



Funding Treatment of Urban Stormwater: The Groundwater Connection

**Nonpoint Source Pollution Program
Texas Commission on
Environmental Quality**



**Texas Groundwater Protection Committee
April 19, 2017**

Three-Part Presentation

Groundwater as it is related to:

- **Texas Nonpoint Source Management Program**
- **Watershed Planning and Implementation**
- **Low Impact Development (LID).**
 - **TCEQ-funded projects**
 - **Special issues related to groundwater**





Texas NPS Management Program

- Five-year plan for state efforts.
- Draft 2017 version currently available.
- Incorporates the Texas Groundwater Protection Strategy by reference.
- Appendix D presents Groundwater Constituents of Concern and an Aquifer Vulnerability Ranking table.





Texas NPS Management Program

- **Groundwater strategy: non-degradation and elimination of exceedances of Maximum Contamination Limits (MCLs)**
- **Nitrate is the primary NPS-driven form of groundwater pollution.**
- **Highlights nitrates in the Rio Grande Valley area of the Gulf Coast aquifer.**



Texas NPS Management Program

- References the groundwater assessment in the Texas Integrated Report of water quality
- Analysis of well data 2003 – 2013:
 - total sampling data by aquifer and pollutant
 - # of MCL exceedances by pollutant
 - # of samples with non-detect results by pollutant
- Maps color-code wells according to relative concentrations of various pollutants.



TCEQ NPS Project Selection Criteria

- **Request for Grant Applications (RFGA) for NPS projects set for June 1 release.**
- **Selection criteria have included points for addressing groundwater, sometimes ranked in relation to the aquifer vulnerability index and documented exceedances of MCLs.**
- **Official selection criteria are published with each RFGA.**



Current NPS Program Priorities

- **Implement watershed-based plans**
- **Restore impaired water bodies**
- **Significantly reduce N, P, and Sediment**
- **Implement measures with high potential for successful replication to additional sites**
- **Significant leveraging: commitments beyond the project-funded activities**
- **“Phase 2” projects (pre-planned)**





Watershed-Based Plans

**EPA guidance for state NPS programs
emphasizes developing and implementing
watershed-based plans.**





Watershed-Based Plans

- **Actions needed to achieve water quality goals in a water body.**
- **The top priority is restoring surface waters listed as impaired.**
- **Some plans are preventive.**





Watershed-Based Plans

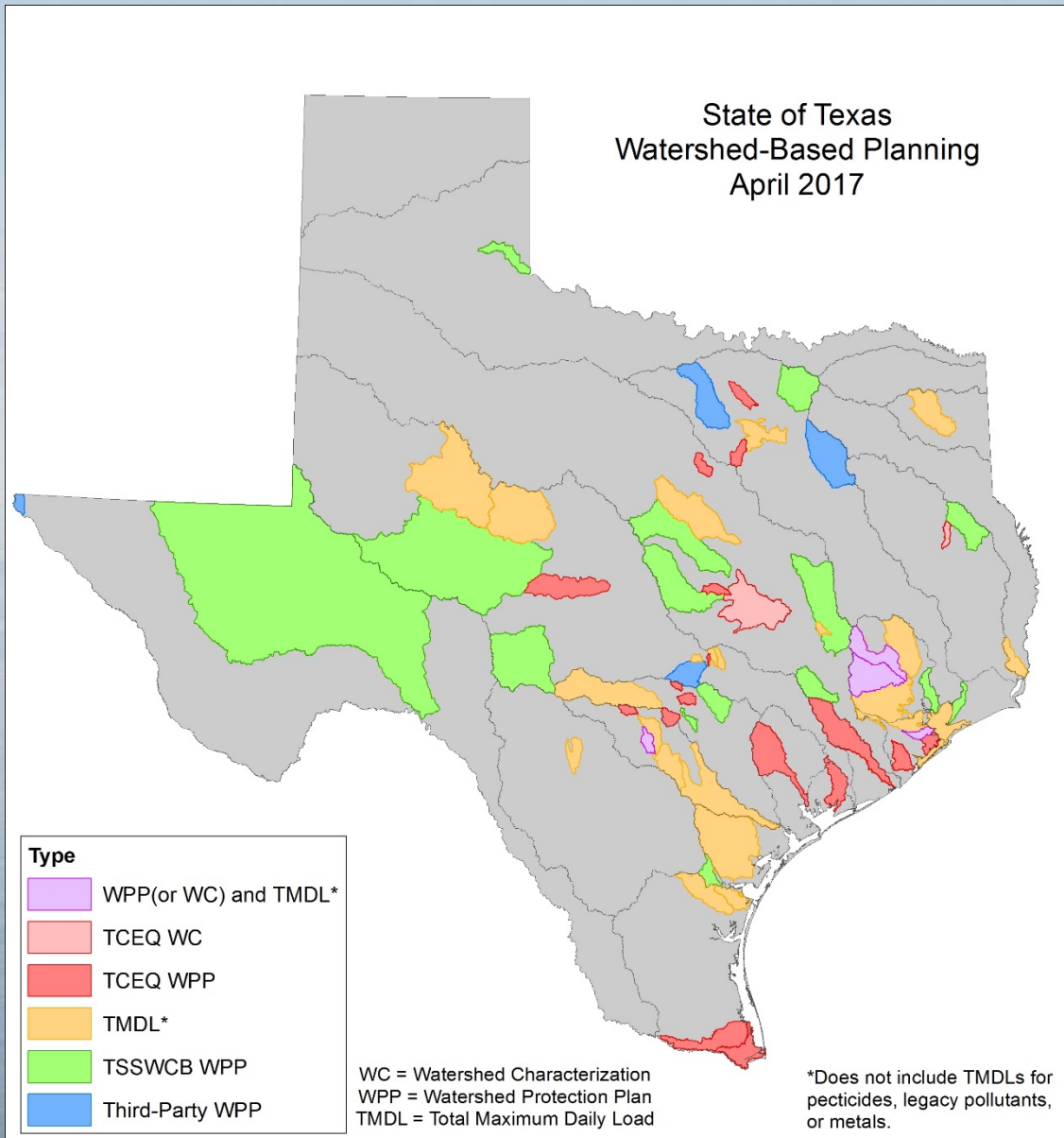
There are several kinds of plans.

- **Watershed Protection Plans (WPPs) developed by TCEQ, TSSWCB, or third parties.**
- **TMDL Implementation Plans**
- **TMDL “bridge documents”**
- **Other watershed planning documents**

Only plans accepted by EPA under the CWA Section 319 program qualify for implementation funding.



Watershed Protection Plans

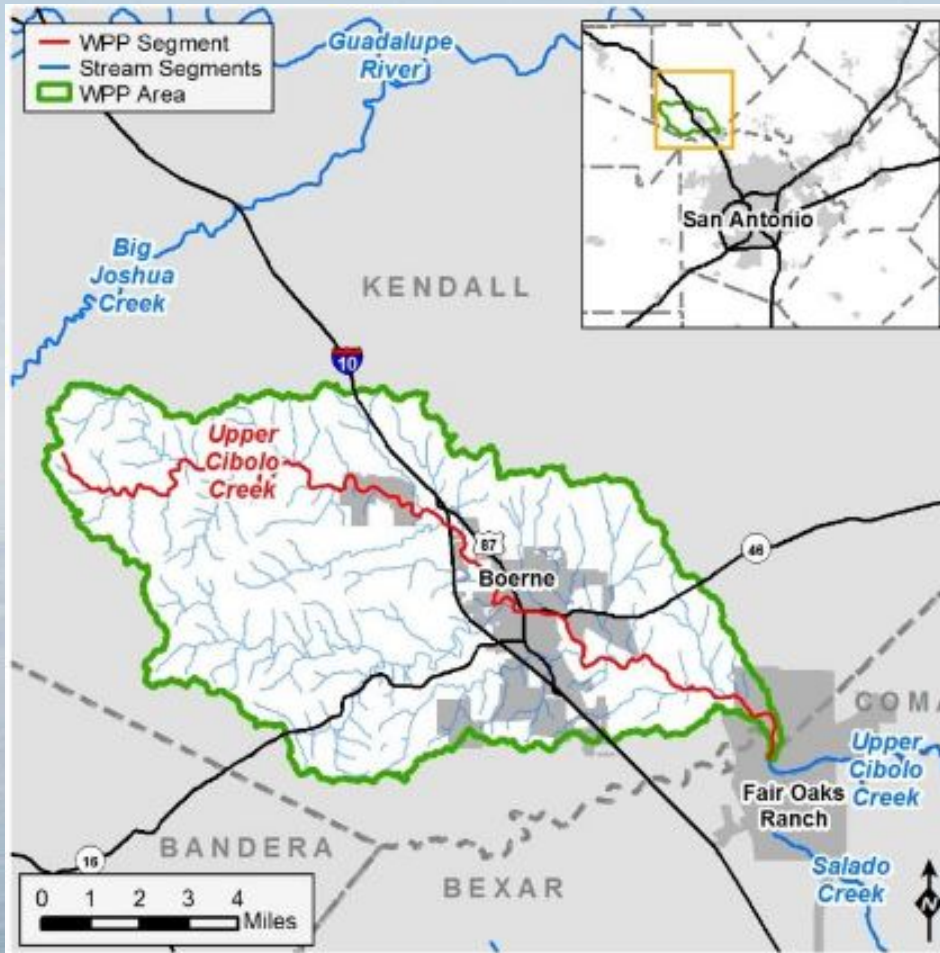


This map shows the watersheds of all Texas plans:

- 18 have been accepted by EPA
- Another 18 are currently in development.



Watershed Protection Plans



Some of these water bodies have significant connectivity to groundwater, including:

- Upper Cibolo Creek
- Upper San Antonio River
- Upper San Marcos River
- Cypress Creek





Watershed Protection Plans

The Cypress Creek WPP :

- Addresses bacteria, nutrients, and other pollutants as well as **low dissolved oxygen**.
- States that restoring adequate **dissolved oxygen** requires a streamflow of 6 cfs.
- Prioritizes adequate artesian outflow from the Trinity Aquifer primarily at Jacob's Well.
- Makes promoting and incentivizing water conservation the principal strategies to achieve this goal.



Watershed Protection Plans

Cypress Creek implementation: installing LID demos and designing a model development review process to accommodate LID features more easily.

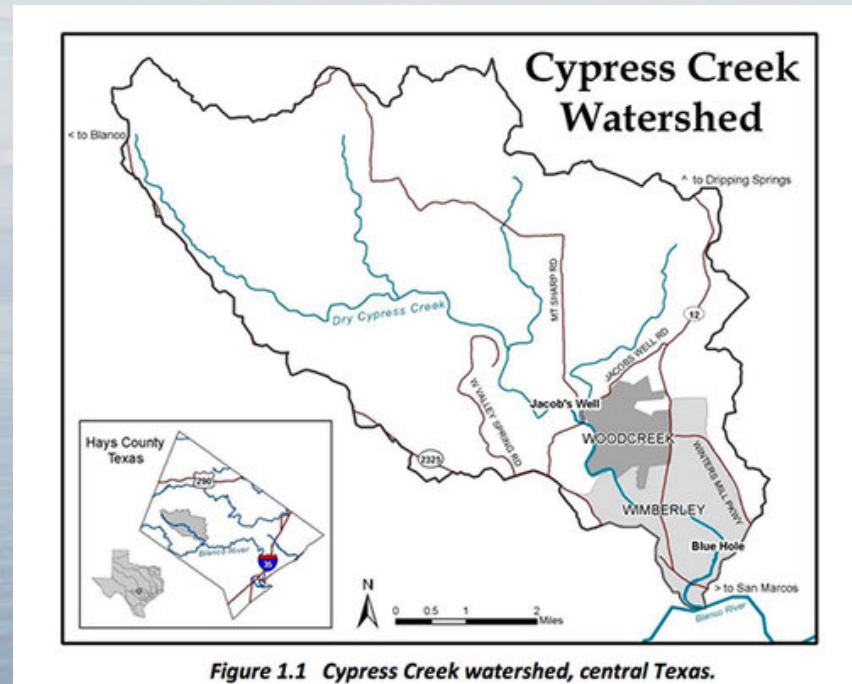
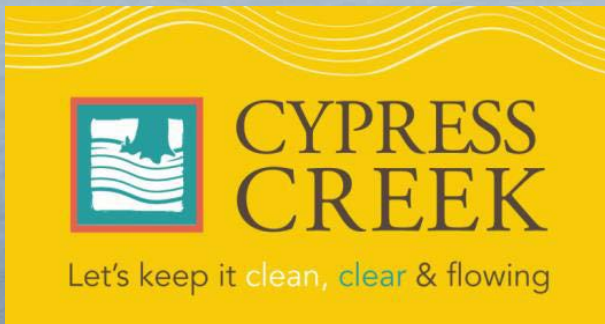


Figure 1.1 Cypress Creek watershed, central Texas.





Watershed Protection Plans

The Upper Cibolo Creek WPP :

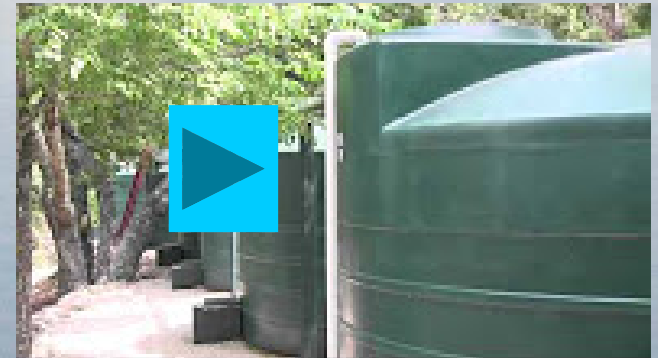
- Also addresses bacteria, nutrients, and **low dissolved oxygen**.
- Its lower reach crosses the Trinity Aquifer recharge zone – where the entire creek flow goes underground during normal flows.
- WPP Modeling (SWAT) addressed transformations of pollutants through cycles of transition between groundwater and surface water



Watershed Protection Plans

The Upper Cibolo Creek WPP :

- Has no specific goals for groundwater but includes outreach on water conservation.
- Recent implementation project: manuals and instructional videos for rainwater harvesting



Reduce and Re-direct Runoff

Low Impact Development (LID)



Reduce and Re-direct Runoff

Low Impact Development (LID)

Conventional Drainage
Plan



LID Drainage Plan



Reduce and Re-direct Runoff

Low Impact Development (LID)

Conventional Drainage
Plan



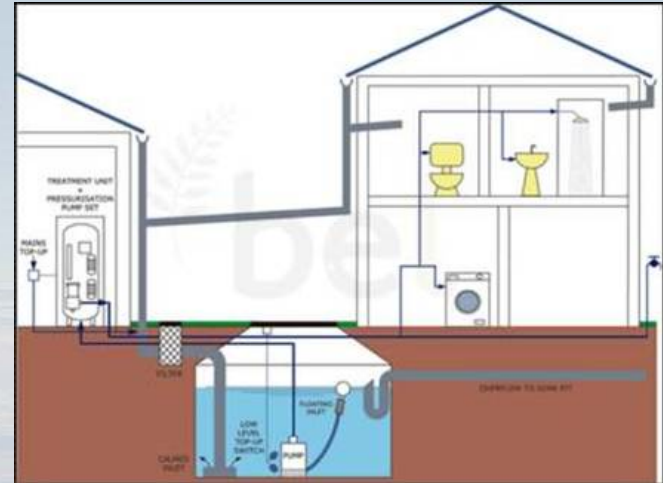
LID Drainage Plan



Reduce Runoff – BMPs

Rain Water Harvesting

Household Uses



Commercial Scale



Reduce Runoff – BMPs

Bio-retention

Shallow low-lying garden with a base of porous material



Reduce Runoff – BMPs

Bio-retention

Bio-retention Along City Streets



Reduce Runoff – BMPs

Bio-swales

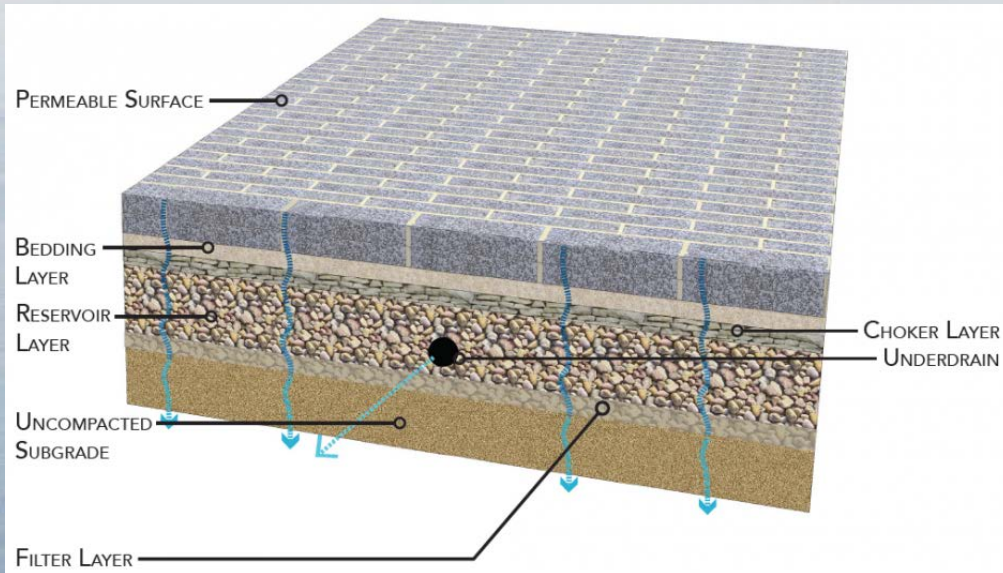
- Bioswales are vegetated open channels with a deep porous base to slow and infiltrate runoff drainage without flooding.



Reduce Runoff – BMPs

Permeable Pavement

Permeable pavement captures, filters, and treats runoff, usually with a storage layer underneath.



Reduce Runoff – BMPs

Green Roofs

Green roofs absorb and treat runoff in landscaped planting beds.





Statewide LID Workshops 2010-11

Dallas/Fort Worth

Waco

Austin

Houston

San Antonio

Corpus Christi

Lower Rio Grande Valley



Mission Drive-In Redevelopment, San Antonio



Cisterns



Bioswales



Bioretention



Mission Drive-In Redevelopment, San Antonio



**Permeable Friction Course Pavement
Draining to Bioswale**



**Automated
Monitoring**



Street Drainage BMPs, Houston



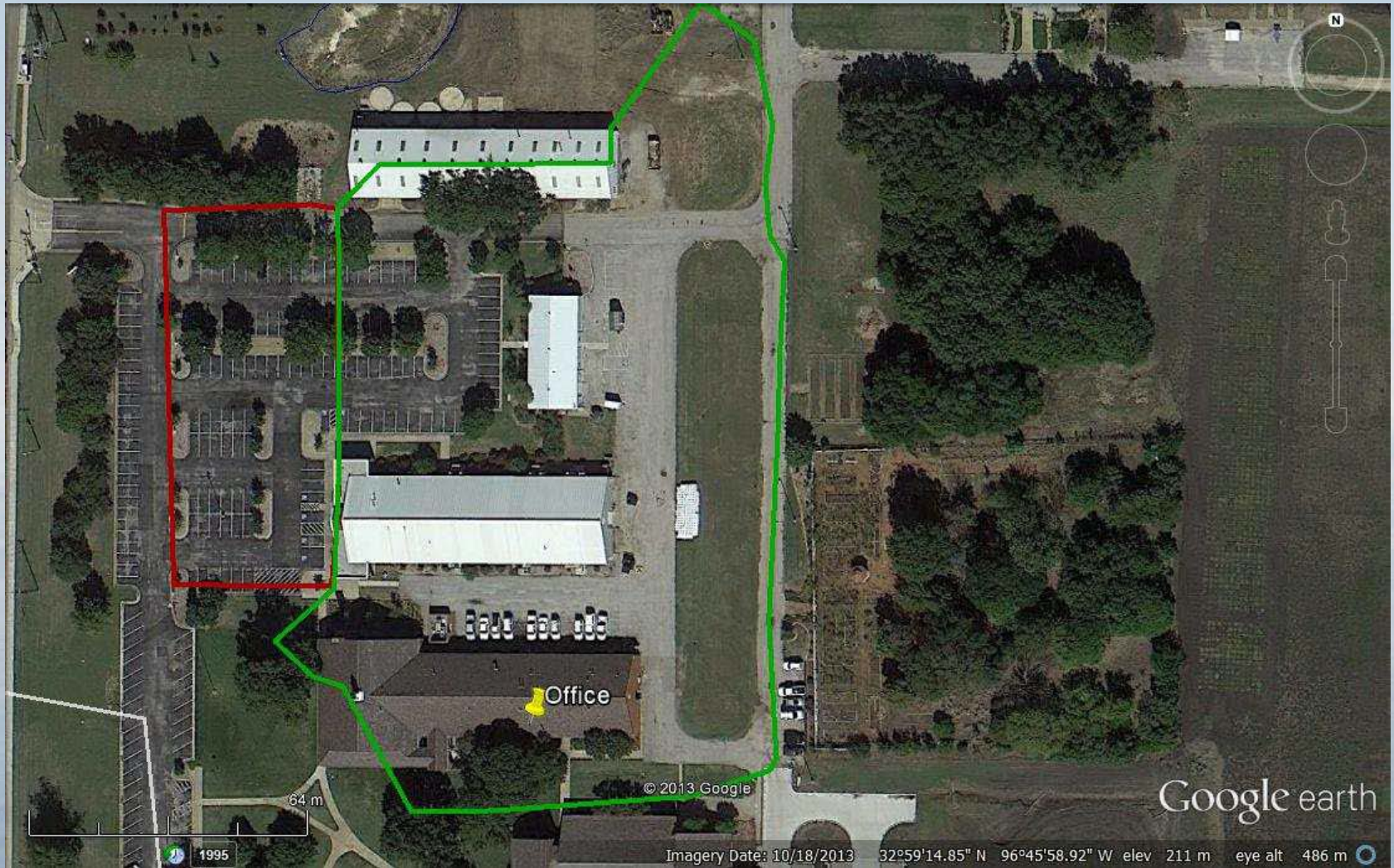
Rain Gardens



Tree Boxes



Dallas AgriLife Center



Dallas AgriLife Center

Rain Garden



Retention Pond



Dallas AgriLife Center

Green Roof Experiment

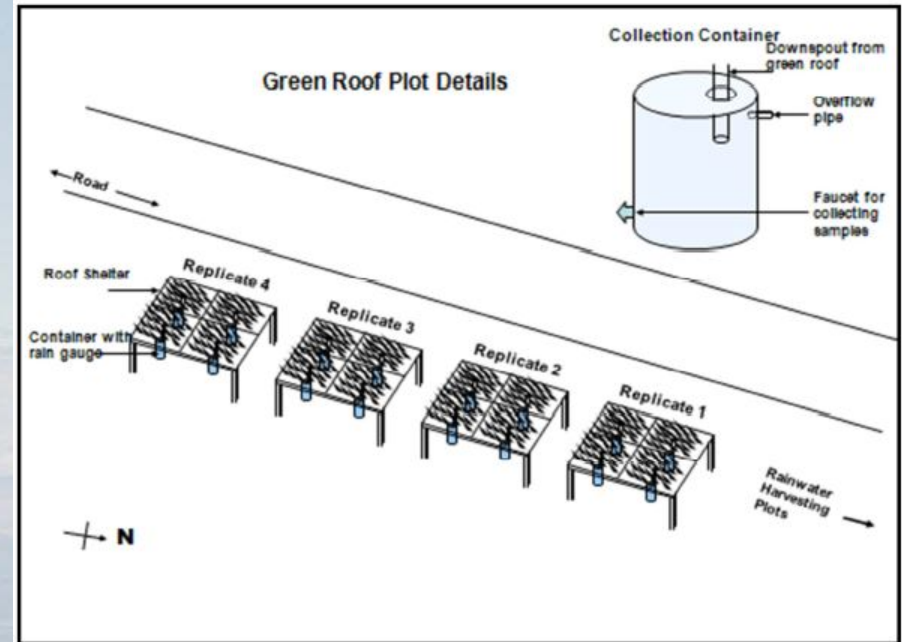


Figure 5. Details of green roof monitoring set up.

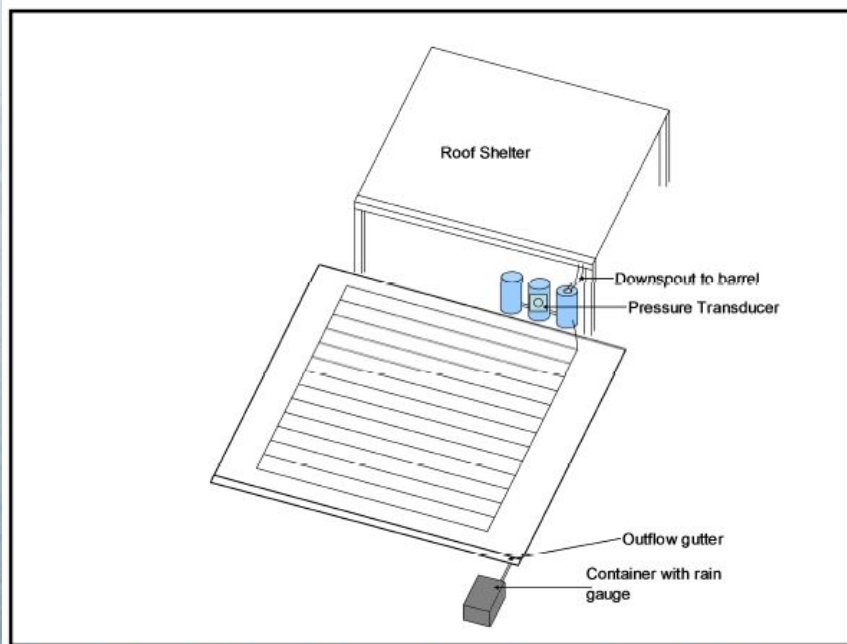
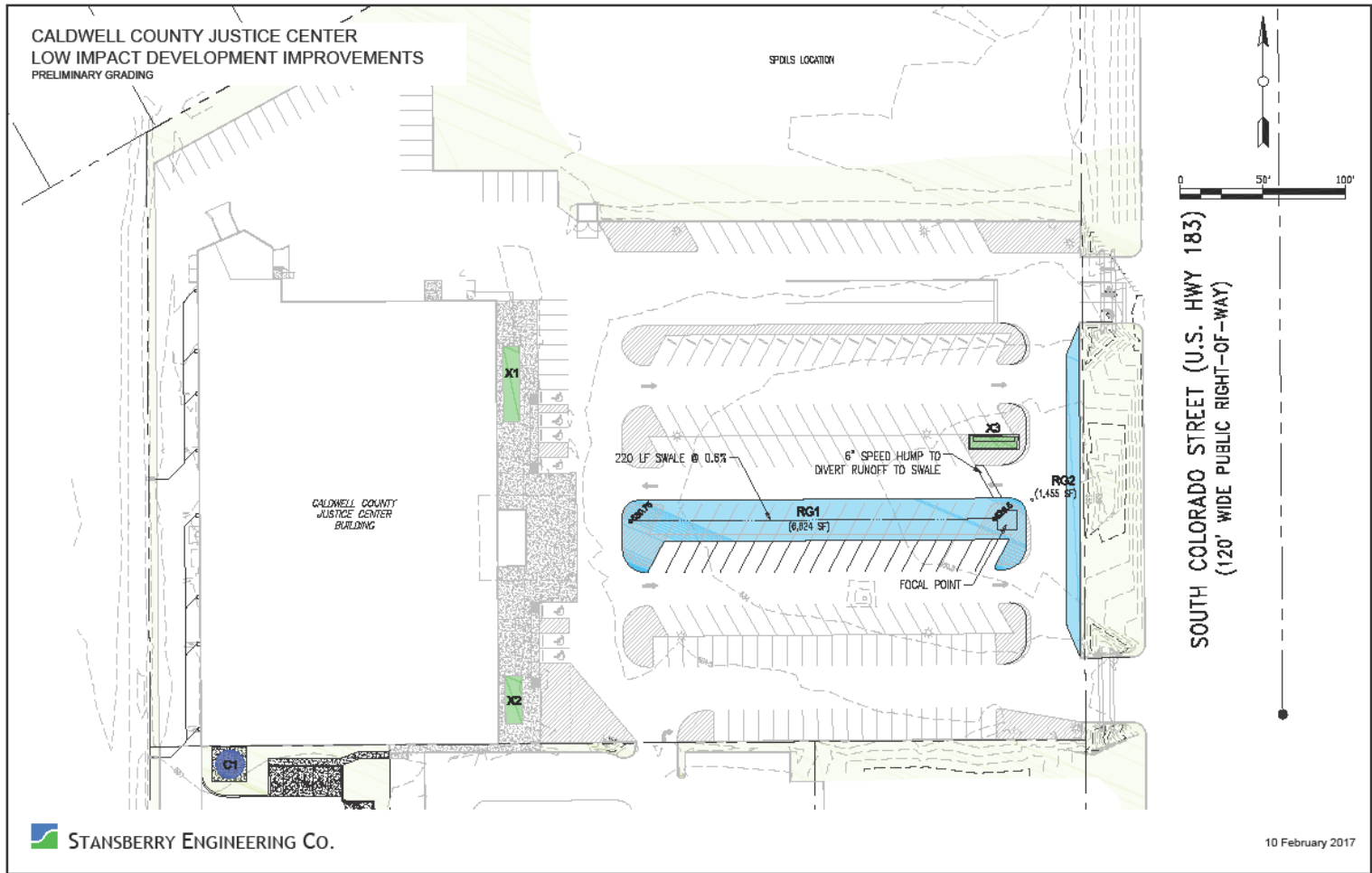


Figure 6. General design of rainwater harvesting experimental plot

Rain Barrel Experiment



County Justice Center. Lockhart



San Antonio River Authority Retrofits: Guenther Street



Bioretention



Cisterns



San Antonio River Authority Retrofits: Euclid Street



Massive Cisterns

Bioswale



San Antonio River Authority

Retrofits: Euclid Street

**Cisterns
Installed**



Lower Rio Grande Valley



Lower Rio Grande Valley



**Permeable
Pavement**



Cisterns



Seguin Outdoor Learning Center



**Permeable
Pavement**



**Vegetated
Swale**



Rain Garden





Detention Basin Retrofit, Pflugerville



**Automated controller
retaining runoff in
Pon Court basin,
Pflugerville**





LID and Groundwater

Some Infiltration BMPs Need

Class V Injection Well Authorization:

- “Storm Water Drainage” injection wells
- Recent attention to “infiltration panels” in Houston – rock-filled layers below parking lots, receiving stormwater via drop inlets.
- No fee or charge, just completion of an authorization form stamped by a PE or PG



LID and Groundwater

Some Infiltration BMPs Need

Class V Injection Well Authorization:

- Rule of Thumb: It usually needs an authorization if it is deeper than its inlet is wide, and/or if it has a “subsurface fluid distribution system”
- Most typical LID BMPs are exempt: bioretention, bioswales, permeable pavement, rain gardens, and more





LID and Groundwater

TCEQ's Edwards Aquifer Zone Rules

place special restrictions on LID:

- Infiltration of stormwater poses special risks in karst aquifer recharge zones.
- Many BMPs, including rain gardens, must use impermeable liners and underdrains to prevent exfiltration into recharge features.
- Dispersion of concentrated runoff using surface features like rock berms is acceptable.





TCEQ NONPOINT SOURCE PROGRAM

- **Website: How to apply for grants, summaries of recent and current projects, etc.**

<https://www.tceq.texas.gov/waterquality/nonpoint-source/index>

- **Email:**
- nps@tceq.texas.gov



NPS Project Summaries



Texas Commission on Environmental Quality
Nonpoint Source Program



Low Impact Development: Redevelopment of the Mission Drive-In Project

Water Body	Upper San Antonio River (Seg 1911)
Location	Bexar County
River Basin	San Antonio River (19)
Contractor	City of San Antonio
Project Period	August 31, 2011 to August 31, 2014
Project Total	\$867,368 (Federal 60% and Local 40%)

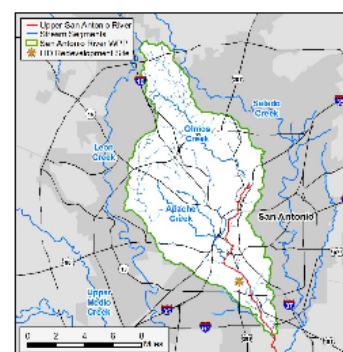
Low Impact Development (LID)

LID is a comprehensive approach to site planning, design, and pollution prevention strategies that, when combined, create a more economically sustainable and ecologically functional landscape. LID works with nature to manage stormwater as close to its source as possible. This approach treats stormwater as a resource, rather than a waste product, and integrates hydrologic and water quality functions into all aspects of the urban landscape and infrastructure. The result is a functional and appealing landscape providing site drainage that restores the ecological integrity of receiving waters, promotes the natural movement of water within an ecosystem or watershed, and reduces construction, maintenance, and inspection costs. Examples of LID management approaches and technologies include rain gardens, porous pavements, green roofs, and rainwater harvesting for later use.

Portions of the Upper San Antonio River (Segment 1911) have been impaired for bacteria since 2000. As a result, this segment does not currently meet its contact recreation use. In 2006, the San Antonio River Authority completed the [Upper San Antonio River Watershed Protection Plan \(WPP\)](#), and in 2007 the TCEQ adopted a [total maximum daily load \(TMDL\)](#) addressing this segment among others.

Project Description

The purpose of this project is to implement a portion of the Upper San Antonio River WPP by designing, installing, demonstrating, and monitoring the effectiveness of a set of LID features. LID practices appropriate for the region will be installed at the City of San Antonio's Mission Drive-In redevelopment site in order to demonstrate their regional effectiveness. Elected officials, developers, and the general public will be educated on the values of LID to the region and the feasibility of adding LID features to the Unified Development Code. The pollutant-removal effectiveness of the LID features will be evaluated by collecting stormwater samples at their inlets and outlets. The goal is to sample at least five stormwater events.



Current Status

Contract was executed 08/31/2011. Construction progress at the site prior to project initiation made it necessary to revise some of the LID features for the site. A large rainwater harvesting system was integrated into the site irrigation system. All BMP design and construction is completed. Monitoring the project site and a paired site for comparison of runoff quality is in preparation.

For More Information

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June 2013

<https://www.tceq.texas.gov/waterquality/nonpoint-source/projects/index.html>





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