



SAN ANTONIO  
RIVER AUTHORITY

# Tools for Stormwater Quality Management

July 18, 2025

Sheeba M Thomas Dominguez, PE, PhD – Lead Technical Engineer



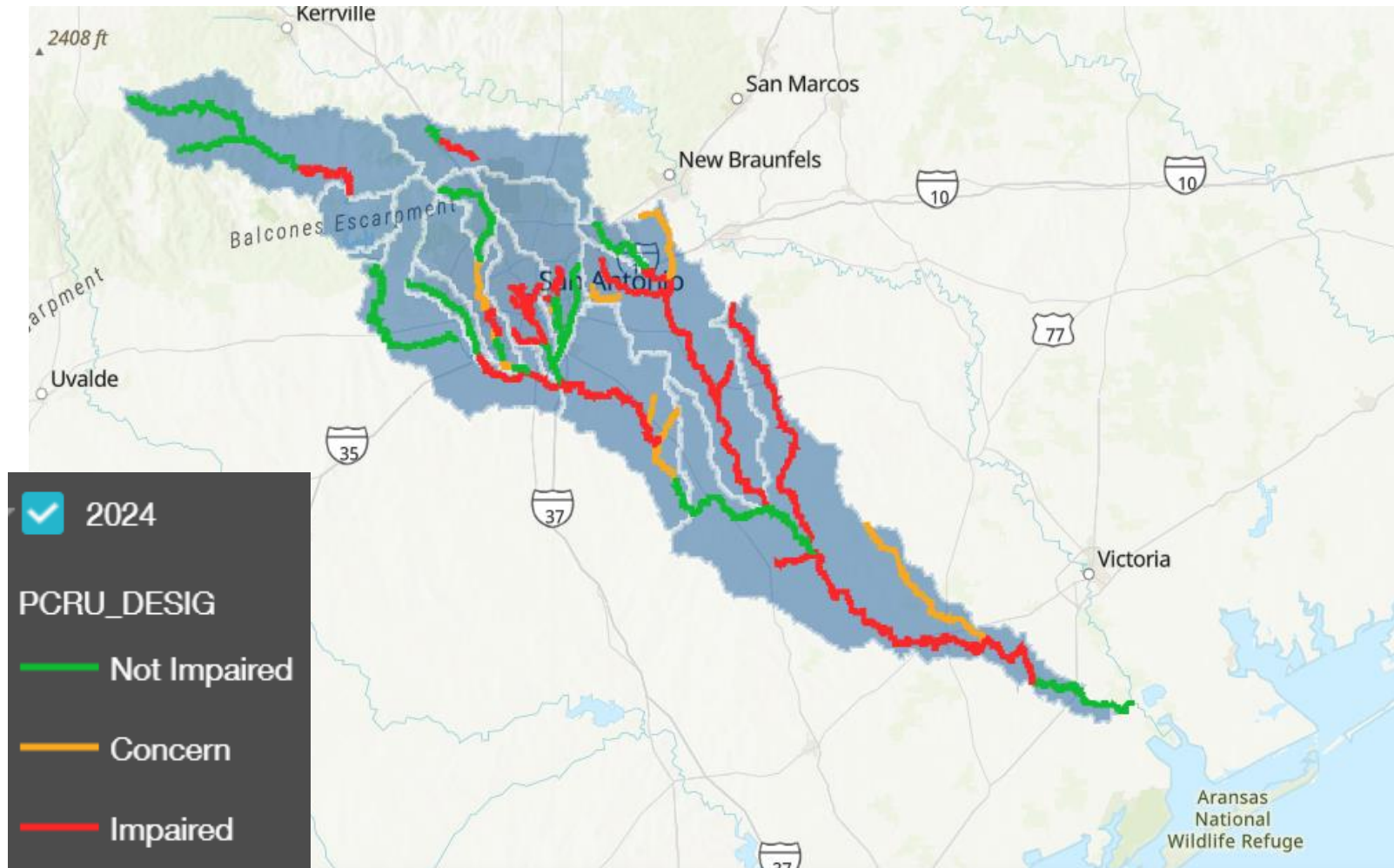
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# Agenda

- Background
- Approach
- Models and Analysis
- Results
- WQ Improvement Implementation

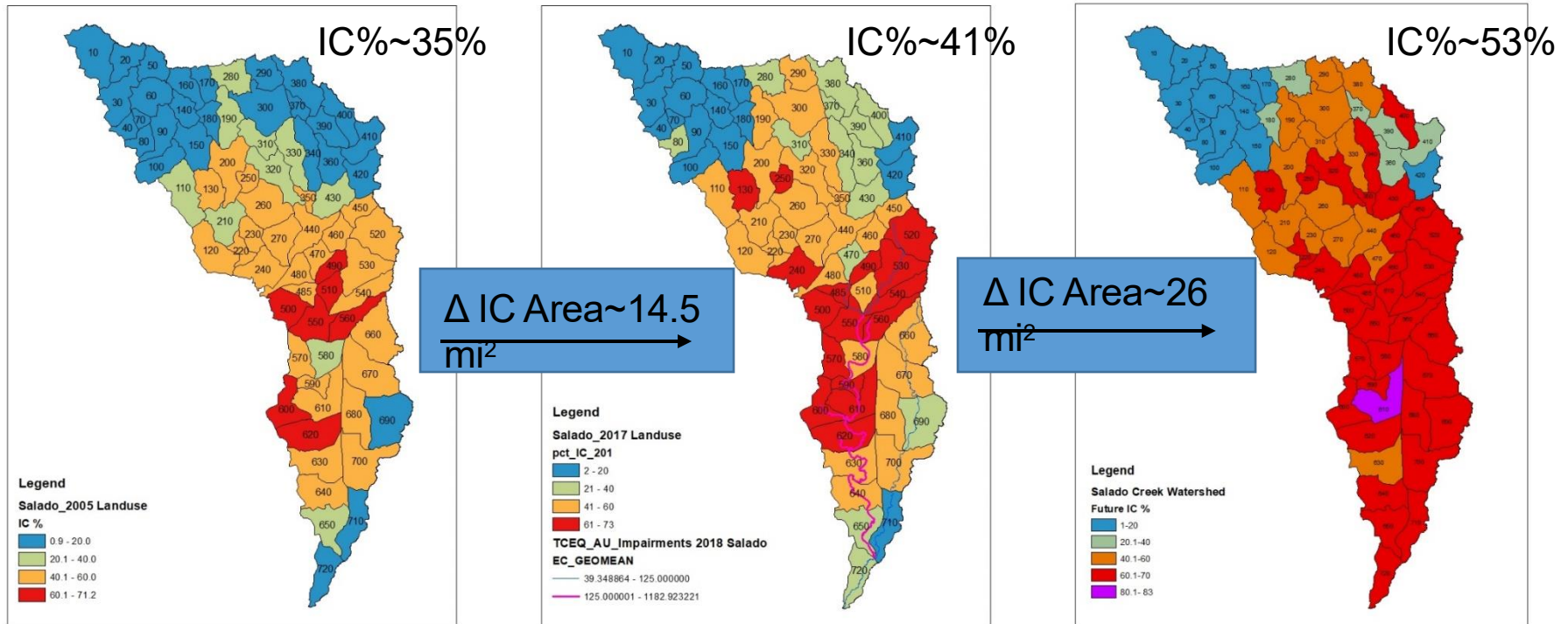


# Impaired Waterbodies for Primary Contact Recreation



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# Salado Creek Watershed



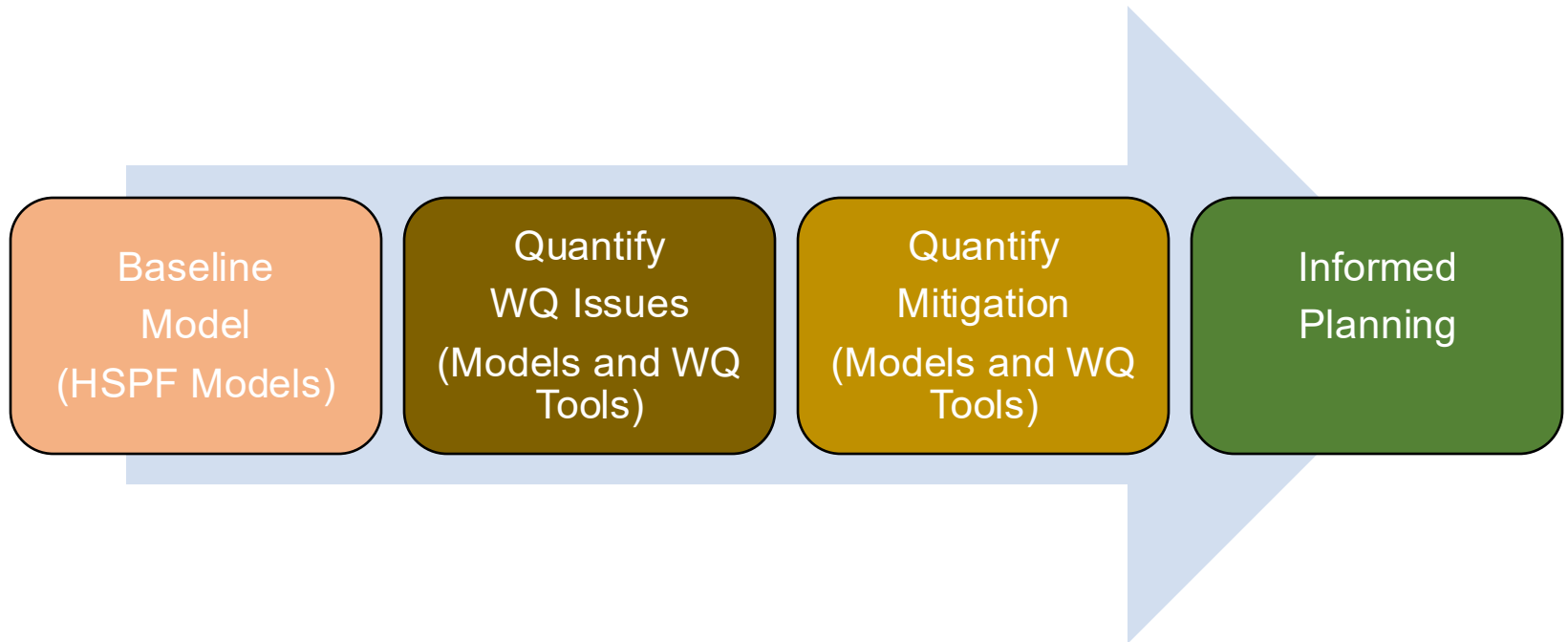
2005 Impervious Cover

2017 Impervious Cover

2040 Impervious Cover



# Our Approach



# SARA Project Team



Sheeba Thomas, PhD, P.E., PMP



Yu-Chun Su, PhD, PE, CPESC,  
CPSWQ



Paul Duda



RESPEC (formerly Aqua Terra)



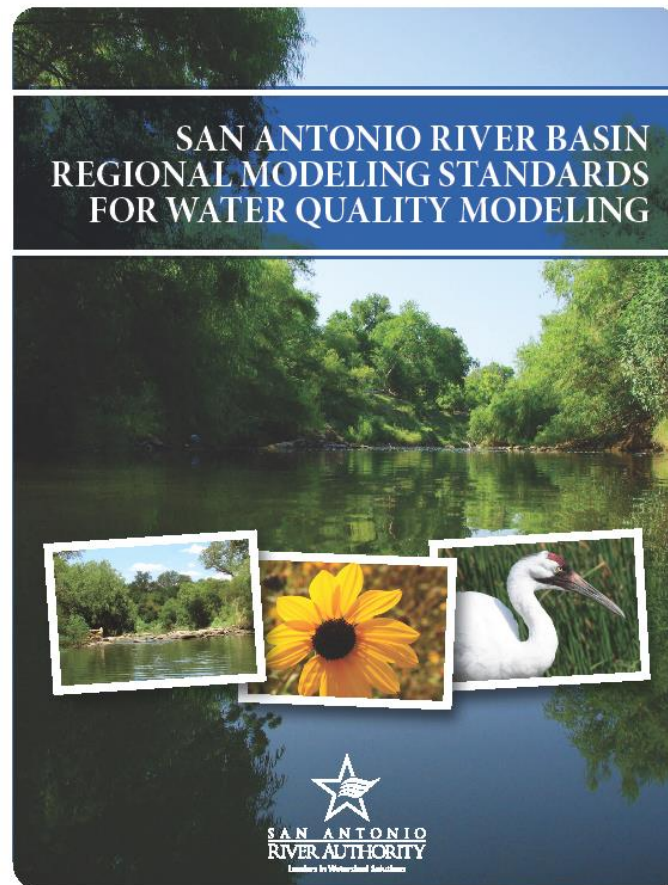
# SARA Suite of WQ Modeling Tools

Approach and Tools to allow quantitative WQ planning:

- SARA WQ modeling standards
- WQ model development and calibration
  - HSPF
- Timeseries Utility Tool
- Load Reduction Tool
- SARA Enhanced BMP Tool
  - BMP Database



# SARA WQ Modeling Standards



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# Data Needed for WQ Modeling

- DFIRM
  - Subbasin delineation
  - Stream shapefile
  - HEC-HMS
  - HEC-RAS
- Topography
  - DEM
  - Contours
- Channel XS
- Dams/reservoirs
- Aerial images
- SSURGO soil data
- Major development centers

- Met data (NOAA)
- Rainfall
  - NOAA
  - EAA (gage, NEXRAD)
  - SARA
  - USGS
- Diversion
- USGS flow data
- Groundwater recharge & spring flow
- Latest 303(d)
- CRP Screening levels
- Landuse & IC%

- Water Quality
  - SWQM
  - USGS
- Wastewater data
- SSO
- OSSF (estimates)
- QUAL-TX models
- Atmospheric deposition
- Edwards Aquifer Infiltration Data
- Rural watershed data
  - Agricultural data
  - SELECT or EC loading estimates



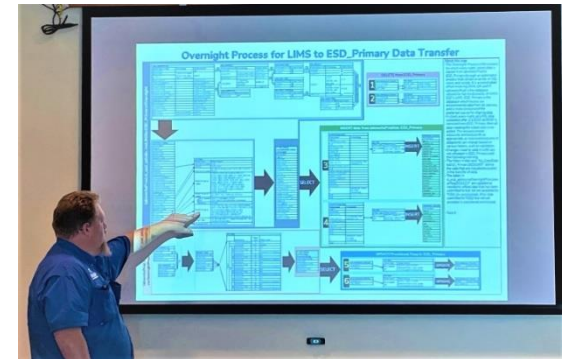
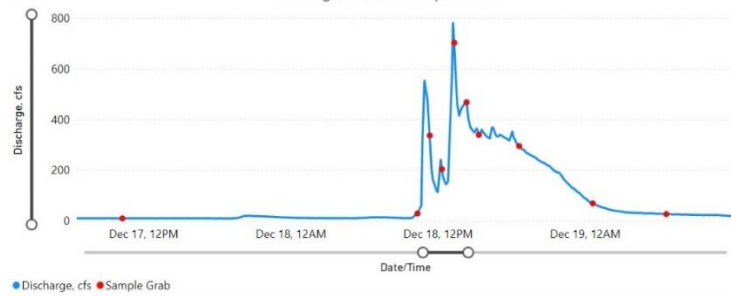
# Water Quality Data

## Environmental Services Department Superstars!



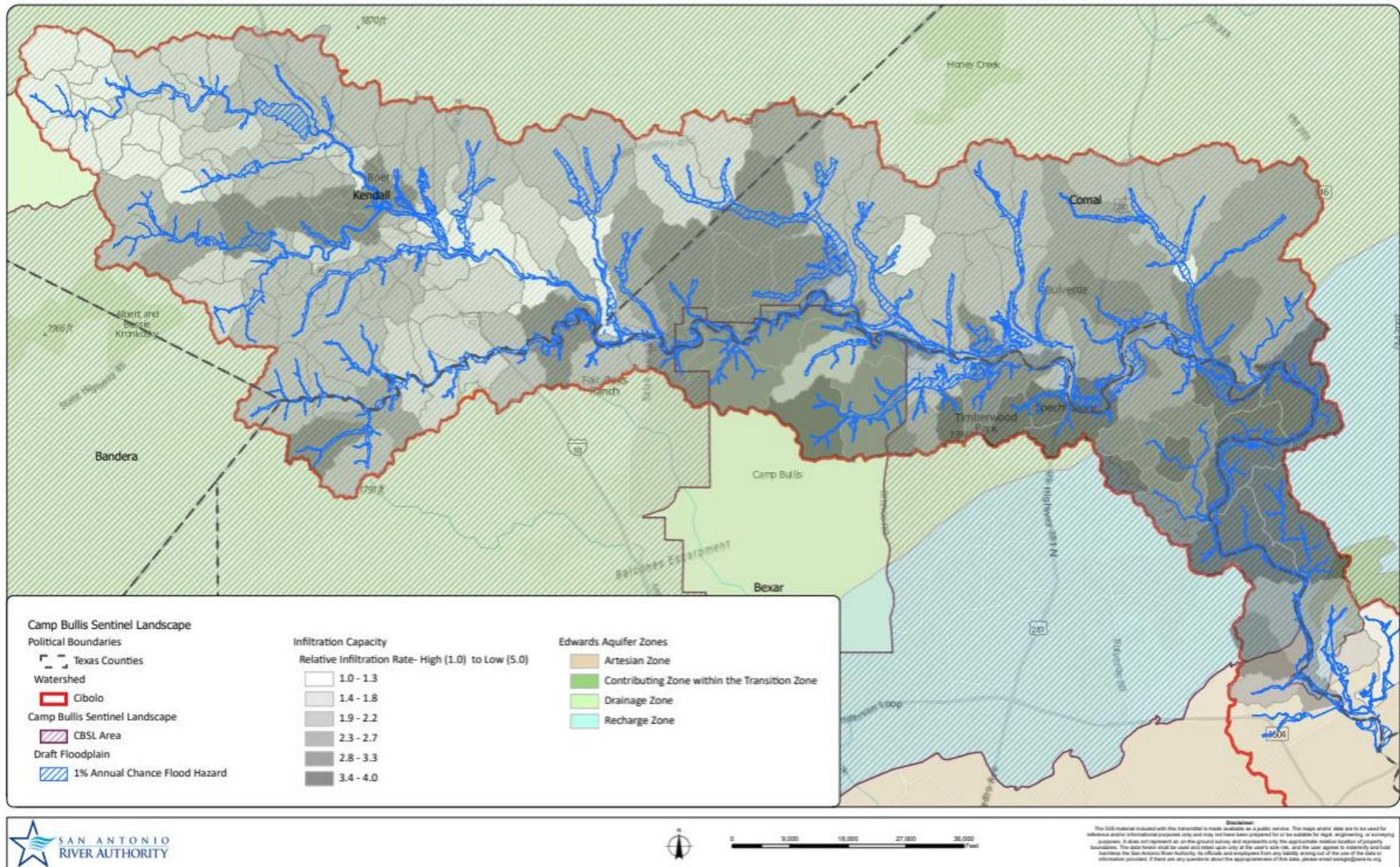
**San Antonio River at Mitchell**

Discharge, cfs, with Sample Grabs

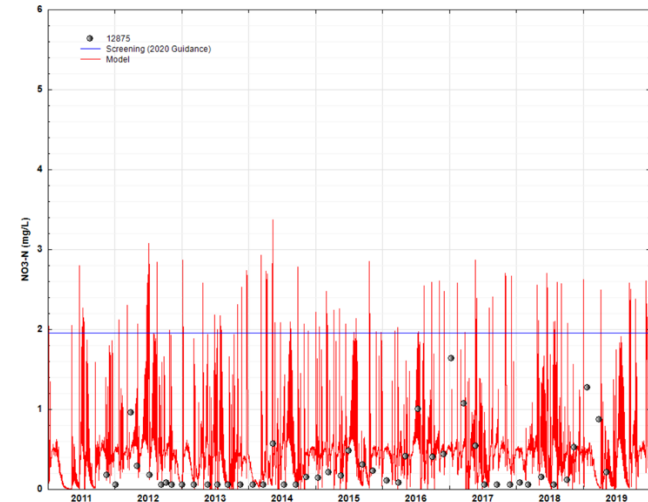
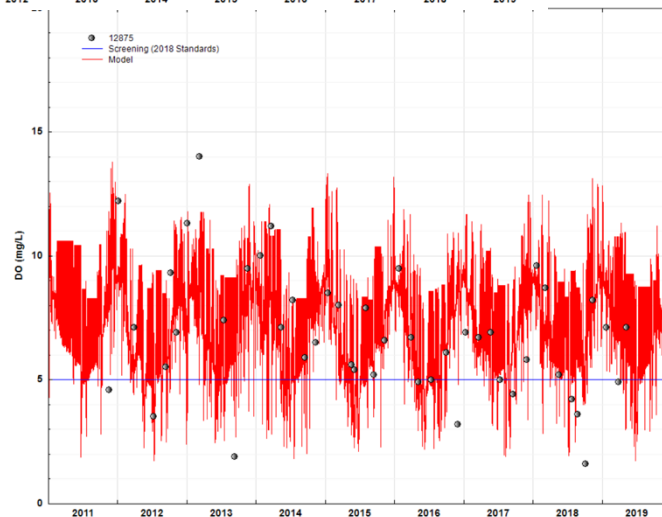
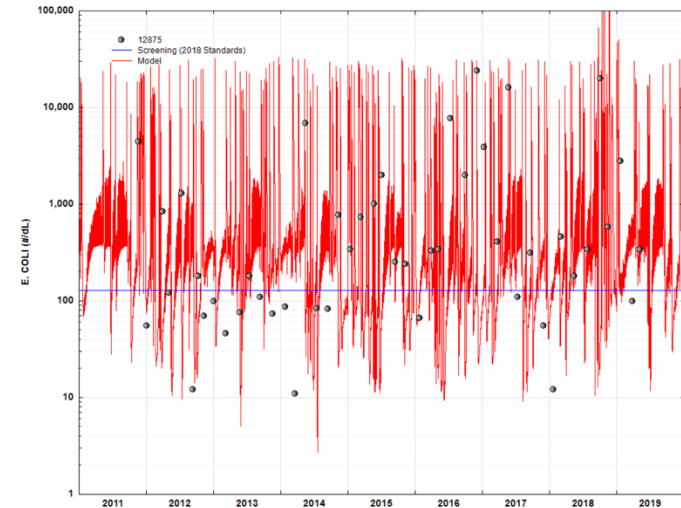
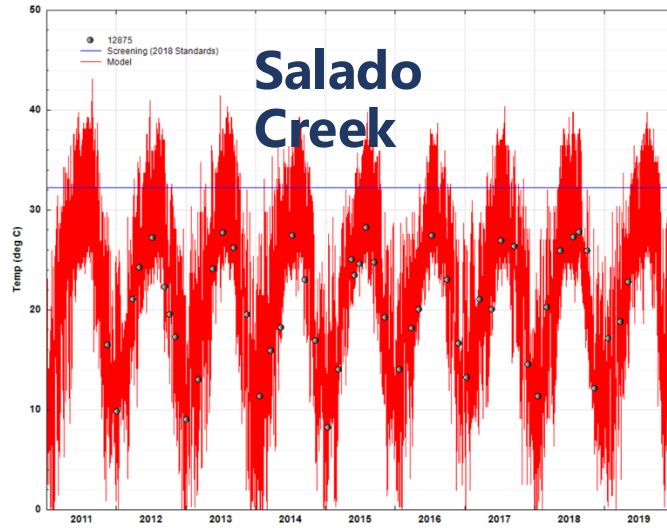


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# EAA's Relative Infiltration Data



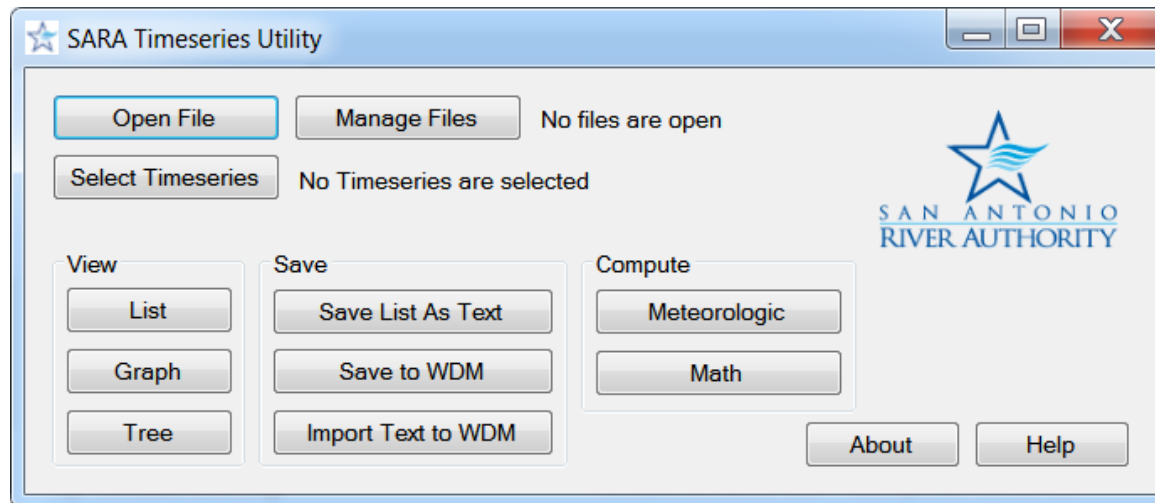
# HSPF Calibration – Continued Simulation Thru Wet/Dry



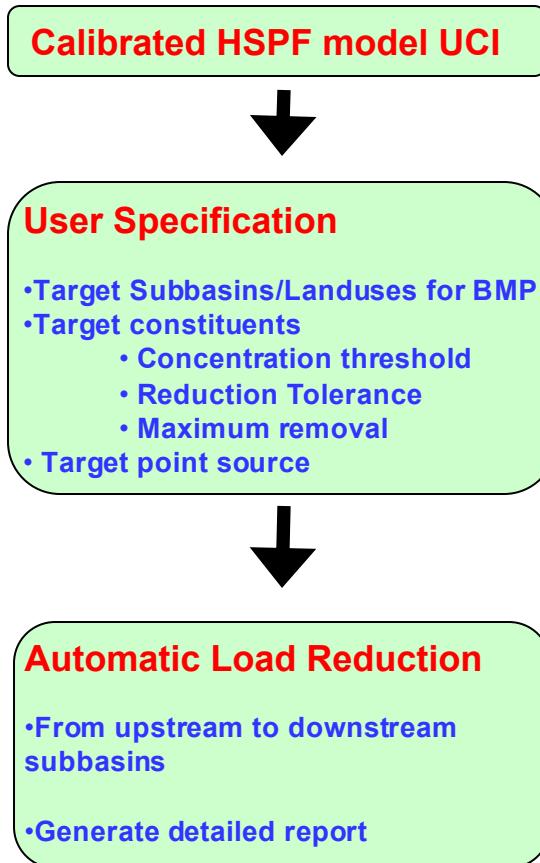
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# SARA Timeseries Utility Tool

- Enhanced efficiency in reading large timeseries records (e.g. HSPF binary output).
- Developed, tested, and released to public through EPA BASINS user community on 10/24/2013.
- Replaced WDMUtil



# SARA Load Reduction Tool

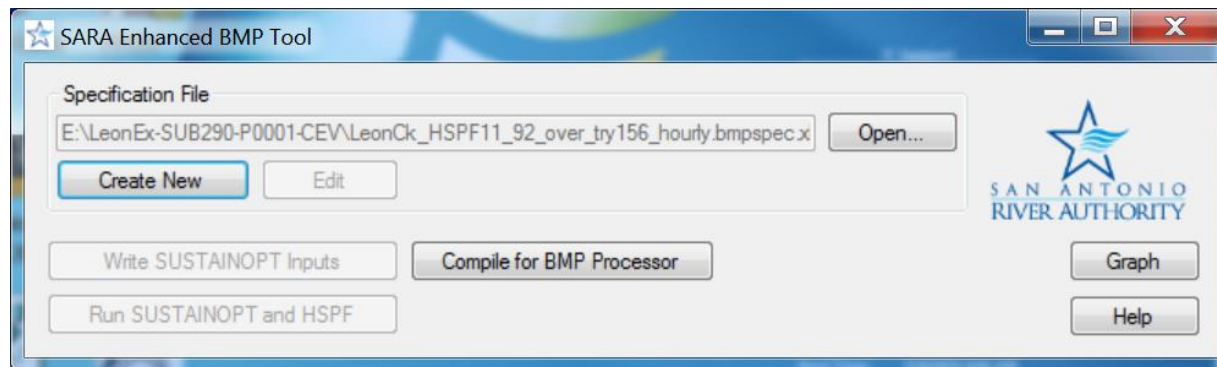


- Uses load reduction factors in HSPF BMP Module.
- Automates tedious process for large watershed models.
- Compared to manual processes.
- Developed, tested, and released to public through EPA BASINS user community on 5/09/2014.



# SARA Enhanced BMP Tool

- Identify LID/BMPs to achieve needed load reductions.
- Use LRT results or any calibrated HSPF models.
- Combines robust land surface representation from HSPF with EPA SUSTAIN's BMP capabilities.
- Avoids ArcGIS version issue inherent in SUSTAIN by using non-GIS component (SUSTAINOPT)



# SARA BMP Tool Database

SustainBMPParameters\_Q21015TextOnly - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW Juhn-Yuan Su

Paste Font Alignment Number Styles Cells Editing

F26 : X ✓ fx 5

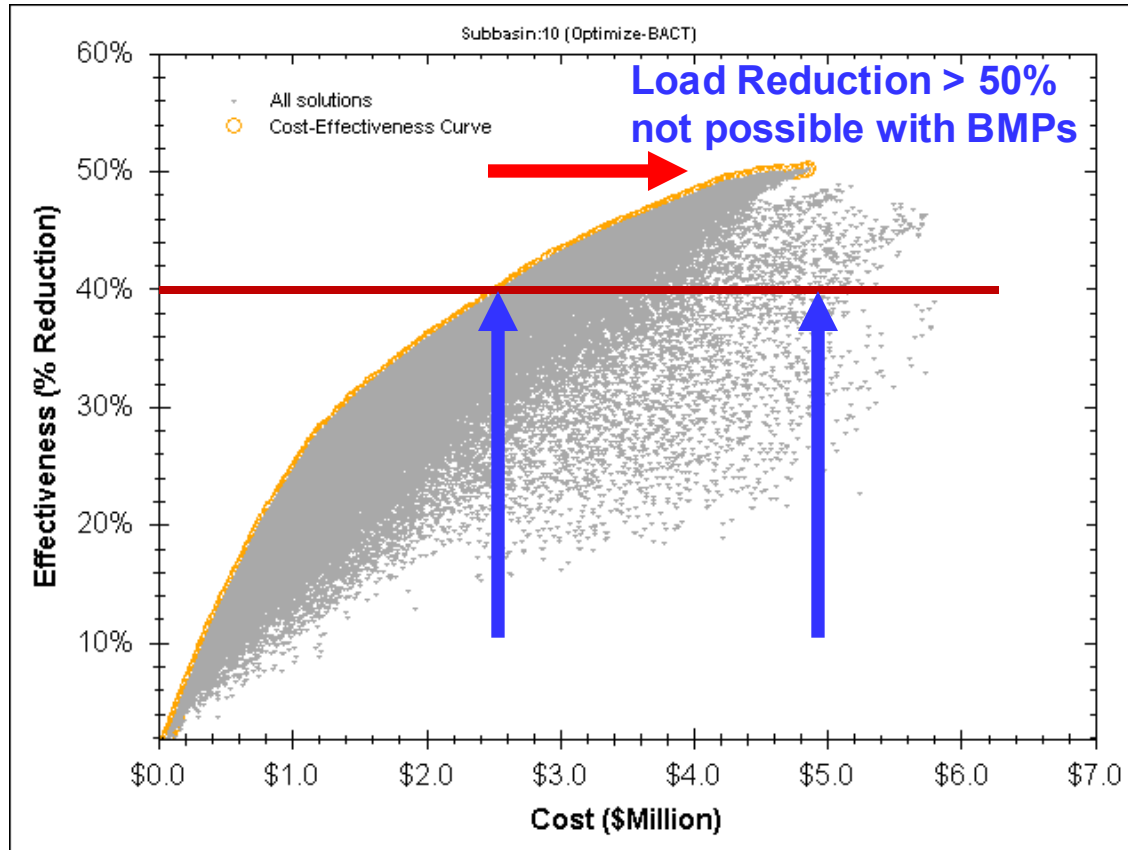
	A	B	C	D	E	F	G	H
	CBMPSITE	BMPNAME	BMPTYPE	DArea	NUMUNIT	DDAREA	PreLUType	AquiferID
2	1	DryPond_Ave	DRYPOND	-99	-99	10	1	0
3	2	ExtendedDetention_Small	DRYPOND	-99	-99	10	1	0
4	3	ExtendedDetention_Ave	DRYPOND	-99	-99	42.5	1	0
5	4	ExtendedDetention_Large	DRYPOND	-99	-99	75	1	0
6	5	StreetSweep_Arterial_4X	DRYPOND	-99	-99	1	1	0
7	6	StreetSweep_Arterial_4X_New	DRYPOND	-99	-99	1	1	0
8	7	StreetSweep_Arterial_8X	DRYPOND	-99	-99	1	1	0
9	8	StreetSweep_Arterial_8X_New	DRYPOND	-99	-99	1	1	0
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11	10	StreetSweep_Resid_2X_New	DRYPOND	-99	-99	1	1	0
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13	12	StreetSweep_Resid_4X_New	DRYPOND	-99	-99	1	1	0
14	13	StreetSweep_CBD_363	DRYPOND	-99	-99	1	1	0
15	14	StreetSweep_CBD_363_New	DRYPOND	-99	-99	1	1	0
16	15	StreetSweep_CBD_182	DRYPOND	-99	-99	1	1	0
17	16	StreetSweep_CBD_182_New	DRYPOND	-99	-99	1	1	0
18	20	RainBarrel_Ave	RAINBARREL	-99	-99	0.01377	1	0
19	30	BioRetentionBasin_Ave	BIORETENTION	-99	-99	2.5	1	0
20	31	BioRetentionBasin_Small	BIORETENTION	-99	-99	0.03061	1	0
21	32	BioRetentionBasin_Large	BIORETENTION	-99	-99	5	1	0
22	33	PlanterBox_Ave	BIORETENTION	-99	-99	0.35	1	0
23	40	WetPond	WETPOND	-99	-99	25	1	0
24	41	StormWaterWetland	WETPOND	-99	-99	10	1	0

BMP\_LanduseMatrix BMP\_Trains 715\_BMPDef 725\_ClsABMPParm 730\_CisternControl 735\_ClsBBMPParm ...

READY 120%



# Cost Saving with Optimization



**Target: 40% Load Reduction**

**Optimal BMPs: \$2.5 MM**

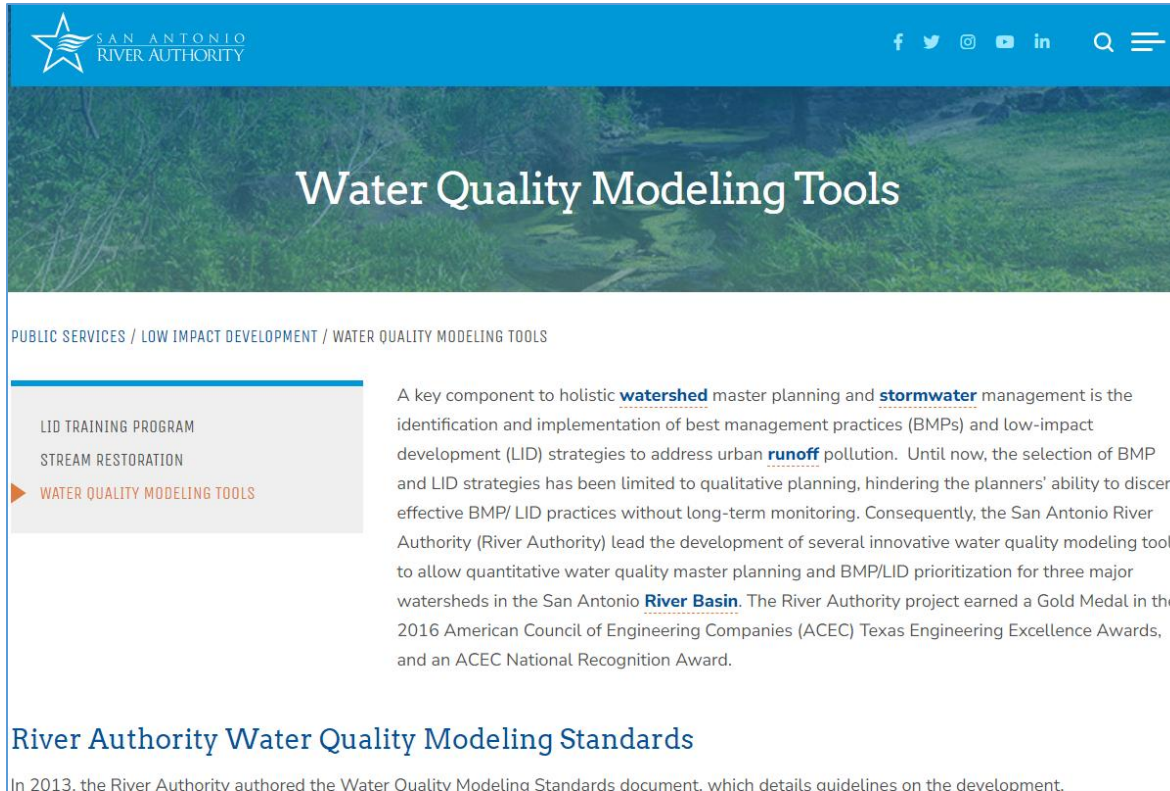
**Non-Optimal BMP Combinations: can be > \$5MM**

**Cost Saving: can be \$2.5 MM or 100%**

**Avoid building first then discover it won't work or too costly**



# SARA WQ Modeling Tools Download Website



The screenshot shows the San Antonio River Authority website. The header features the organization's logo and social media icons. The main banner image is a lush green stream with the text "Water Quality Modeling Tools" overlaid. Below the banner, a breadcrumb trail reads "PUBLIC SERVICES / LOW IMPACT DEVELOPMENT / WATER QUALITY MODELING TOOLS". A left sidebar lists "LID TRAINING PROGRAM", "STREAM RESTORATION", and "WATER QUALITY MODELING TOOLS" (highlighted with an orange arrow). The main content area contains a paragraph about watershed planning and stormwater management, mentioning BMPs, LID, runoff, and the 2016 ACEC Texas Engineering Excellence Award. At the bottom, a section titled "River Authority Water Quality Modeling Standards" includes a link to a 2013 document.

**SAN ANTONIO RIVER AUTHORITY**

**Water Quality Modeling Tools**

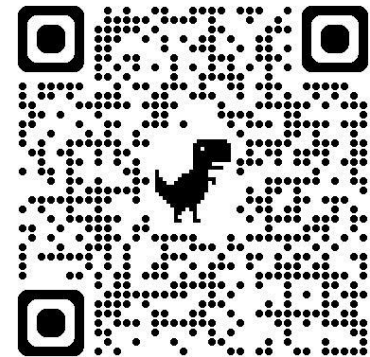
PUBLIC SERVICES / LOW IMPACT DEVELOPMENT / WATER QUALITY MODELING TOOLS

- LID TRAINING PROGRAM
- STREAM RESTORATION
- WATER QUALITY MODELING TOOLS**

A key component to holistic **watershed** master planning and **stormwater** management is the identification and implementation of best management practices (BMPs) and low-impact development (LID) strategies to address urban **runoff** pollution. Until now, the selection of BMP and LID strategies has been limited to qualitative planning, hindering the planners' ability to discern effective BMP/ LID practices without long-term monitoring. Consequently, the San Antonio River Authority (River Authority) lead the development of several innovative water quality modeling tools to allow quantitative water quality master planning and BMP/LID prioritization for three major watersheds in the San Antonio **River Basin**. The River Authority project earned a Gold Medal in the 2016 American Council of Engineering Companies (ACEC) Texas Engineering Excellence Awards, and an ACEC National Recognition Award.

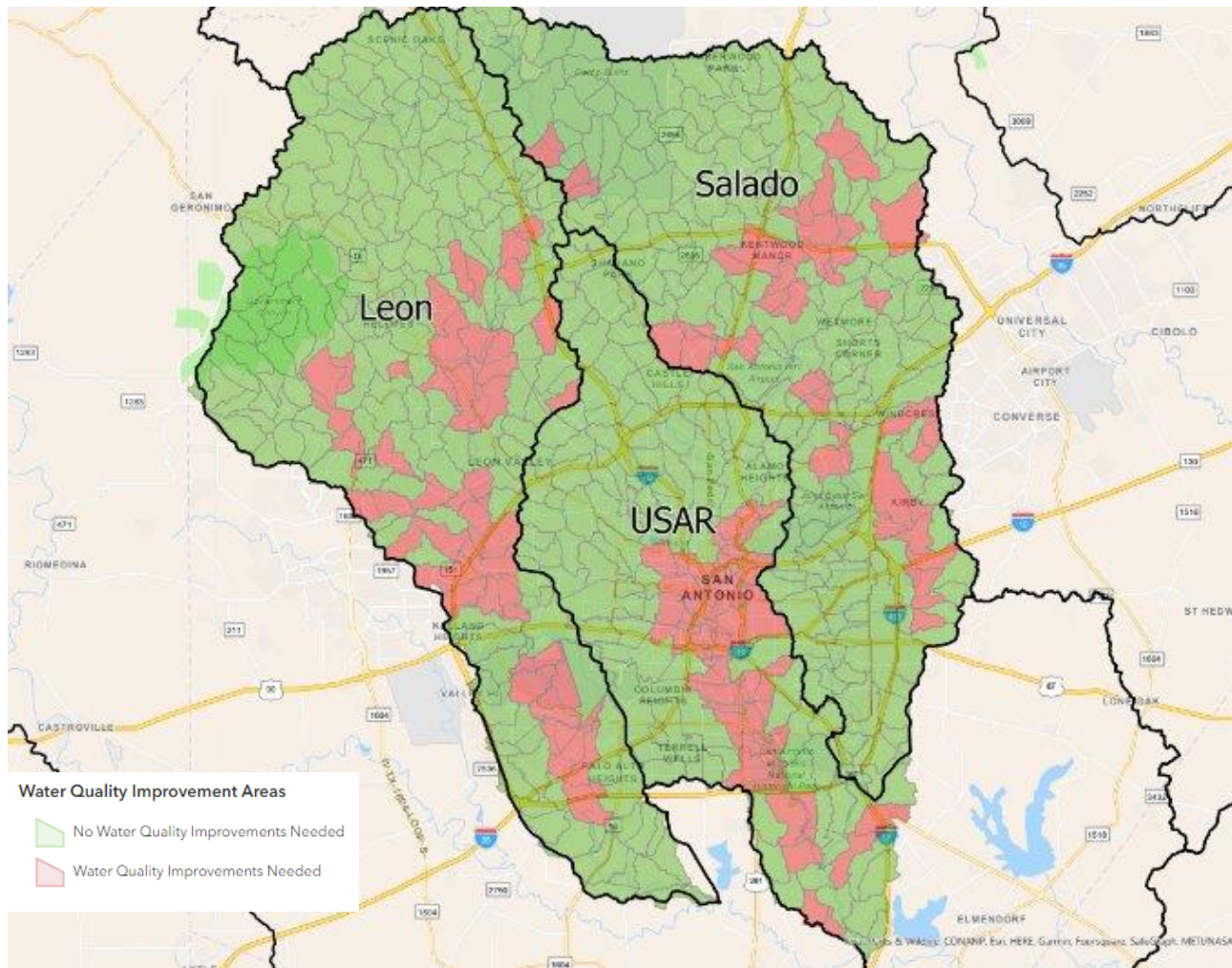
### River Authority Water Quality Modeling Standards

[In 2013, the River Authority authored the Water Quality Modeling Standards document, which details guidelines on the development.](#)



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# Water Quality Improvement Areas

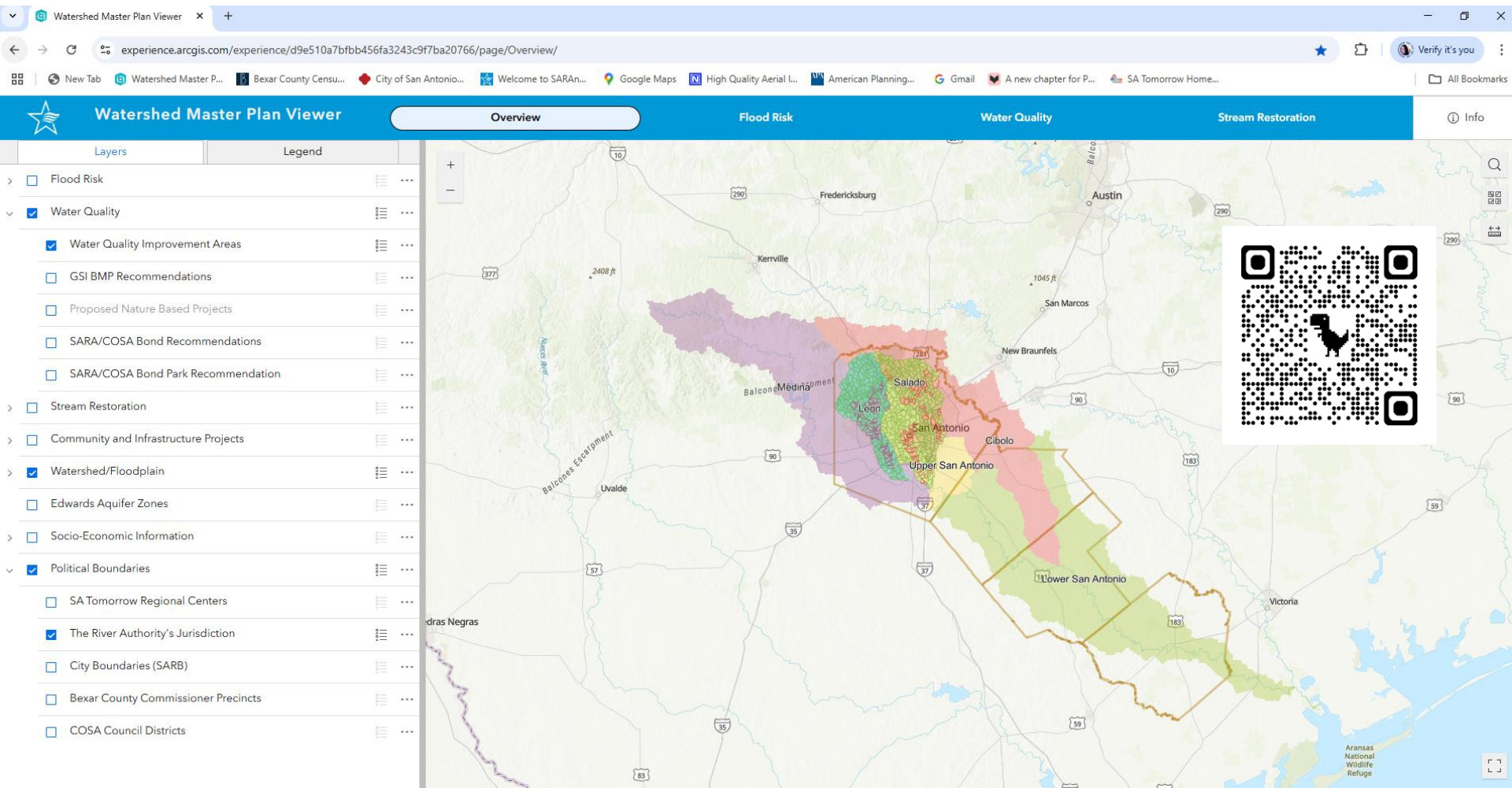


# Implementation of WQ Improvement and Collaboration

- Models and analysis provide information on where improvement strategies need to be implemented
- City of San Antonio
  - MS4
  - Bond Projects
- EAA is partly providing funding for the Cibolo Creek Watershed
- Team pursuing collaboration with other agencies for WQ improvement



# Watershed Master Plan Viewer



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# Thank you!

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