

SAN ANTONIO  
RIVER  
AUTHORITY



Seagull  
P M E

## From Proposition 1 to Policy Impact: Building Resilience through the Edwards Aquifer Protection Program

Gian Villarreal & Becca Oliver  
Seagull PME

Mikel Wilkins  
San Antonio River Authority

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# Agenda

- Program Overview (MW)
  - 11 funded projects
- EAPP Program & Project Results (GV)
  - Quantified Benefits & Impacts
  - Pollutants / NBS Effectiveness
- Applying Findings & Practical Takeaways (BO)
  - NBS system design & implementation
  - MS4 Permit Applicability
- Legacy & Vision (MW)





# Edwards Aquifer Protection Project: Program Overview

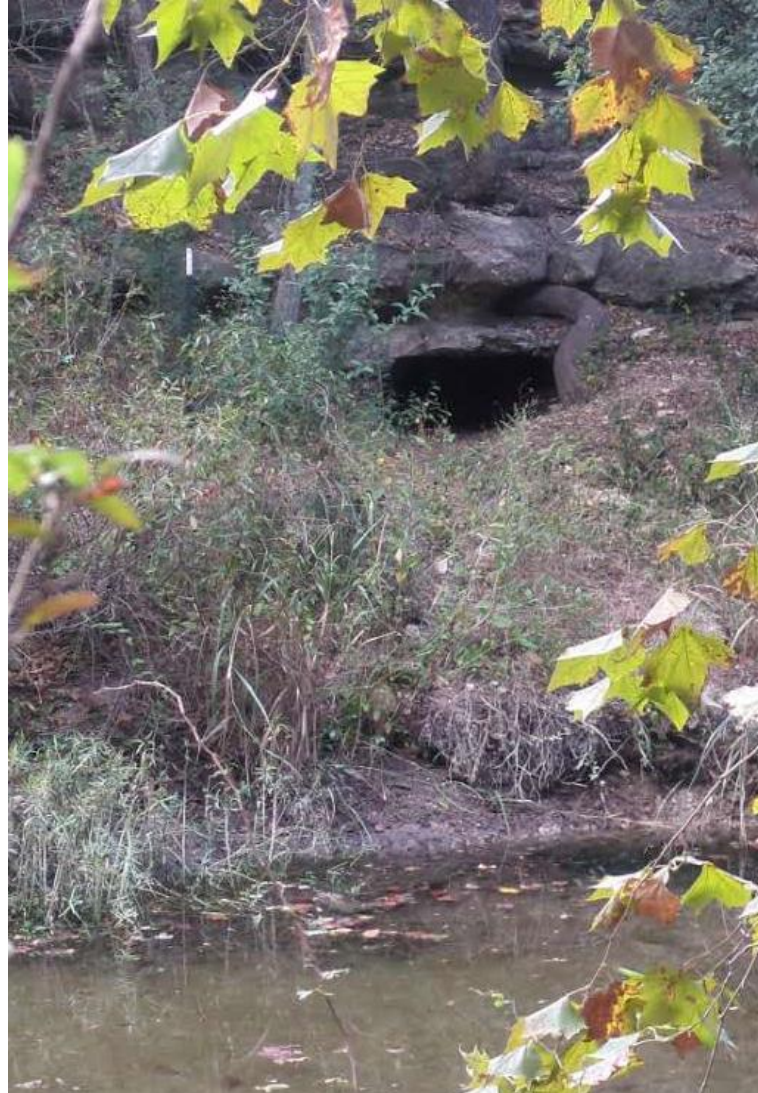




# San Antonio Proposition 1 Edwards Aquifer Protection Venue Project



- Proposition 1 authorized the CoSA to continue the watershed & preservation project initiated in 2000
  - 1/8 cent sales tax collects \$100 million and creates a new focus area
  - \$90 million is funded for protection of property over the EA through the purchase of conservation easements
  - **\$10 million is dedicated for EA protection projects (EAPP)**
- Awarded funding to 11 Projects
  - Data on BMP performance – water quality, peak flow reduction, O&M
  - Recommendations to improve BMP performance



*More than 82% of drinking water used by SAWS customers comes from the EA*

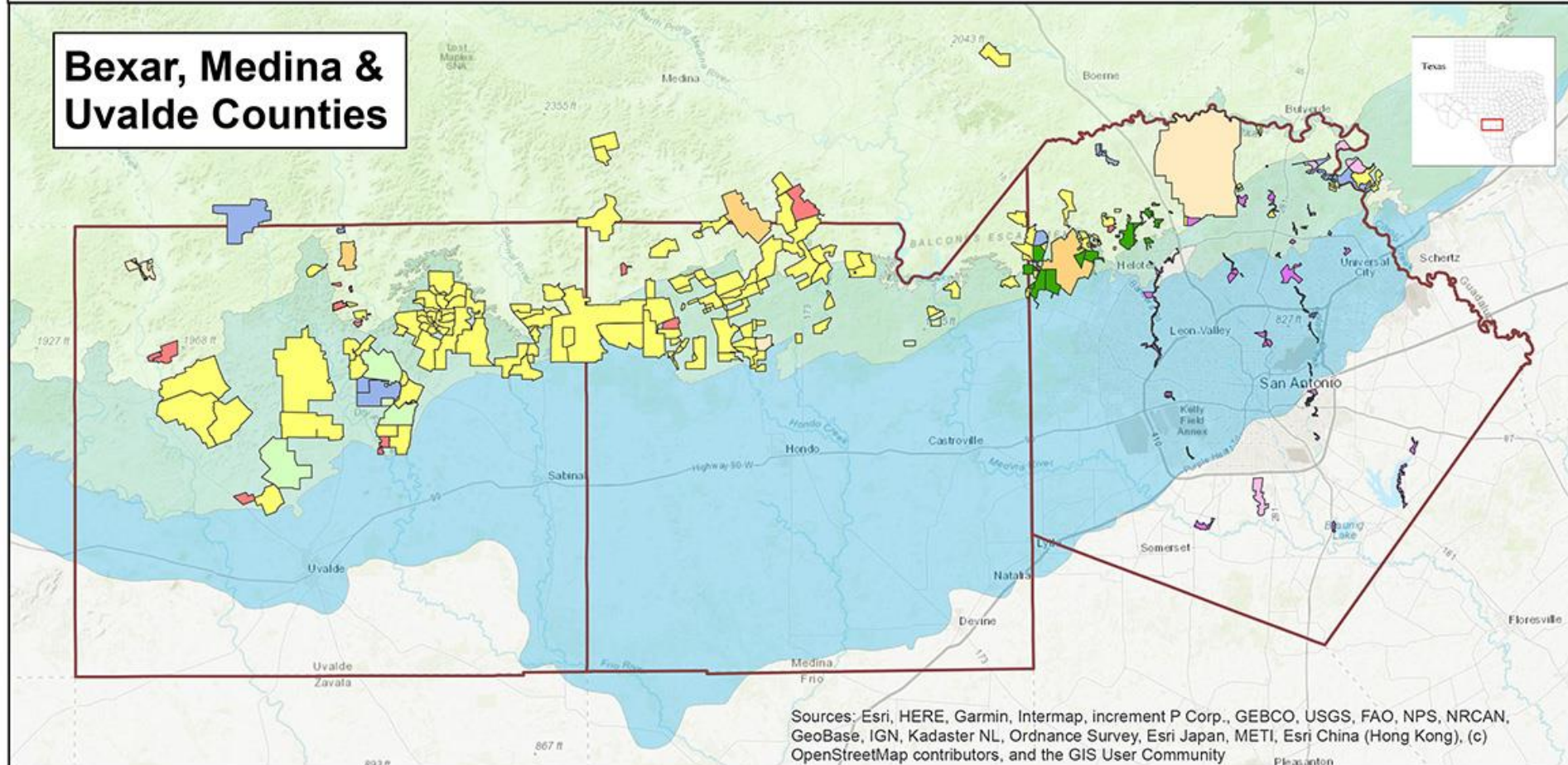




# City of San Antonio Edwards Aquifer Protection Program



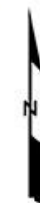
## Bexar, Medina & Uvalde Counties



- |                          |                          |                          |                                   |
|--------------------------|--------------------------|--------------------------|-----------------------------------|
| Proposition 3 Properties | City Parks               | Texas Parks and Wildlife | Edwards Aquifer Contributing Zone |
| Proposition 1 Properties | Federal Managed Land     | The Nature Conservancy   | Edwards Aquifer Recharge Zone     |
| SAMFC* Properties        | San Antonio Water System | Conservation Land        | Edwards Aquifer Artesian Zone     |

\*San Antonio Municipal Facilities Corporation

0 5 10 20 30 40  
Miles



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More information, including the project summaries and full reports, is available at [saprop1edwardsprojects.org](http://saprop1edwardsprojects.org)

## Constructed / Monitored Stormwater BMPs

IN  
PROGRESS

Project	Entity	Investment	Project Title
1		\$432,000	Characterizing the Stormwater Runoff to Ground Water Quality Connection in the Recharge Zone of the Edwards Aquifer, Bexar, County, TX
2		\$530,398	Evaluation of Wastewater Disposal in the Recharge and Contributing Zones of the Edwards Aquifer Using a Coupled Surface-Water/Groundwater Model
3		\$1,069,113	Implementation of a Low Impact Development Test Bed at the University of Texas at San Antonio (UTSA) Main Campus
4		\$351,474	Proposal for Stormwater Retrofit and Research Project
5		\$1,057,401	Roof Top Harvesting and Stormwater Disbursement over the Edward's Aquifer Recharge Zone: A Retrofit for Previously Untreated Impervious Cover
6		\$692,452	Tracking the Primary Sources of Fecal Pollution in the Recharge and Contributing Zones of Edwards Aquifer in Bexar County, Texas, Using Molecular Tools
7		\$2,671,236	Water Quality in the Leon Creek Watershed Recharge Zone as a Function of Urban Development, and Community Education of the Threats and Conservation of the Edwards Aquifer
8	 TEXAS A&M UNIVERSITY SAN ANTONIO	\$218,937	Edwards Aquifer water Quality Protection from Catastrophic and Low to Mid-Level Effects of Discharge of Hazardous and Polluting Materials from Contaminated Water Runoff during Emergency Response
9		\$1,035,761	Demonstrating the Environmental Benefits of Permeable Paved Surfaces over the Edwards Aquifer
10		\$798,636	Evaluation of the Vegetation along Roadways in Edwards Aquifer Recharge and Contributing Zones for Storm Water Management and Water Quality Improvement
11		\$619,656	BMP Maintenance Requirements to Ensure Protection of Edwards Aquifer Water Quality





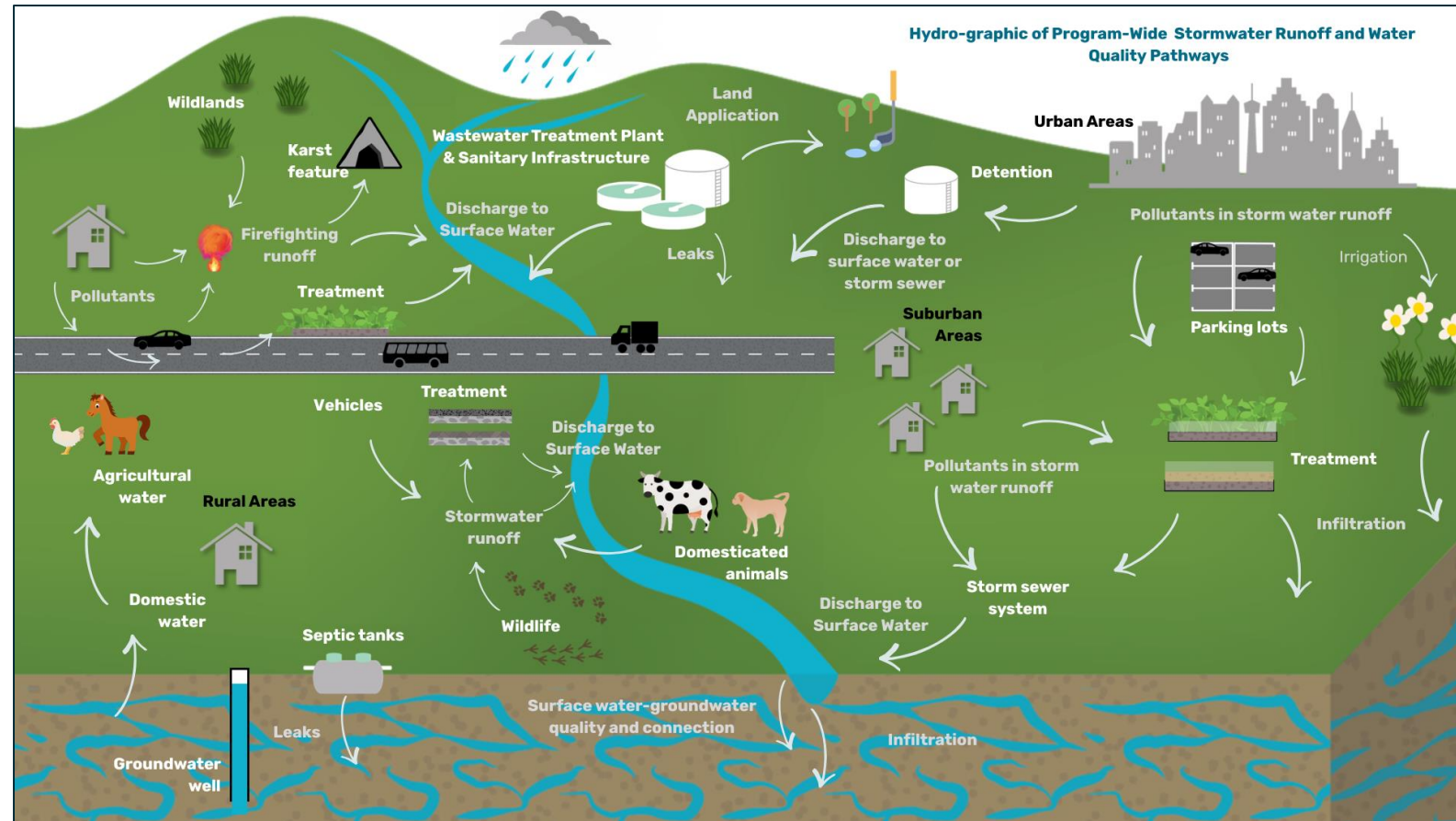
# Edwards Aquifer Protection Project: Program and Project Results







# EAPP Program Results

- Review Prop 1 funded projects
  - Green infrastructure / Nature-Based Solutions / Low Impact Development
  - Ground-surface water models
  - Education / outreach
  - Maintenance
- Assess benefits
  - Define metrics
  - Water quality protection
- New Development
  - Wastewater
  - Septic





# Project Components

<b>Public Education</b>	       	<b>8</b> Projects
<b>Water Sampling</b>	       	<b>8</b> Projects
<b>BMP Installed / Retrofit</b>	    	<b>5</b> Projects
<b>Maintenance</b>	  	<b>3</b> Projects
<b>Vegetation &amp; Soil Analysis</b>	   	<b>4</b> Projects
<b>Water Modeling</b>	 	<b>2</b> Projects



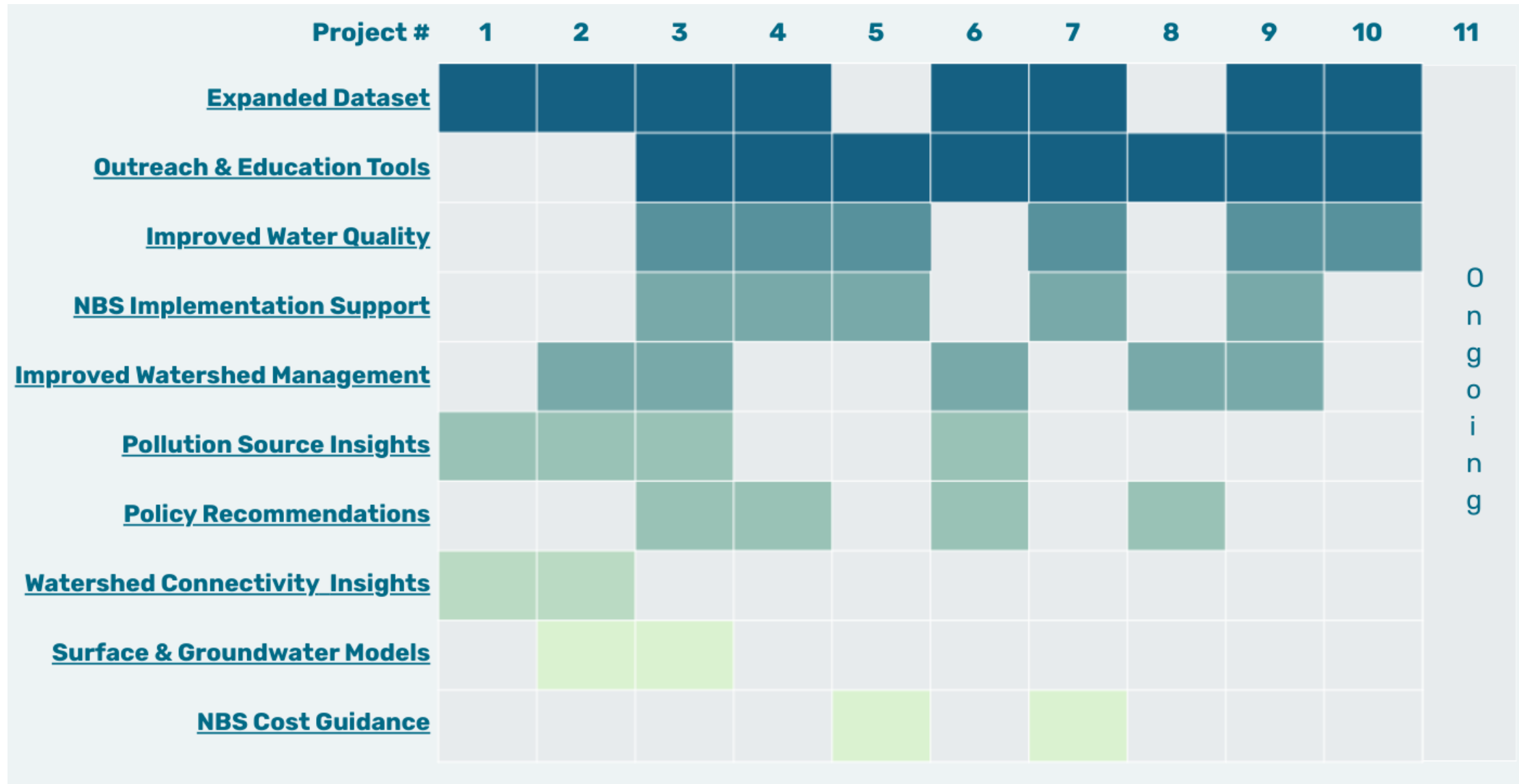


# Benefits Summary





# Benefits Breakdown



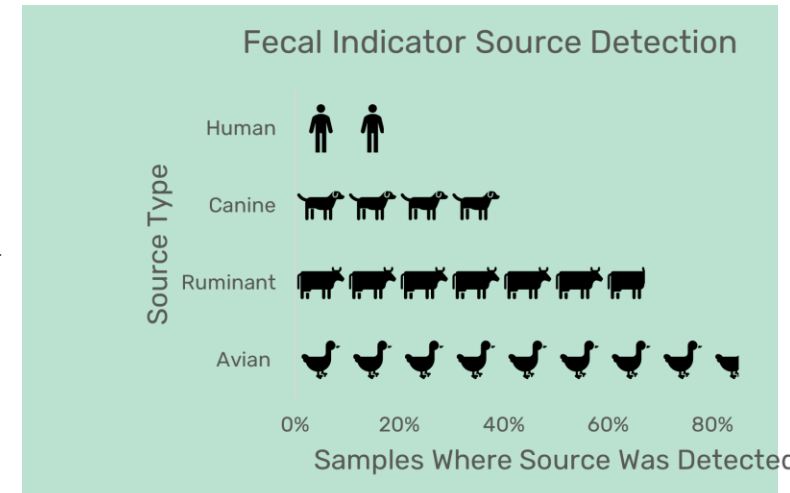
Legend Fewer → Greater Number of Projects





# Pollutants: Key Findings

- Pollutant Source Insights
  - Traditional indicators of **fecal pathogens** were found in 90% of samples →
  - Large loads of **sediment** were found even in established neighborhoods.
  - **Nitrogen** and other **nutrients** were found to leach from organic debris and engineered soil media





# NBS Effectiveness

- Projects estimated pollutant removal efficiency and total load reductions
  - Bioretention basins, permeable pavements, and vegetated swales were highly effective at removing TSS.
  - Bioretention systems were highly effective at reducing fecal pathogen levels
  - Results for the removal of metals and nutrients were inconsistent

Total Suspended Solids  
Removed Per Year

777 lbs

Equivalent to  
a full-sized  
grand piano



Estimated benefit from projects 3 & 9

*Estimating pollutant loading is important to understanding the full water quality impacts of BMPs. In addition to pollutant concentrations, ensure you are also measuring volumes at both the inflow & outflow or flow rates.*





# Edwards Aquifer Protection Project: Applying Findings and Practical Takeaways





# NBS System Design

- The program identified plants with minimal maintenance / mortality and optimal bioremediation for specific pollutants.
- Permeable pavers were highly effective at reducing runoff volume and delaying peak flow. Permeable concrete and aggregate-filled plastic grid were effective at mitigating high temperatures of stormwater runoff.



Appendix 4. Native plant species suggested for planting in Low Impact Development Structures in Bexar County.

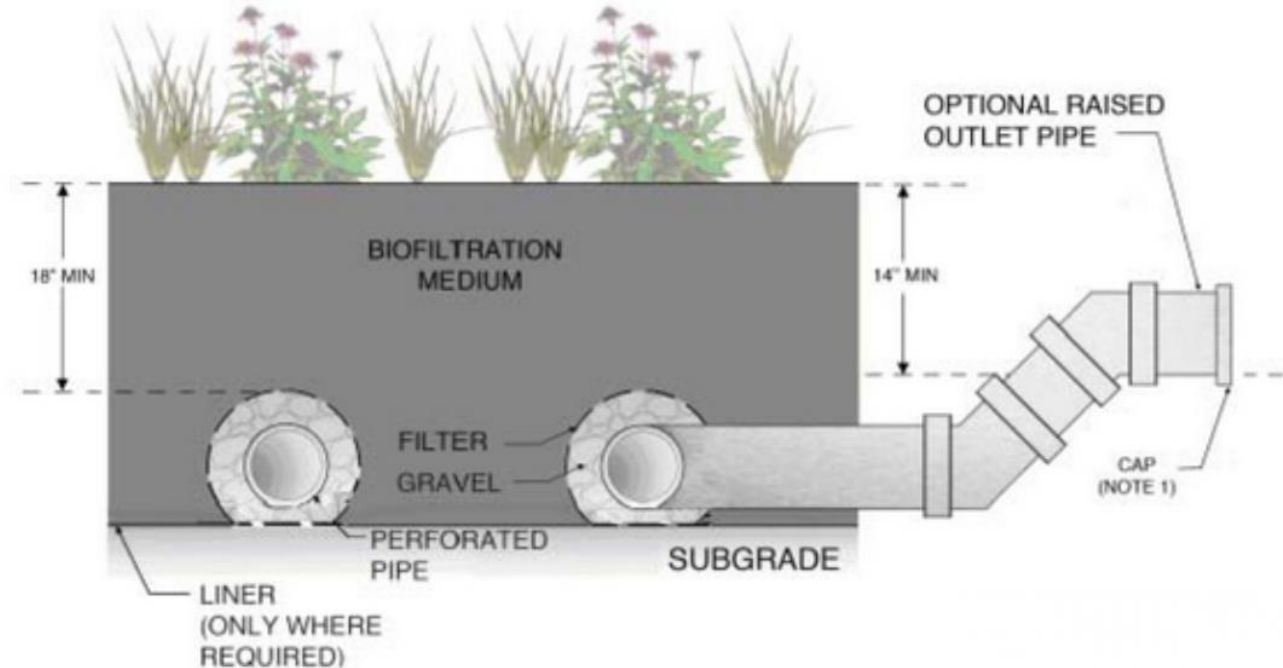
Common name	Taxonomic name	USDA Symbol	Group	Duration	Growth Habit	Wetland Status <sup>1</sup>
Silver bluestem	<i>Bothriochloa laguroides</i>	BOLA2	Monocot	Perennial	Graminoid	FACU
Sideoats Grama	<i>Bouteloua curtipendula</i>	BOCU	Monocot	Perennial	Graminoid	Upland
Buffalograss	<i>Bouteloua dactyloides</i>	BODA2	Monocot	Perennial	Graminoid	FACU
Texas grama	<i>Bouteloua rigidiseta</i>	BORI	Monocot	Perennial	Graminoid	Upland
Indian paintbrush	<i>Castilleja indivisa</i>	CAIN13	Dicot	Annual	Forb/Herb	FAC
American star-thistle	<i>Centaurea americana</i>	CEAM2	Dicot	Annual	Forb/Herb	Upland
Lady Bird's centaury	<i>Centaureum texense</i>	CETE2	Dicot	Annual	Forb/Herb	Upland
Sorrelvine	<i>Cissus trifoliata</i>	CITR2	Dicot	Perennial	Vine	FACU

Project 5 developed a list of 56 plant species recommended from planting in LID systems within Bexar Co.



# NBS System Design

- Soil media was found to perform better for pollutant load reduction when amended with limestone.
  - Elevated initial N and organics concentrations in soil media were theorized to leach from the media into the stormwater effluent when the system first goes online.
- Lined and unlined systems were found to have the same levels of pollutant reduction.
- Systems designed with internal water storage were found to improve water quality.



*Example cross section of a biofiltration bed with a raised outlet pipe to provide internal water storage – City of Austin ECM Figure 1.6.7.C-3*



# NBS System Implementation

- Construction Tips
  - Assign an owner's representative during construction to monitor LID installation
  - Verify that systems are built per specifications at key milestones throughout construction. Ensure all specs (landscape vs. engineering) match!
  - Ensure proper preventative measures are taken to minimize deficiencies that can lead to maintenance issues.
- Costs
  - When providing initial costs for funding requests, it is important to provide an accurate cost analysis & budget to provide predictability
  - Demonstrate value outside of water quality and flood benefits



*Protect systems until the contributing drainage area and the system itself are stabilized to prevent erosion and sedimentation*



*Opportunities for community engagement*



*Rock that is unwashed, heavily silted, or more chipped than specified will not function as designed*

- Maintenance
  - Incorporate appropriate plant species
  - Require an approved maintenance plan
  - Routinely remove accumulated sediment and debris to ensure it is not flushed out in subsequent rain events
  - Thoughtful design can facilitate maintenance

# MS4 (TPDES) Permit Applicability

- Requires permittees to control the discharge of pollutants of concern to impaired waters and waters with approved TMDLs
- NBS/LID Systems are directly beneficial!

TMDLs / Impaired Waters	Post-Construction	Education / Public Involvement
<ul style="list-style-type: none"><li>• Reduce Runoff Volume</li><li>• Slow and treat stormwater where it falls</li><li>• Cut pollutant loads</li><li>• Act as demonstrable BMPs that can be added to the SWMP and annual reports</li></ul>	<ul style="list-style-type: none"><li>• Manage stormwater on-site</li><li>• Reduce the water quality volume and pollutant loads leaving a site</li></ul>	<ul style="list-style-type: none"><li>• Highly visible and make excellent demonstration projects for outreach (examples include signage, tours, volunteer plantings, school programs)</li></ul>

**NBS funding options:** Federal 319h grants, Clean Water State Revolving Fund, Flood Infrastructure Fund, and more.







# 11

## Projects Funded

# EAPP Impacts



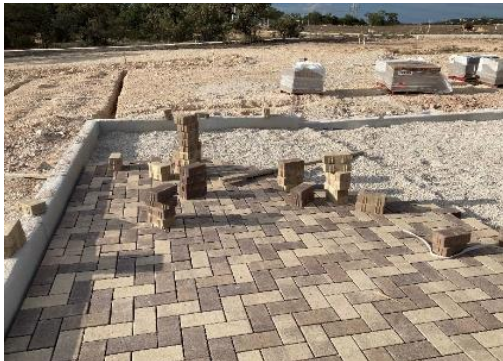
## 44

Acres Treated



## 3,227

Samples Collected



## 21

BMPs Installed /  
Retrofitted



## 62

Pollutants Evaluated



## 1,228

Professionals Trained



## 1,510

Students Impacted

Benefits from 10 projects and still counting!



# Legacy & Vision

- **Demonstrating the power of NBS in Texas**
  - Bioretention basins, permeable pavements, and sand filters can significantly reduce runoff, TSS, and fecal pathogens
  - Broad benefits: improved water quality, reduced erosion, community education, and economic savings.
- **Improve NBS performance**
  - Incorporate limestone-amended media
  - Design for internal water storage
  - Select specific vegetation for target pollutants
- **Generated practical tools**
  - Water quality datasets
  - Models
  - Design guidance
  - Education & outreach materials



*These findings provide a pathway for updating technical guidance and regulatory standards to ensure that San Antonio's policies reflect the best available science.*





# THANK YOU!

Principal- Water Services

Gian C. Villarreal, PE, CFM, CPSWQ

[gvillarreal@seagullpme.com](mailto:gvillarreal@seagullpme.com)

210-446-6865

Senior Engineer

Mikel Wilkins, PE

[mwilkins@sariverauthority.com](mailto:mwilkins@sariverauthority.com)

210-302-3642

Senior Scientist

Becca Oliver, CPESC, CESSWI

[boliver@seagullpme.com](mailto:boliver@seagullpme.com)

512-270-9026