SAN ANTONIO RIVER AUTHORITY

Leon Creek Watershed WQ Model and Analysis

Agenda

- Project Goals
- HSPF Model Development
- Discussion of Results

Team

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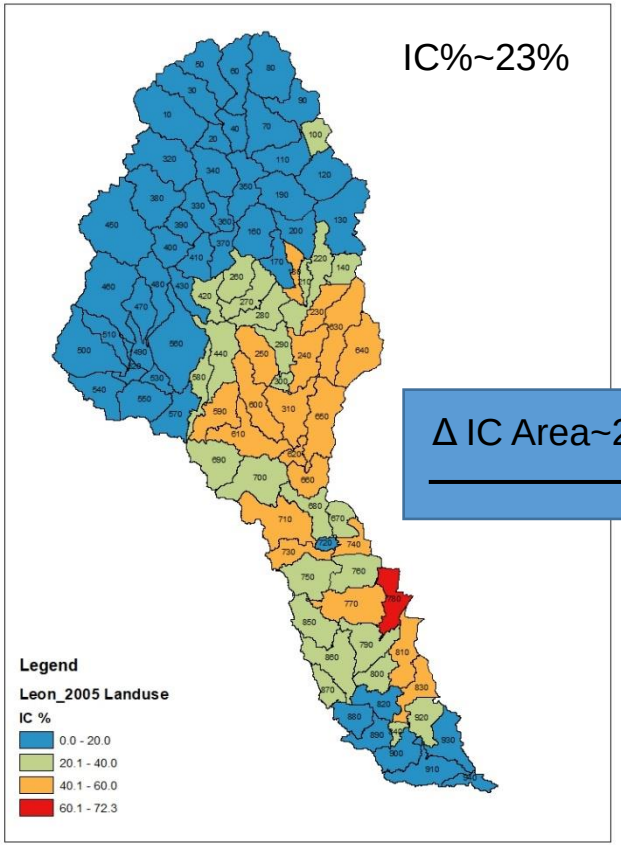
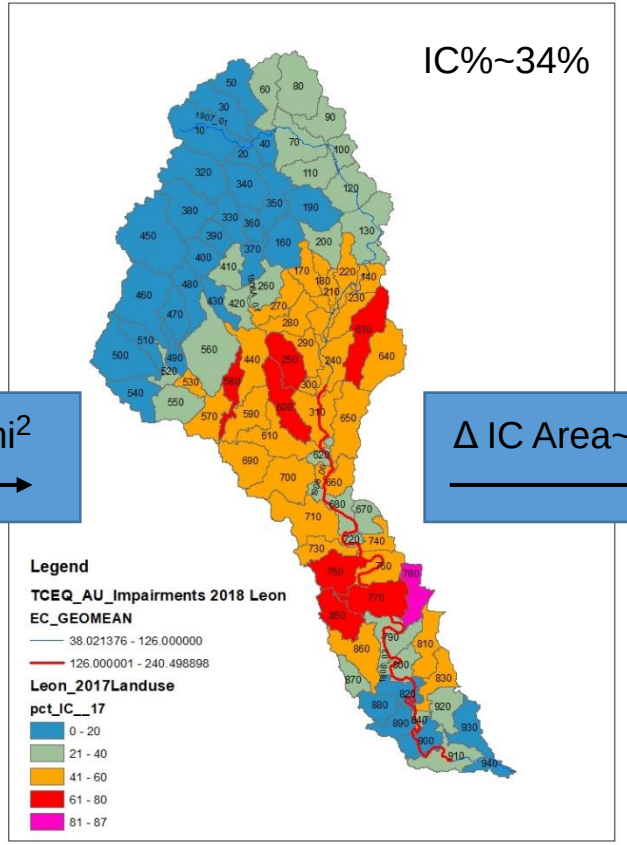
Leon Creek Watershed



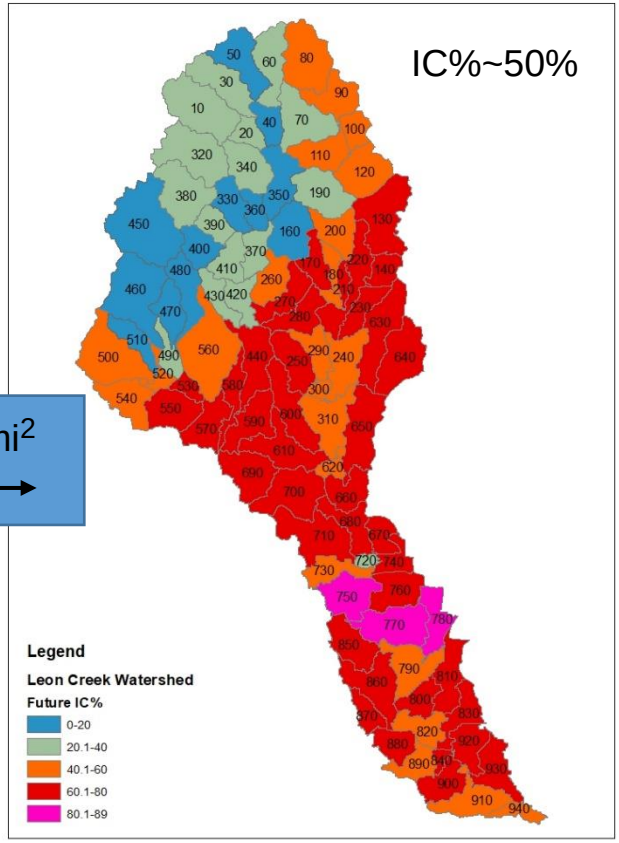
2005 Impervious Cover

Δ IC Area~26 mi^2



2017 Impervious Cover

Δ IC Area~38 mi^2



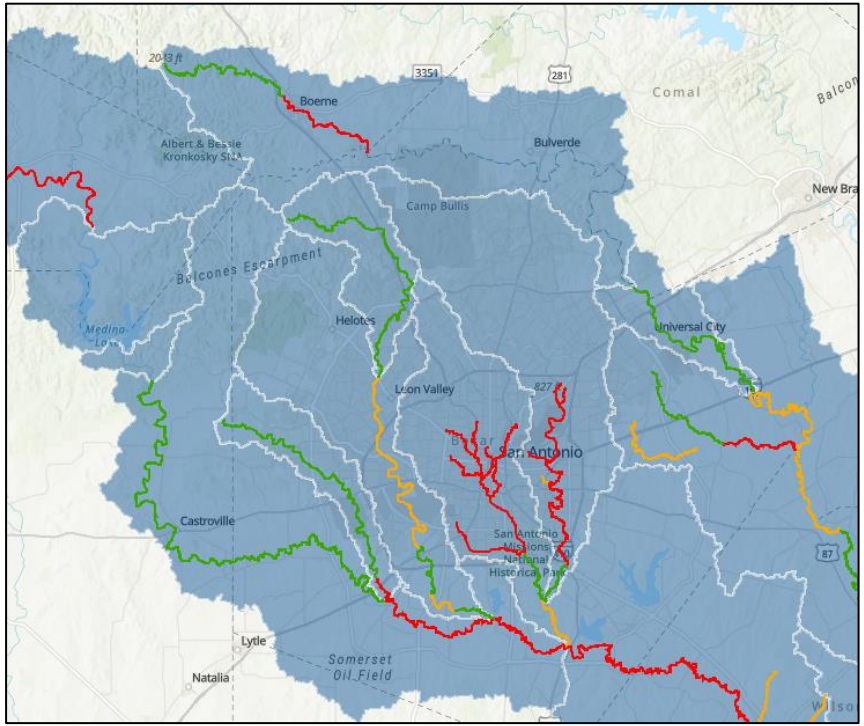
2040 Impervious Cover

Contact Recreation E-coli Standards

E-Coli Standards	Concentration
Primary Contact Recreation 1	126 #/dL
Primary Contact Recreation 2	206 #/dL
Secondary Contact Recreation 1	630 #/dL
Secondary Contact Recreation 2	1030 #/dL
Noncontact Recreation	2060 #/dL

*Source: 2014 Texas Surface Water Quality Standards

2020 WQ Assessment



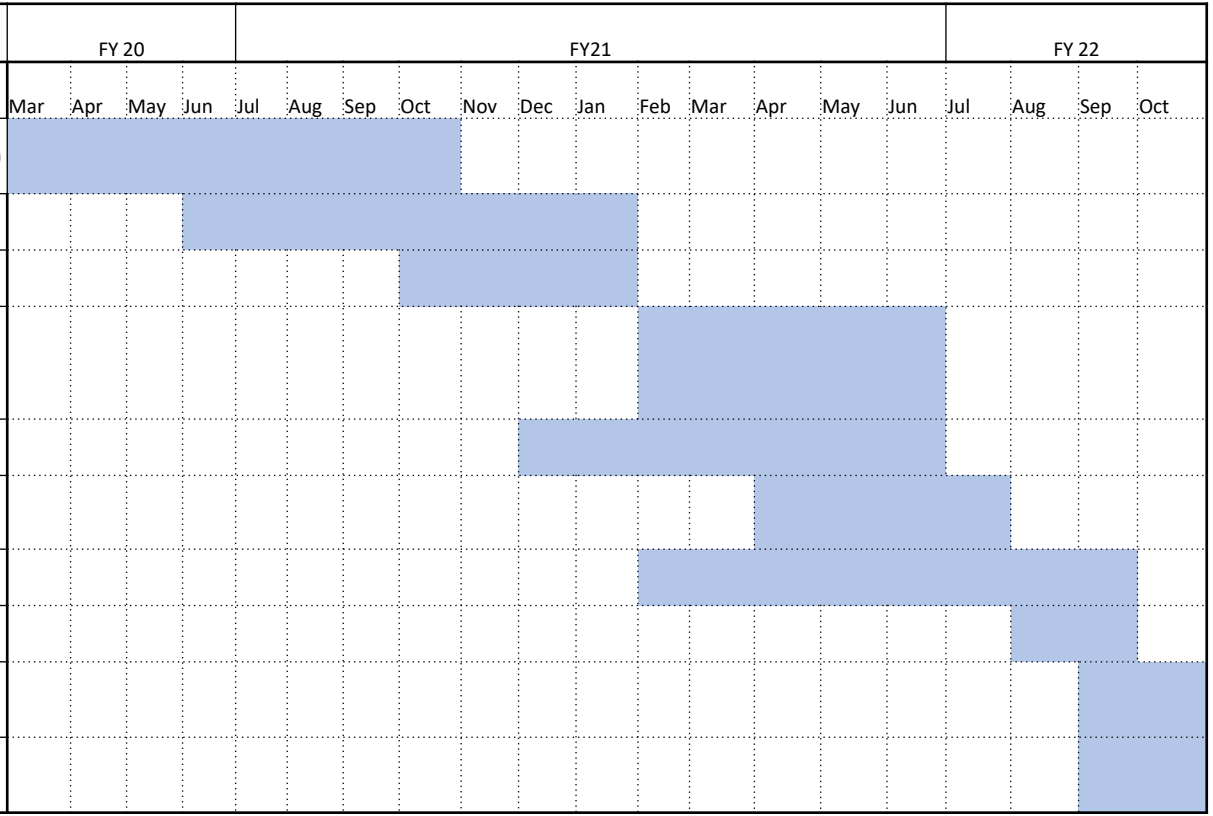
Source: https://sara-tx.maps.arcgis.com/apps/MapSeries/index.html?appid=3a4ca132222e41589e6f41eebfe6d36d

Project Goals

- Develop WQ model with 2017 landuse data, simulate 2011-2019 and recalibrate
- Simulate future conditions scenario
- Develop priority subbasins (i.e. location and quantification of where mitigation needs to occur)

Tasks

Tasks	Start	End
Data Collection and Analysis	3/24/2020	10/30/2020
Update Channel Characteristics	6/1/2020	1/29/2021
Draft model development	10/1/2020	2/1/2021
Calibration of Existing Conditions Model	2/3/2021	6/23/2021
Update WQ Modeling Tools	1/2/2021	6/23/2021
Develop Future Conditions Model	4/1/2021	7/31/2021
WQ Modeling Tools Application	2/1/2021	9/15/2021
Sensitivity Analysis	7/1/2021	9/10/2021
Prepare WQ Priority Subbasins	9/15/2021	10/15/2021
Report	9/1/2021	10/29/2021



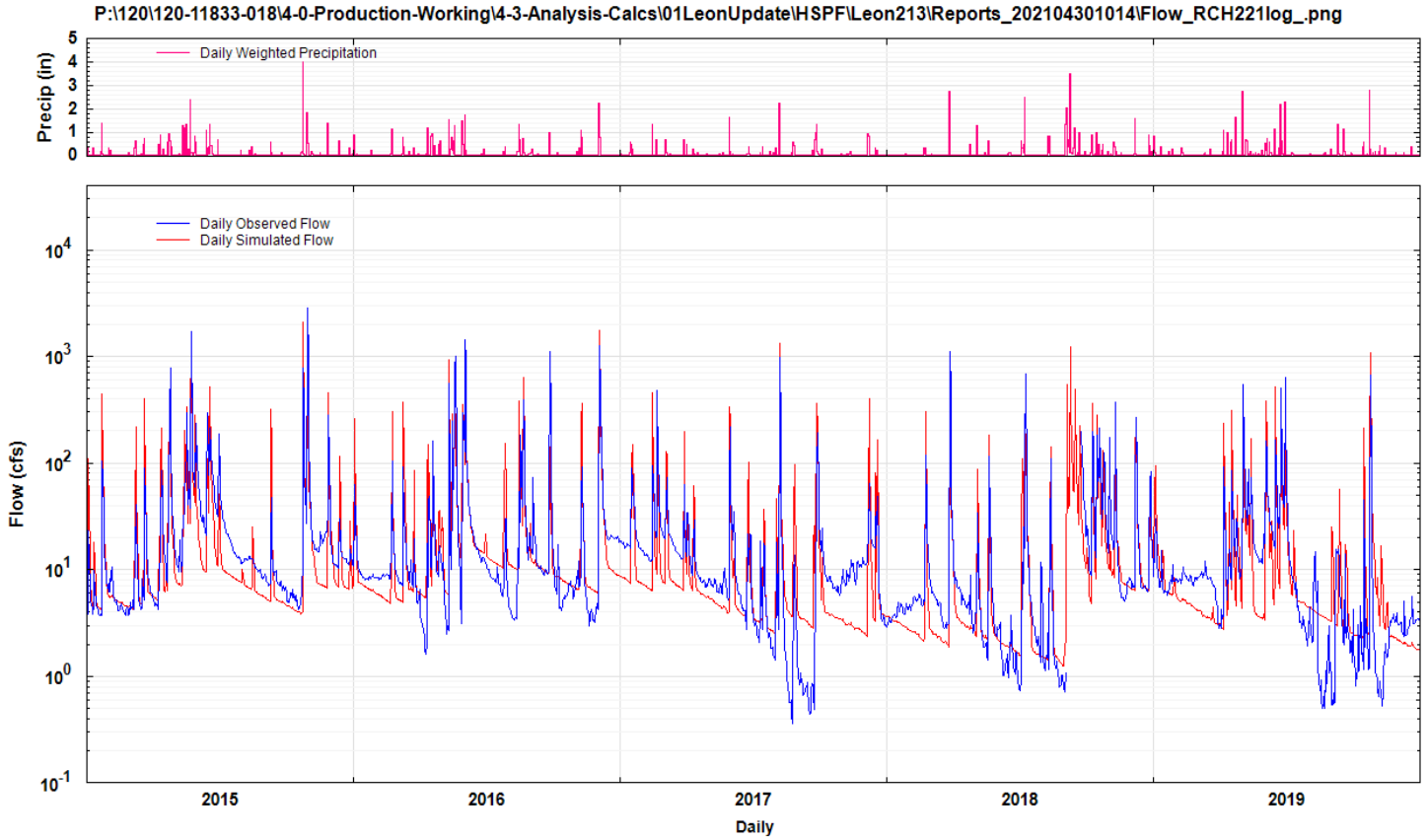
Data

- DFIRM
  - Subbasin delineation
  - Stream shapefile
  - HEC-HMS
  - HEC-RAS
- Topography
  - DEM
  - Contours
- Aerial images
- SSURGO soil data
- Landuse & IC%
- Met data (NOAA)

- Rainfall*
  - NOAA
  - EAA (gage, NEXRAD)
  - SARA
  - USGS
- Diversion
- Wastewater data
- USGS flow data*
- Water Quality
  - SWQM
  - USGS
- 2020 303(d)
- Screening levels

- SSO*
- OSSF (estimates)
- Dams/reservoirs
  - From HMS
- Groundwater recharge & spring flow
- Major development centers
- QUAL-TX models
- Atmospheric deposition
- No relevant data
  - Agricultural data
  - SELECT or EC loading estimates

Leon Creek Hydro Calibration Results



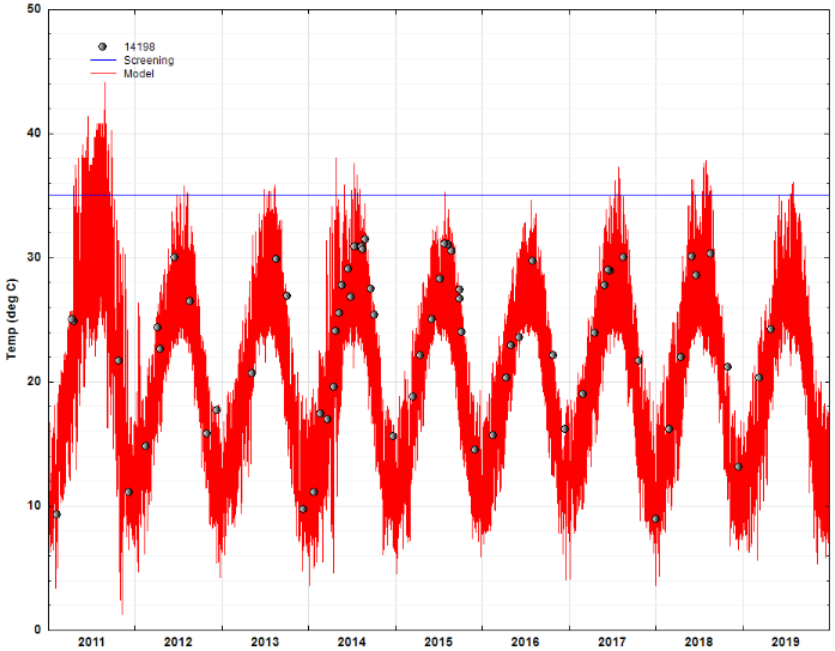
Model Quality

Comparison at USGS Gauge -8181480 Leon Creek @IH 35

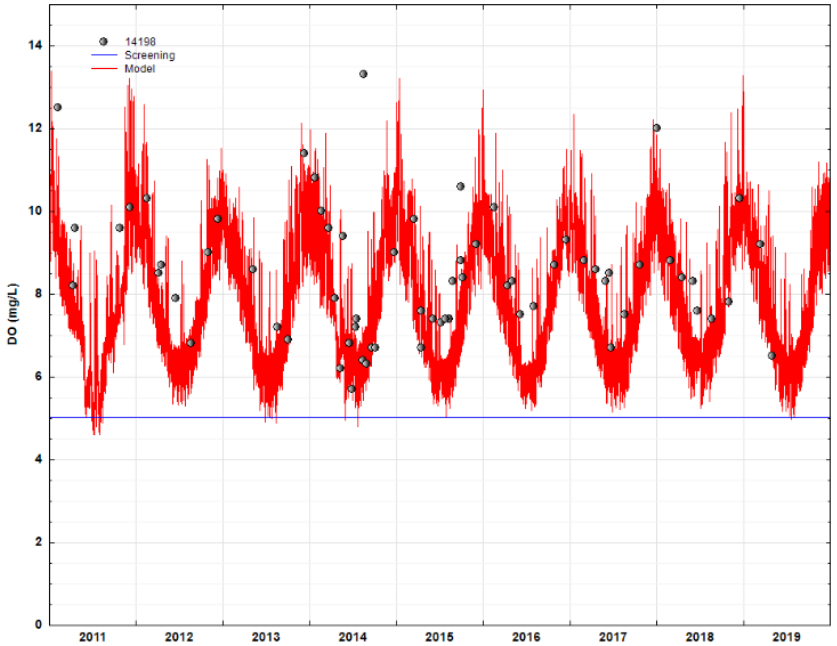
	08181480, Leon Creek at IH 35, San Antonio			
	Volume (inches)		% error	Assess
	Observed	Simulated		
Total volume	1.993	1.952	-2.0	very good
Yearly comparison				
2015	2.973	2.613	-12.1	good
2016	2.858	2.913	1.9	very good
2017	1.237	1.448	17.1	fair
2018	1.499	1.214	-19.1	fair
2019	1.286	1.464	13.8	good
Monthly comparison				
Jan	0.070	0.098	40.9	fair
Feb	0.083	0.081	-2.9	very good
Mar	0.126	0.142	12.3	very good
Apr	0.122	0.137	12.6	very good
May	0.364	0.332	-8.8	very good
Jun	0.293	0.260	-11.3	very good
Jul	0.103	0.083	-19.8	good
Aug	0.116	0.156	34.8	fair
Sep	0.123	0.108	-12.3	very good
Oct	0.302	0.268	-11.3	very good
Nov	0.108	0.096	-11.0	very good
Dec	0.168	0.188	12.3	very good
R2 (daily)	0.514			fair
NSE (daily)	0.487			fair
R2 (monthly)	0.844			good
NSE (monthly)	0.836			very good

	08181480, Leon Creek at IH 35, San Antonio				
	Observed	Simulated	% error	Criteria	Assess
total volume (inches)	1.993	1.952	-2.048	10	OK
10% highest flows (inches)	1.400	1.456	4.011	15	OK
25% highest flows (inches)	1.653	1.686	1.959	10	OK
50% highest flows (inches)	1.847	1.826	-1.101	10	OK
50% lowest flows (inches)	0.146	0.126	-14.012	10	
25% lowest flows (inches)	0.040	0.043	6.964	10	OK
10% lowest flows (inches)	0.008	0.013	65.115	10	
baseflow recession rate	0.958	0.985	-0.027	0.03	OK
storm volume (inches)	1.344	1.154	-14.108	15	OK
Seasonal volume			-21.829	10	
average storm peak (cfs)	606.110	517.010	-14.699	15	OK
summer volume (inches)	1.005	0.932	-7.234	20	OK
winter volume (inches)	0.324	0.371	14.596	15	OK
summer storm volume (inches)	0.788	0.683	-13.294	15	OK
winter storm volume (inches)	0.131	0.128	-1.949	15	OK

WQ Results



Plot for Temperature



Plot for Dissolved Oxygen

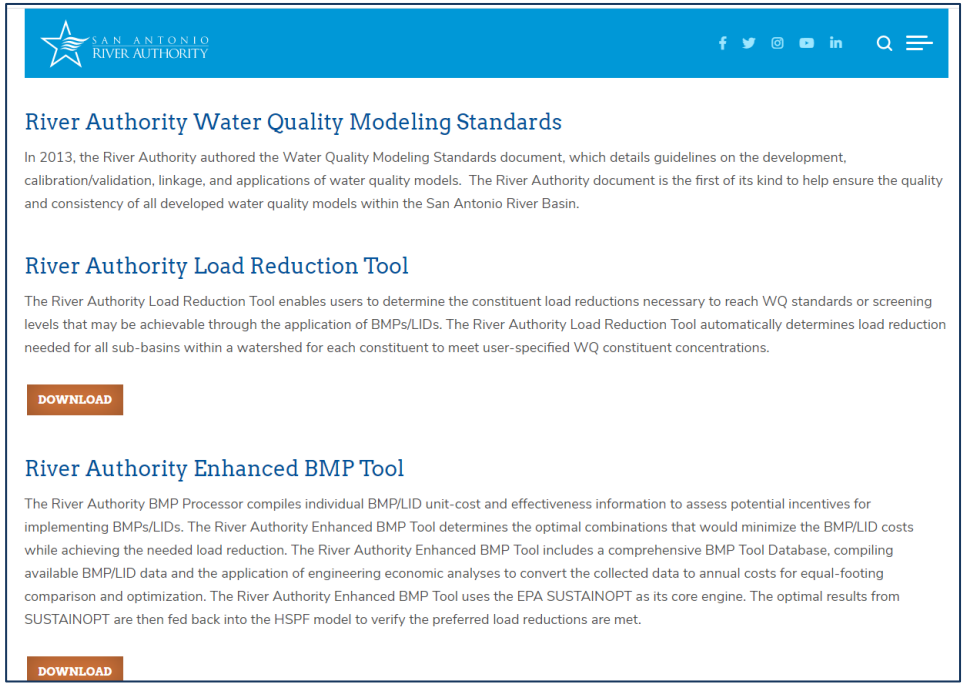
Peer-Review Comments

- Overall, the setup of the model appears to have been an extensive and impressive effort with a high level of detail, especially in the spatial definition for both land uses and stream reaches.
- In summary, the model demonstrates that a significant and comprehensive effort was invested in this model development work. The models contain reasonable parameter sets, have no serious flaws (to our knowledge), and should provide a sound basis for future use.

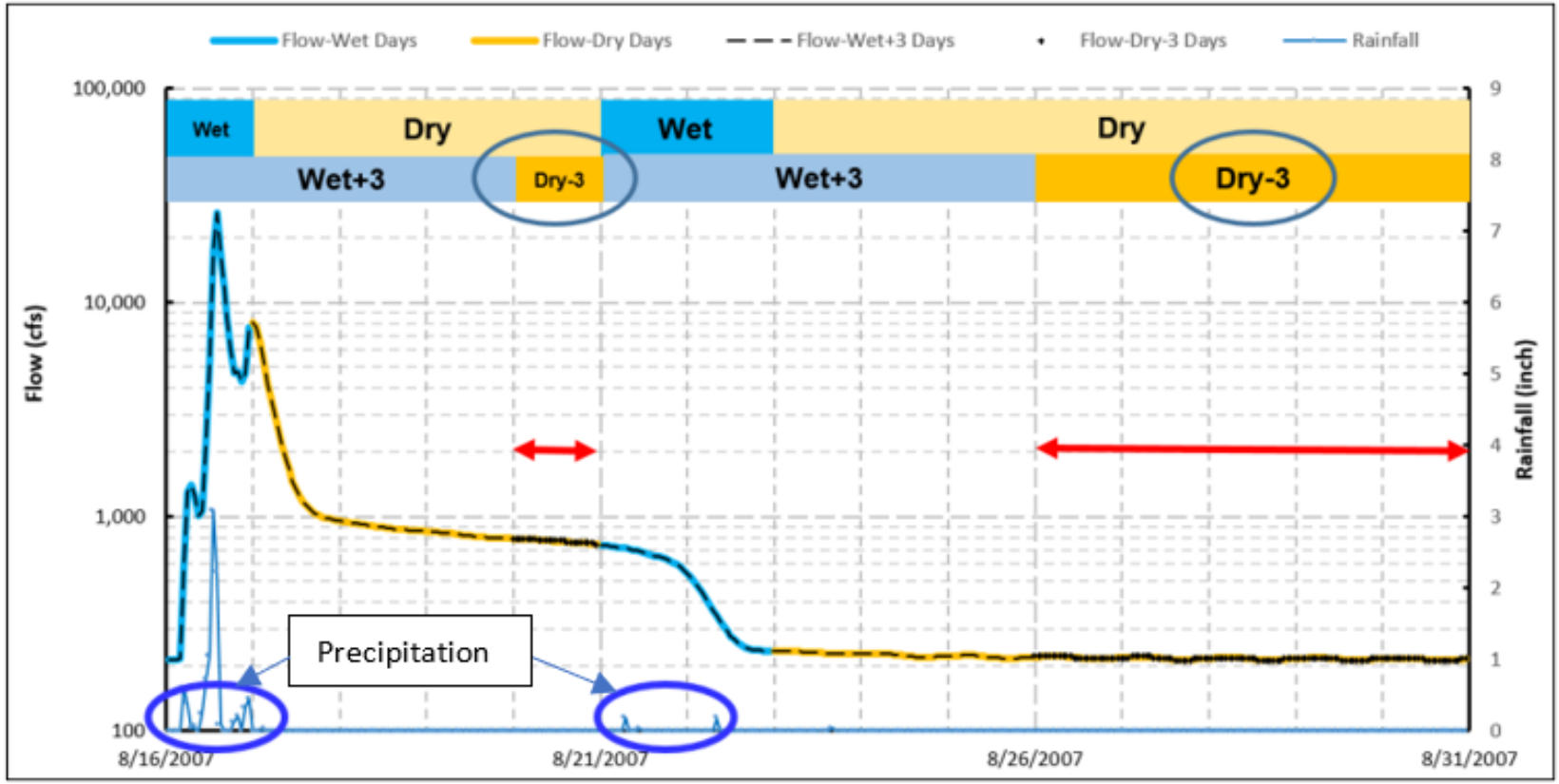
Results

SARA Suite of WQ Tools

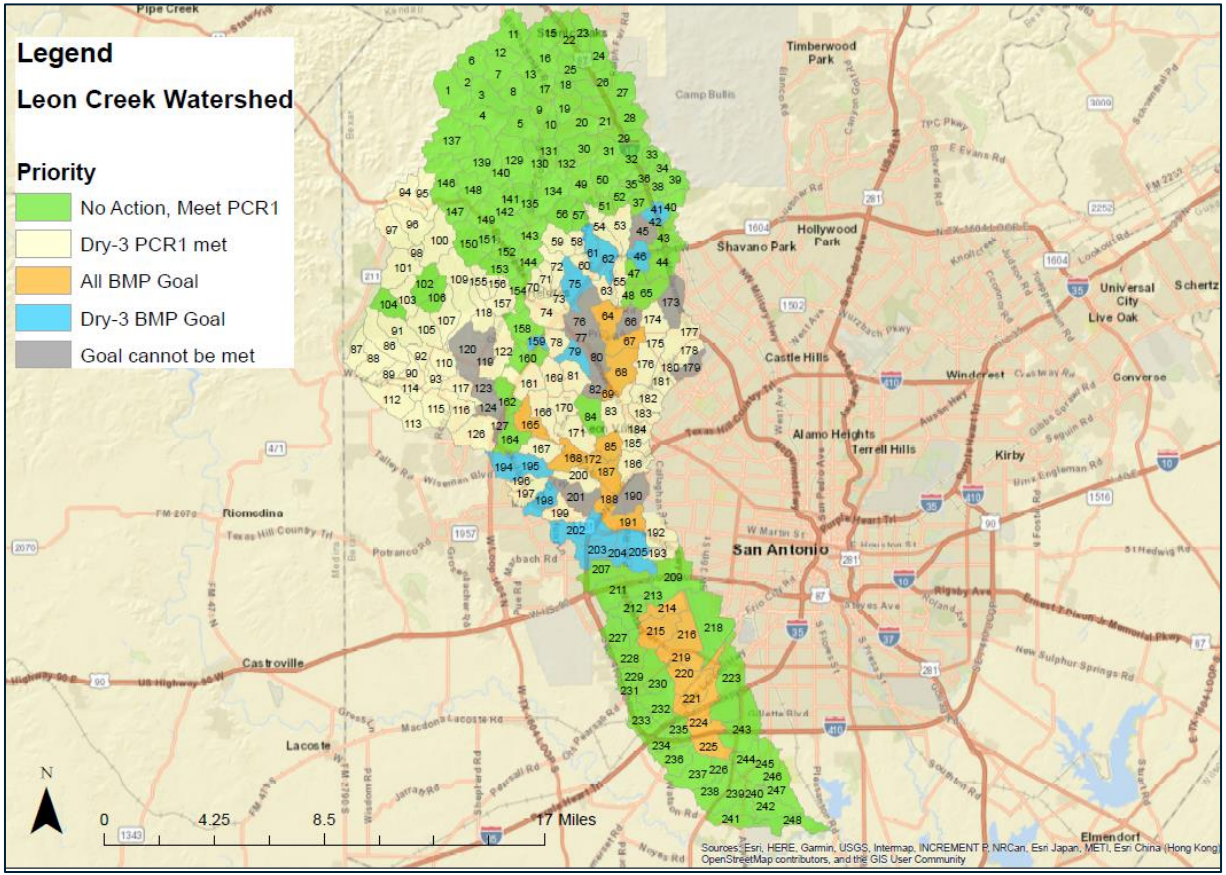
- Tools
  - Timeseries Utility
  - Load Reduction
  - Enhanced BMP
- BMPs
  - Database



Classification of Results



BMP Implementation in the Leon Creek Watershed



BMP Implementation Category 1

- No BMP implementation required
- Subbasins account for 49.4% of the Watershed
- PCR 1 is met during “All” conditions.

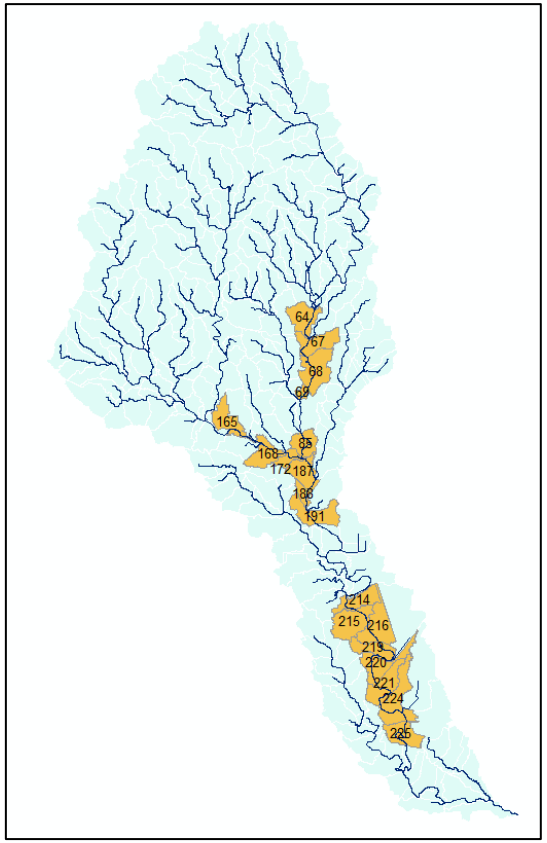
BMP Implementation Category 2

- PCR1 is not achievable during “All” conditions
- Subbasins account for 30.1% of the Watershed
- PCR 1 is met during “Dry-3” conditions without any BMP deployment
- Subbasins have steep slope
- Includes parks

BMP Implementation Category 3

- Subbasins account for 8.8% of the Watershed

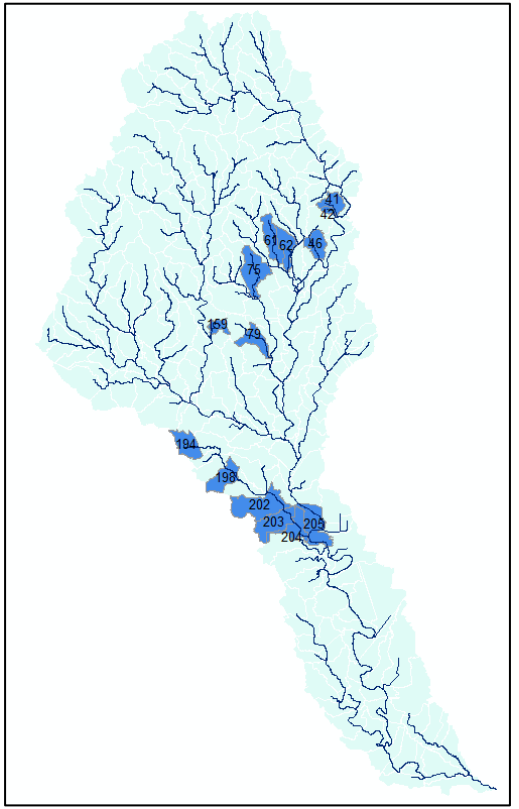
Subbasin ID	Edwards Aquifer Regulatory Zone	Area (acres)	%IC Existing	% IC Difference	Required BMP Footprint (acres)	Required Footprint as % Subbasin area	Regional Center
64	Yes	733.7	51.96	4.82	11.0	1.5%	Northwest
67	Yes	700.5	48.08	2.51	17.4	2.5%	Northwest
68	Yes	1049.6	46.15	1.4	34.7	3.3%	Northwest
69		134.5	45.79	11.79	3.6	2.7%	West Northwest
85		566.0	55.58	4.78	17.0	3.0%	West Northwest
165		712.9	60.2	4.4	24.6	3.4%	West Northwest
168		685.9	55.8	9.7	24.9	3.6%	Far West
172		282.4	54.5	3.6	7.6	2.6%	West Northwest
187		698.8	43.72	12.69	19.2	2.7%	West Northwest
188		235.2	48.04	20.7	7.9	3.4%	Far West
191		855.1	45.19	32.67	22.5	2.6%	Far West
214		637.2	40.82	35.26	4.6	0.7%	Port SA
215		1003.1	57.54	23.66	22.8	2.3%	Port SA
216		1015.5	72.71	16.88	30.5	3.0%	Port SA
219		590.9	25.96	19.23	11.7	2.0%	Port SA/Southwest
220		805.9	21.57	11.1	7.7	1.0%	Southwest
221		820.3	38.24	36.91	20.7	2.5%	Southwest
224		1152.8	19.1	44.2	8.2	0.7%	Southwest
225		701.5	15	48.7	0.8	0.1%	Far Southwest



BMP Implementation Category 4

- Subbasins account for 5.4 % of the Watershed

Subbasin ID	Subbasin Area	Edwards Aquifer Regulatory Zone	IC% Existing	%IC Difference	Required BMP Footprint (ac)	Required BMP Footprint as % Subbasin Area	Regional Center
41	365.7	Yes	70.5	11.3	13.0	3.6%	UTSA
42	85.9	Yes	35.1	39.3	2.2	2.6%	UTSA
46	473.2	Yes	57.6	32.4	13.7	2.9%	UTSA
61	626.2	Yes	33.4	24.5	18.6	3.0%	Northwest
62	494.0	Yes	47.7	9.3	15.2	3.1%	Northwest
75	890.2	Yes	49.4	21.2	17.6	2.0%	Northwest
79	492.8	Yes	61.6	1.8	29.3	5.9%	West Northwest
159	234.8	Yes	77.3	2.8	8.7	3.7%	West Northwest
194	583.4		63.9	20.4	20.3	3.5%	Hwy 151 and Loop 1604
195	628.3		55.9	26.7			Hwy 151 and Loop 1604
198	615.1		52.7	23.3	23.7	3.9%	Far West
202	1202.1		61.1	15.4	33.0	2.7%	Far West
203	765.4		50.9	11.4	20.5	2.7%	Far West
204	549.8		59.1	2.1	18.9	3.4%	Far West
205	873.7		27.7	20.1	12.0	1.4%	Far West



EA WPAP Rules

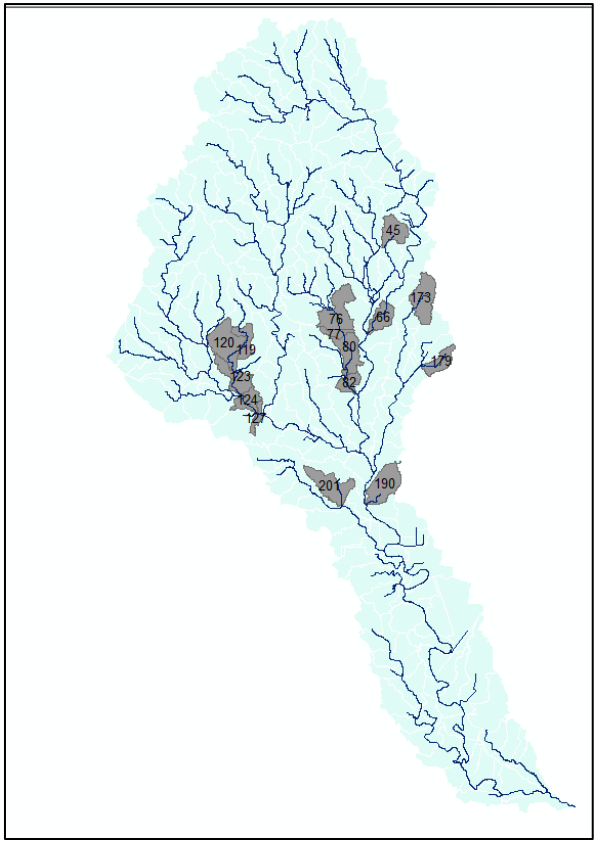
- Using simplified analysis

Subbasin	Goals Potentially Addressed by WPAP Rules
41	18%
42	68%
46	32%
61	36%
62	13%
75	21%
79	2%

BMP Implementation Category 5

- Subbasins account for 6.2 % of the Watershed

Subbasin ID	Edwards Aquifer Regulatory Zone	AREA (ac)	Existing %IC	% IC Difference	Standard met during Dry-3 With BMP Deployment
45	Yes	597.3	46.7%	37.3%	PCR2 (206 #/dL)
66	Yes	522.1	59.0%	4.5%	PCR2
76	Yes	1051.6	50.7%	8.6%	SCR1 (1030 #/dL)
77	Yes				
80	Yes	767.4	48.0%	4.1%	PCR2
82		336.1	48.6%	6.8%	PCR2
119		430.2	31.5%	13.4%	Not CR standards met
120	Yes	1083.3	25.1%	31.6%	SCR1 (630#/dL)
123		635.35	47.7%	12.9%	SCR1
124		433.4	53.5%	9.8%	SCR1
127		197.3	79.8%	7.5%	PCR2
173	Yes	892.3	84.6%	1.5%	PCR2
179	Yes	458.9	51.5%	18.0%	PCR2
190		938.9	51.5%	23.8%	PCR2
201		907.2	54.5%	16.2%	PCR2



Questions?

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