____

Affix address label here





DISCUSSIONS ON LOW IMPACT DEVELOPMENT
BIOSWALES AND BIORETENTION
WORKSHOP, April 30, 2015



- Bannock

DISCUSSIONS ON LOW IMPACT DEVELOPMENT
BIOSWALES AND BIORETENTION
WORKSHOP, April 30, 2015

Future Monitoring

- What do we hope to learn?
 - Green Street overall load reductions
 - Bioretention soil media impact
 - Validate & update modeling parameters
 - Compare climate region to other regions



Future Monitoring

- What will be monitored?
 - Influent flow
 - Underdrain effluent for each media mix

Table 1: Field Measurement Parameters

Parameter	Method
pH	YSI 6 Series Sonde
EC	
Temperature	
Turbidity	
Dissolved Oxygen	

Table 3: Grab Samples Analytical Parameters and Methods

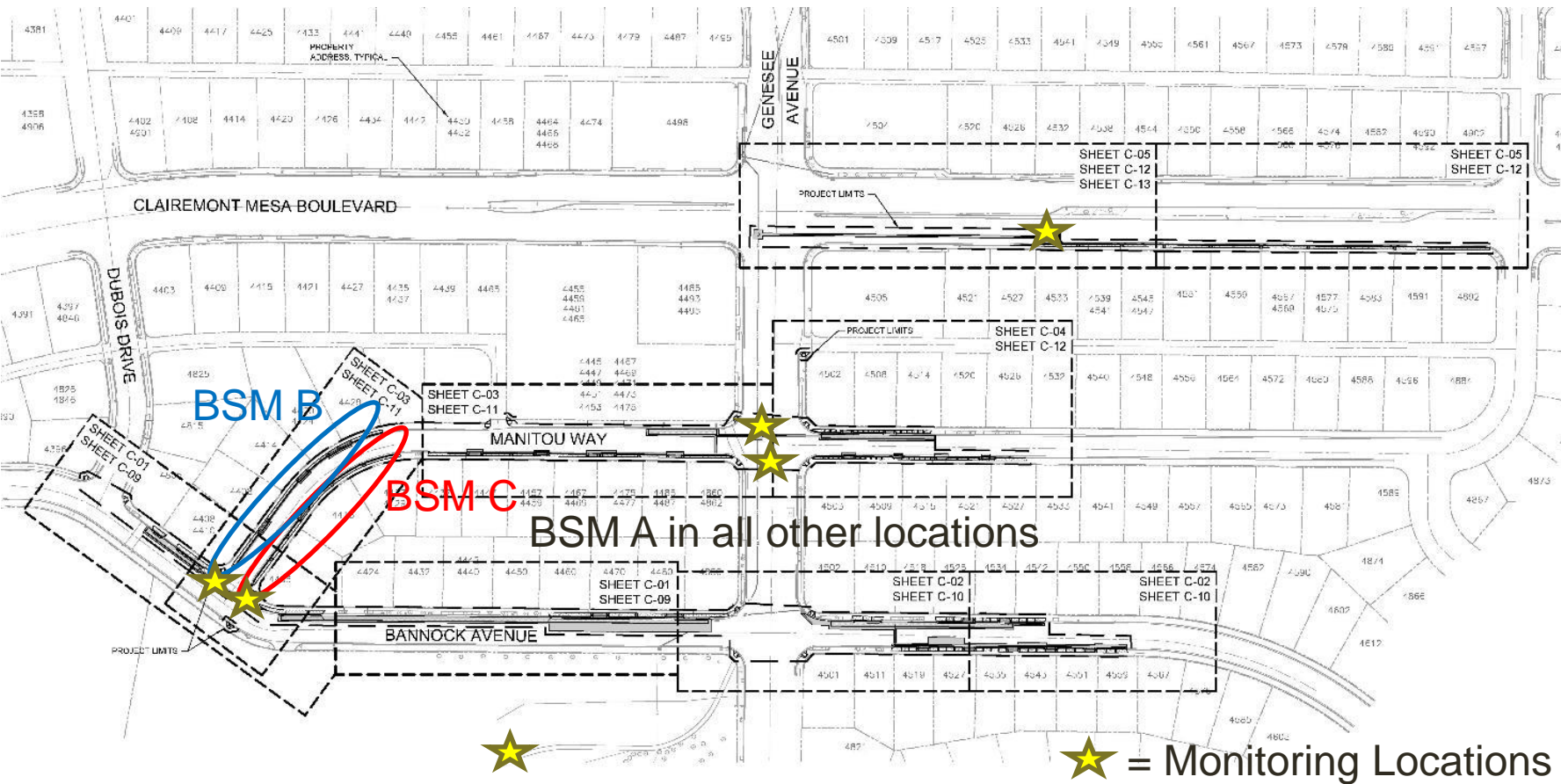
MICROBIOLOGY	
Total Coliform	SM 9221B
Fecal Coliform	SM 9221E
<i>Enterococci</i>	EPA 9000-1600

Table 2: Composite Sample Analytical Parameters and Methods

Analytical Parameter	Method
GENERAL CHEMISTRY	
Total Hardness as CaCO ₃	SM 2340 B
Total Suspended Solids	SM 2540-D
METALS (TOTAL AND DISSOLVED)	
Cadmium	EPA 200.8(m)
Copper	EPA 200.8(m)
Lead	EPA 200.8(m)
Selenium	EPA 200.8(m)
Zinc	EPA 200.8(m)
NUTRIENTS	
Total Nitrogen	SM 4500-N
Total Phosphorus	SM 4500-P E

Future Monitoring

-Where will it be monitored?



Future Monitoring

-How will it be monitored?

- Inlet hydraulic monitoring (fabricated H-flume)
- Pressure transducers to measure BMP water level
- Outlet monitoring of underdrain & overflow (V-notch weir)
- ISCO samplers for flow weighted composite water quality





DISCUSSIONS ON LOW IMPACT DEVELOPMENT
BIOSWALES AND BIORETENTION
WORKSHOP, April 30, 2015



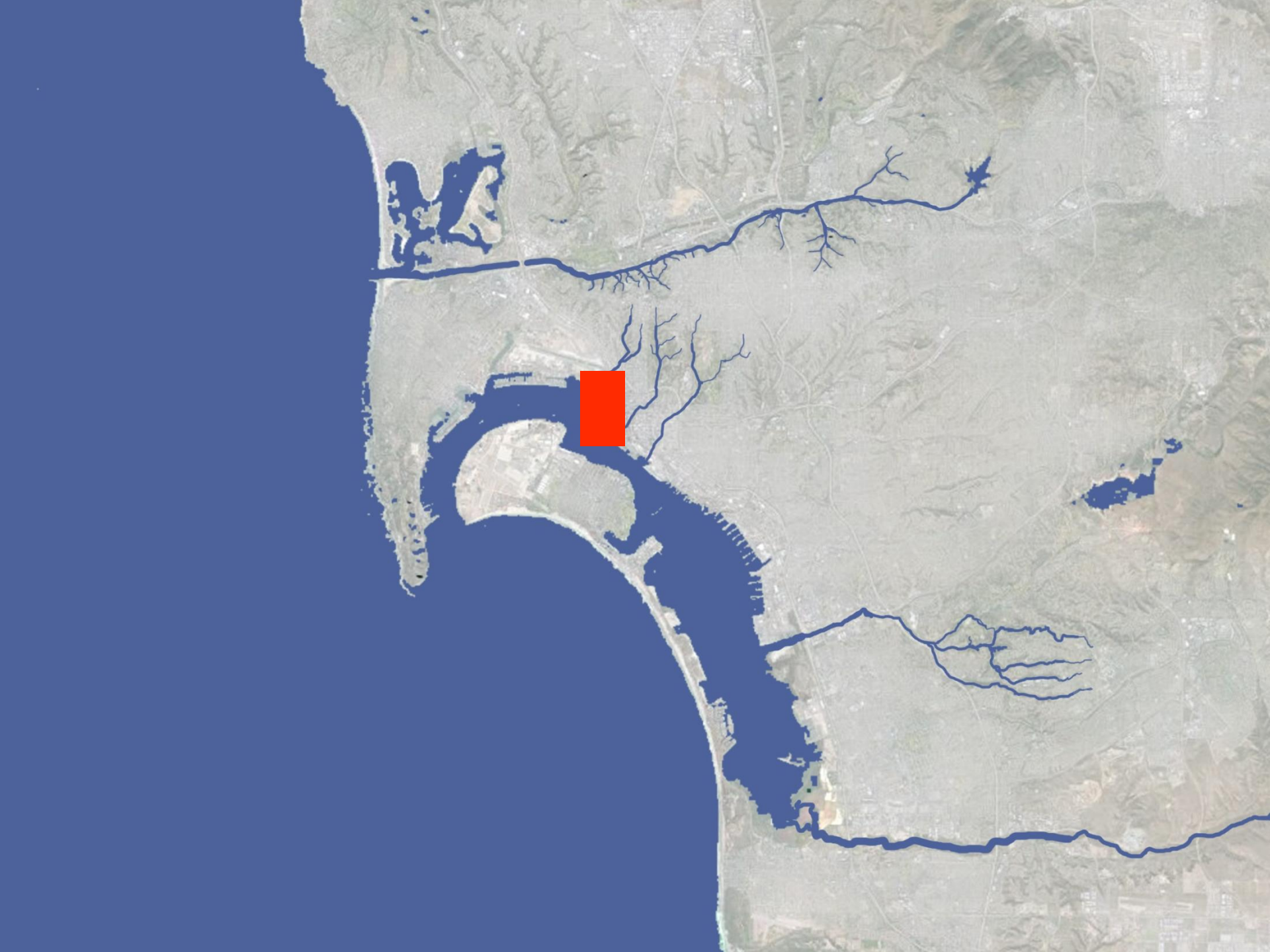
Questions??

DISCUSSIONS ON LOW IMPACT DEVELOPMENT
BIOSWALES AND BIORETENTION
WORKSHOP, April 30, 2015



DISCUSSIONS ON LOW IMPACT DEVELOPMENTS AND BIOSWALES







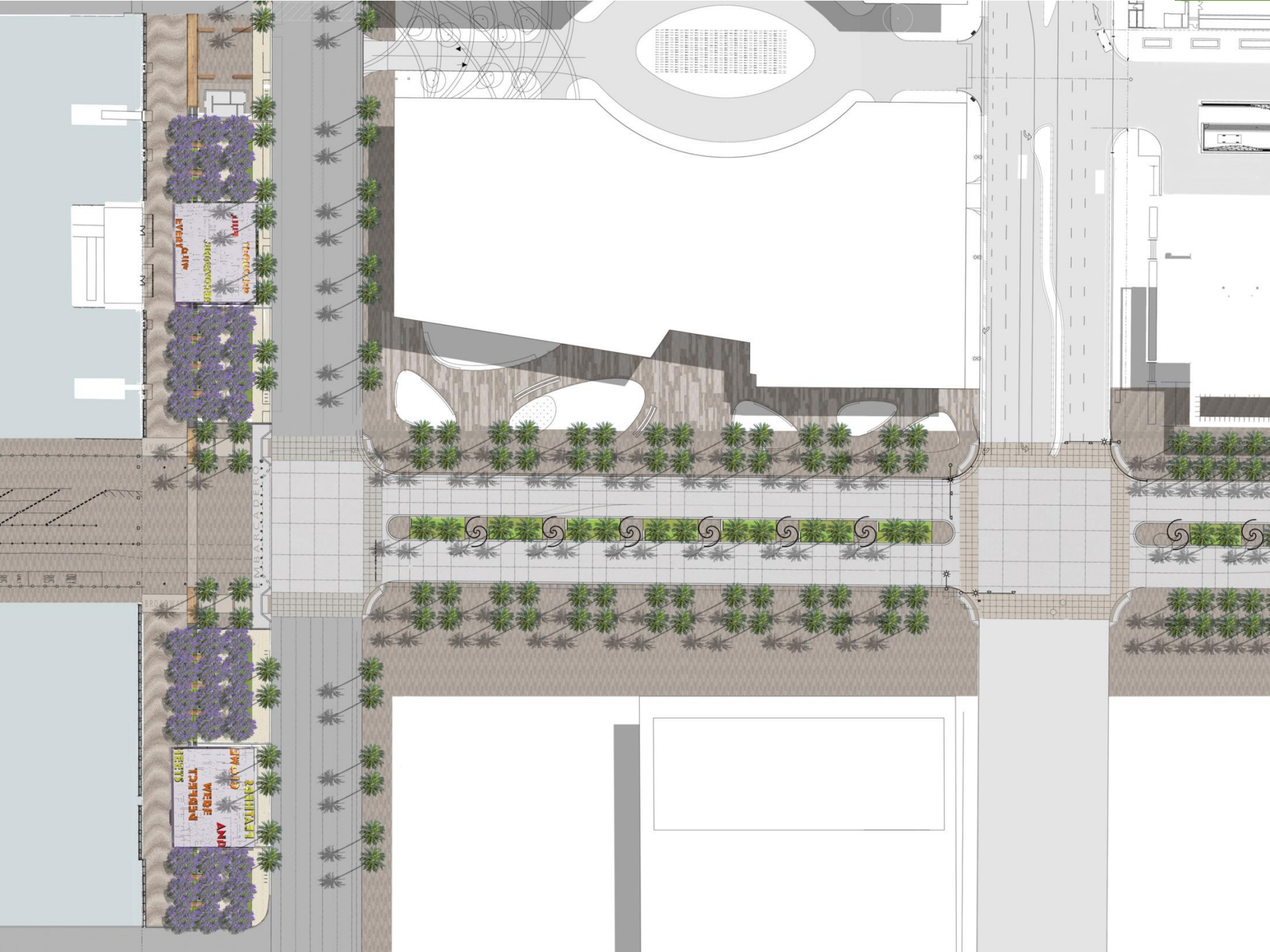


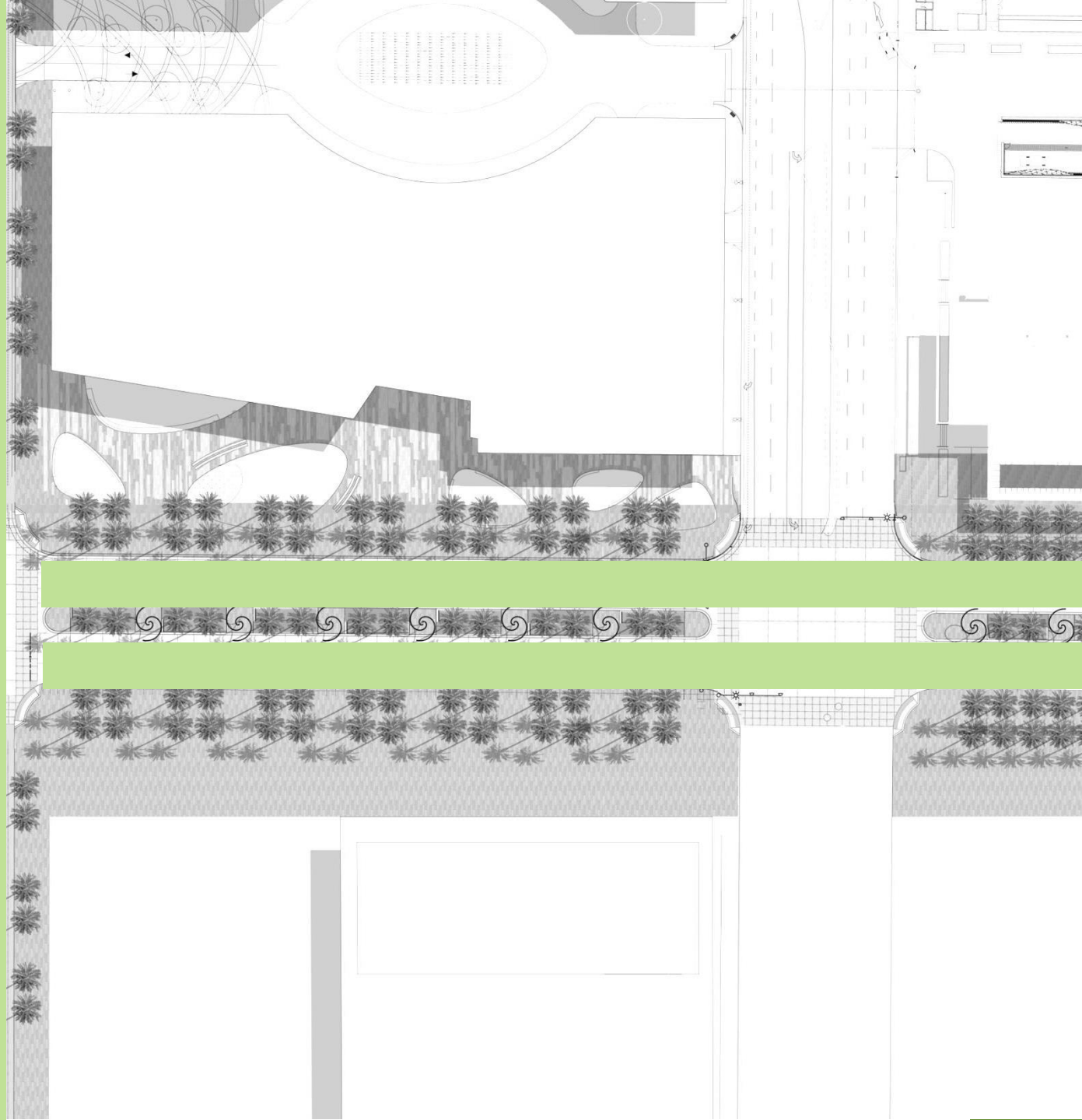
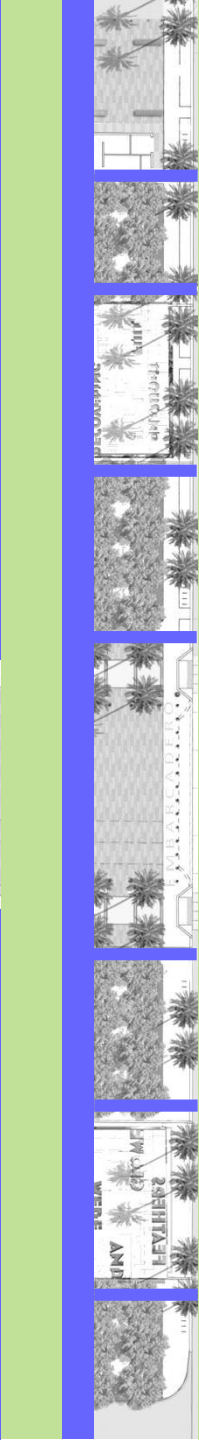
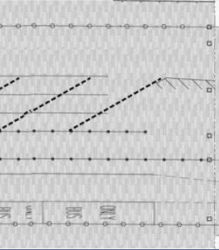














required to provide source control and treatment best management practices

treat the volume of runoff produced from an 85th percentile storm event (2 year storm)

pollutants of concern:

sediment, nutrients, heavy metals, trash and debris, oxygen demanding substances, oil, grease, pesticides and organic compounds

ESPLANADE DESIGN WATER QUALITY BIOFILTRATION

evapotranspiration
bioremediation and
phytoremediation

sedimentation and
filtration

filtration, absorption
nutrient assimilation
and biodegradation

soil media
2'-0" recommended
3'-0" to remove
phosphorous



perennial

mulch

soil media

bridging stone

pea gravel

conveyance
channel

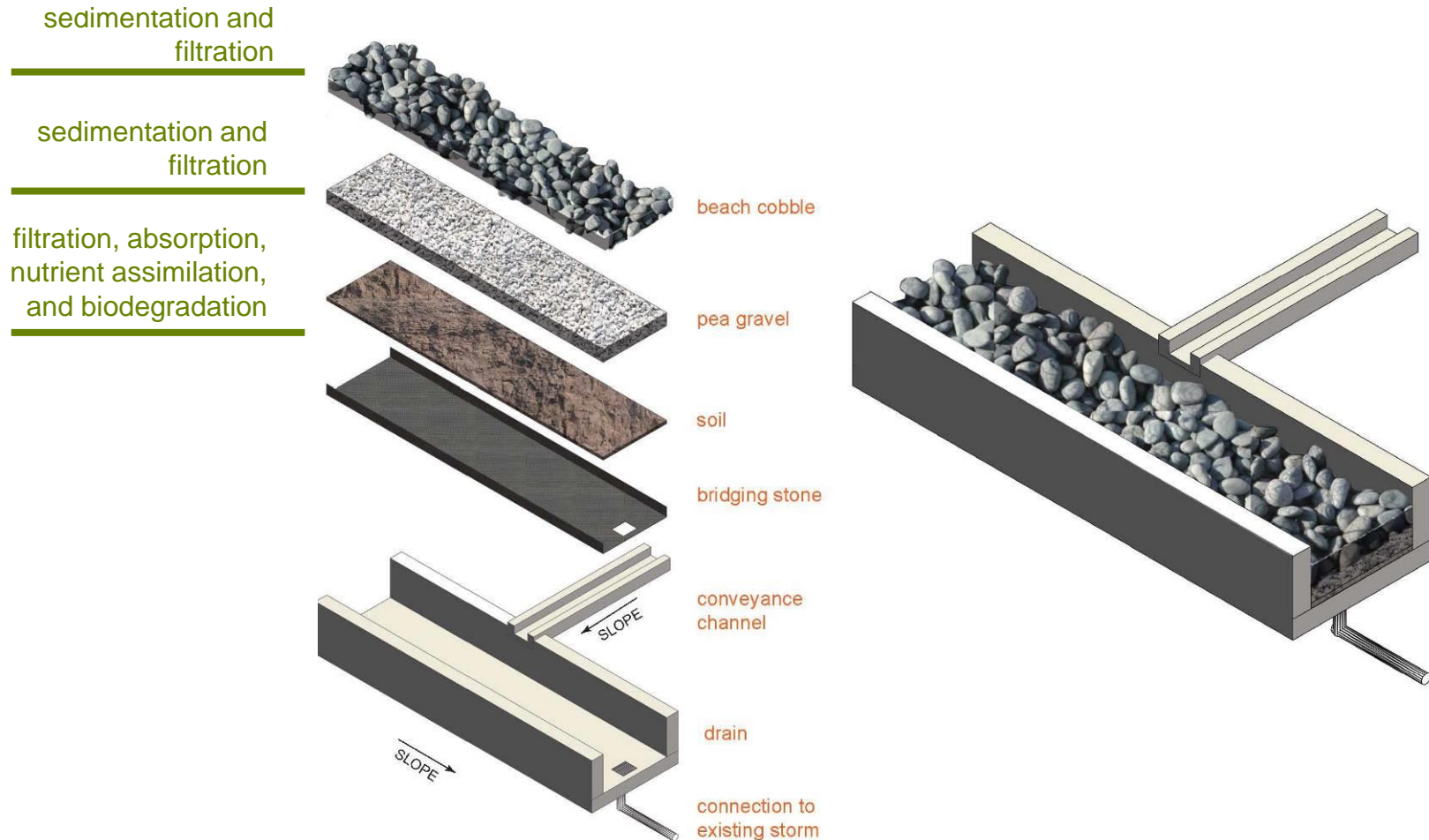
perforated pipe

drain

connection to
existing storm



ESPLANADE DESIGN WATER QUALITY STRUCTURAL BMP

















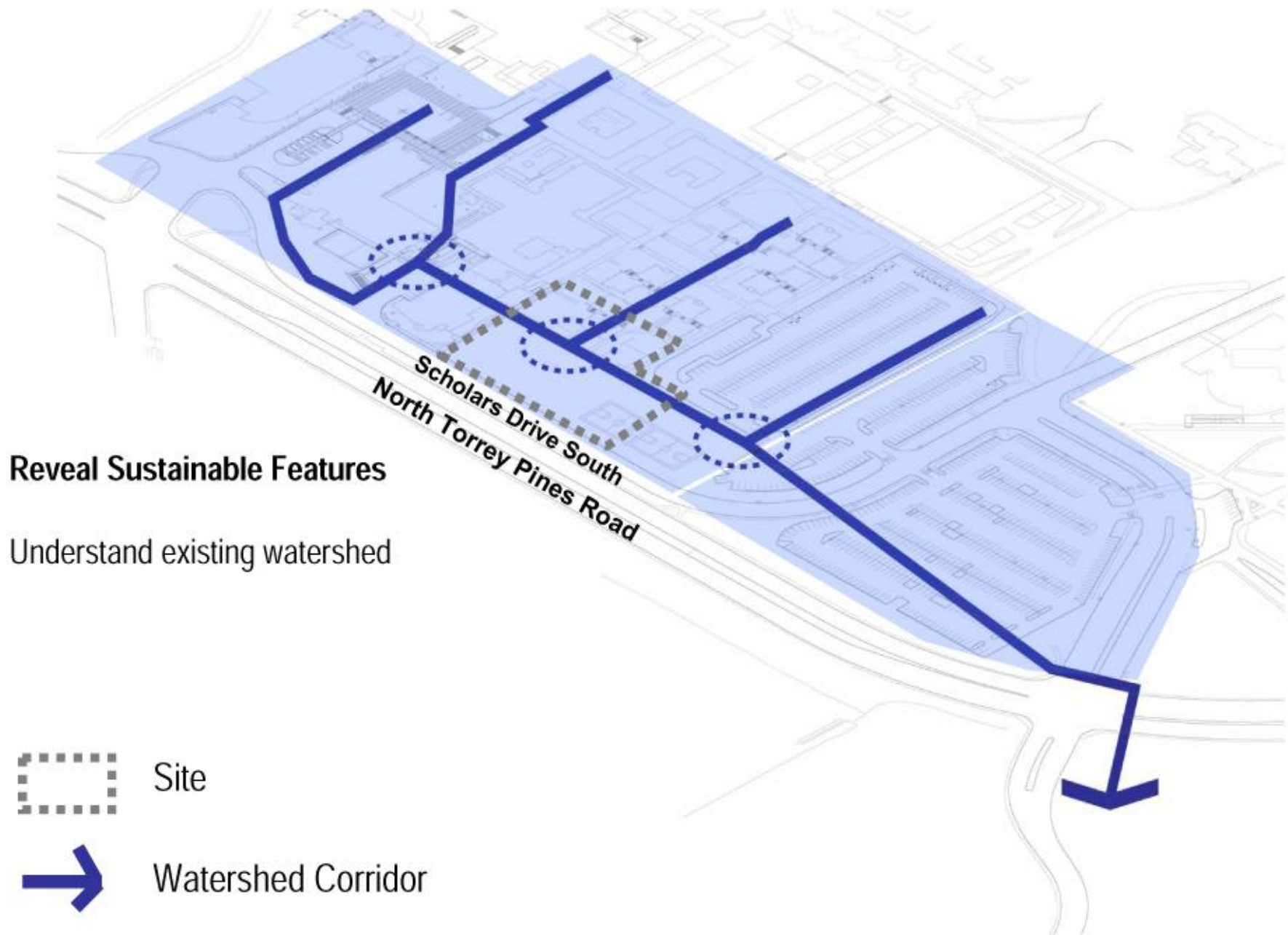




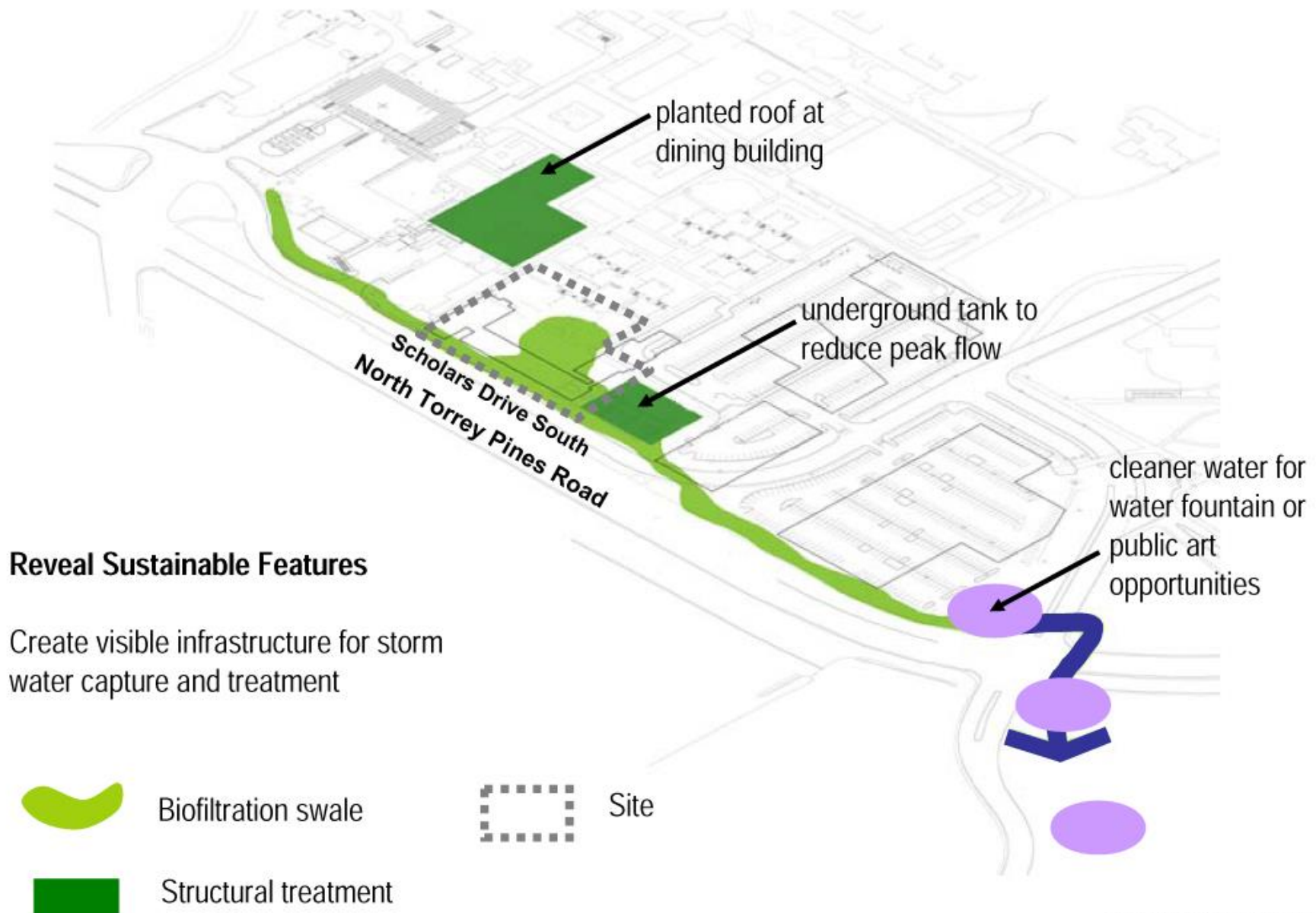




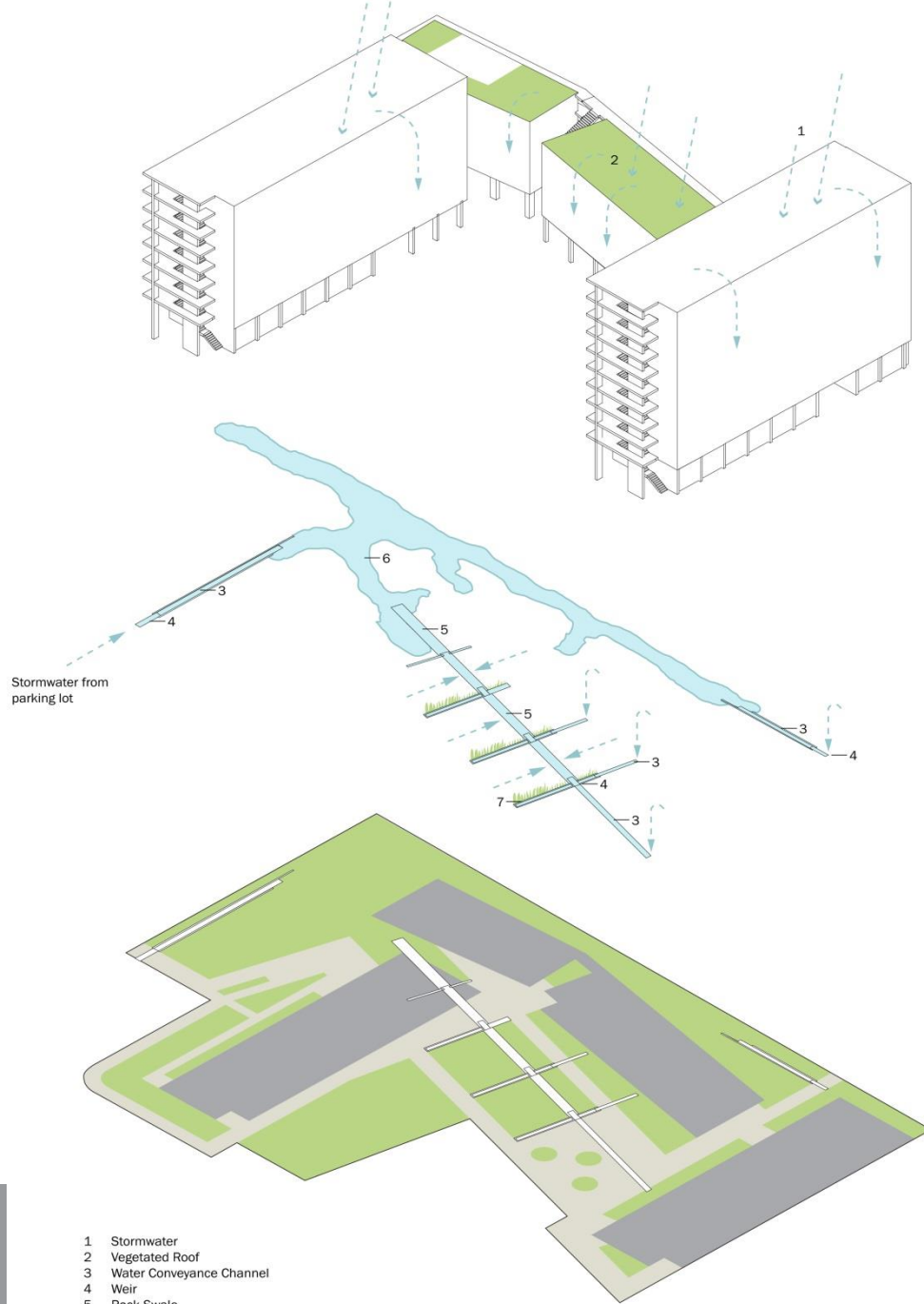
Preliminary Landscape and Site Design Principles



Preliminary Landscape and Site Design Principles



Collection + Storage Concept

















**LOW IMPACT
DEVELOPMENT
BIOSWALES
BIORETENTION**

DISCUSSIONS ON LOW IMPACT DEVELOPMENT BIOSWALES AND BIORETENTION

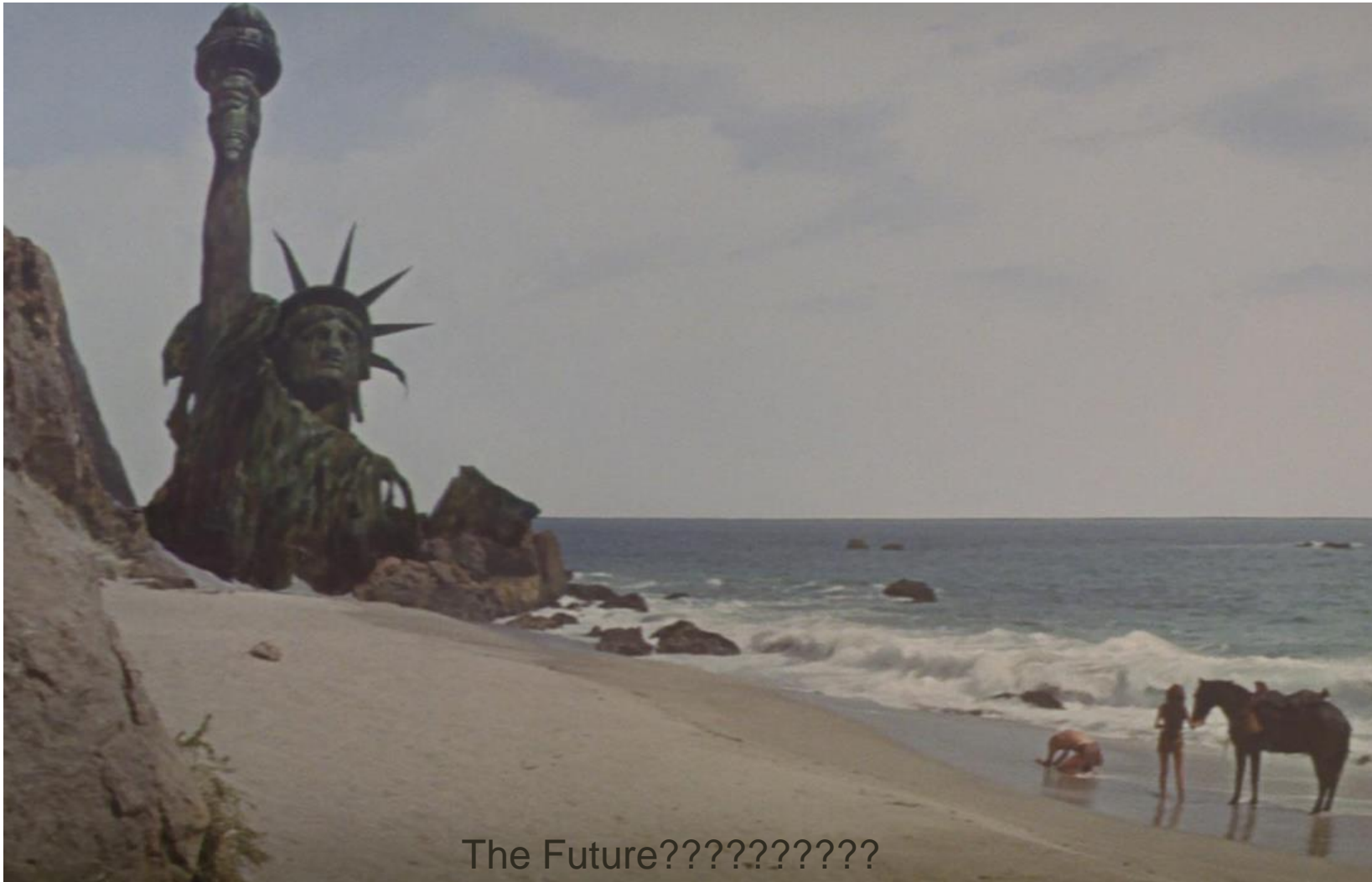
BIOPHILIA

BIOPHILIC DESIGN



MIKE SULLIVAN

BRIAN SO



The Future??????????

THE FUTURE RUIN
WORKSHOP, April 30th, 2015



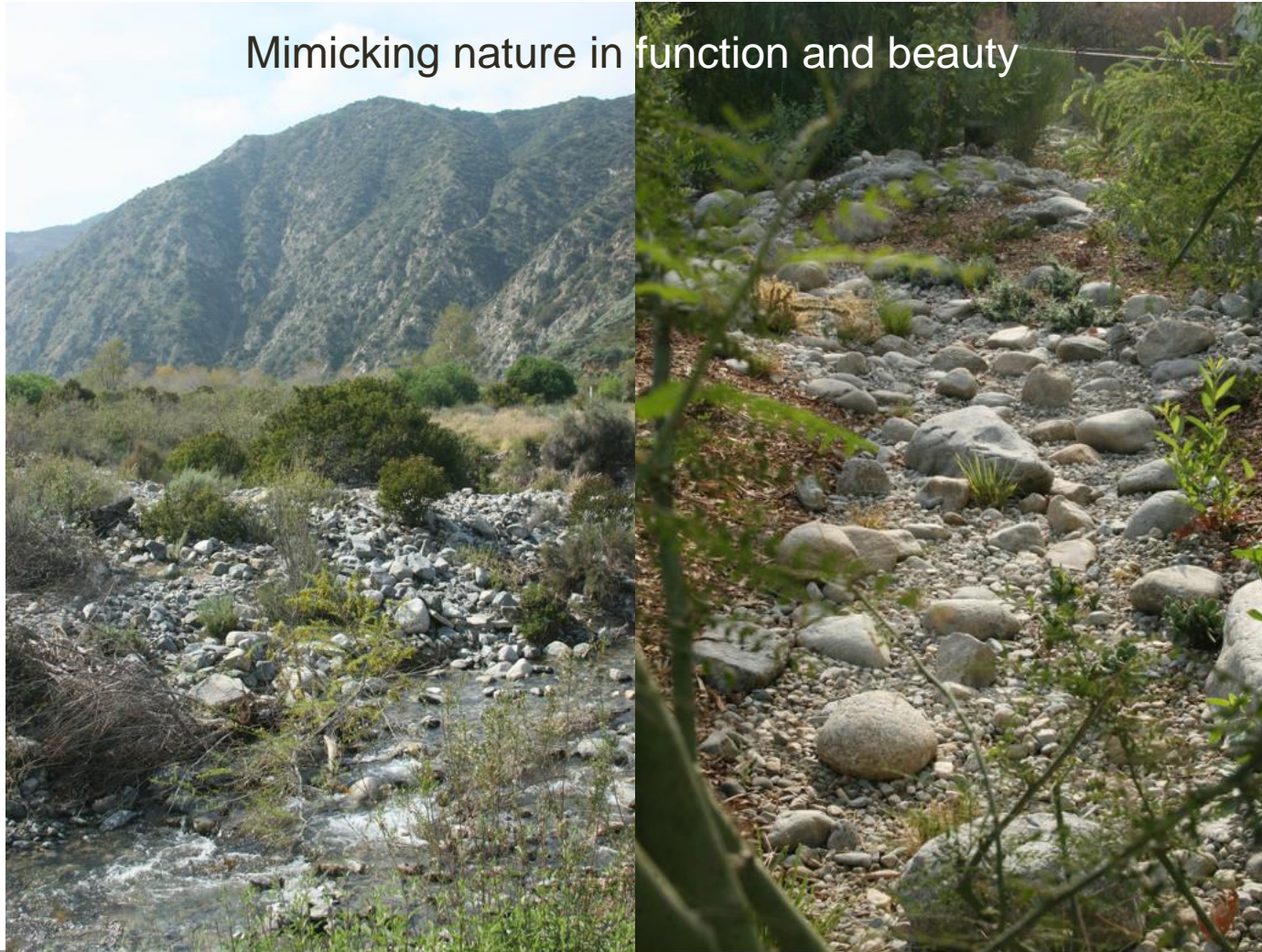


CAPTURING ALIVE: SIERRA MEADOW
WORKSHOP, April 30th, 2015



CAPTURE THE EXPERIENCE
WORKSHOP, April 30th, 2015

Mimicking nature in function and beauty











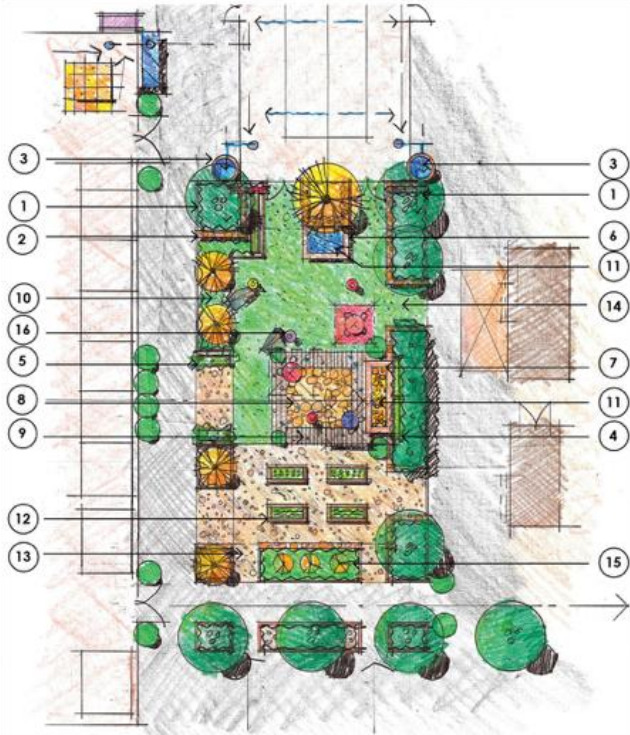
MOSAIC: MIXED MEADOW
WORKSHOP, April 30th, 2015





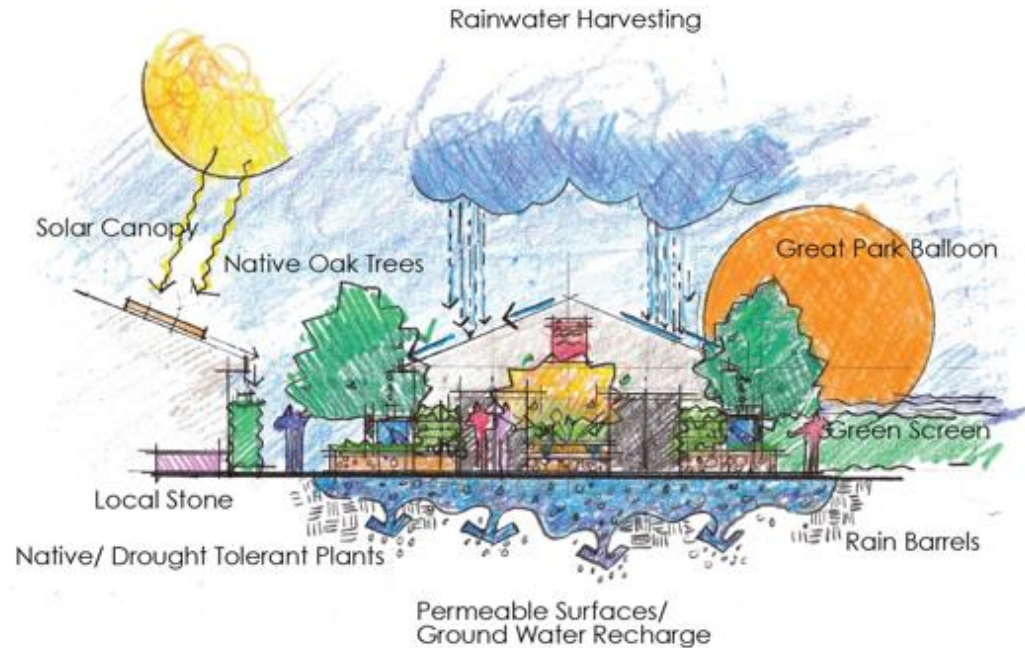






LEGEND

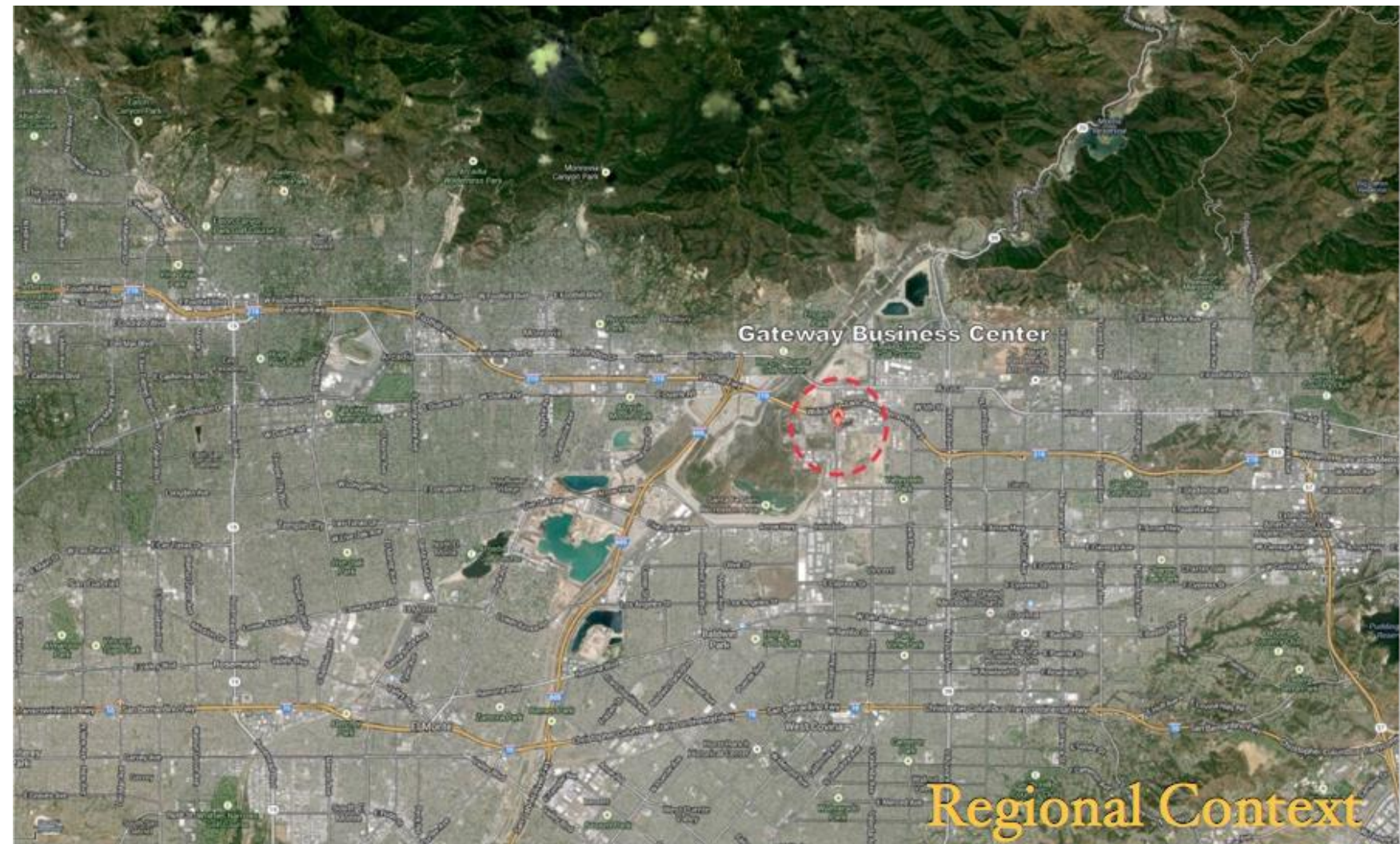
- 1 Native Oak Tree
- 2 Gabion Baskets Filled With 4"-10" Mission Cobble (Southwest Boulder and Stone)
- 3 60 gallon Rain Barrel (Bushman)
- 4 Terra Screen (Tournesol Siteworks)
- 5 Self Watering Pots (Tournesol Siteworks) with Chondropetalum tectorum (El Nativio Growers)
- 6 Water Feature, Belgard Wall System, 'Antique Quarry' (Belgard)
- 7 Fire Pit, Belgard Wall System, 'Weston' (Belgard)
- 8 Belgard Permeable Pavers 'Eco-Dublin' (Belgard)
- 9 Belgard Permeable Pavers 'Aqua-Roc' (Belgard)
- 10 Native and Drought Tolerant Plants (El Nativio Growers)
- 11 Recycled Glass (Southwest Boulder and Stone)
- 12 Vegetable Planters Constructed from 8" x 8" Recycled Timber
- 13 Decomposed Granite with NexPave™ Organic-Lock™ (Gall Materials)
- 14 Synthetic Turf, Tiger Turf 'Majestic Pro Natural' (Synthetic Grass Warehouse)
- 15 Citrus Trees
- 16 Solar Telescopes



Sustainable Garden Diagram







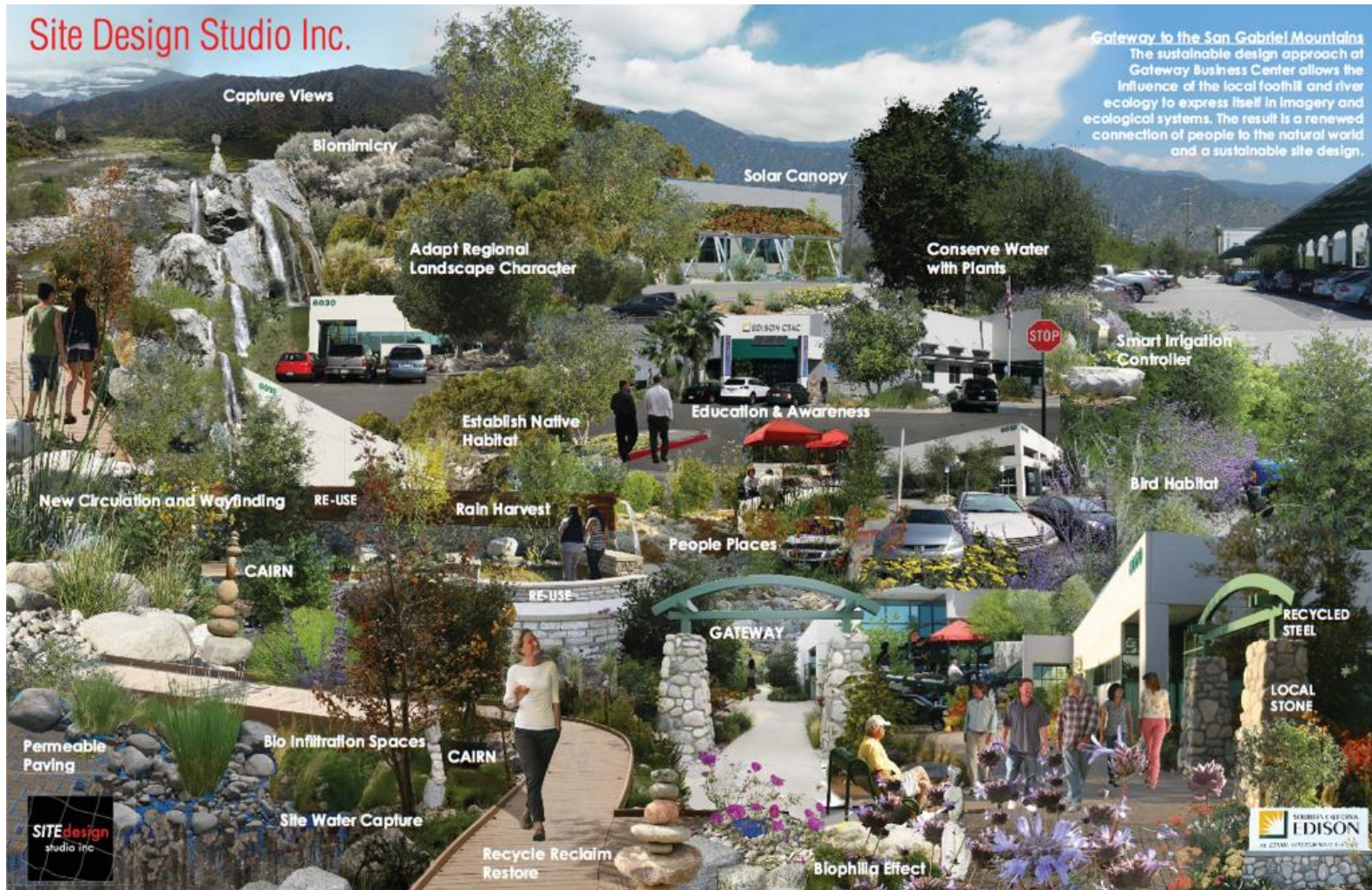


SAN GABRIEL MOUNTAIN WATERSHED

WORKSHOP, April 30th, 2015



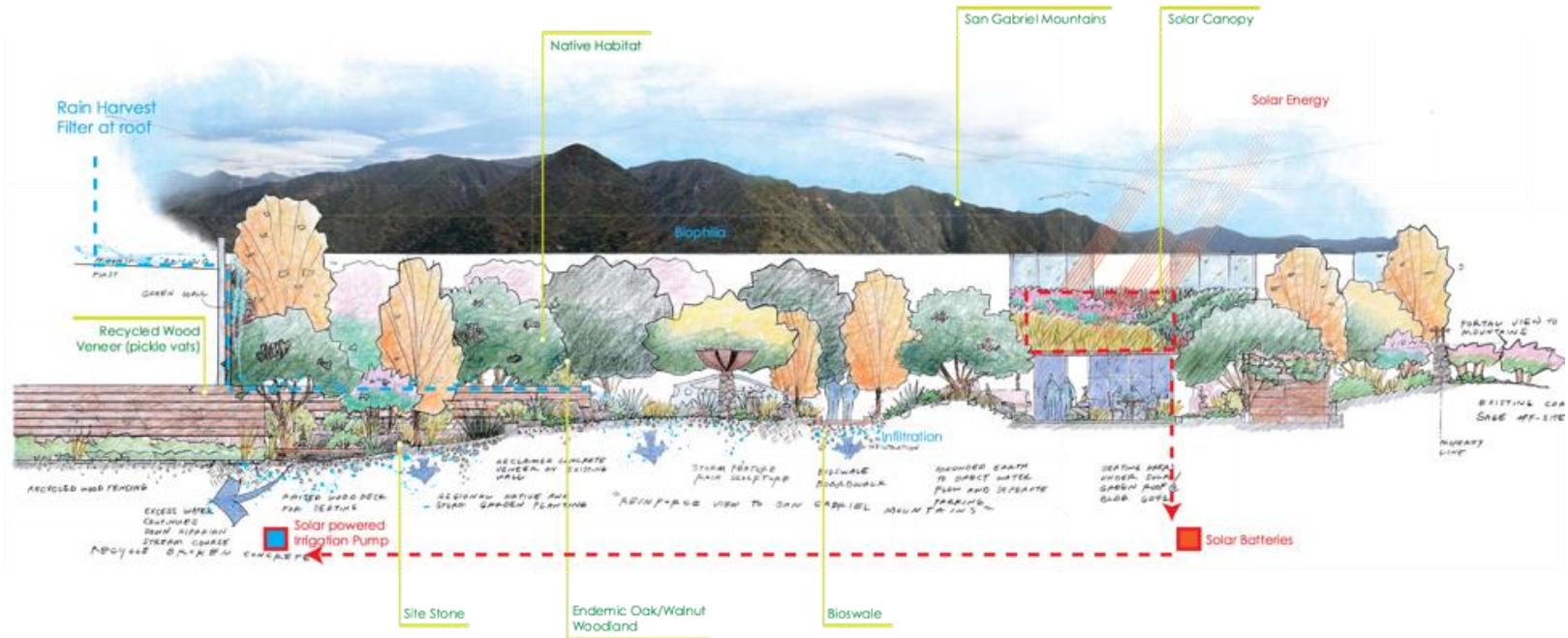
Site Design Studio Inc.



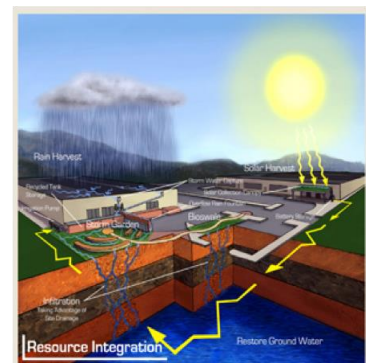
GATEWAY DESIGN CONCEPT
WORKSHOP, April 30th, 2015

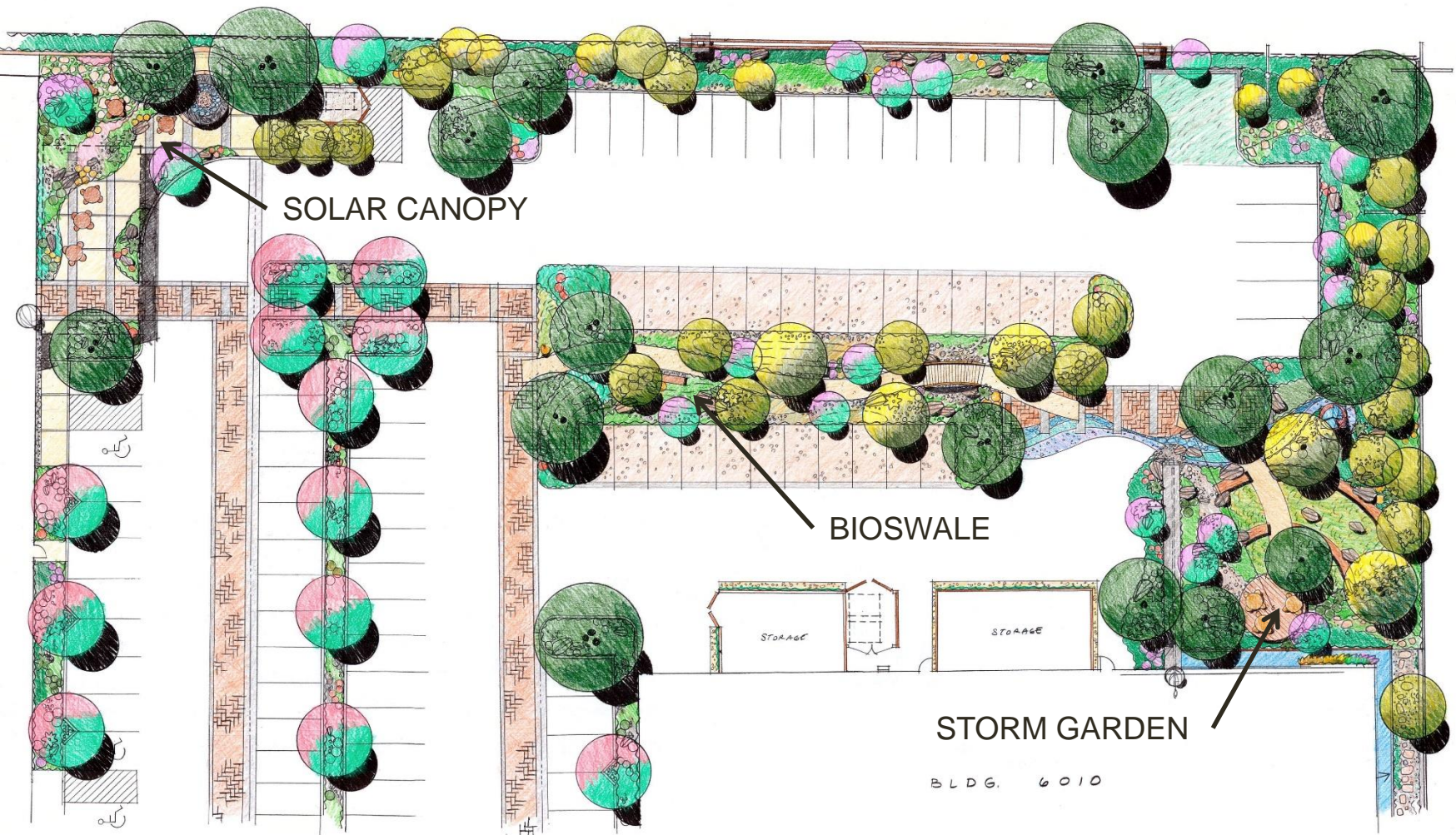




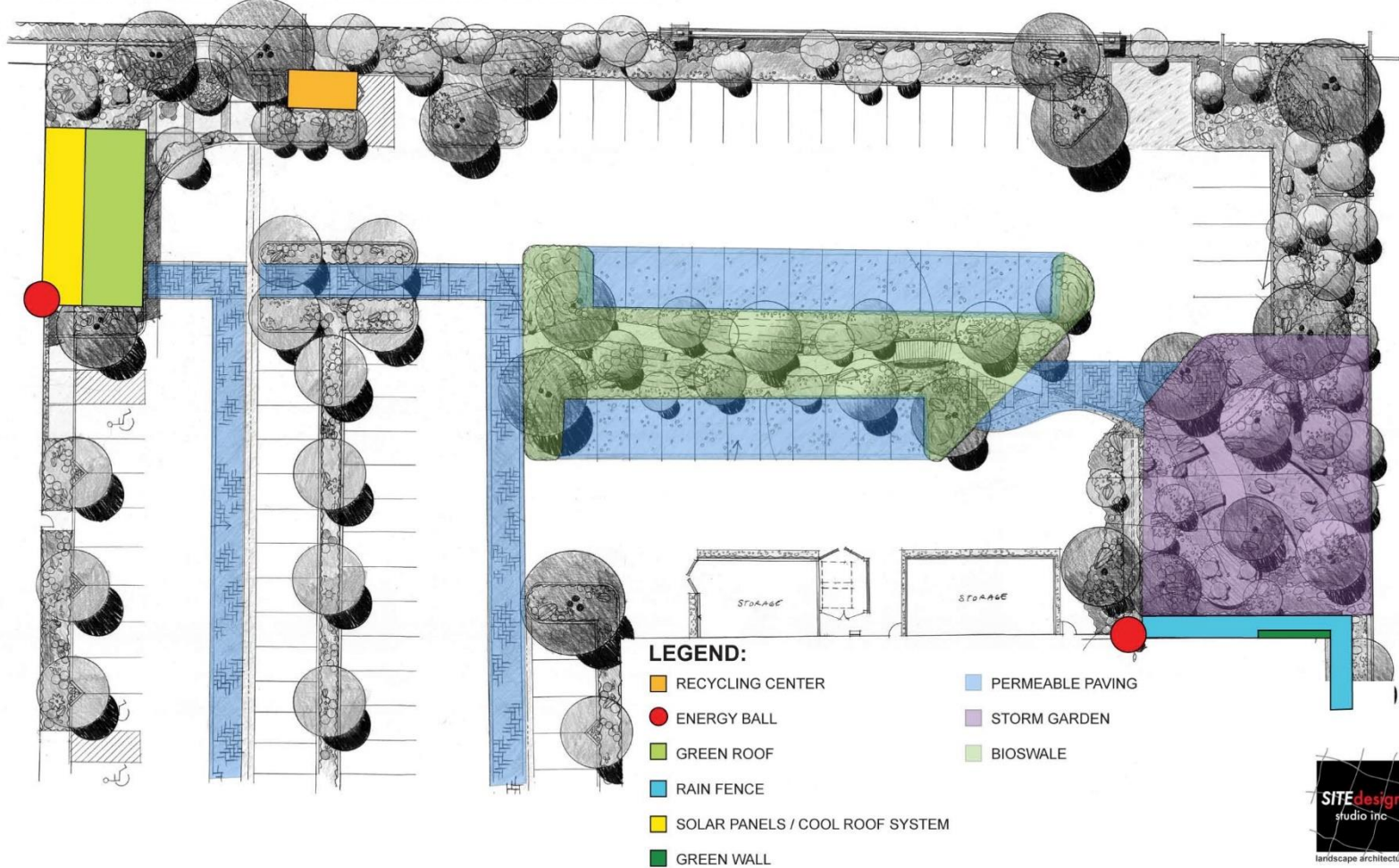


Goal: Net zero / off grid

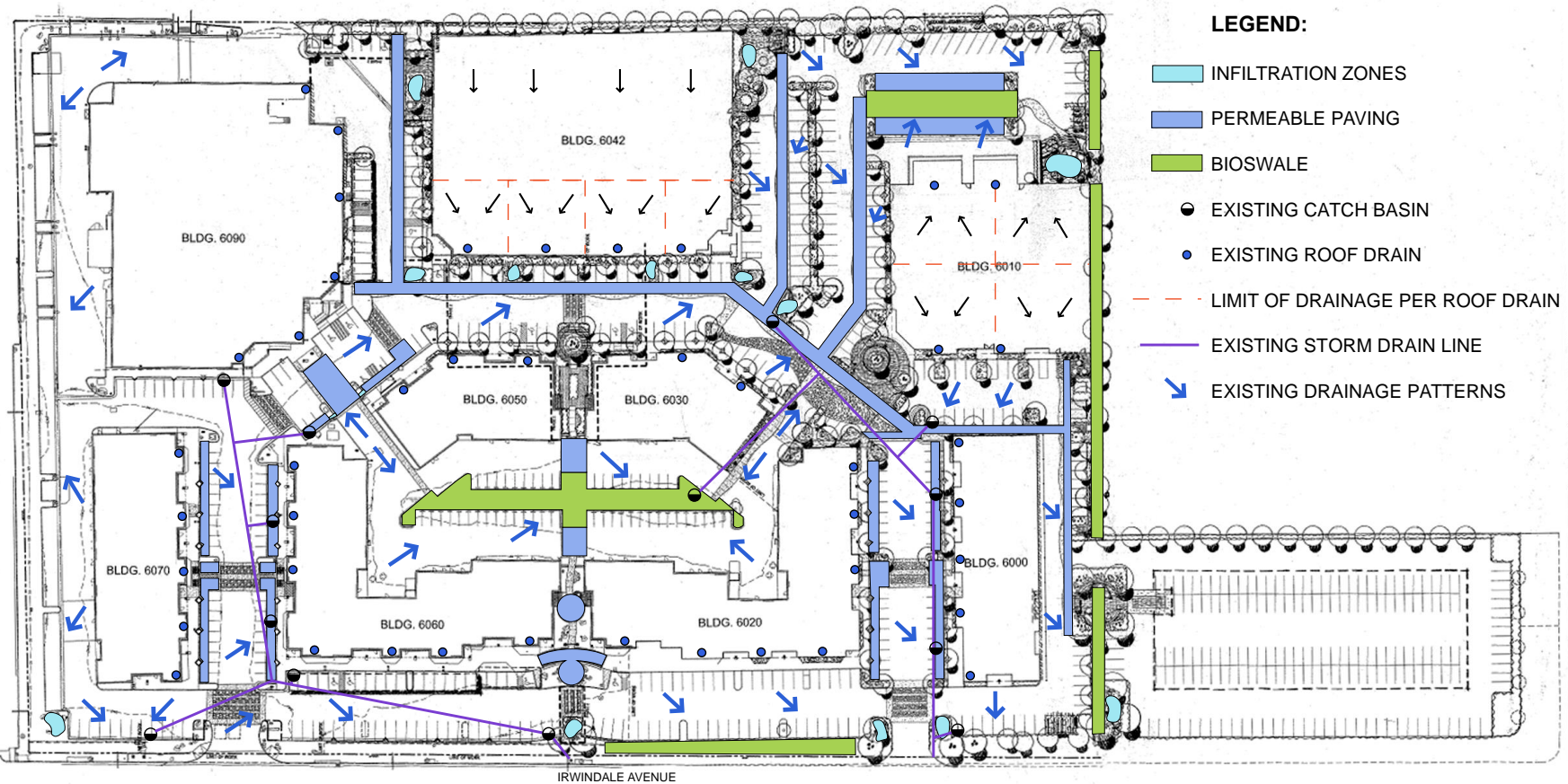




SUSTAINABLE TECHNOLOGY DIAGRAM



WATER CAPTURE DIAGRAM



RAINWATER HARVESTING DIAGRAM OPTION 1



ZONE 1 HARVESTING

Roof Watershed = 110,925 Gallons/YR.
Water Storage = 22,480 Gallons
Water Demand = 21,479 Gallons/YR.

IRWINDALE AVENUE

ZONE 2 HARVESTING

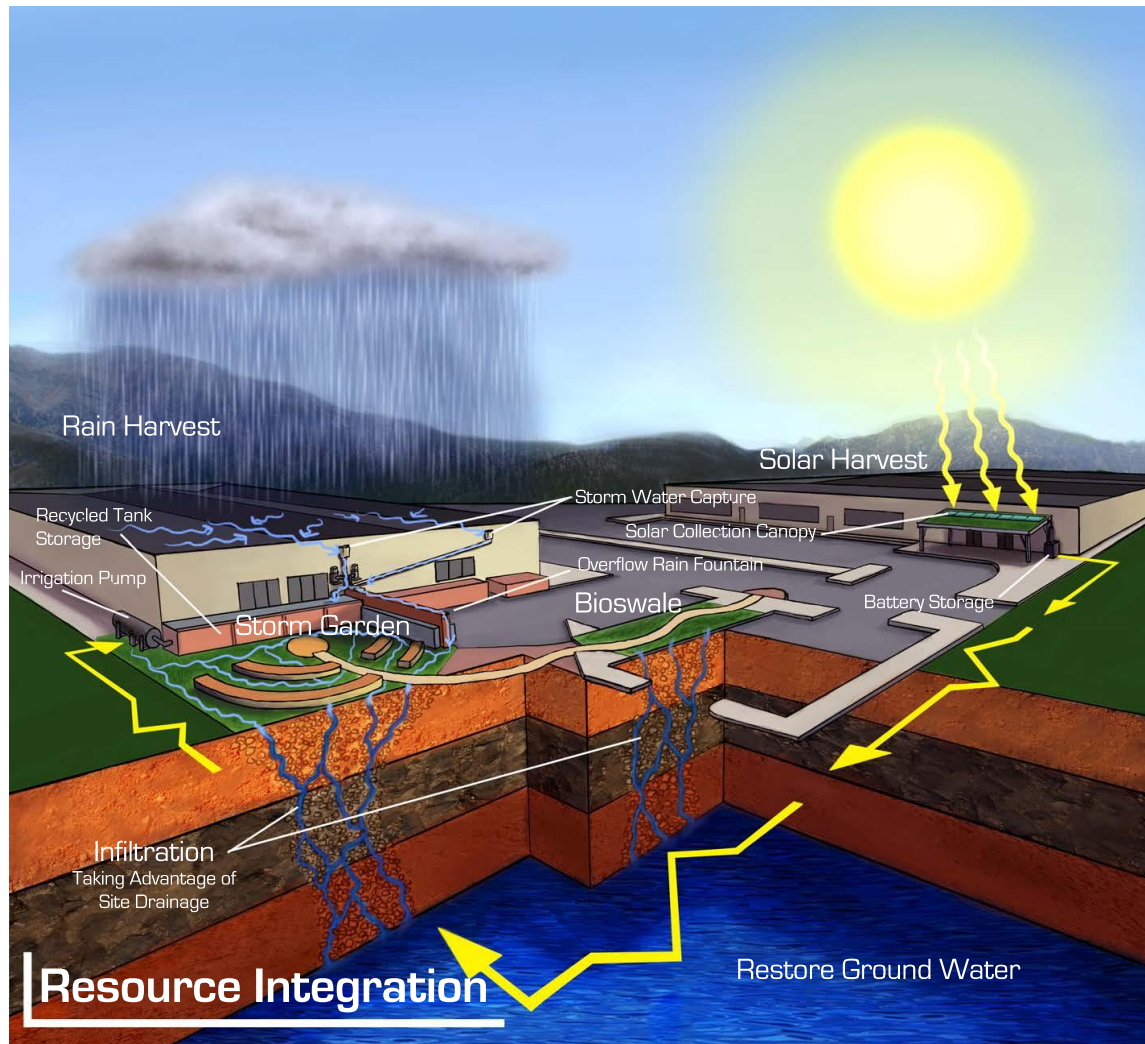
Roof Watershed = 428,543 Gallons/YR.

Sustainable Practice

Ecological Component

- ❖ Adapt Regional Character
- ❖ Recycle, Reclaim, Restore
- ❖ Conserve water with plants
- ❖ Establish Native habitat
- ❖ Site water Capture
- ❖ Bio/Infiltration swales
- ❖ Rain Harvest
- ❖ Solar Canopy
- ❖ Smart Irrigation Control



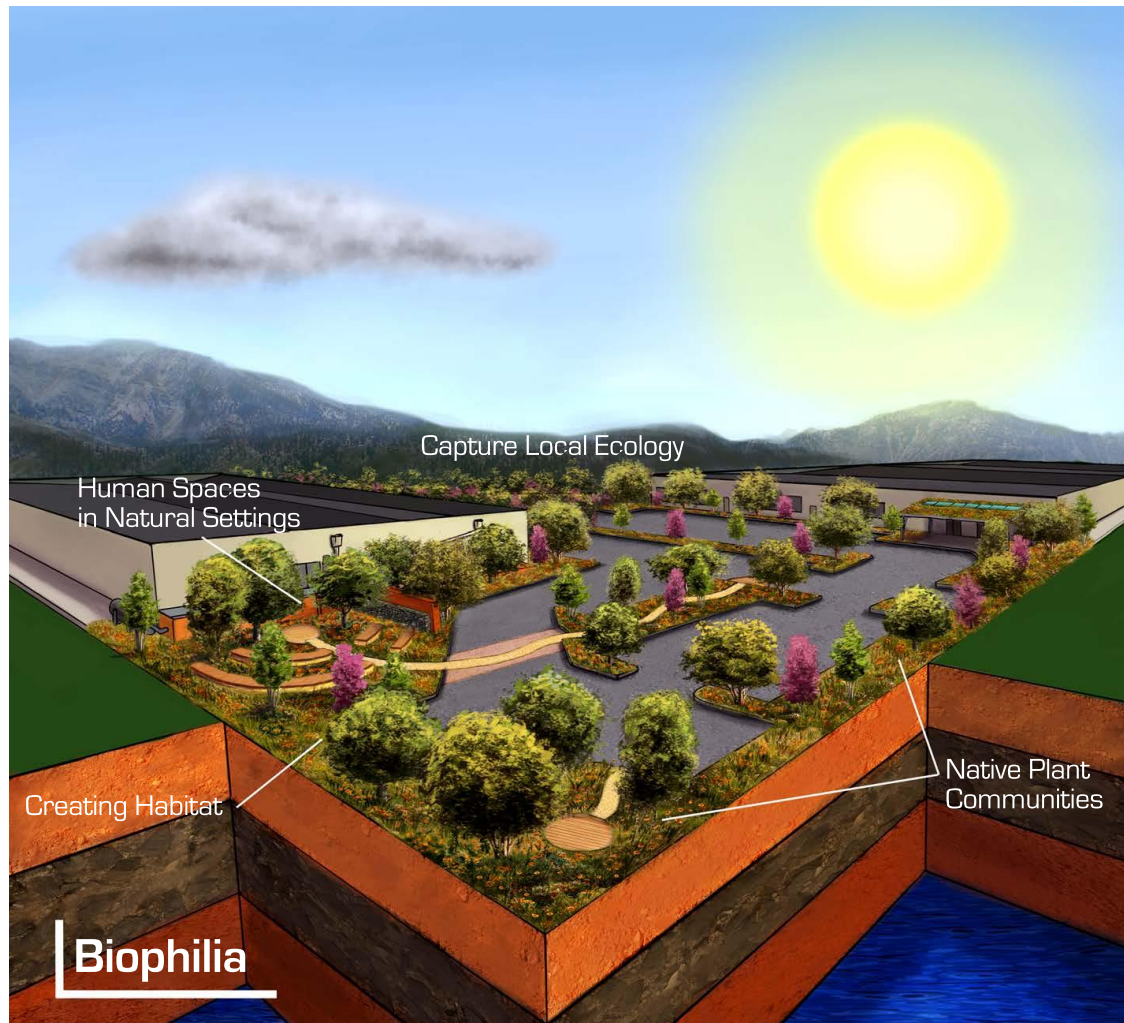


Sustainable Practice

Human Component

- ❖ Adapt Regional Character
- ❖ Biophilia Effect
- ❖ New Circulation and Wayfinding
- ❖ People Places
- ❖ Education and Awareness
- ❖ Capture Views







SITE MAP



Before







After



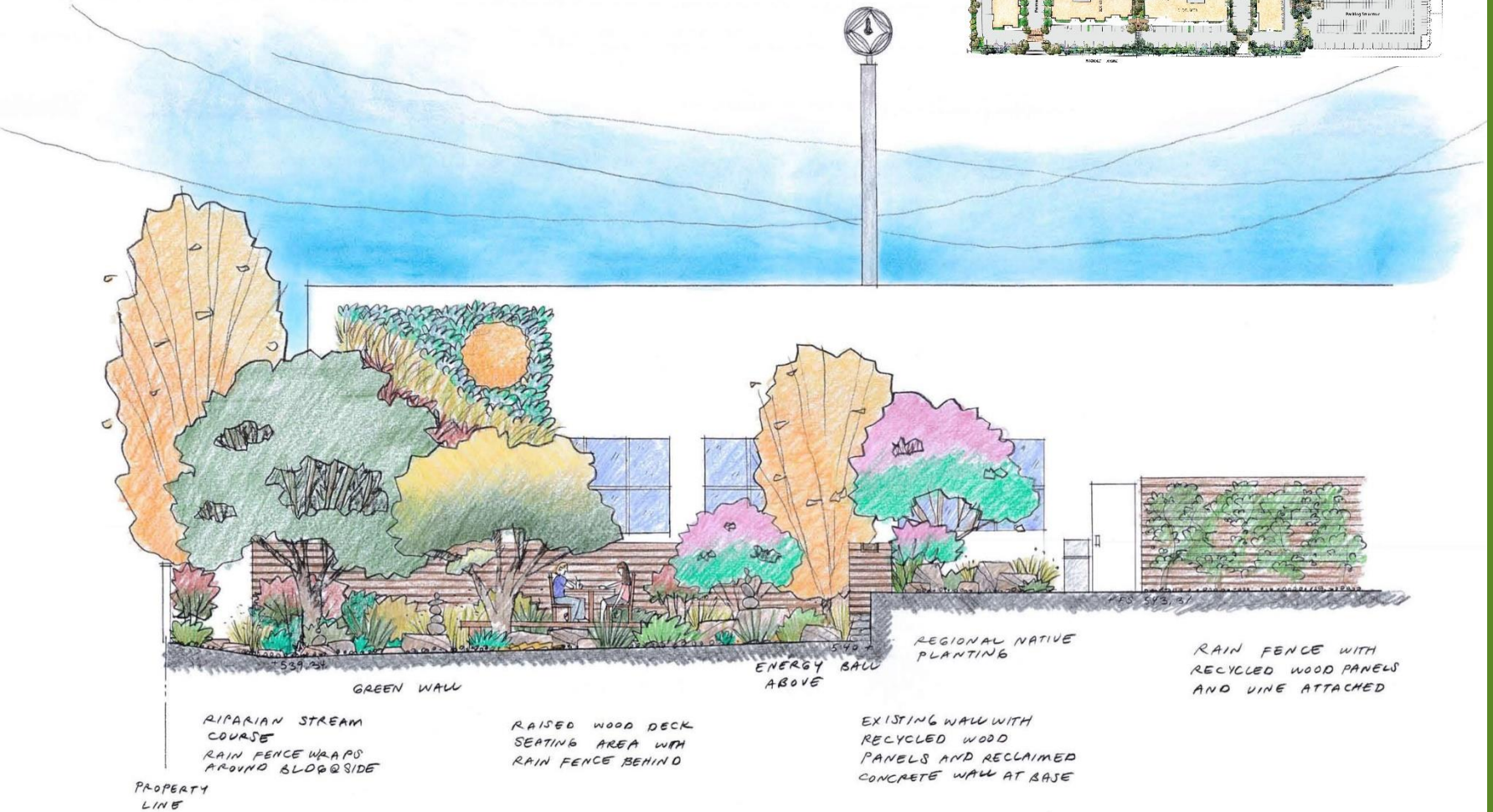




Concept









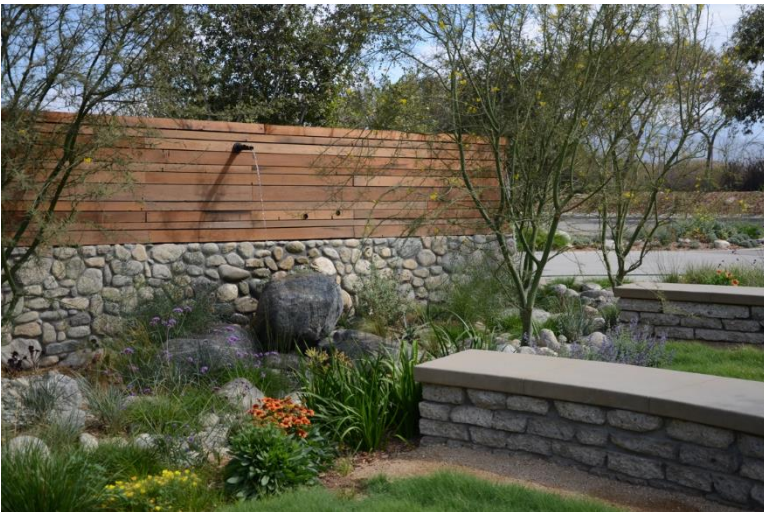
SITE MAP



Before



During



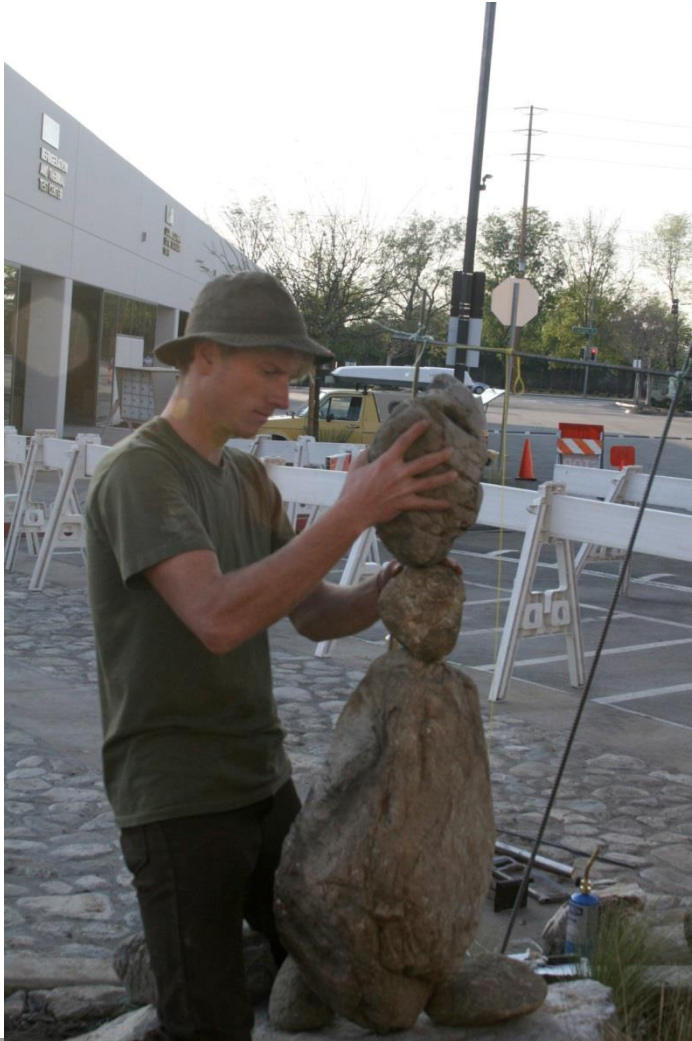




STORM GARDEN: THE RAIN FOUNTAIN

WORKSHOP, April 30th, 2015





THANK YOU



THANK YOU TO THE FOLLOWING EVENT SPONSORS:

