



Making It Easier to Design for River Water Quality

Presented to the EAC on September 25, 2020

Low Impact Development (LID)

A site-planning and design approach that

- Manages stormwater runoff close to its source
- Provides water quality treatment
- Treats stormwater as a resource instead of a nuisance
- Mitigates negative downstream impacts



Permeable Pavement



Bioretention



Bioswales



Stormwater Cisterns



Multi-pronged Approach to Barrier Removal

Education
and Tools

Pilot
Projects

Policy

Incentives

Maintenance
Inspections



SA River Authority-funded LID Incentives

- Watershed Wise Rebate
- Watershed Wise School Grant



Watershed Wise Rebates

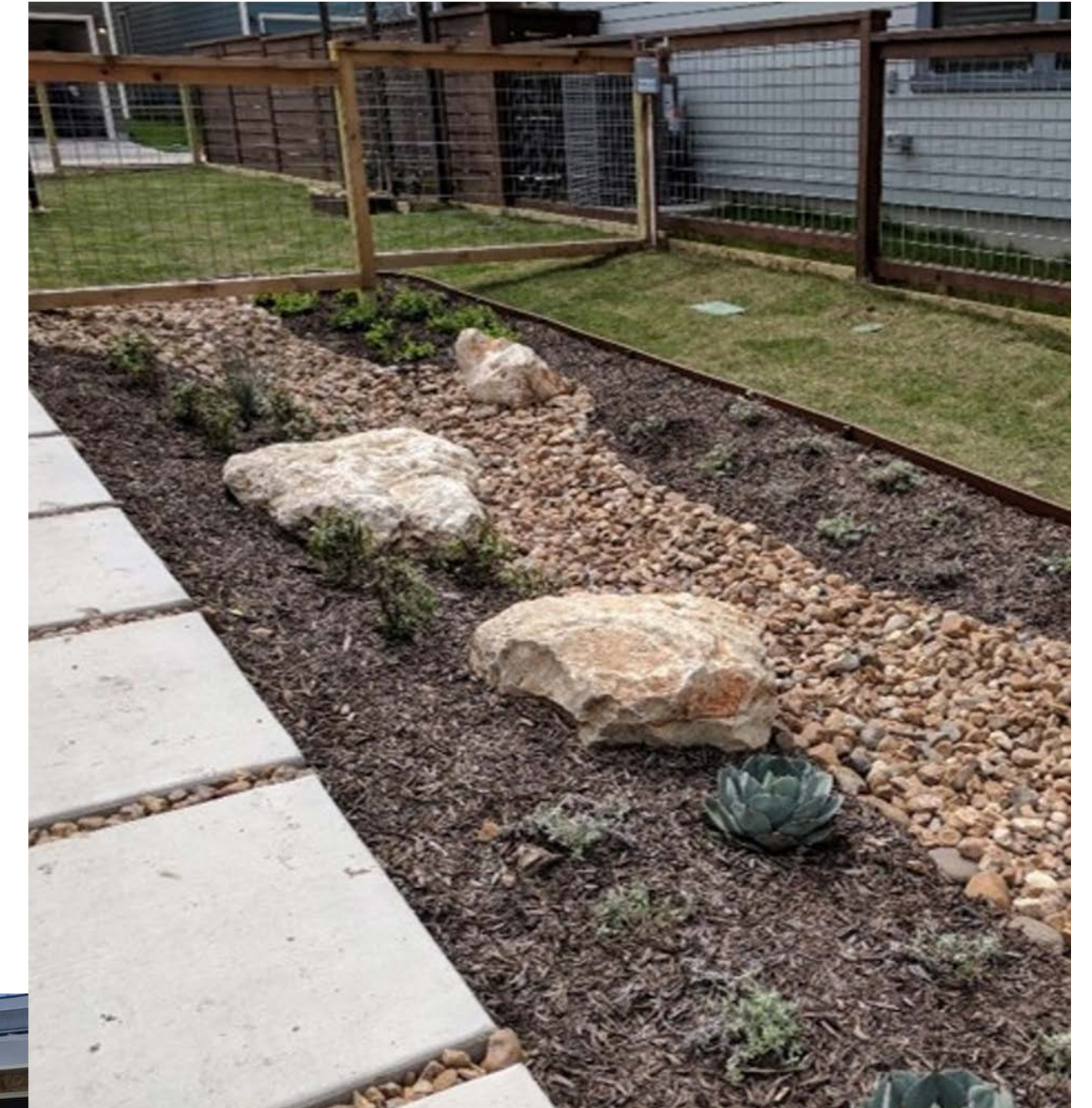
Available

- To Bexar, Wilson, Karnes, and Goliad counties
 - Public
 - Private
 - Non-profit entities
- For new and retrofit projects
- On projects \$15,000 or more



Watershed Wise Rebates

- Rebate Agreement required
 - Maintenance period
- LID courses required:
 - design
 - construction inspection
 - annual maintenance

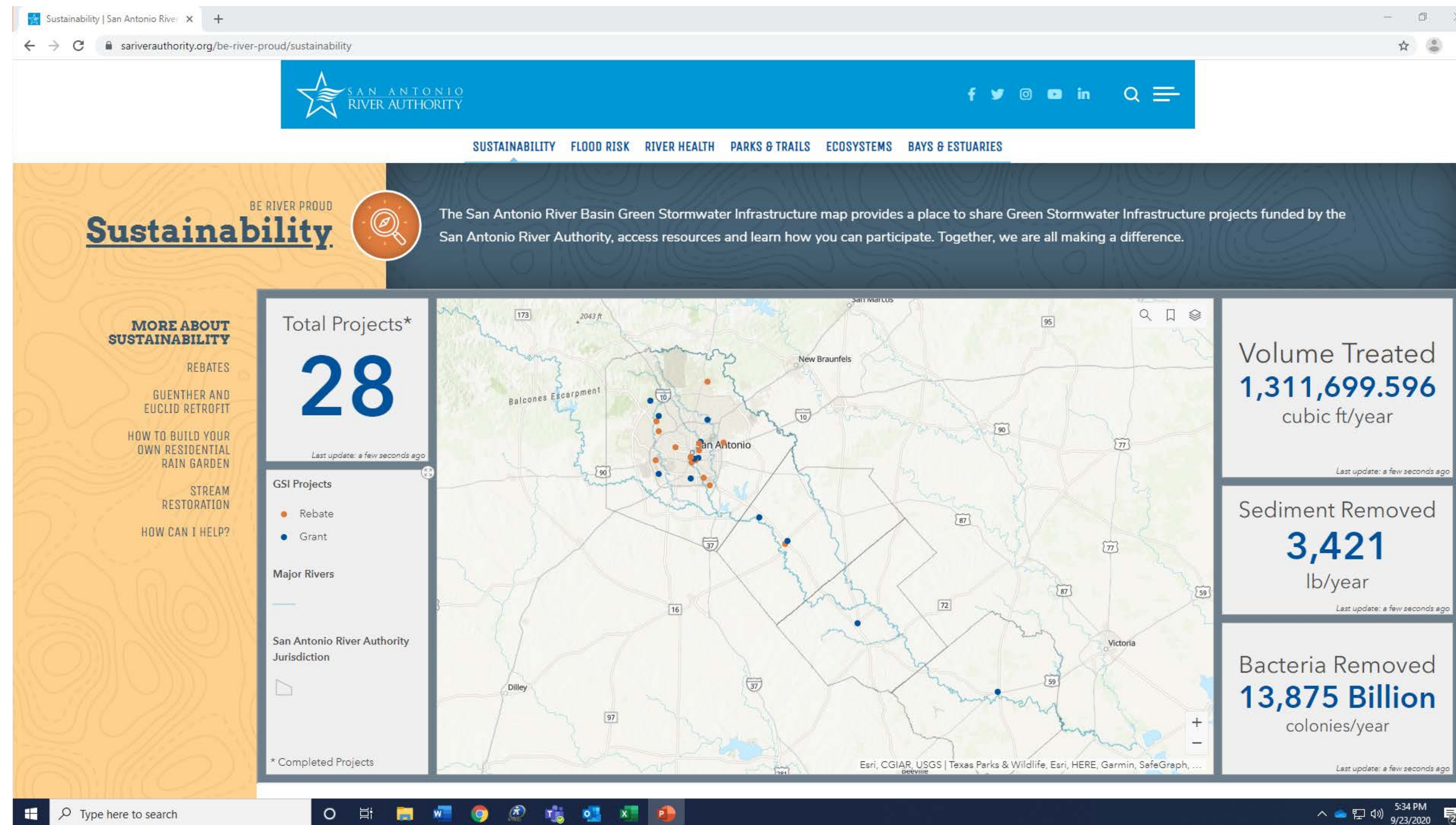


Watershed Wise Rebates

- Ranking Criteria
 - Priority sub-watersheds
 - Direct impact to receiving water body
 - Treatment percentage
 - Visibility
- Demand is greater than funding.



Interactive Map



<https://www.sariverauthority.org/be-river-proud/sustainability>



School Grants

- Competitive
- K-12 public schools
- Components of grant award:
 - Design professional
 - Grant agreement
 - Maintenance period
 - Signage package
 - Construction inspection

Before LID



After LID



New Rebate/Grant Inspection Program

Bioretention Maintenance Protocol

1 DESCRIPTION OF BIORETENTION

Bioretention areas are landscaped shallow depressions that capture and temporarily store stormwater runoff which is filtered through the soil media to remove pollutants. Bioretention areas usually consist of an inlet, a ponding area, mulch layer, planting soil media, native plants, an overflow device, or underdrain.



Figure 1. Examples of bioretention



2 SUMMARY OF PROTOCOL

Bioretention areas require regular plant, soil, and mulch layer maintenance to ensure optimum infiltration, storage, and pollutant-removal capabilities. Inlets, overflow drains, and underdrains, if components of your bioretention design, also require inspection and maintenance to ensure proper function. Table 1 provides a detailed list of maintenance activities and Table 2 is a checklist that will guide field personnel in identifying the appropriate outcomes of maintenance activities.

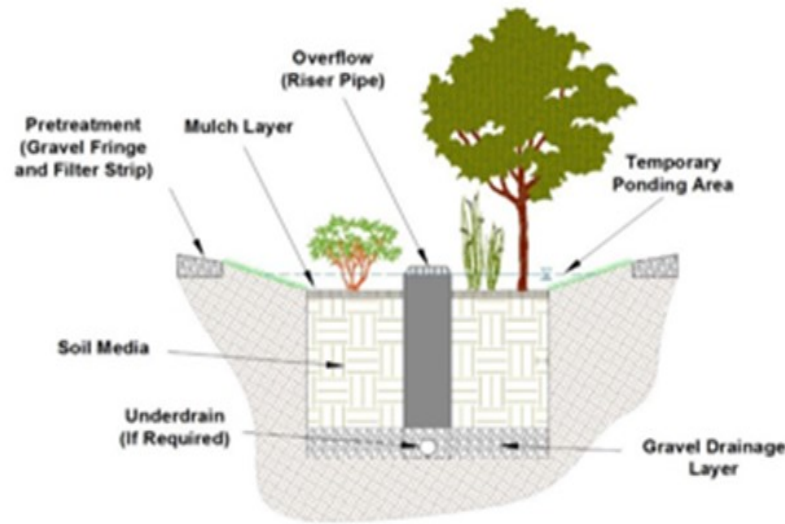


Figure 2. Schematic of bioretention highlighting the ponding area and overflow area. (Not all systems have the riser pipe.)

3 DESCRIPTION OF MAINTENANCE TASKS

1. **Mulch:** Maintain a 2 to 3-inch depth of dimensional chipped hardwood mulch, or triple-shredded hardwood mulch. Periodically, the mulch layer should be broken up and raked out, as over time it tends to solidify into a solid mass with reduced capacity for infiltration. Mulch should be completely replaced every 2 to 5 years.



Figure 3. Maintain 2 to 3 inches of mulch

2. **Plant Material and Weeding:** Replace all dead plants, and if specific plants have a high mortality rate, assess the cause. If necessary, replace with more appropriate native species. Periodic weeding is necessary until plants are established. The weeding schedule can become less frequent if the appropriate plant species and planting density have been used and, as a result, undesirable plants are excluded. Prune as necessary to maintain the desired aesthetic.



Figure 4. Example of vegetation growth that eliminates the need to weed. Woolly Star, shown, and Gulf Muhly are well suited to bioretention.



Maintenance Activities Sheet

Task	Frequency	Indicator maintenance is needed	Maintenance notes
Catchment inspection	Weekly or biweekly with routine property maintenance	Excessive sediment, trash, or debris accumulation on the surface of bioswale	Permanently stabilize any exposed soil and remove any accumulated sediment. Adjacent pervious areas might need to be regraded.
Inlet inspection	Weekly or biweekly with routine property maintenance	Internal erosion or excessive sediment, trash, and/or debris accumulation	Check for sediment accumulation to ensure that flow into the bioswale is as designed. Remove any accumulated sediment.
Litter and leaf litter removal	As needed potentially weekly or biweekly in peak seasons	Accumulation of litter and leafy debris within bioswale	Litter and leaves should be removed to reduce the risk of outlet clogging, to reduce nutrient inputs to the bioswale, and to improve facility aesthetics.
Pruning	1–2 times per year	Overgrown vegetation that interferes with access, lines of sight, or safety	Nutrients in runoff often cause bioswale vegetation to flourish.
Mowing	2–12 times per year	Overgrown vegetation that interferes with access, lines of sight, or safety	Frequency depends on location and desired aesthetic appeal.



Inspection and Maintenance Checklist

Inspection and Maintenance Checklist BIOSWALE	Property Address _____
	Property Owner _____
	Treatment Measure No. _____ Inspection Date _____
	Inspector(s) _____
	Type of Inspection:
	<input type="checkbox"/> Monthly <input type="checkbox"/> Pre-wet season <input type="checkbox"/> Post-wet season <input type="checkbox"/> After heavy runoff <input type="checkbox"/> Other _____

Defect	Conditions when maintenance is needed	Maintenance needed?	Comments _a	Results expected when maintenance is performed
1. Standing water	Water in the bioswale does not drain within 24 hours after rainfall.			There should be no areas of standing water once inflow has ceased. Any of the following could apply: sediment or trash blockages need to be removed, grade from head to foot of the bioswale improved, media surface scarified, or underdrains flushed.
2. Trash and debris	Trash and debris accumulate in the bioswale and around the inlet and outlet.			Trash and debris are removed from the bioswale and disposed of properly.
3. Sediment	Sediment accumulates in the bioswale			Material is removed such that that there is no clogging or blockage. Material is disposed of properly.
4. Erosion	Channels have formed around inlets, there are areas of bare soil, or there is other evidence of erosion.			Obstructions and sediment are removed so that water flows freely and disperses over a wide area. Obstructions and sediment are disposed of properly.
5. Vegetation	Vegetation is dead, diseased or overgrown.			Vegetation is healthy and attractive. Grass is maintained at least 3 inches in height.
6. Mulch	Mulch is missing or patchy. Areas of bare earth are exposed or mulch layer is less than 3 inches deep.			All bare earth is covered, except mulch is kept 6 inches away from trunks of trees and shrubs. Mulch is even at a depth of 3 inches.
7. Inlet/outlet	Sediment accumulations.			Inlet/outlet is clear of sediment and debris and allows water to flow freely.
8. Miscellaneous	Any condition not covered above that needs attention for the bioswale to function as designed.			The design specifications are met.



Inspections Findings

- Weeding and grass removal
- Native plant understanding
- Water volume / infiltration
- Cistern maintenance



New Rebate/Grant Inspection Program

Responds to

- Citizen complaints and concerns of water quality and illegal dumping
- Fish kills, permit violations, chemical and fuel spills
- Terrestrial and aquatic habitat destruction
- Floodplain violation and stream encroachment
- Unauthorized or unpermitted activities

Environmental
Investigation Team:
210-215-9202



New Rebate/Grant Inspection Program

Conducts

- Environmental sampling
- Environmental site assessment
- River crossings
- Emergency spill response
- Environmental report review



Formal, Credential Courses

Course	When Offered
LID Construction Inspection	Fall 2020
LID Annual Operations and Maintenance	Fall 2020
LID Site Planning and Design	Winter 2020



Committed to Safe, Clean, Enjoyable Creeks and Rivers.

San Antonio River Basin LID Manual

- 2nd issue
- 10th LID Feature
Added: Extended
detention pond
- Addresses multiple
audiences
- Condensed manual

Coming
Soon!



2015 Unified Development Code Amendment

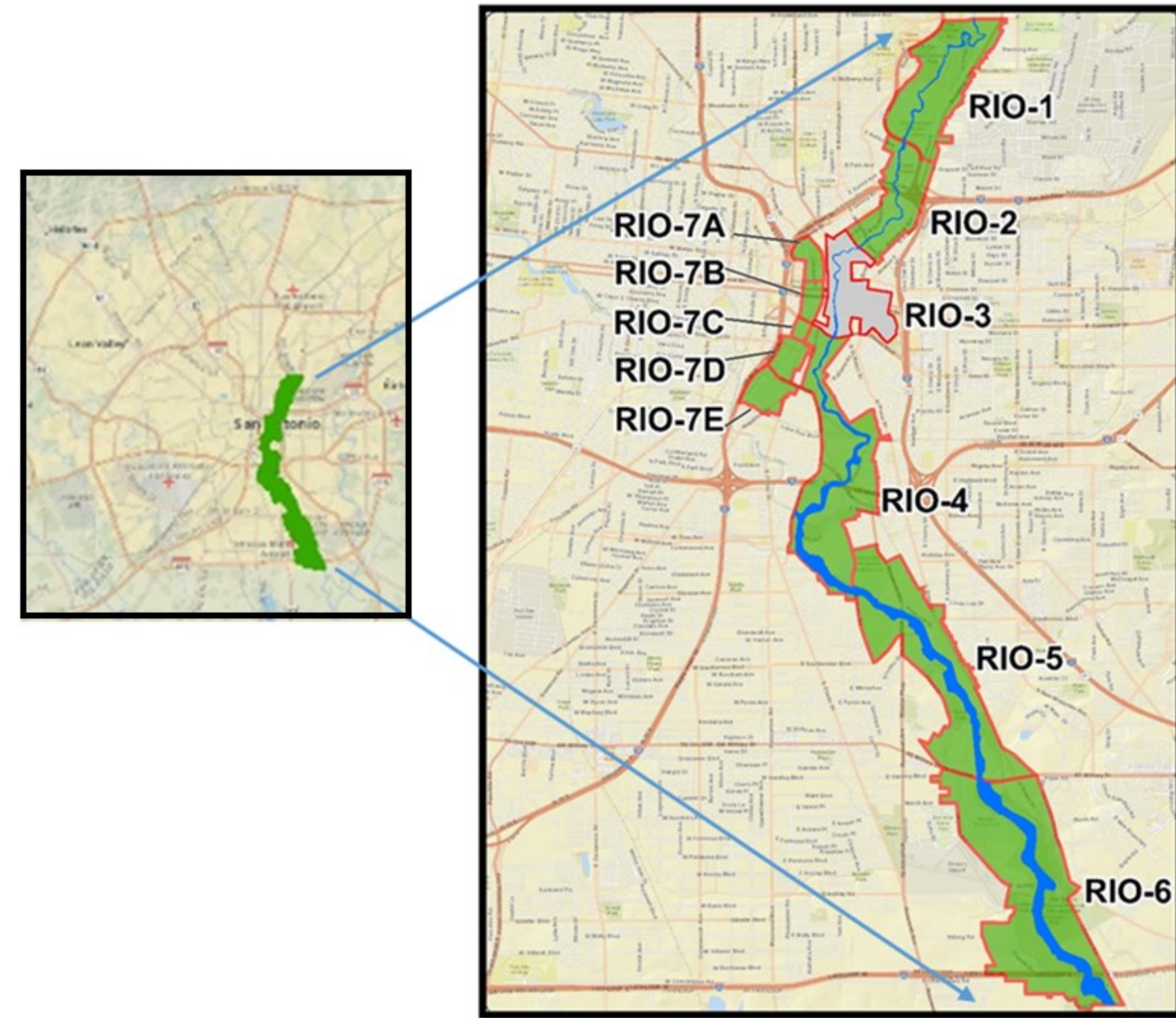
- In coordination with City of San Antonio's Public Works Department
- *Voluntary*
- Provides City of San Antonio incentives
 - Fee
 - Credit off-set
- Removes variance requirement to do LID



2015 Unified Development Code Amendment

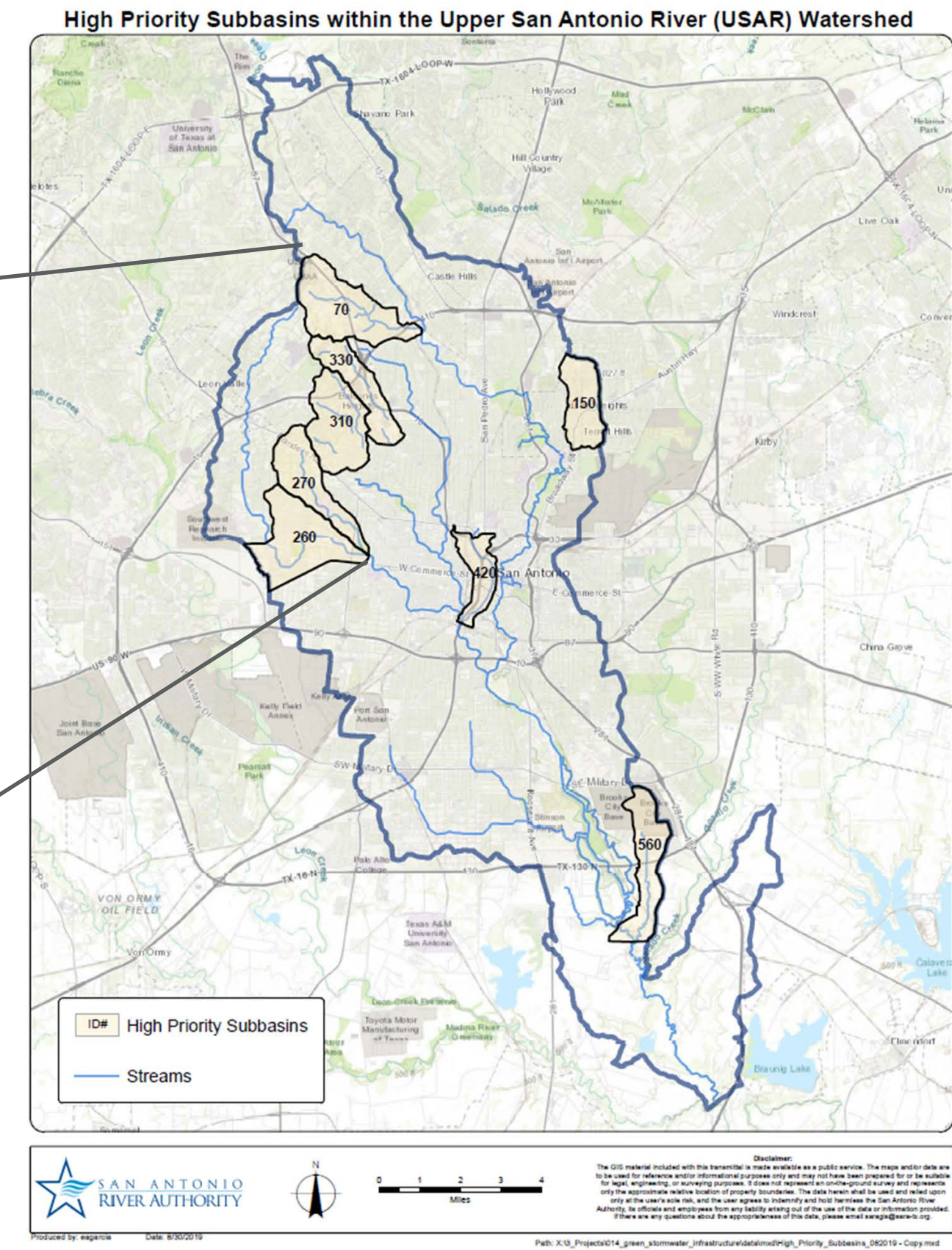
RIO District **Mandates**

- Properties *abutting* the San Antonio River and San Pedro Creek
- Requires
 - LID
 - Coordination with SARA on
 - Drainage along River Walk
 - Ties to River Walk
 - Easements



Special Projects

- Avian Study
- Edwards Aquifer Protection Program
- Water Quality Projects
- Green Stormwater Infrastructure Master Plan
- Impervious Cover Mitigation



Website Resources: Rain Gardens

4 How-to Videos



- How to Build a Rain Garden

<https://youtu.be/UXaEfSbjP9Y>

- Perc Test

<https://youtu.be/kYVWh6MuOBJM>

- Rain Garden Blueprint (sizing)

<https://youtu.be/-7SBA8OpSVM>

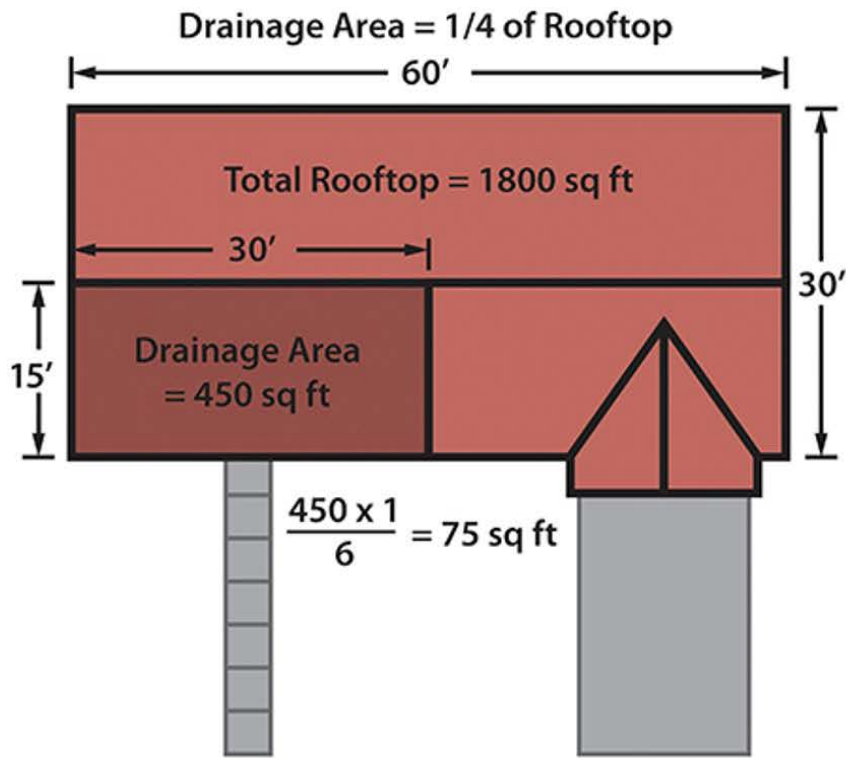
- Digging and Planting

<https://youtu.be/1ihv6zbDuPs>



Website Resources: Rain Gardens

- Narrative companion to the videos including
 - Illustrations
 - Calculation tables
- Great plants for rain gardens



Impervious Surface Area (sq.ft.)	Rain Garden (sq. ft.)	Site Options (ft. x ft.)
200	33	3x11; 4x9
400	67	5x14; 7x10
600	100	5x20; 8x12
800	133	6x22; 10x13
1000	167	6x28; 10x17

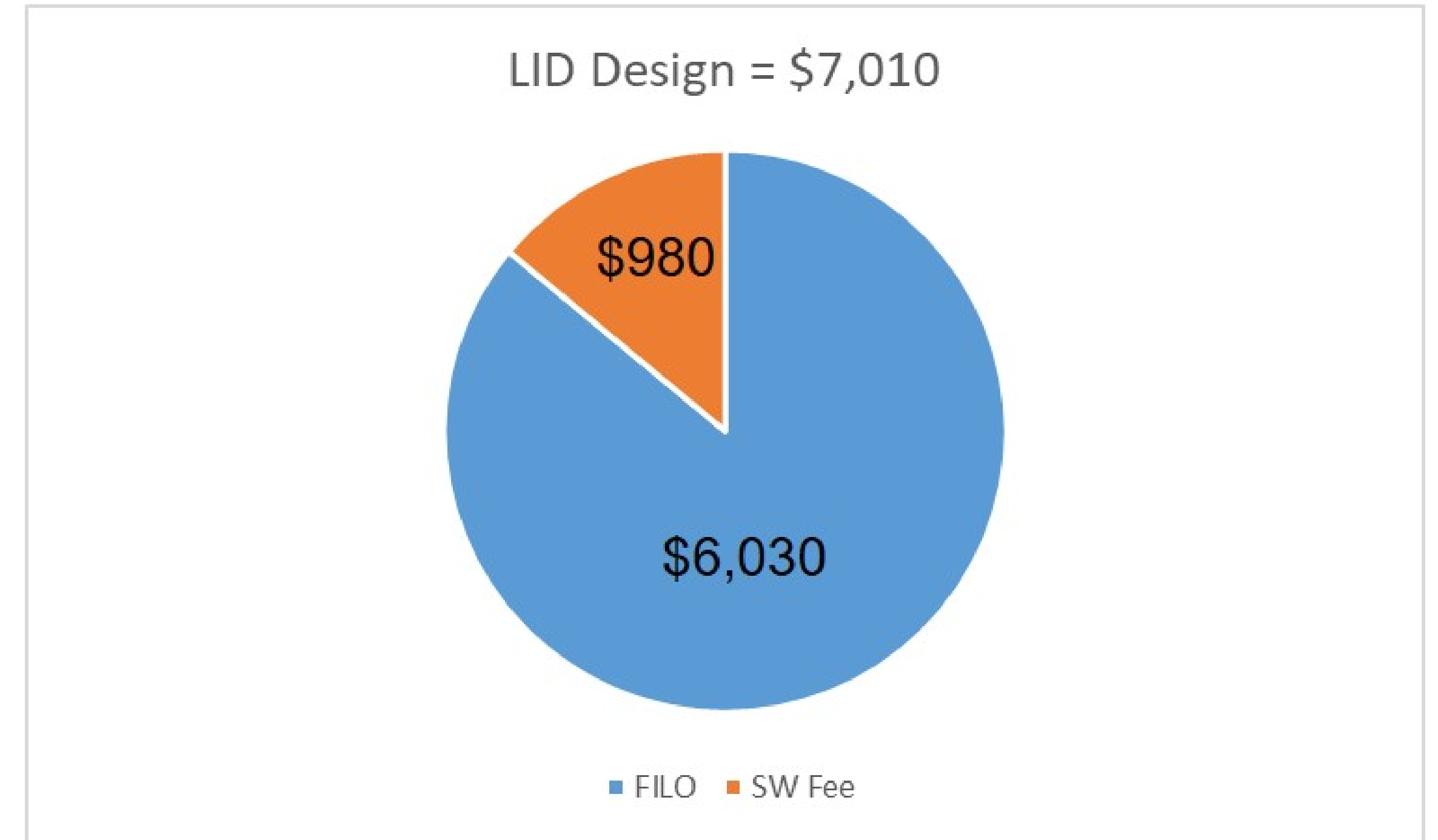
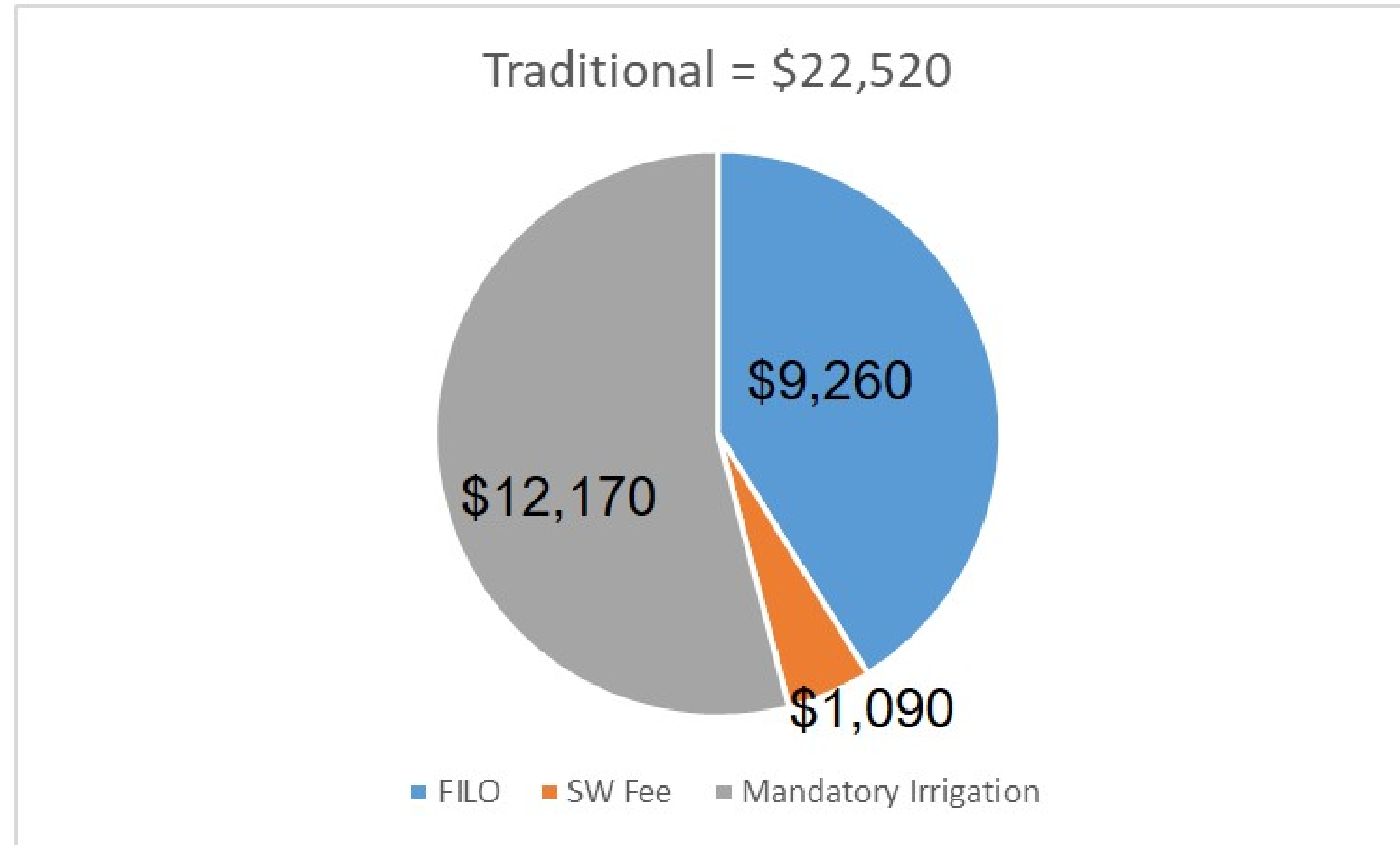


Questions?

Karen Bishop
Senior Supervisor
Sustainable Infrastructure Unit
San Antonio River Authority
(210) 302-3642
kbishop@sara-tx.org



Traditional vs. LID Comparison



40,000 SF traditional parking lot design compared to LID design with bioswale: \$15,510 savings with LID.

