Cibolo Creek Watershed:
Bacteria Source Estimates

Lucas Gregory
Texas Water Resources Institute
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Population Estimates

- Used to estimate bacteria contributions

- Animal estimates strongly tied to specific land uses or covers

- Used to identify priority loading areas in the watershed

- Helps to plan future management

- Estimates Are Needed For:
  - Cattle
  - Hogs
  - Sheep/Goats
  - Dogs
  - Cats
  - Horses
  - Poultry
  - Feral Hogs
  - Deer
  - Septic Systems (OSSFs)

- **Did we miss any?**

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Where Do They Come From?

- Available Data

  - Local, regional, state and national data sets

  - Councils of Government, AgriLife Extension, IRNR, NRCS, TCEQ, TPWD, TWRI, USDA

    - Address data
    - Methodologies
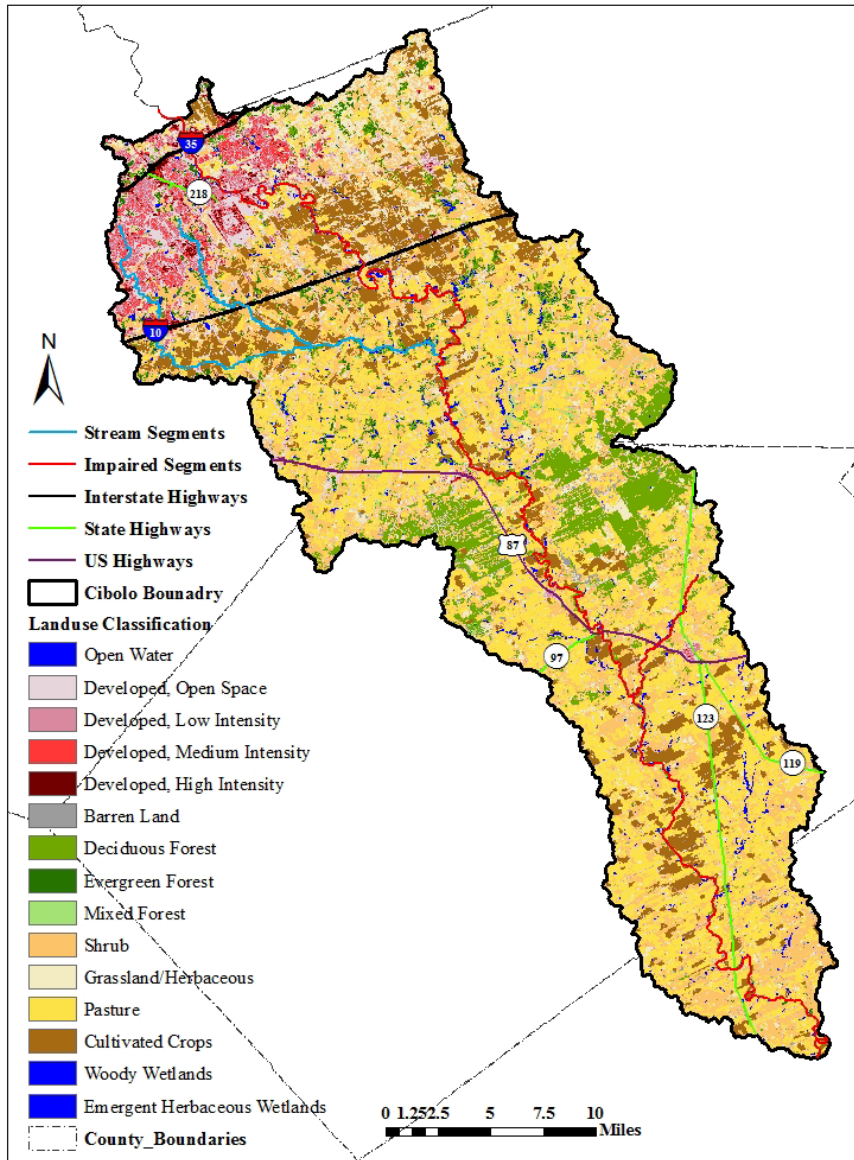   - Population estimates
    - Stocking rates

- Input from You

  - No one knows the watershed like you do

  - We want your opinions on what numbers of each population are appropriate

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Scale Down County Level Data

- Several data sets are reported on the county level

- Entire county not in the watershed

- County level data multiplied by respective percent of each county in the watershed

	Area of Total County (acres)	Area of watershed within the county (acres)	Percent of the total county within the watershed (%)	Percent of the watershed within each county (%)
Bexar	804,048	86,244	10.7	23.2
Wilson	516,500	156,336	30.3	42.1
Guadalupe	458,112	98,624	21.5	26.5
Karnes	480,499	28,970	6.0	7.8
Comal	367,819	1,330	0.4	0.4
Entire Watershed		371,504		

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Land Use and Land Cover

- Hay/Pasture: 29.2%
- Shrub/Scrub: 25.6%
- Developed Land: 13.9%
- Cropland: 11.2%
- Forest: 10.2%
- Herbaceous: 7.1%
- Wetlands: 1.9%
- Barren Land: 0.6 %
- Open Water 0.2%

National Ag Statistics Survey (NASS)

- USDA effort to measure agricultural production across the nation (cattle, sheep, goats, horses, hogs, poultry)

- Conducts the Census of Agriculture every 5 years
  - 2012 most recent published

- Conduct interim surveys to illustrate annual numbers (less extensive survey, but still good idea of what is in the area)

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Recommended Stocking Rates / Densities

- AVMA provides pet population estimation
  - 0.584 dogs and 0.638 cats per household
  - Households is derived from USCB Census Blocks (USCB 2010)

- TPWD estimates deer densities for various areas of the state
  - # of acres per deer

- Texas A&M wildlife department estimated feral hog density
  - # of acres per hog

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Cattle

- 2012 NASS Data
  - Bexar – 3989
  - Wilson – 13817
  - Guadalupe – 8672
  - Karnes – 4442
  - Comal – 37
- Total – 30,957

- NRCS Stocking Rates
  - Bexar – 4984
  - Wilson – 16202
  - Guadalupe – 6267
  - Karnes – 3300
  - Comal – 33
- Total – 30,786

Improved: Managed Hay Pasture Only

County	Improved Pasture Rate		Unimproved Pasture Rate	
	irrigation	dryland	dryland	Thick brush
Bexar	5 ac/AU		12 - 14 ac/AU	
Wilson	2~3 ac/AU	5~7 ac/AU	15 ac/AU	30 ac/AU
Guadalupe	5~7 ac/AU		12~15 ac/AU	
Karnes	Using Wilson			
Comal	Using Guadalupe			

Unimproved: shrub/scrub and herbaceous

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Other Livestock

⊙ 2012 NASS Data

County	Hogs	Horses	Goats	Sheep	Poultry
Bexar	199	482	119	458	559
Wilson	193	676	955	431	1128
Guadalupe	351	564	164	561	8395
Karnes	10	62	54	19	41
Comal	1	3	2	11	32
Total	754	1787	1294	1480	10155

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Dogs

- American Vet Med. Assoc. 2012 estimated 0.584 dogs per household

- 2010 Census Data: 77,640 households estimated in watershed

  - Bexar – 27,314
  - Wilson – 4,293
  - Guadalupe – 13,639
  - Karnes – 132
  - Comal – 102
    - Total – 45,480

Cats

- American Vet Med. Assoc. 2012 estimated 0.638 cats per household

  - Bexar – 29,804
  - Wilson – 4,668
  - Guadalupe – 14,870
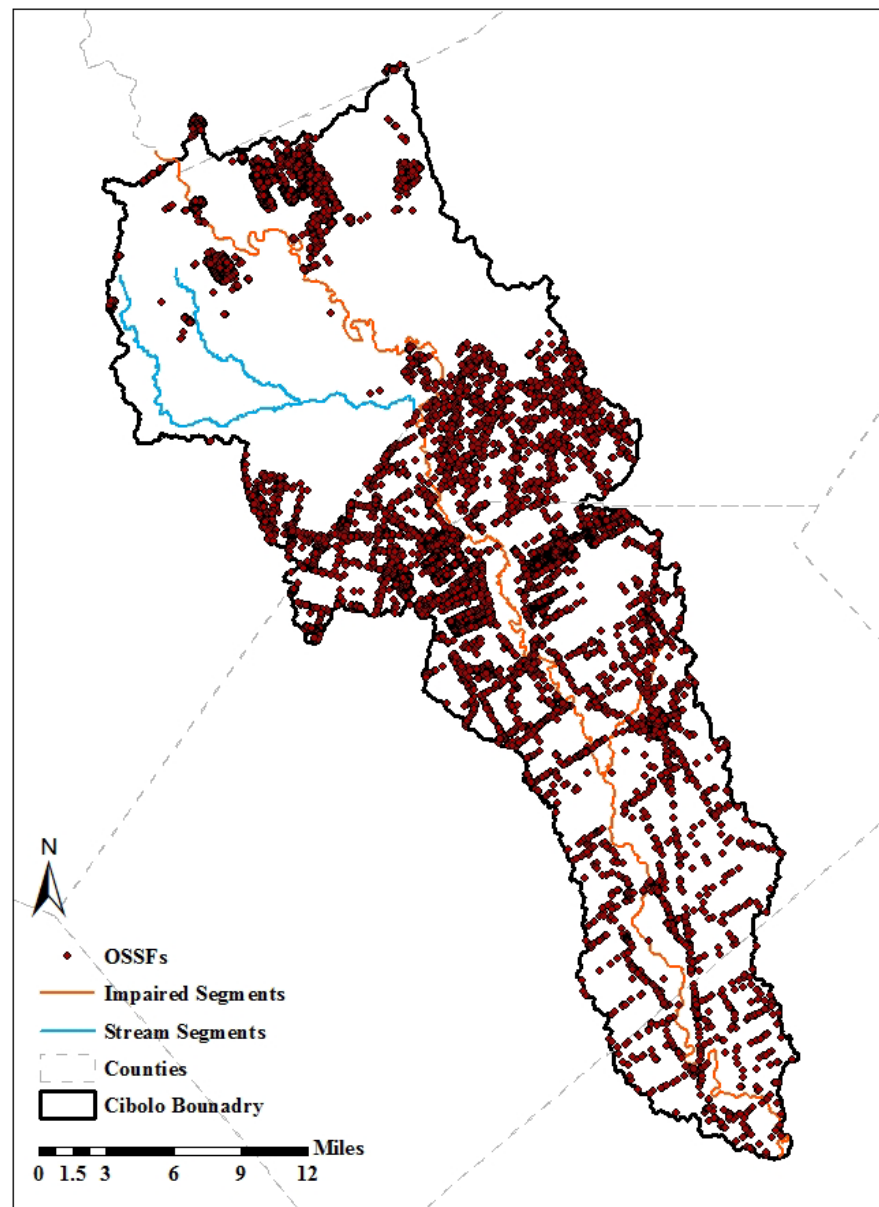 - Karnes – 139
  - Comal – 109
    - Total – 49,590

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Deer

- Deer – RMU density estimates survey density: variation for different counties
  - Bexar – 8499 (7.16 ac/deer)
  - Wilson – 5950 (24.2 ac/deer)
  - Guadalupe – 4312 (19.4 ac/deer)
  - Karnes – 948 (29.04 ac/deer)
  - Comal – 140 (7.16 ac/deer)
- Total – 15,116

- Applied to shrub/scrub, herbaceous, hay/pasture, cropland, forests, wetlands

Feral Hogs

- Feral Hogs – Texas A&M Survey + Landowner Feedback 16 – 33.3 ac/hog
  - Bexar – 885
  - Wilson – 1846
  - Guadalupe – 1100
  - Karnes – 358
  - Comal – 8
- Total – 4,197

- Applied to shrub/scrub, forests, wetlands

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Septic Systems - OSSF

- Estimated using
  - 2010 Census block housing units
  - 911 address points
  - Aerial imagery
  - Removed areas serviced by WWTF (Cities Area)

- 16,231 OSSFs estimated in watershed

Legend:
- OSSFs
- Impaired Segments
- Stream Segments
- Counties
- Cibolo Bounadry

Miles
0 1.5 3   6   9   12

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Septic Systems - OSSFs

- Estimated Failure Rates:
  - Reed, Stowe and Yanke, 2001 Report

  - State-wide failure rate ~13%; 50% of 'older' systems failing

  - Soils and system age primary reasons for failure

- Any thoughts on failure rate?
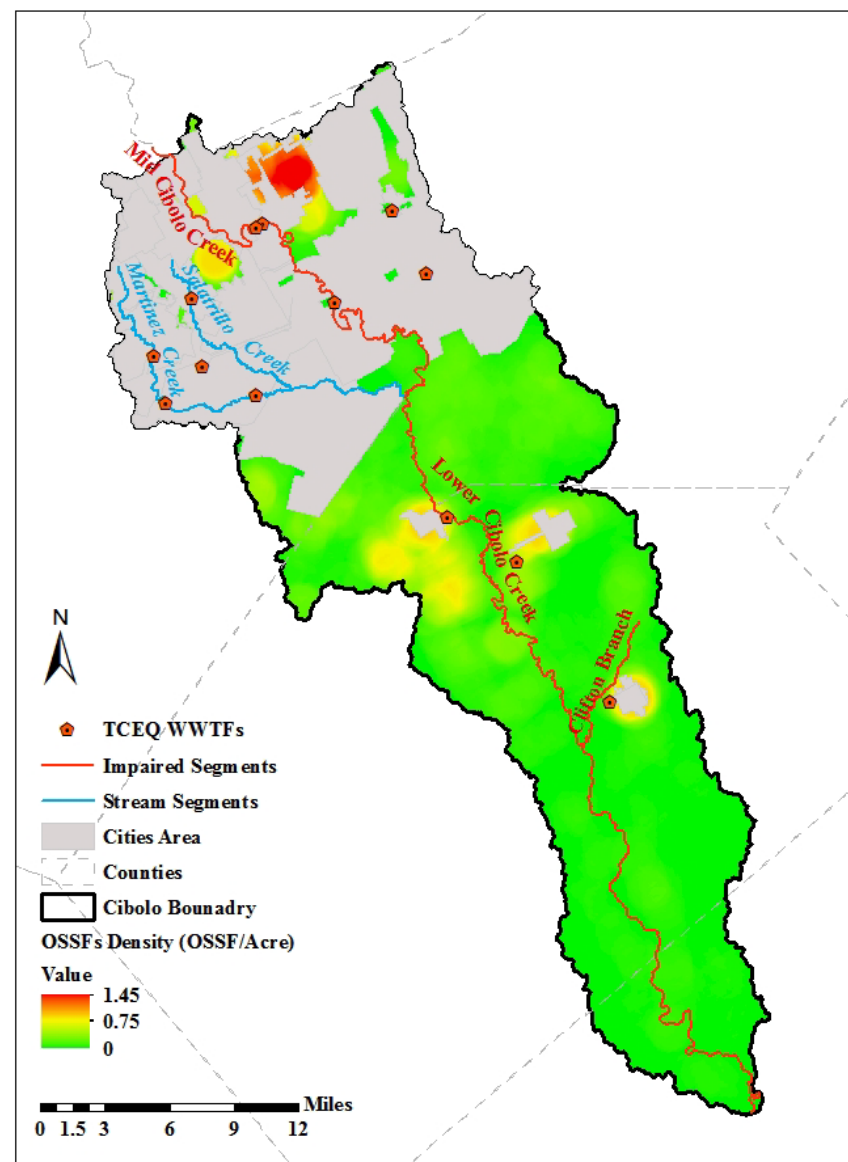
Wastewater Treatment Plants

- 14 WWTFs in the watershed

  - 24.79 MGD total permitted flow

  - 20.96 MGD reported 3-yr average discharge

 - Only a handful of exceedance issues reported in last 3 years

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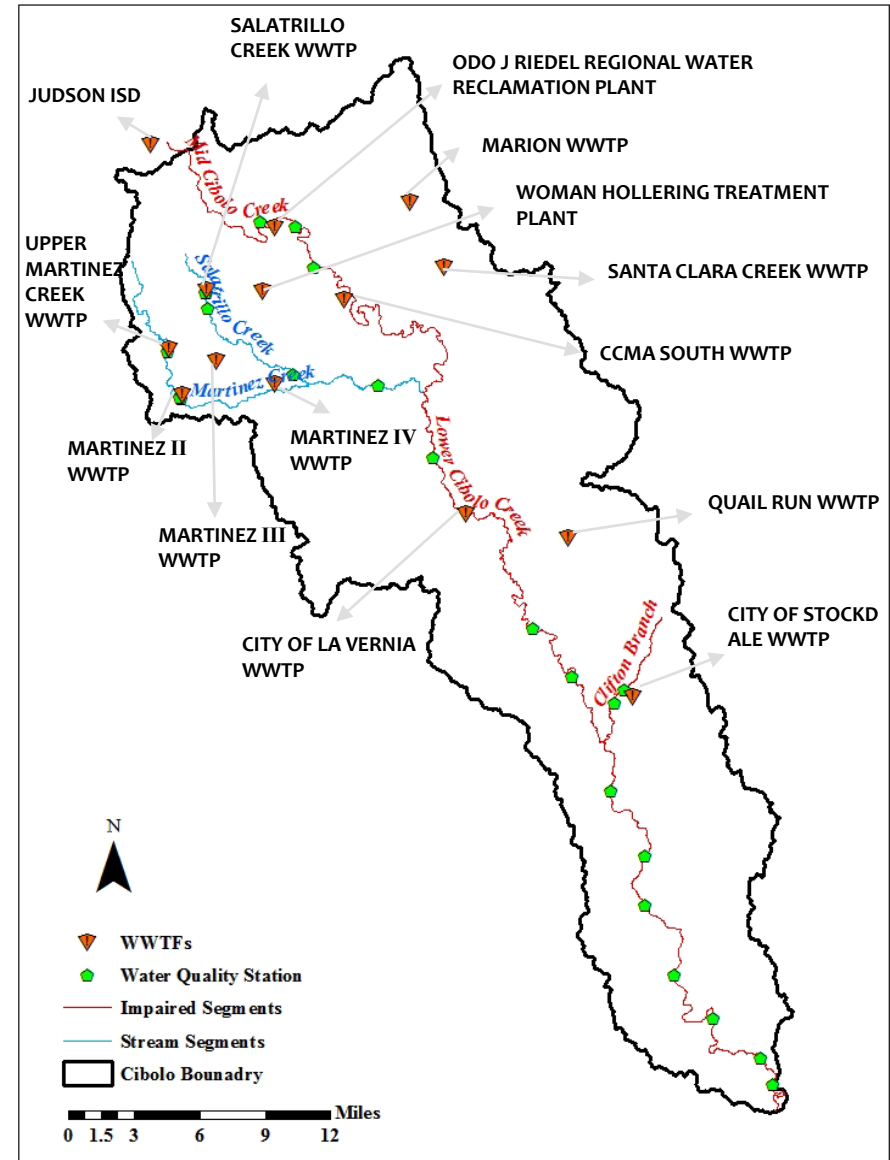
Current Bacteria Loads and Needed Reductions

River Discharge

- Annual average discharge

USGS Station	Discharge (ft³/s)
Cibolo Ck at Selma	35.74
Cibolo Ck nr Saint Hedwig	34.18
Martinez Ck nr Saint Hedwig	35.63
Cibolo Ck Sutherland Springs	110.06
Cibolo Ck nr Fall City	184.32

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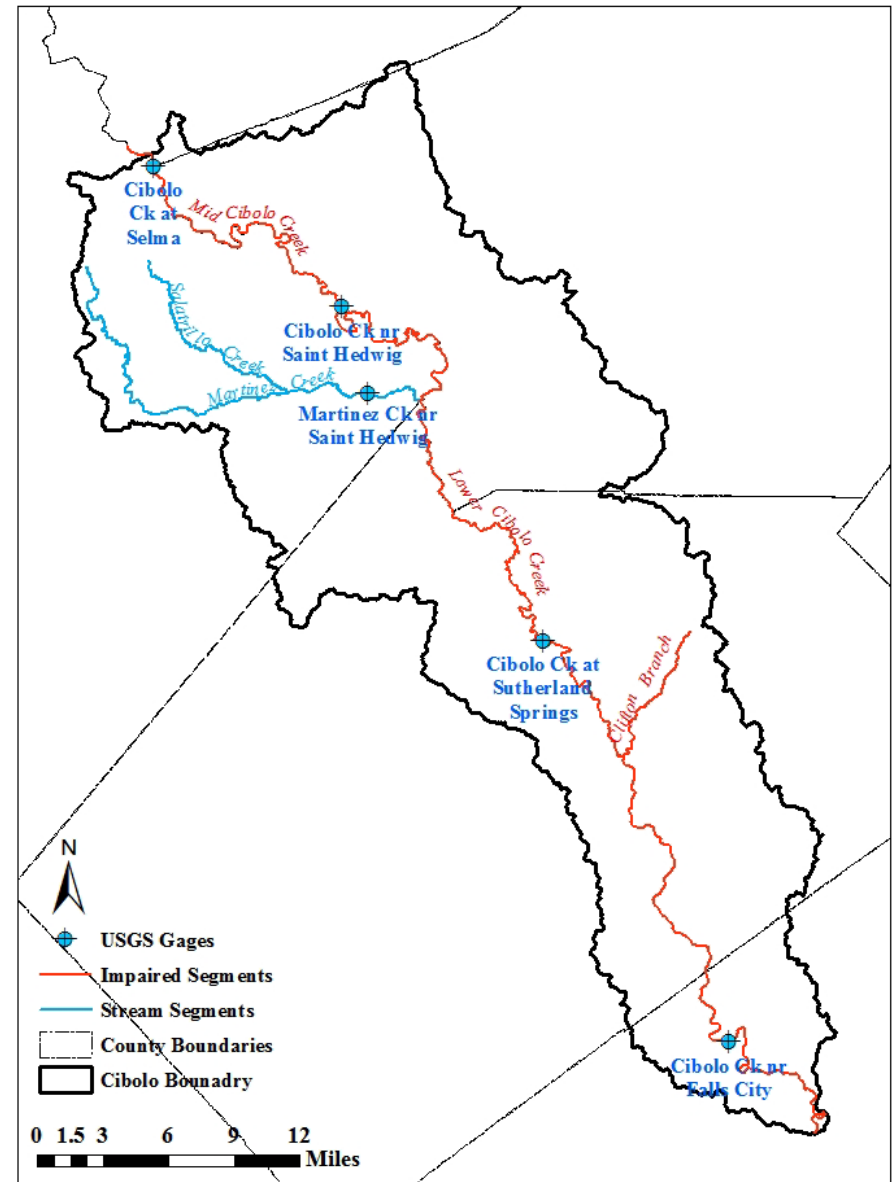
Current Impairment Status
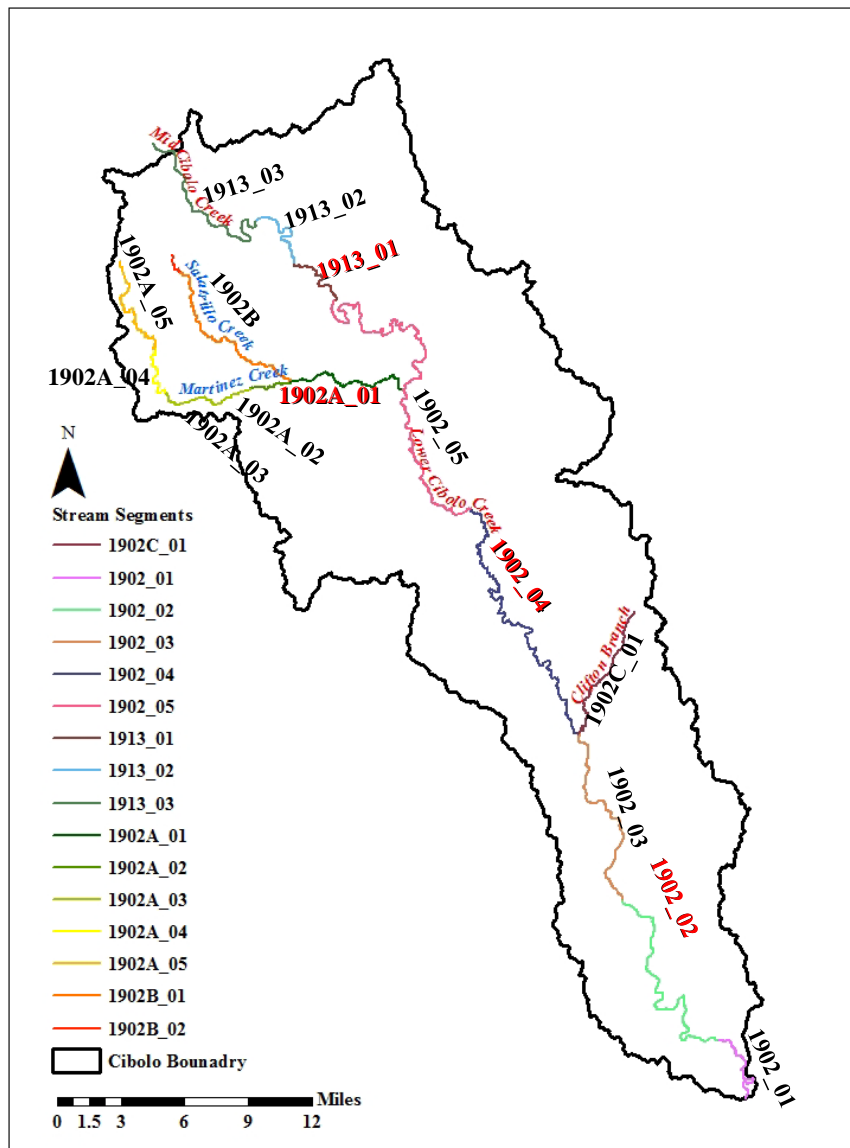
303(d) Water Body Impairments

Parameter	Category	Geomean†
Bacteria	**5b**	
1902_01	Lower Cibolo Creek	166.74
1902_02	Lower Cibolo Creek	191.11
1902_03	Lower Cibolo Creek	141.84
Bacteria	**5c**	
1902C_01	Clifton Branch	160.38
Depressed DO	**5c**	
1902C_01	Clifton Branch	3.59*

† The bacteria criteria for these segments are 126 cfu/100 mL
* Minimum Criteria for 24-hour means for Dissolved Oxygen levels for Lower Cibolo Creek are 5 mg/L
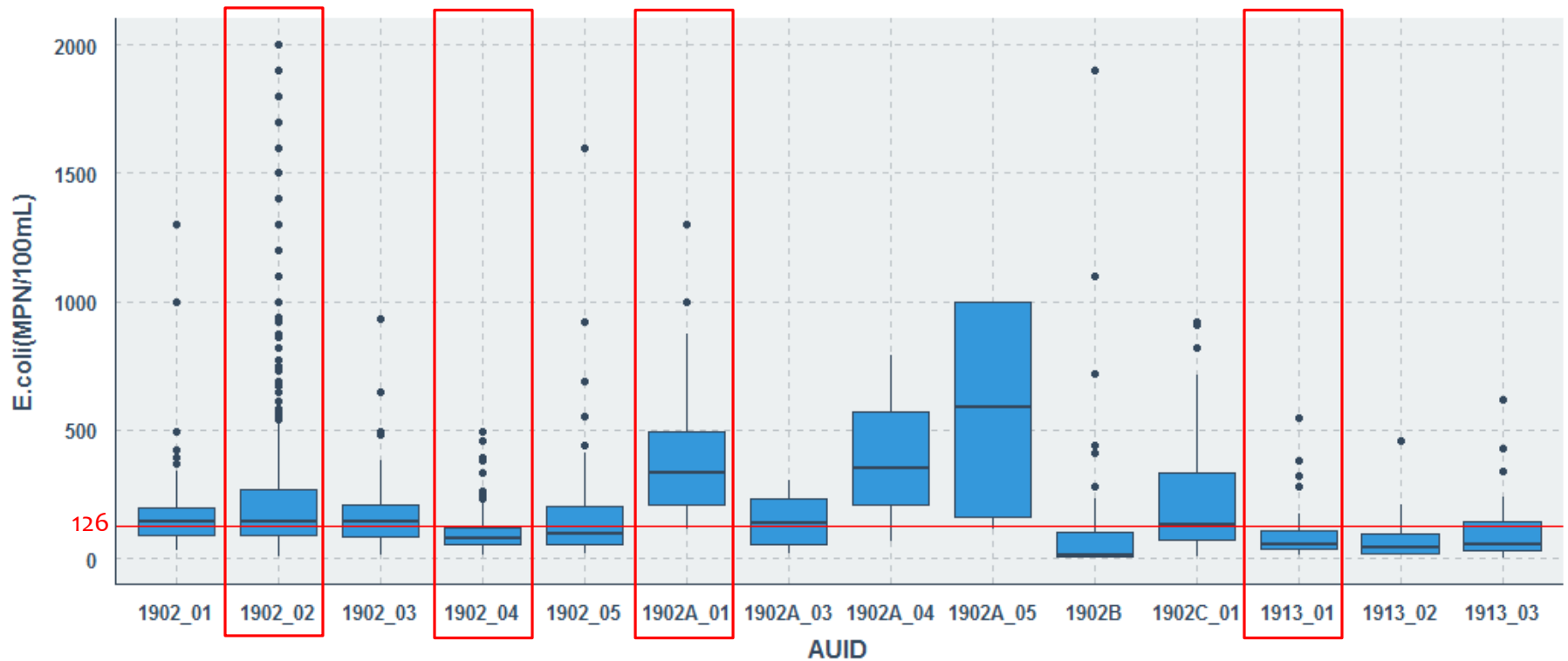
Concern

Bacteria	
1902A_01	Martinez Creek
1902A_03	Martinez Creek
1902A_04	Martinez Creek
1902A_05	Martinez Creek

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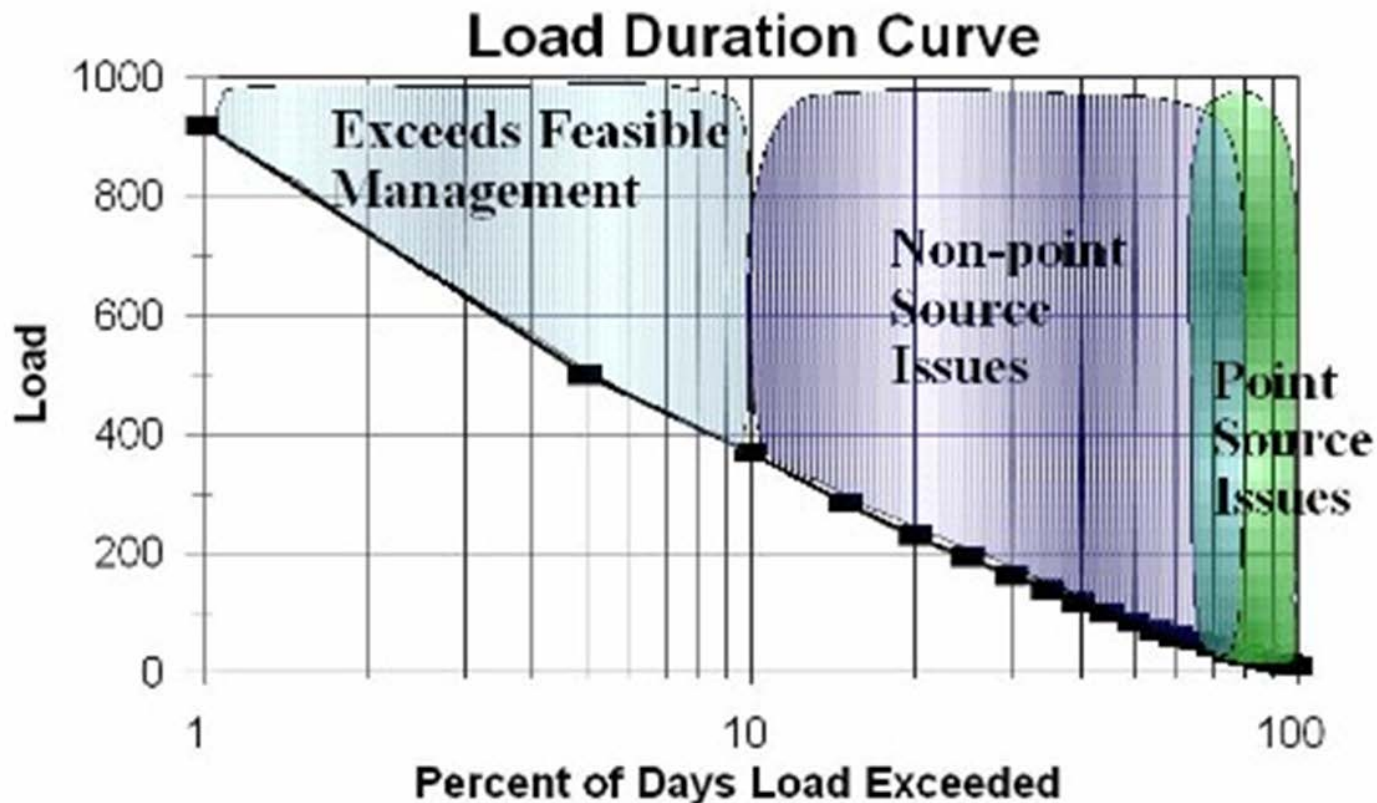RESEARCH | EXTENSION

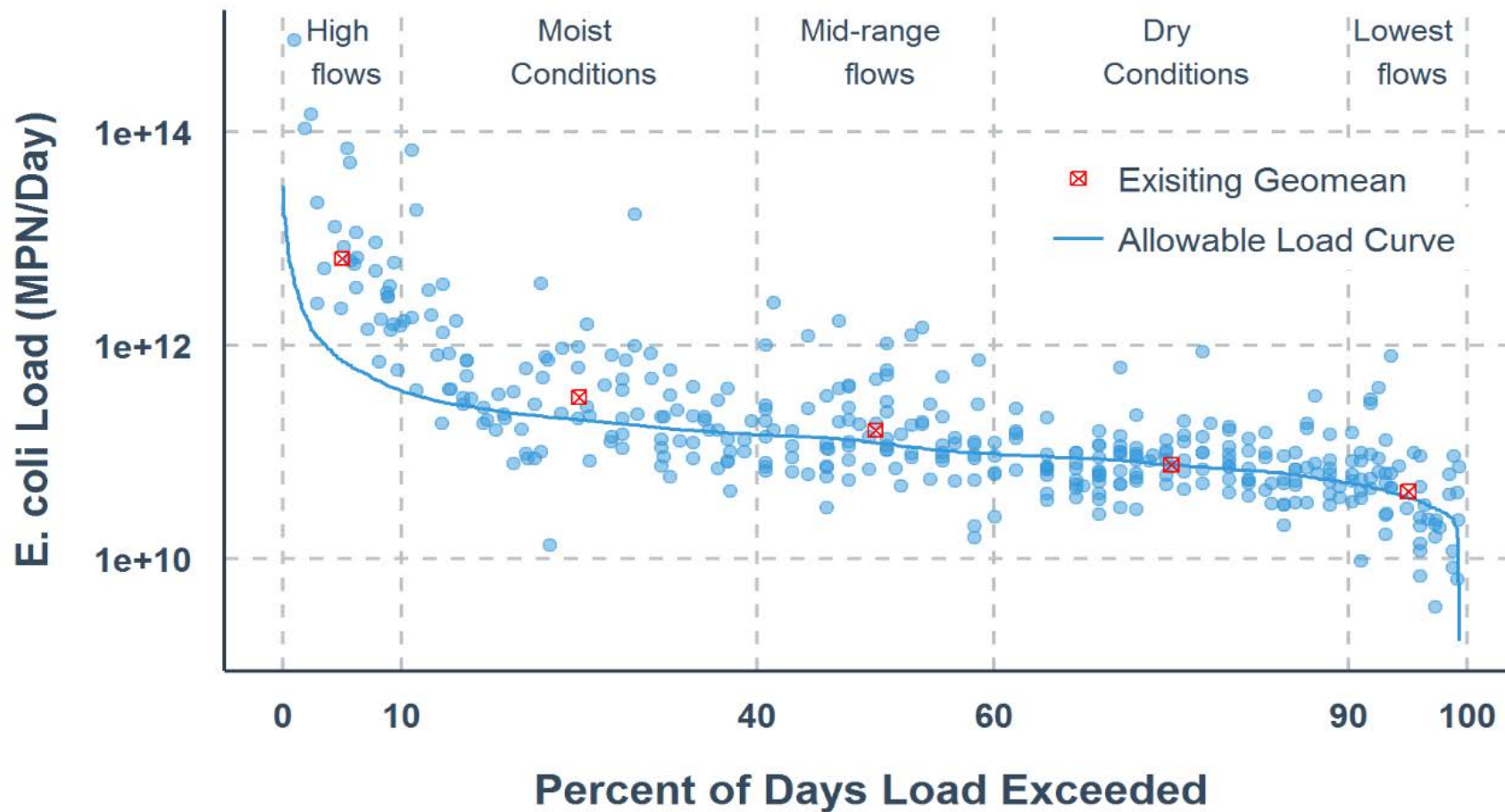# Recent *E. coli* Concentrations

Data range: 01/01/07 – 07/11/16

Load Duration Curves (LDCs)

- Combines concentrations of a pollutant with flow at the same time to develop a load

- The LDC illustrates the load of a pollutant versus the time that a given load is exceeded

- Time is illustrated as percentage of the year

- Able to see if a stream is exceeding the standard in terms of load (flow and concentration)

- Able to calculate a percent reduction based on flow categories

Utility of LDCs: Can Help ID Source Type

Load Duration Curve

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Current LDCs

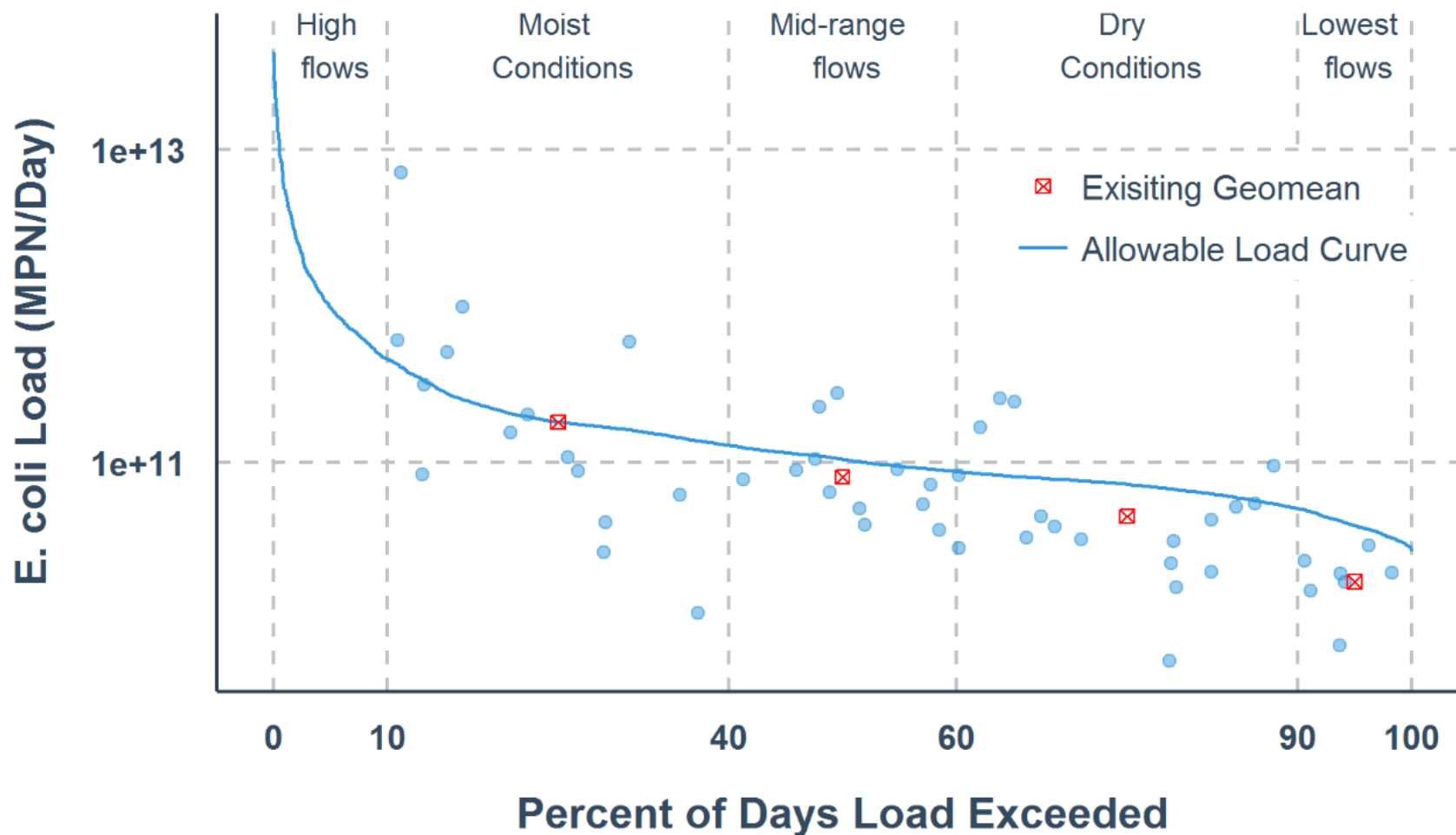**Lower Cibolo Creek Segment 1902-02**

Needed Reductions:
Lower Cibolo Creek: 1902-02

Flow Condition	Percent Exceedance	Load Percent Reduction Needed	Annual Loading Reduction (cfu/year)
High Flow	0-10%	89.04	2.11E+14
Moist Conditions	10-40%	38.45	1.38E+13
Mid-Range Conditions	40-60%	23.56	2.76E+12
Dry Conditions	60-90%	NA*	NA*
Low Flows	90-100%	6.97	1.09E+11

NA signifies that current geomean is below allowable load curve and no reduction is needed

Current LDCs

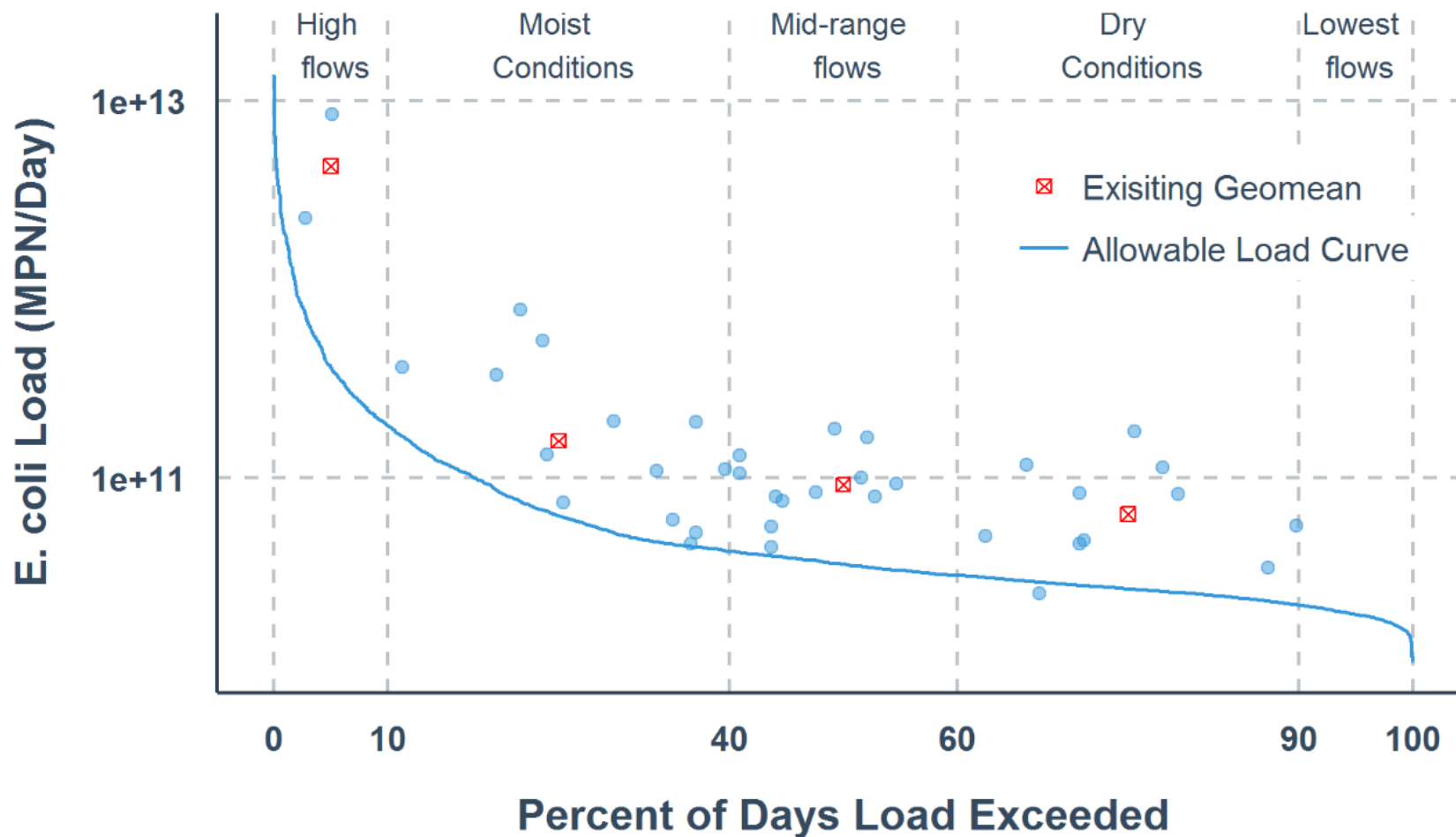**Lower Cibolo Creek**
Segment 1902-04

Needed Reductions:
Lower Cibolo Creek: 1902-04

Flow Condition	Percent Exceedance	Average Daily Load Percent Reduction Needed	Average Annual Loading (cfu/year)
High Flows	0-10%	NA*	NA*
Moist Conditions	10-40%	NA*	NA*
Mid-Range Conditions	40-60%	NA*	NA*
Dry Conditions	60-90%	NA*	NA*
Low Flows	90-100%	NA*	NA*

NA signifies that current geomean is below allowable load curve and no reduction is needed or there was not enough data to assess needed load reductions

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Current LDCs

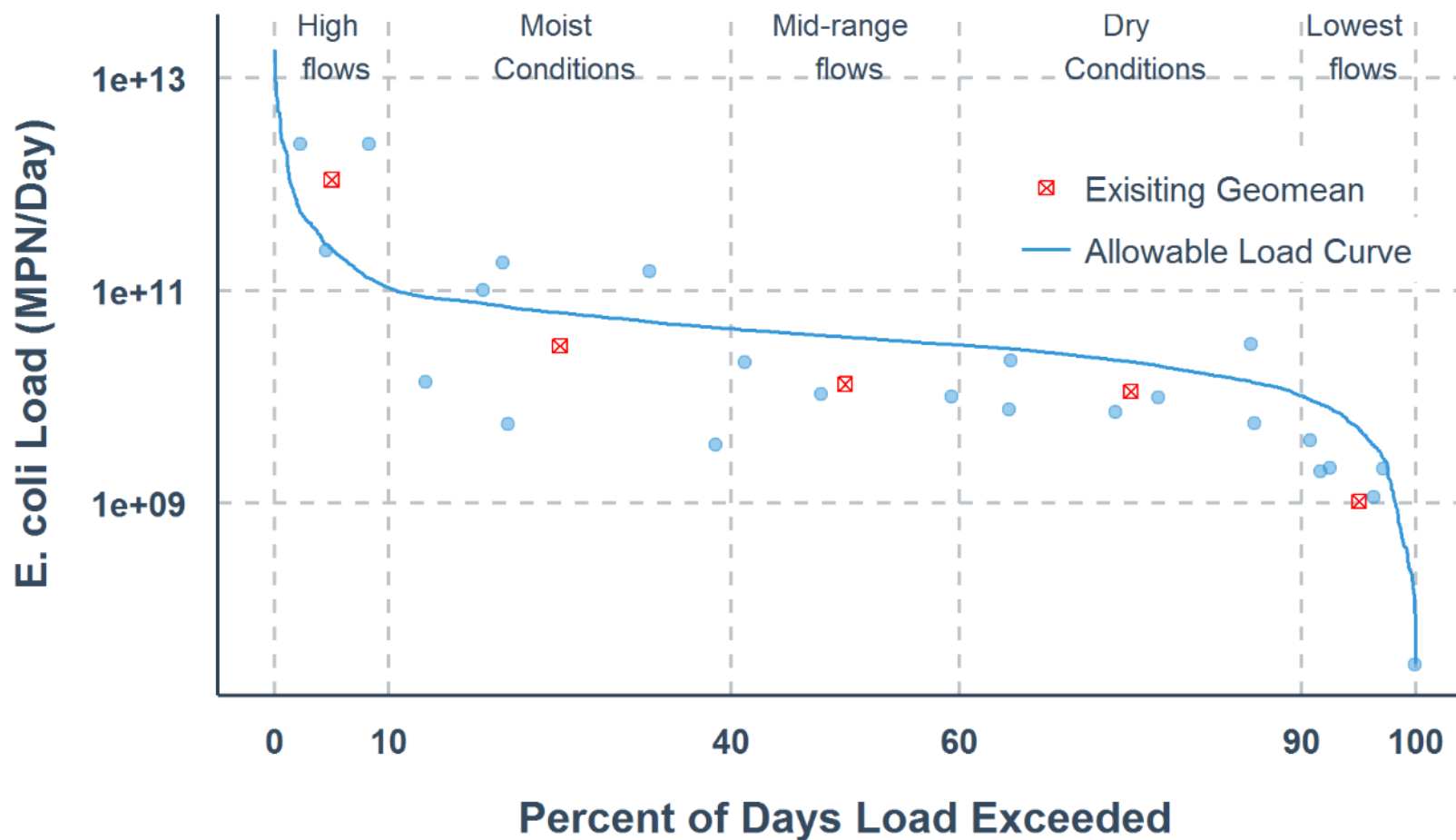

**Martinez Creek
Segment 1902A-01**

Needed Reductions:
Martinez Creek: 1902A_01

Flow Conditions	Percent Exceedance	Average Daily Load Percent Reduction Needed	Average Annual Loading (CFU/year)
High Flows	0-10%	91.49	1.49E+14
Moist Conditions	10-40%	59.84	1.03E+13
Mid-Range Conditions	40-60%	62.27	4.16E+12
Dry Conditions	60-90%	59.88	4.19E+12
Low Flows	90-100%	NA*	NA*

*NA signifies that current geomean is below allowable load curve and no reduction is needed or there was not enough data to assess needed load reductions

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Current LDCs

Mid Cibolo Creek
Segment 1913_01

Needed Reductions:
Mid Cibolo Creek: 1913_01

Flow Conditions	Percent Exceedance	Average Daily Load Percent Reduction Needed	Average Annual Loading (CFU/year)
High Flows	0-10%	77.89	3.15E+13
Moist Conditions	10-40%	NA*	NA*
Mid-Range Conditions	40-60%	NA*	NA*
Dry Conditions	60-90%	NA*	NA*
Low Flows	90-100%	NA*	NA*

*NA signifies that current geomean is below allowable load curve and no reduction is needed

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Load Reduction Assumptions

⊙ Based on meeting the current water quality standard

⊙ Establishes target to base management strategies on

⊙ Is this the appropriate goal?

⊙ Should a 'margin of safety' be included?
  ⊙ 10% cushion is typical
    ⊙ From 126 cfu/100 mL → 113 cfu/100 mL

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Lucas Gregory

Texas Water Resources Institute

LEGregory@ag.tamu.edu

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