La Nana Bayou
Watershed Protection Plan Development

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La Nana Bayou Watershed Protection Plan Development

Stakeholder Meeting #2 Agenda

November 2, 2021, 6:00 pm – 7:30 pm

Stephen F. Austin State University College of Forestry and Agriculture Building,
419 East College Street, room 117

1. Welcome & Meeting Overview
   Lucas Gregory, TWRI

2. Brief review of Meeting #1 and Chapters 1 & 2
   Ward Ling, TWRI

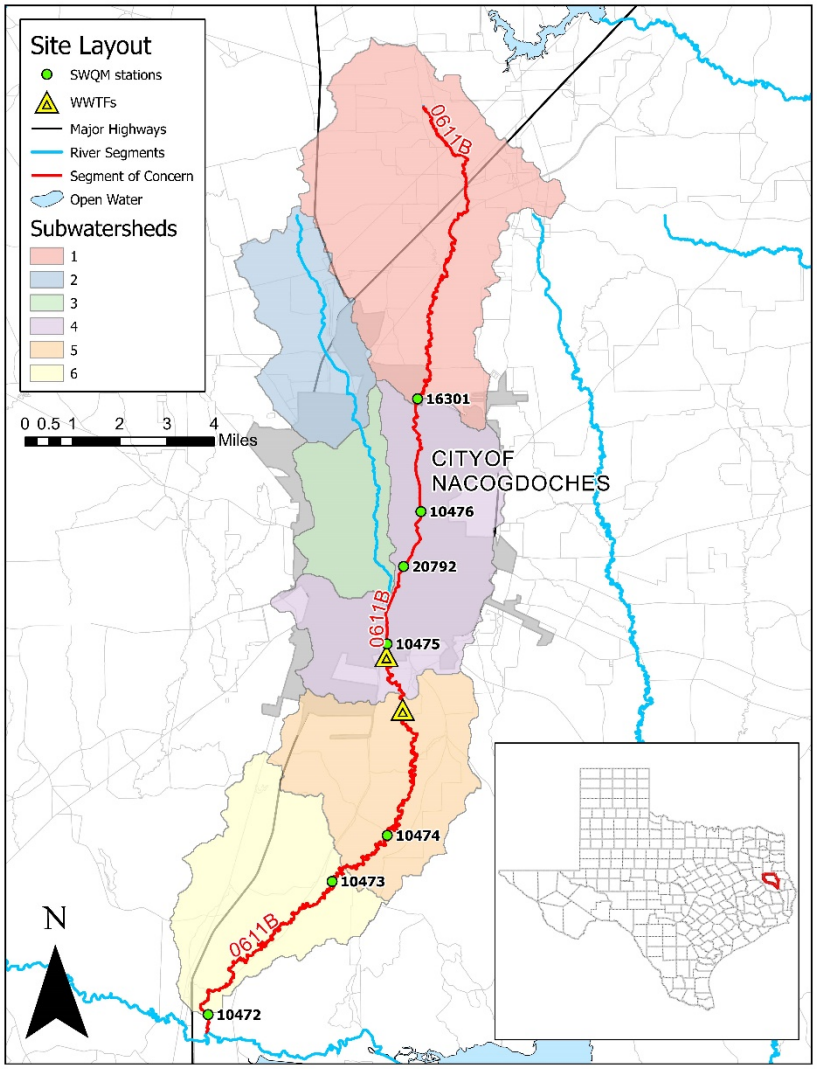
3. Water Quality & Load Duration Curves
   Lucas Gregory, TWRI

4. Subwatershed Delineation & Population and Pollutant Source Estimates
   Ward Ling, TWRI

5. Discussion & Questions

Recap of the Meeting on August 11

- Water Quality Policy in Texas
- What is a Watershed Protection Plan
- La Nana Bayou Overview
- Stakeholder Organization



Project Overview

La Nana Bayou on 303d List for bacteria since 2000

Characterization Report completed in 2019

Watershed Protection Plan (WPP) development project is funded by TCEQ as part of a Clean Water Act Section 319(h) Grant from the U.S. EPA

TWRI, ANRA, and SFASU leading WPP development with local stakeholders to address water quality through voluntary management measures

Project Website: Tx.ag/LaNana

CHAPTER 1: INTRODUCTION TO WATERSHED MANAGEMENT

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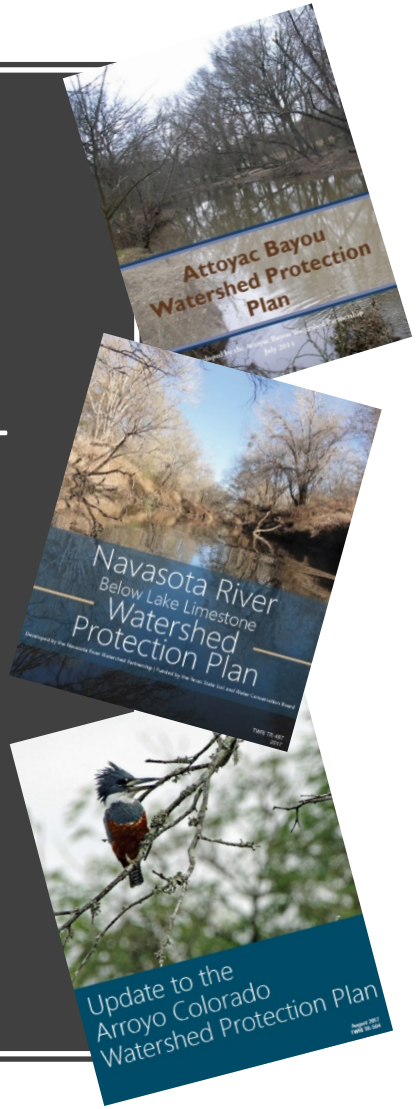
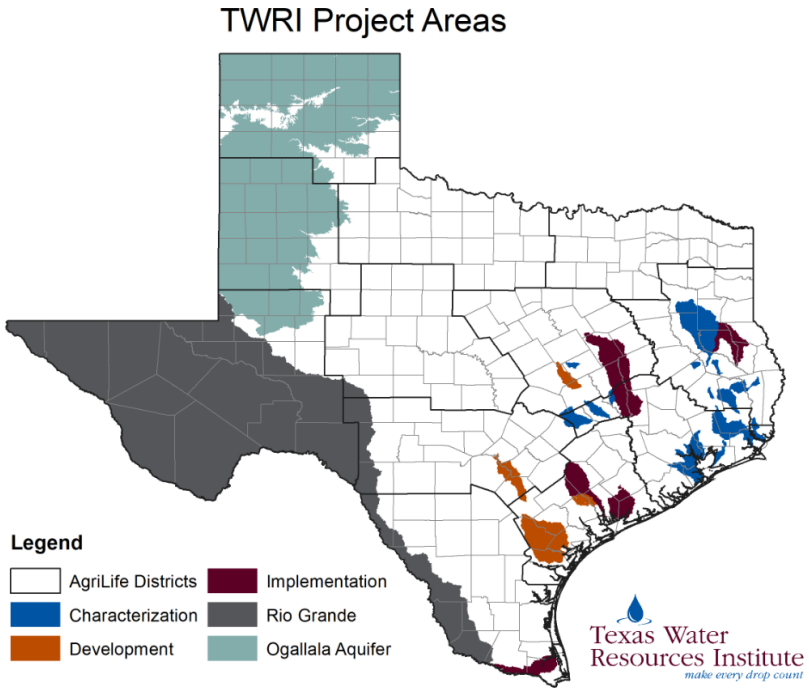
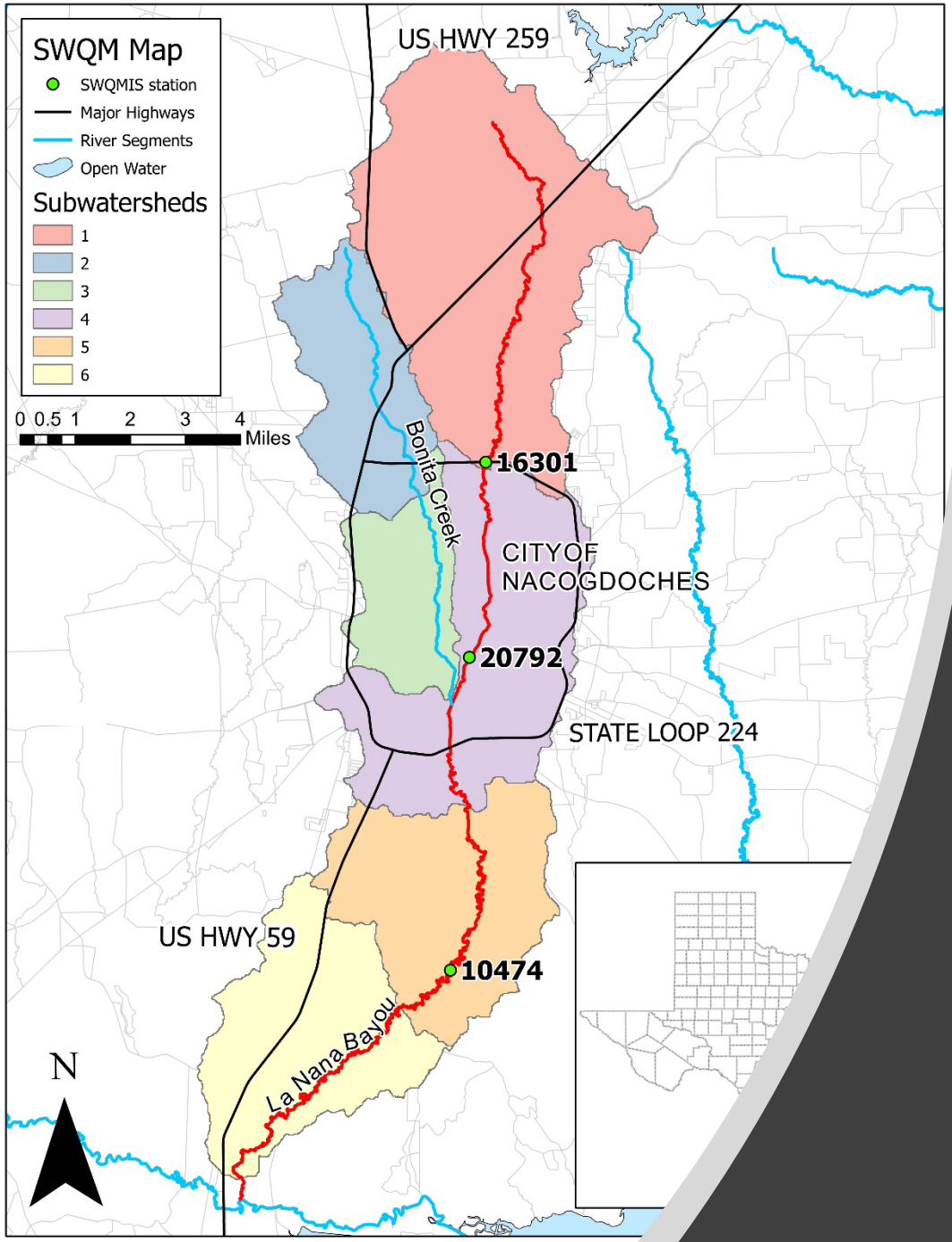
Watershed-Based Planning







Watershed-Based Planning

Strategies for Improving Water Quality

Total Maximum Daily Load (TMDL) – Driven by federal Clean Water Act requirements; defines allowable load; can be regulatory.

Total Maximum Daily Load Implementation Plan (I-Plan) – Stakeholder driven plan that outlines how the TMDL will be achieved

Watershed Protection Plan (WPP) – Stakeholder driven plan that holistically addresses all impairments and concerns in a watershed.

Watershed Protection Plans

A holistic **stakeholder driven** plan that addresses water quality in a watershed rather than political subdivisions

Addresses all water body impairments

A mechanism for **voluntarily** addressing complex water quality problems that cross multiple jurisdictions

Watershed Protection Plans

- Provides a framework for coordinated implementation of prioritized and integrated management strategies
- Integrates ongoing activities, prioritizes implementation based on technical merit and benefits to the community
- Typically focuses on 10-year goals

The **9 Elements** of Successful Watershed Protection Plans

from the U.S. EPA

- Identify causes and sources of pollution
- Estimate needed reductions
- Describe management measures
- Include education and outreach
- Implementation schedule
- Provide measurable milestones
- Estimate costs and document sources of financial assistance
- Progress indicators and adaptive management
- Monitoring to evaluate effectiveness

After EPA Accepts the WPP … then what?

Use Chapter 7 to find funding for Chapters 5 & 6

- Apply for grants (Ex. Section 319)
- Work with local city/county officials
- Request funding from local agencies

Bring Education & Outreach Programs to the watershed

- Example Education Programs: Texas Watershed Stewards, Urban Riparian, Healthy Lawns Healthy Waters, etc.
- Develop newsletters, work with local media to spread the word about the WPP, etc.

Work with local partners and agencies

- continue water quality monitoring (SFA, ANRA)
- developing WQMPs and conservation plans (SWCD)

Periodic Stakeholder Meetings

- Decide what programs to bring
- Provide updates on Chapter 8, comparing to Chapters 3&4

What is a stakeholder?

A group or individual who:

- Has the responsibility for implementing a decision
- Is affected by the decision
- Assists with problem identification
- Promotes awareness, education, and action
- Facilitates implementation of solutions

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Stakeholder Organization

- Meet to discuss development of the La Nana Bayou Watershed Protection Plan in general meetings
- Would not create work groups, unless warranted later in the process
- Work by group consensus

CHAPTER 2: WATERSHED CHARACTERIZATION

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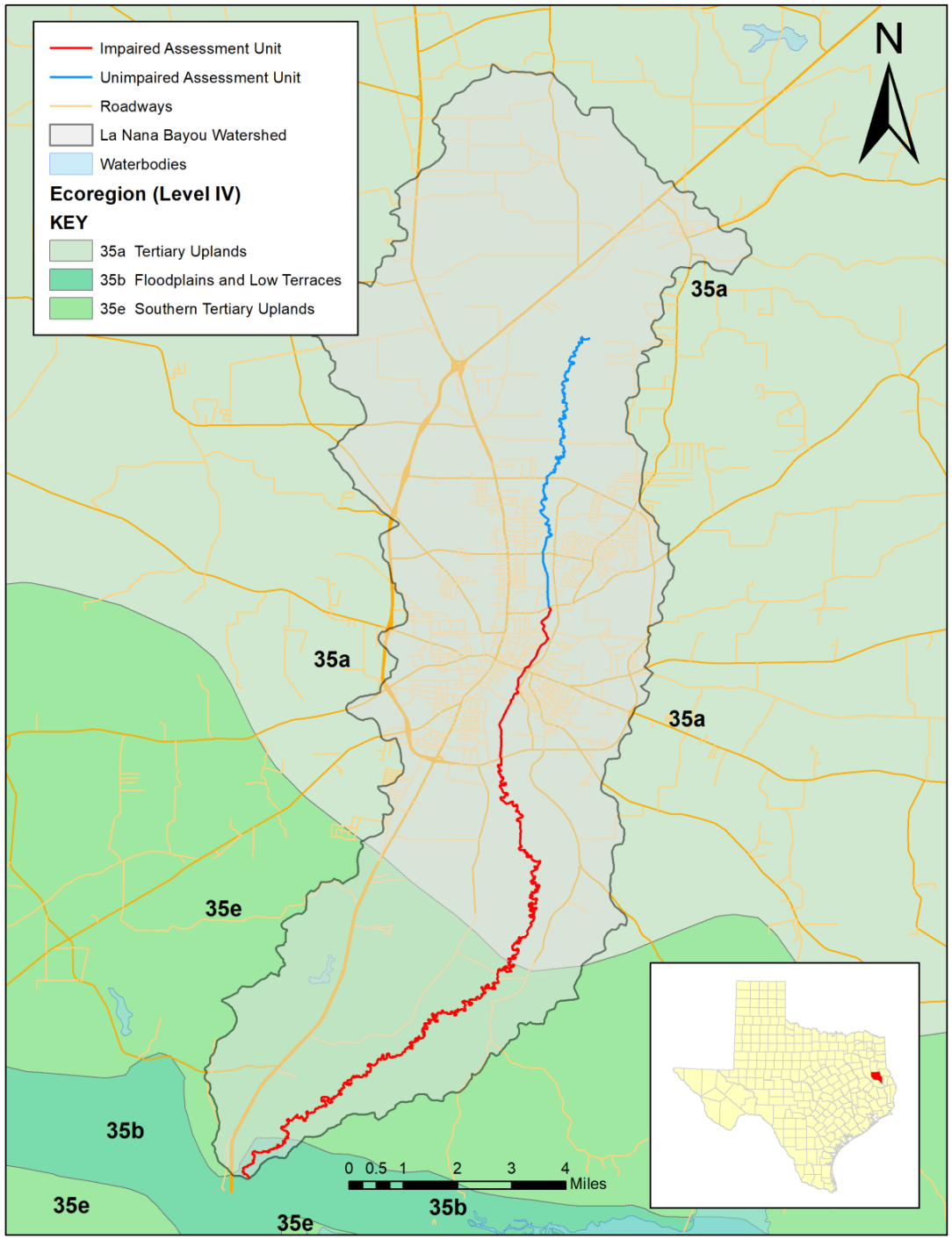
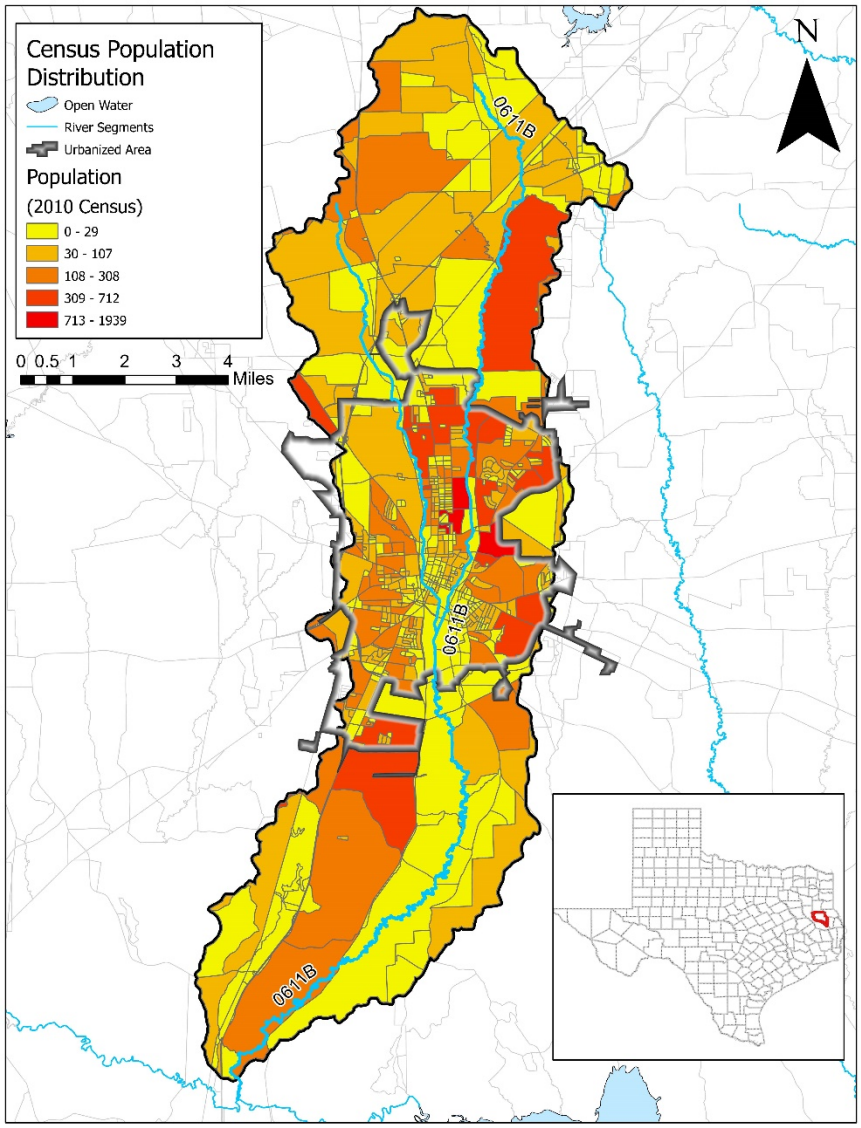
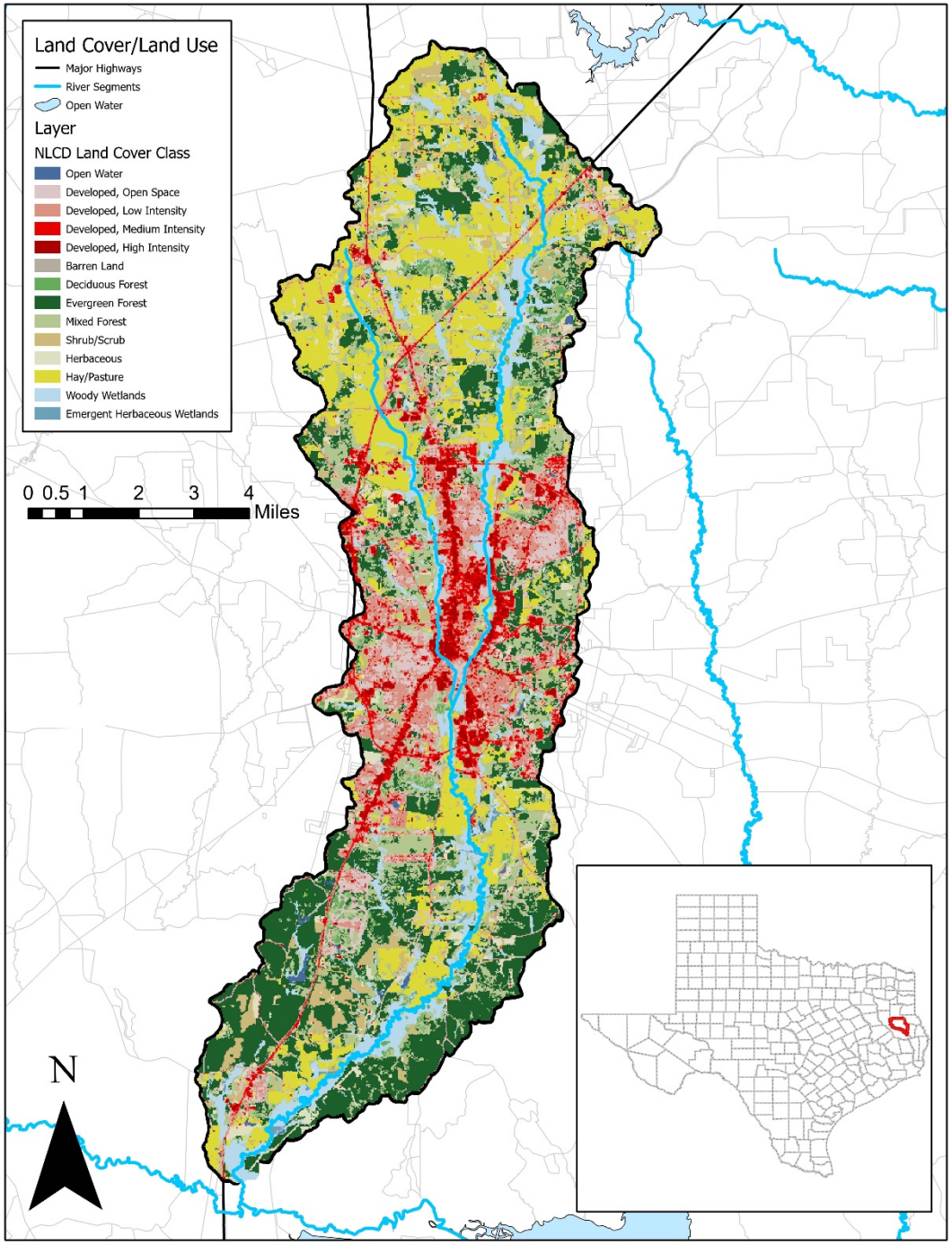
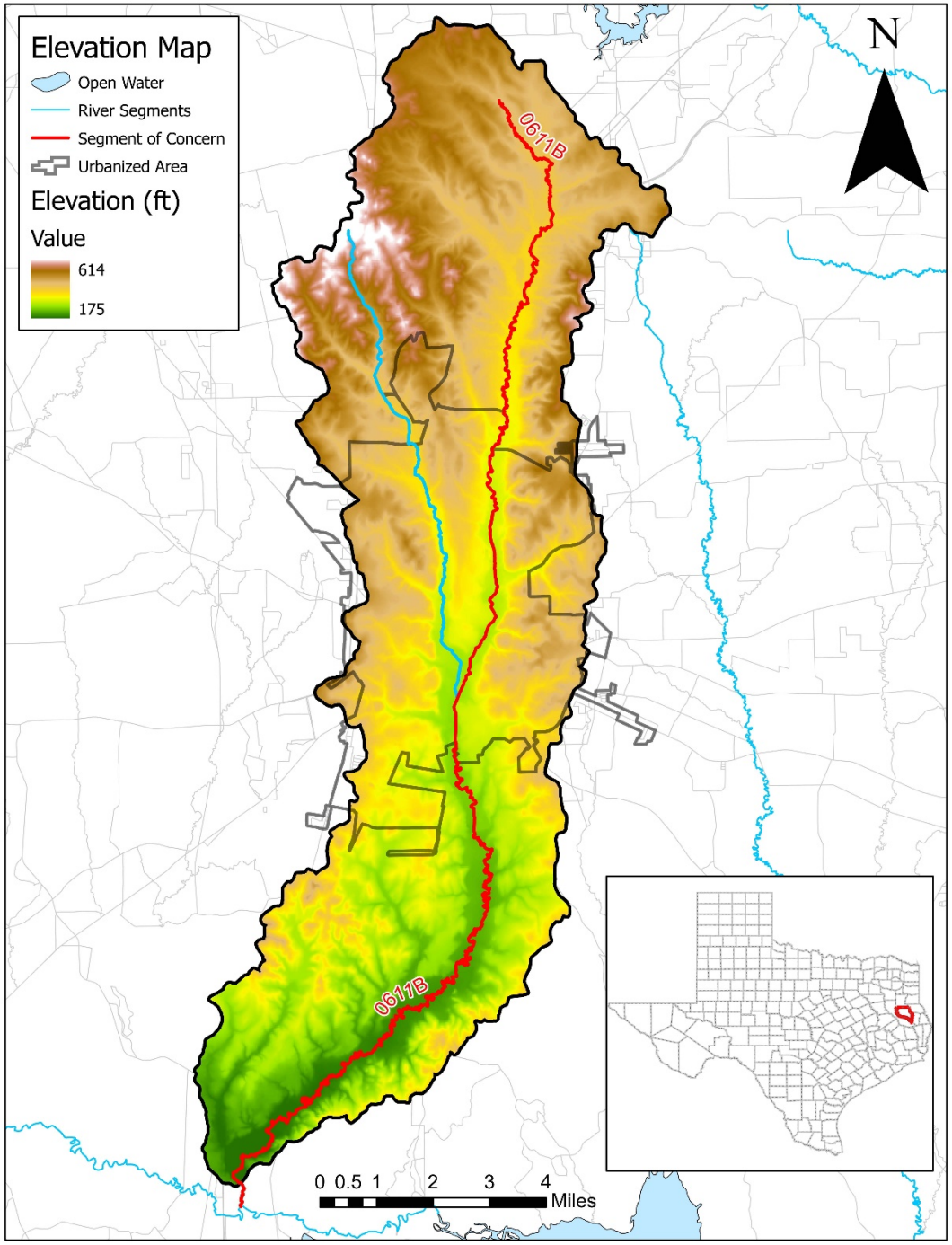
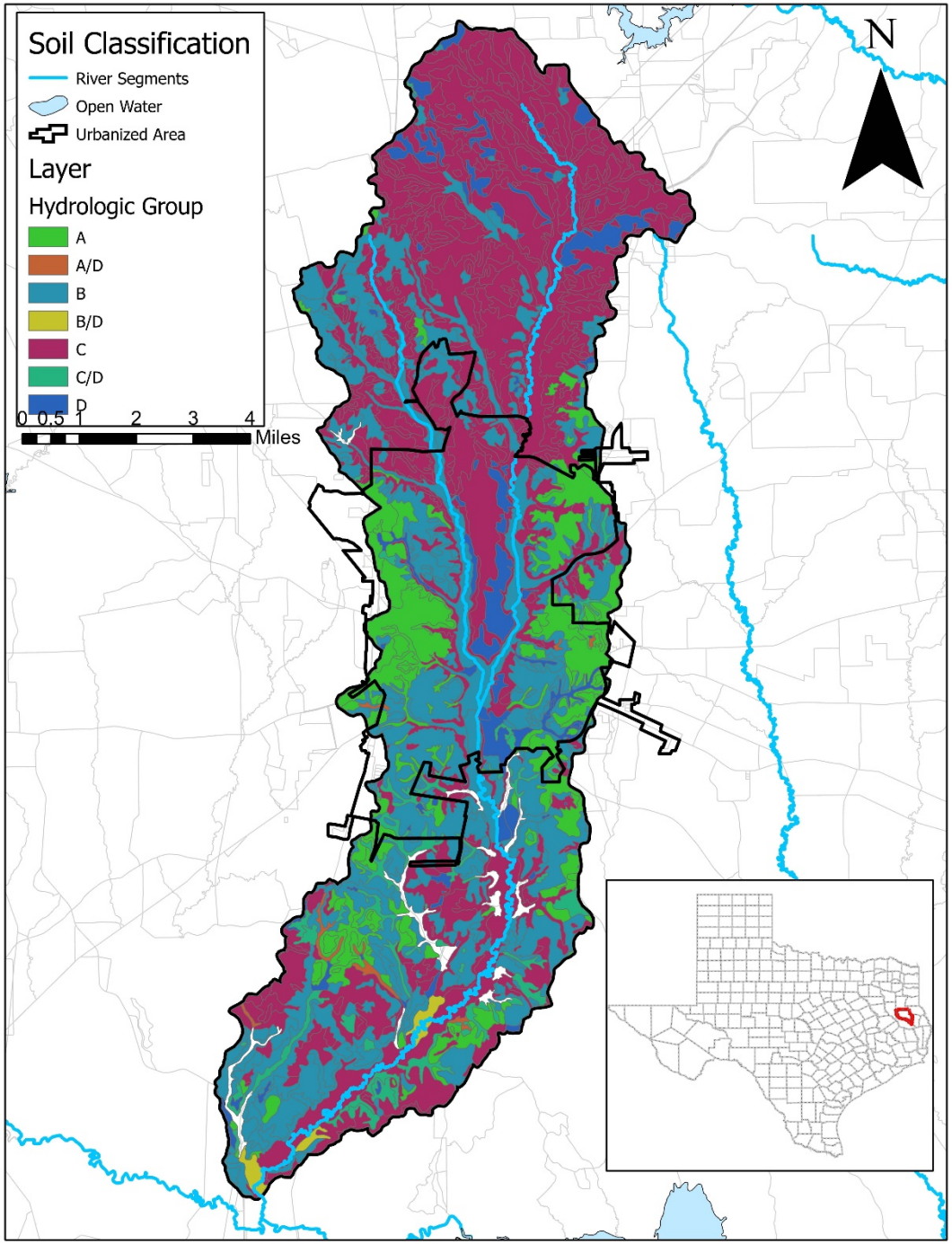
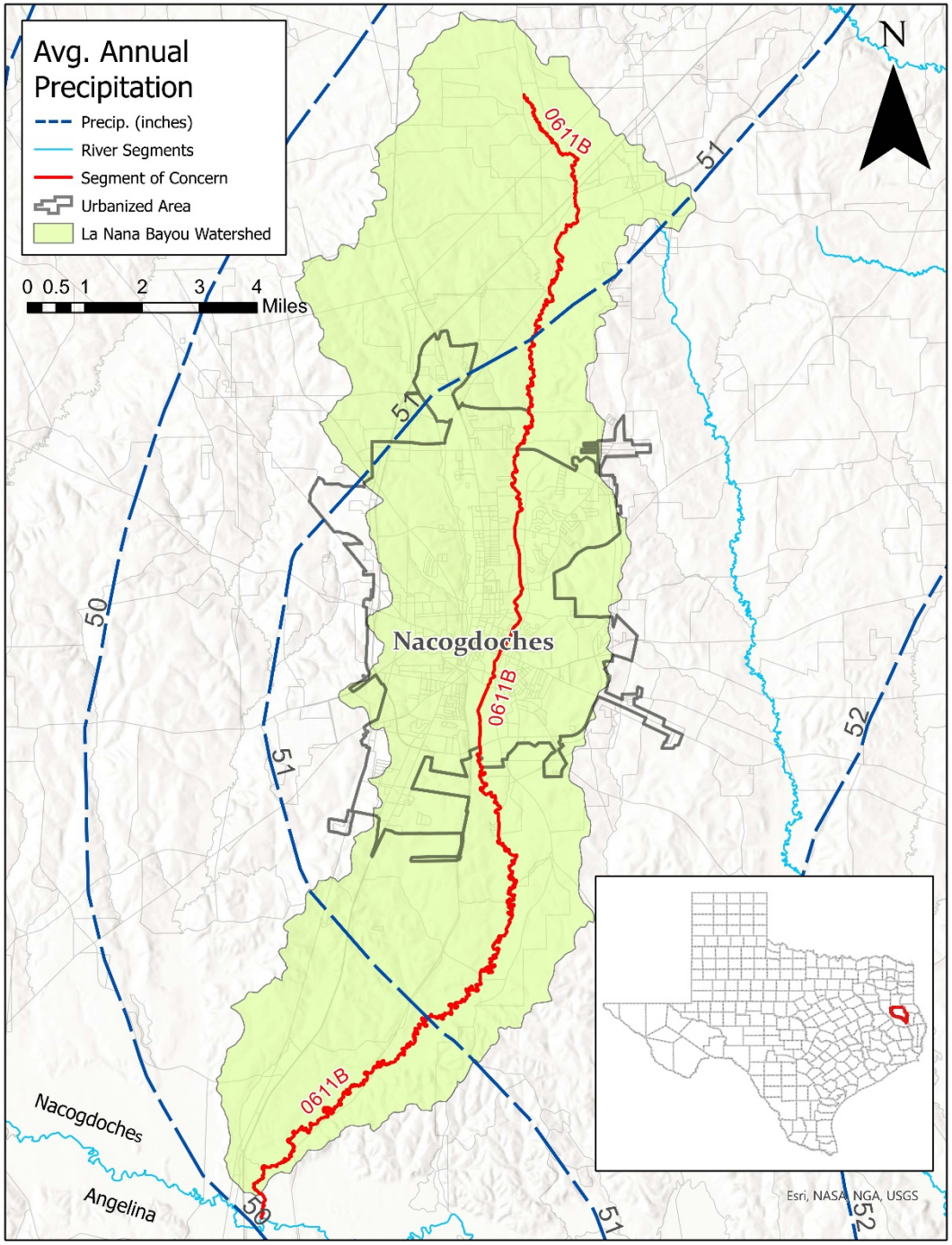

Impaired Assessment Unit
Unimpaired Assessment Unit
Roadways
La Nana Bayou Watershed
Waterbodies
Ecoregion (Level IV)
KEY
35a Tertiary Uplands
35b Floodplains and Low Terraces
35e Southern Tertiary Uplands
N
35a
35a
35a
35e
35e
35b
35e
35b
0 0.5 1 2 3 4
Miles


Census Population Distribution
Open Water
River Segments
Urbanized Area
Population
(2010 Census)
0 - 29
30 - 107
108 - 308
309 - 712
713 - 1939
0 0.5 1 2 3 4
Miles
N
0611B
0611B
0611B


Land Cover/Land Use
Major Highways
River Segments
Open Water
Layer
NLCD Land Cover Class
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Herbaceous
Hay/Pasture
Woody Wetlands
Emergent Herbaceous Wetlands
0 0.5 1 2 3 4
Miles
N


Elevation Map
Open Water
River Segments
Segment of Concern
Urbanized Area
Elevation (ft)
Value
614
175
N
0611B
0617B
0 0.5 1 2 3 4
Miles


Soil Classification
River Segments
Open Water
Urbanized Area
Layer
Hydrologic Group
A
A/D
B
B/D
C
C/D
D
0 0.5 1 2 3 4
Miles
N


Avg. Annual Precipitation
Precip. (inches)
River Segments
Segment of Concern
Urbanized Area
La Nana Bayou Watershed
0 0.5 1 2 3 4
Miles
N
0611B
51
50
52
Nacogdoches
Angelina
Esri, NASA, NGA, USGS

LA NANA BAYOU WATER QUALITY & LOAD DURATION CURVES

Chapters 3 & 5 of the WPP

Lucas Gregory
Texas Water Resources Institute
November 2, 2021

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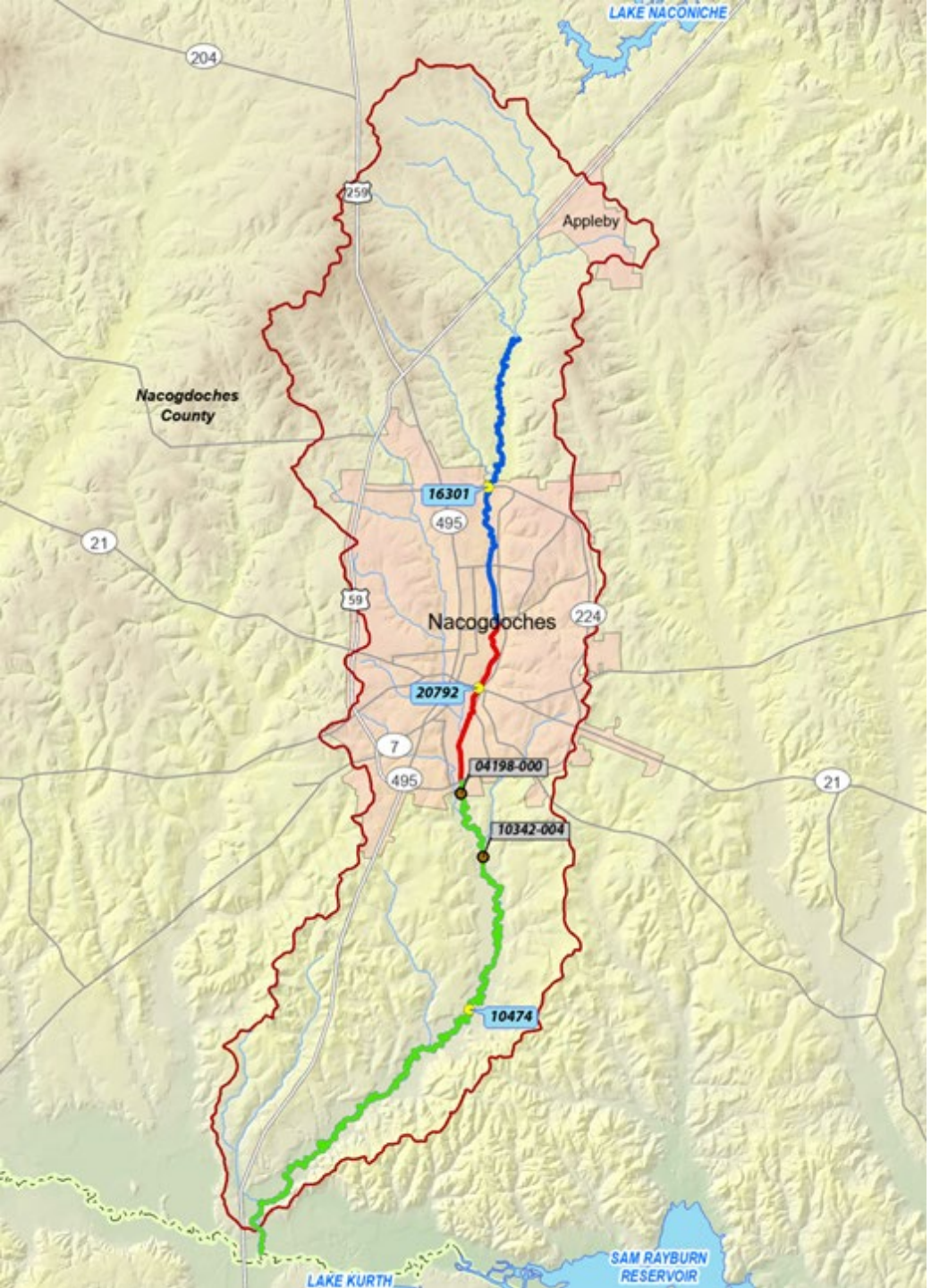


Monitoring Stations

- **AU 0611B_03 (Blue)**

  Station 16301
  La Nana Bayou at Loop 224

- **AU 0611B_02 (Red)**

  Station 20792
  La Nana Bayou at East Main Street

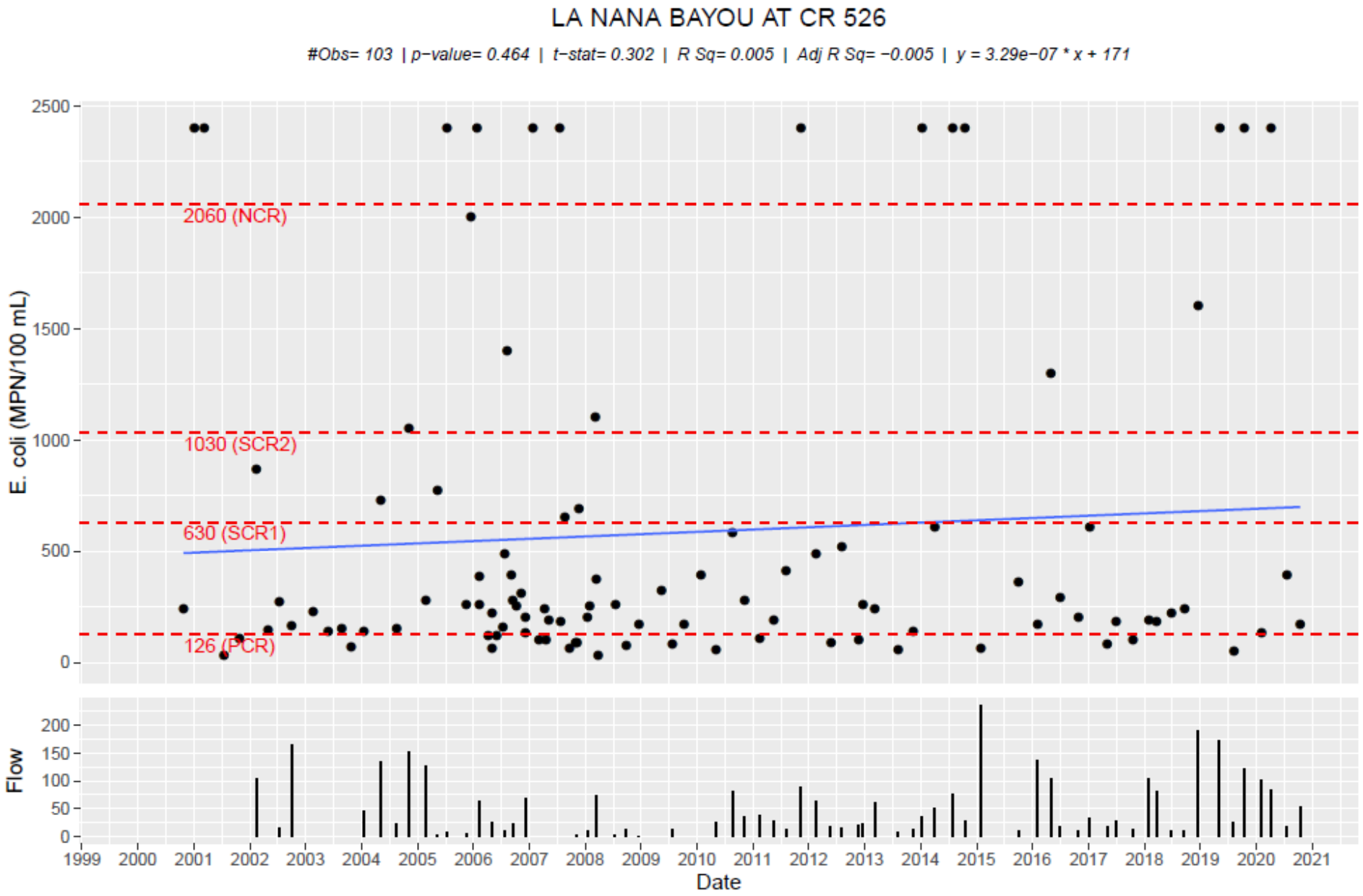
- **AU 0611B_01 (Green)**

  Station 10474
  La Nana Bayou at CR 526

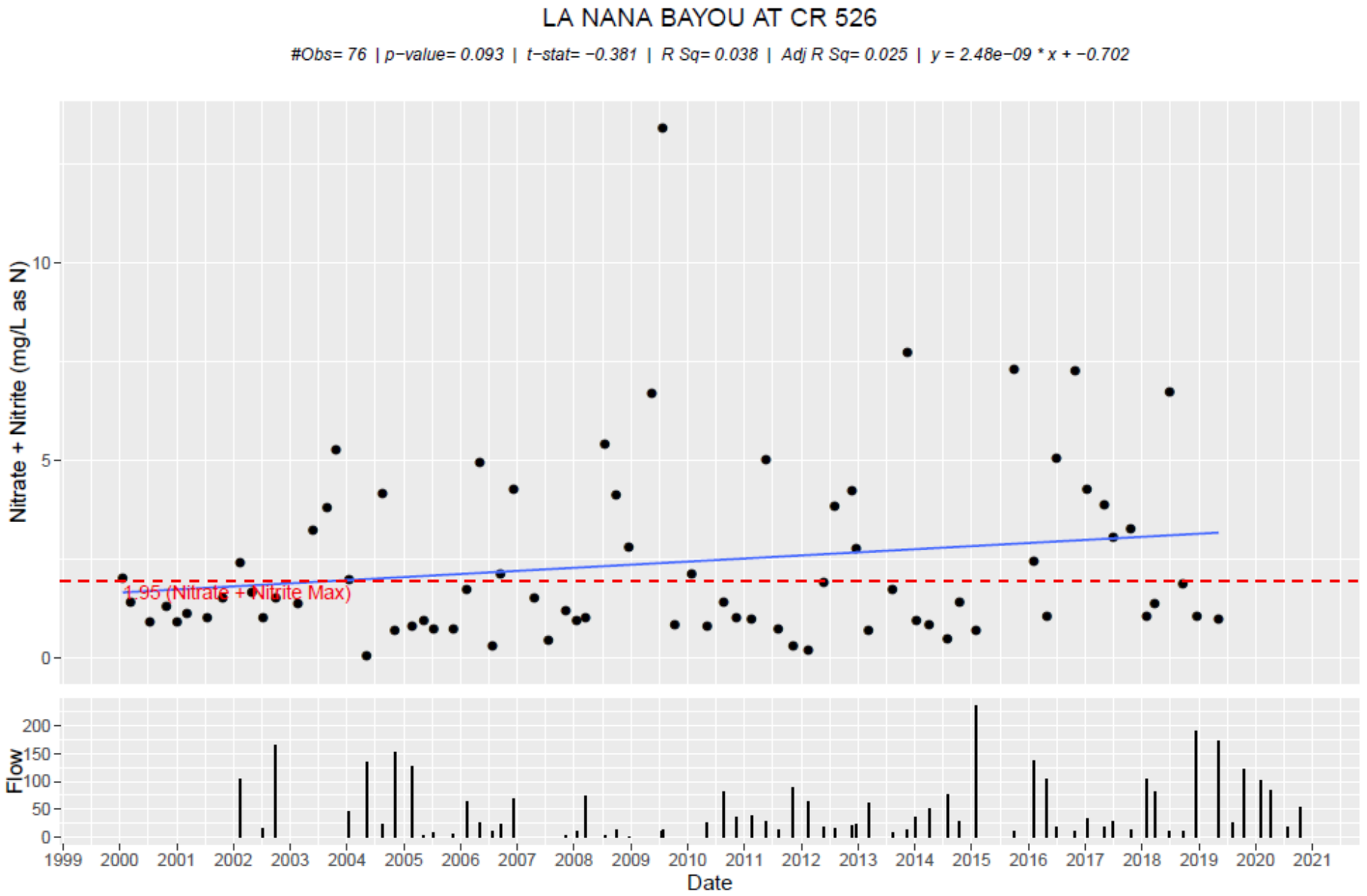
Designated Uses Assessed

- **Aquatic Life Use**
  - Dissolved Oxygen: no concerns for low oxygen concentrations
- **Recreation Use**
  - *E. coli:* All 3 assessment units are impaired
- **General Use**
  - Nutrient screening levels: Ammonia, Chlorphyll-a, Nitrate, Total Phosphorus
    - Nitrate and Total Phosphorus are elevated in the downstream portion of the creek

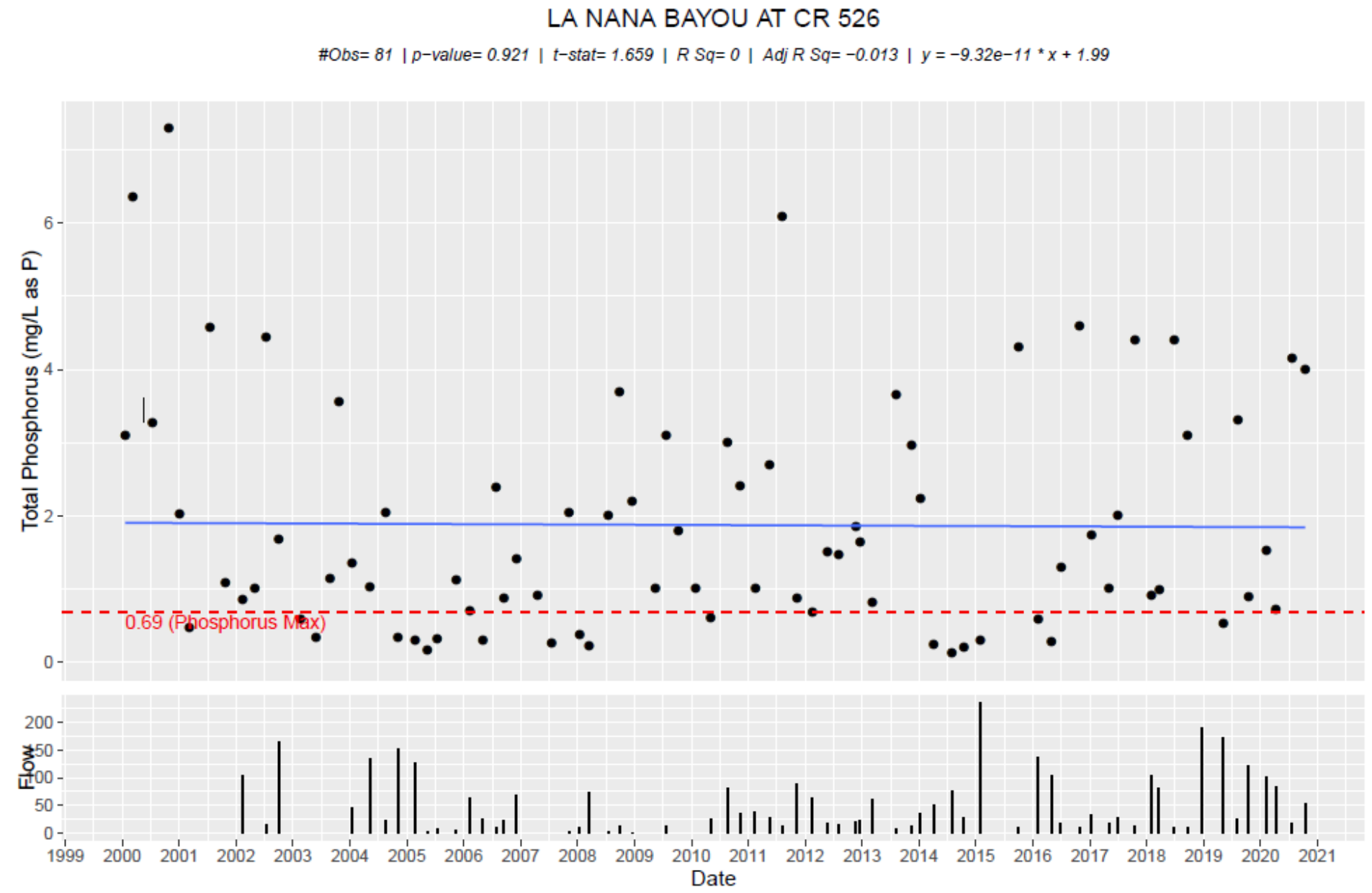
Station 10474 – E. coli



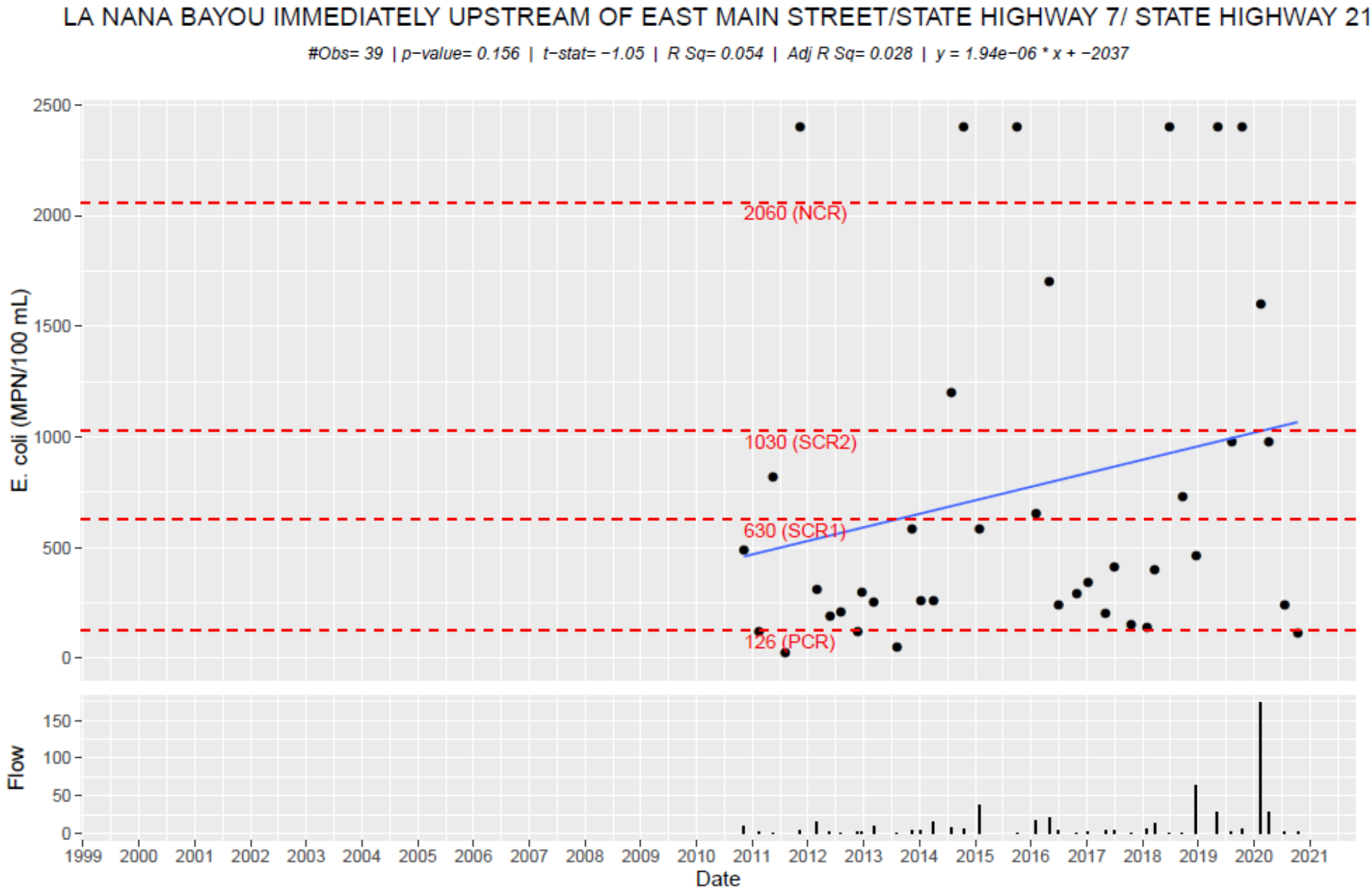
Station 10474 – Nitrate N



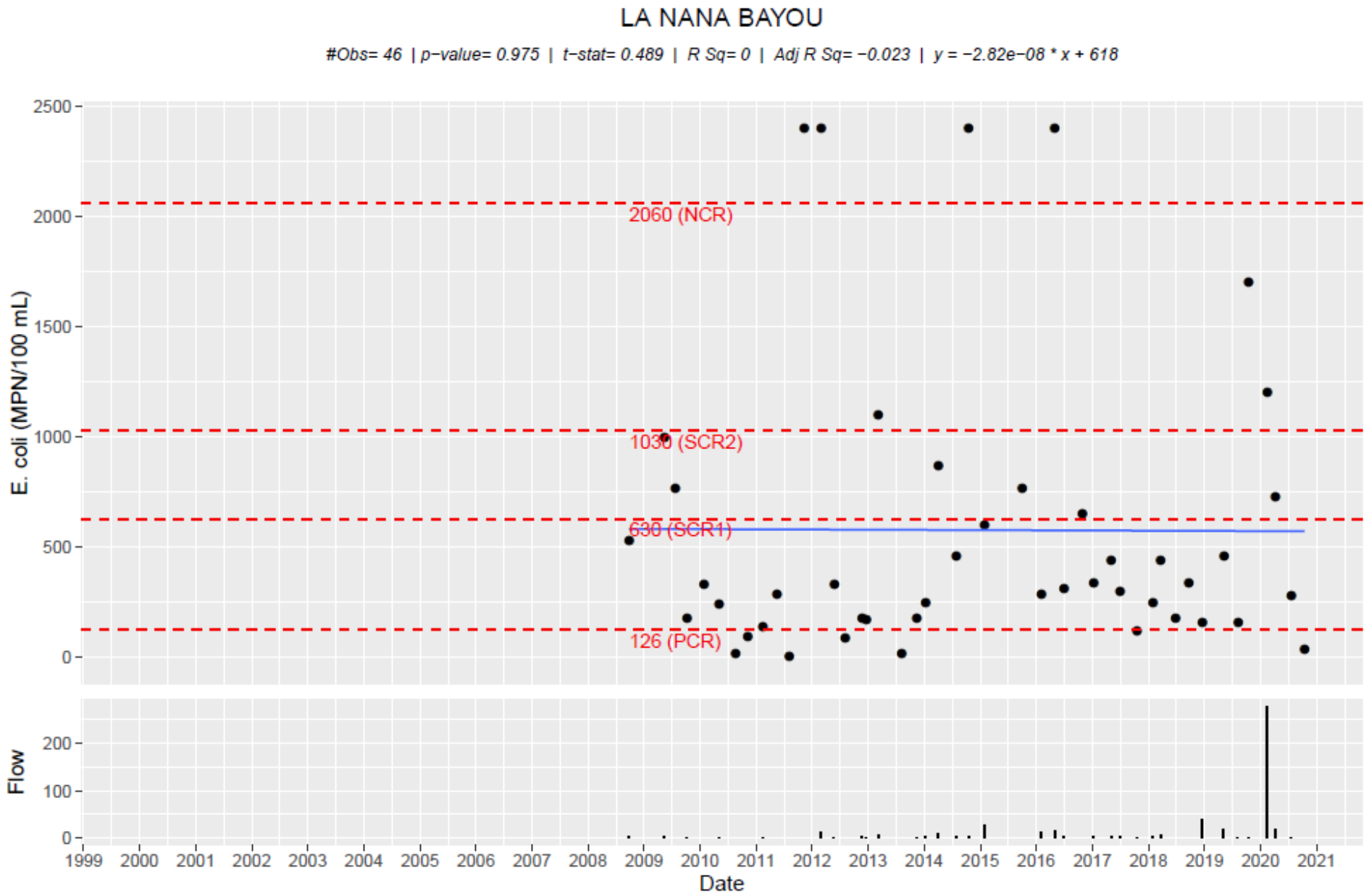
Station 10474 – Total Phosphorus



Station 20792 – E. coli



Station 16301 – E. coli



Assessing Water Quality

- **Load Duration Curves (LDC)**
  - Combines pollutant concentration and flow 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/period of record
  - Able to see if a stream is exceeding the standard in terms of load (flow and concentration)
  - Able to see if exceedances occur during specific flow conditions
  - Able to calculate a percent reduction based on flow categories

Assessment Methods

Load Duration Curves (LDC) estimate current bacteria loads and needed bacteria load reductions

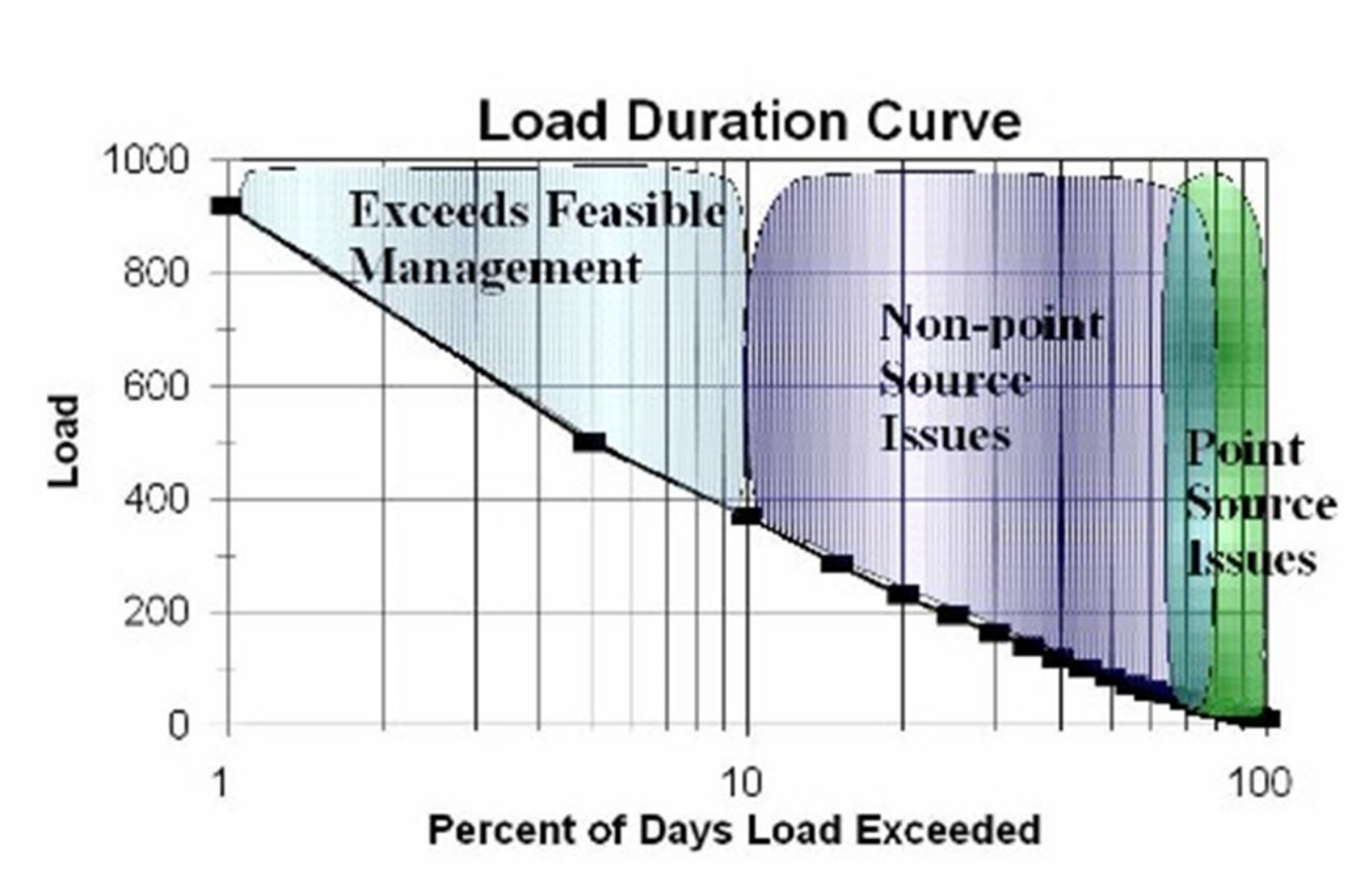
LDCs were calculated for each assessment unit with sufficient bacteria and flow record data

Data used:

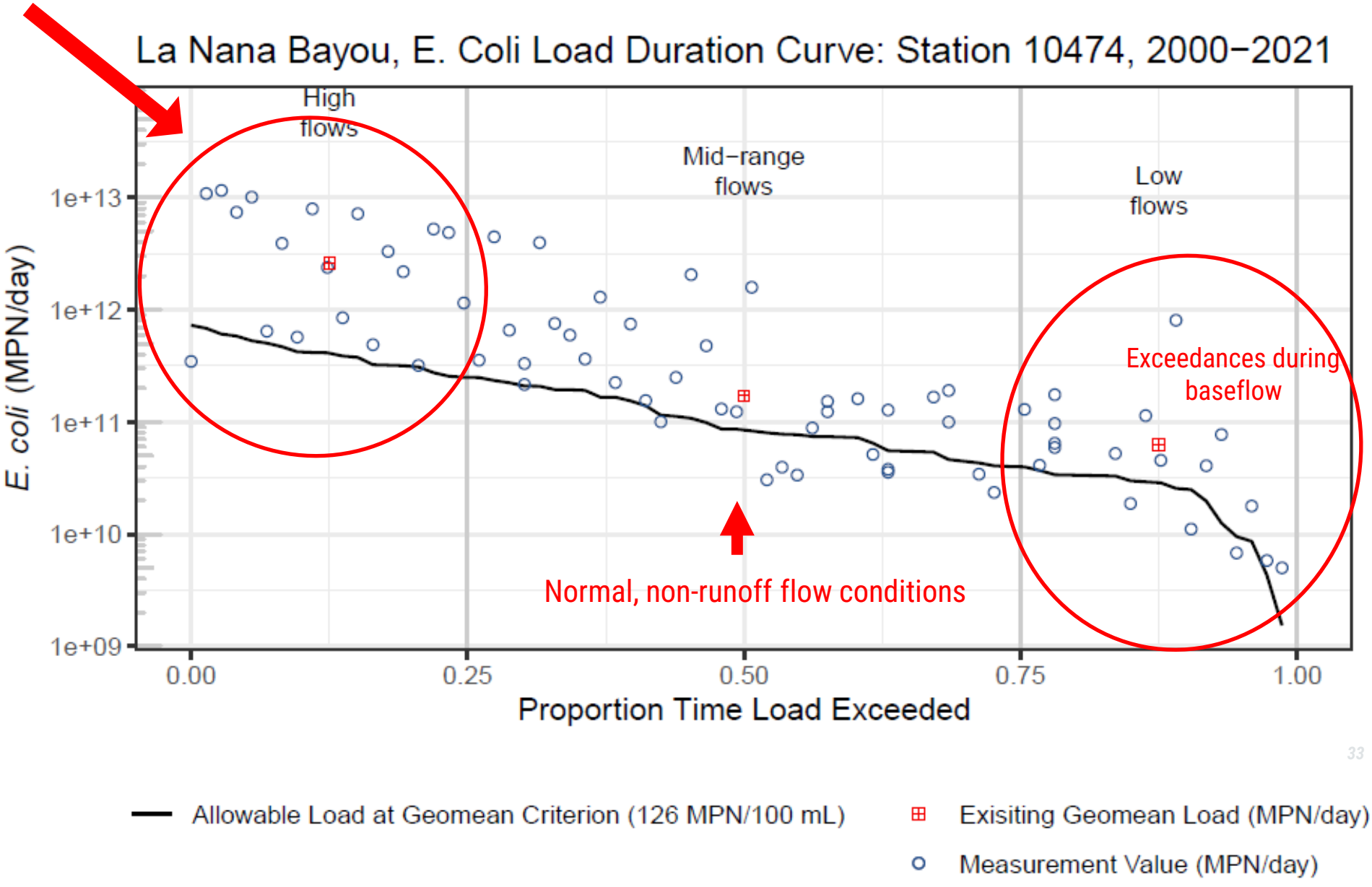
Water quality monitoring data from TCEQ SWQM Database (samples collected by ANRA)

Instantaneous flow measurements collected by ANRA

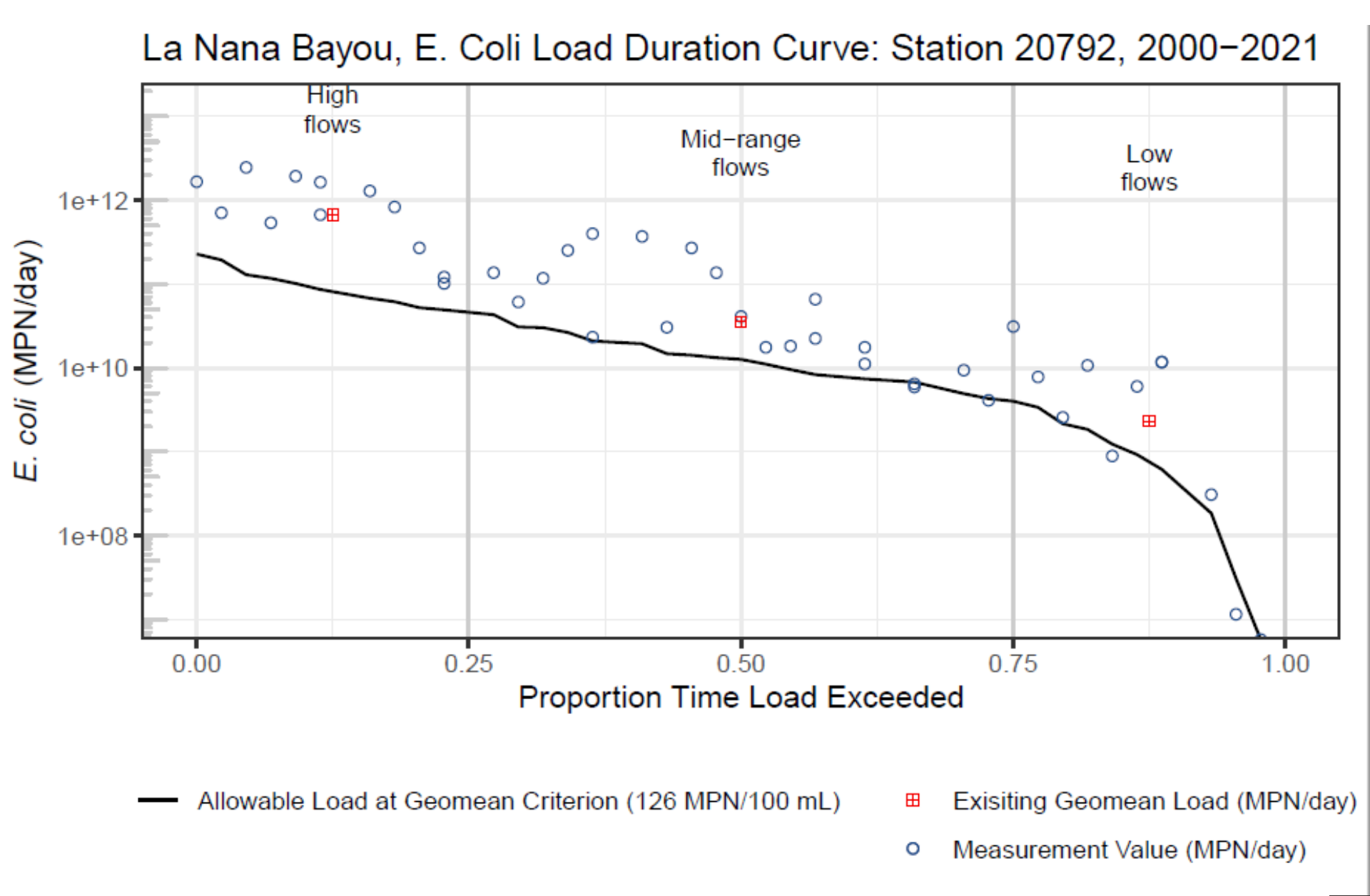
No LDCs for nutrients since no water quality standard


Load Duration Curve
1000
800
600
400
200
0
Load
Exceeds Feasible Management
Non-point Source Issues
Point Source Issues
1
10
100
Percent of Days Load Exceeded

Exceedances associated with
higher flow rates; stormflow perhaps



La Nana Bayou	Flow Condition		
Station: 10474	Lowest Flows	Mid-Range Flows	Highest Flows
Days per year	91.25	182.5	91.25
Median Flow (cubic feet per second)	9.3	27	134
Existing Geomean Concentration (MPN/100 mL)	275	259	742
Allowable Daily Load (Billion MPN)	28.7	83.2	413
Allowable Annual Load (Billion MPN)	2,620.00	15,200.00	37,700.00
Existing Daily Load (Billion MPN)	62.5	171	2,430.00
Existing Annual Load (Billion MPN)	57.10	312.00	2,220.00
Annual Load Reduction Needed (Billion MPN)	3,090.00	16,000.00	18,400.00
Percent Reduction Needed	54.20%	51.30%	83.00%
Total Annual Load (Billion MPN)	258,775.49		
Total Annual Load Reduction (Billion MPN)	203,276.08		
Total Percent Reduction	78.55%		



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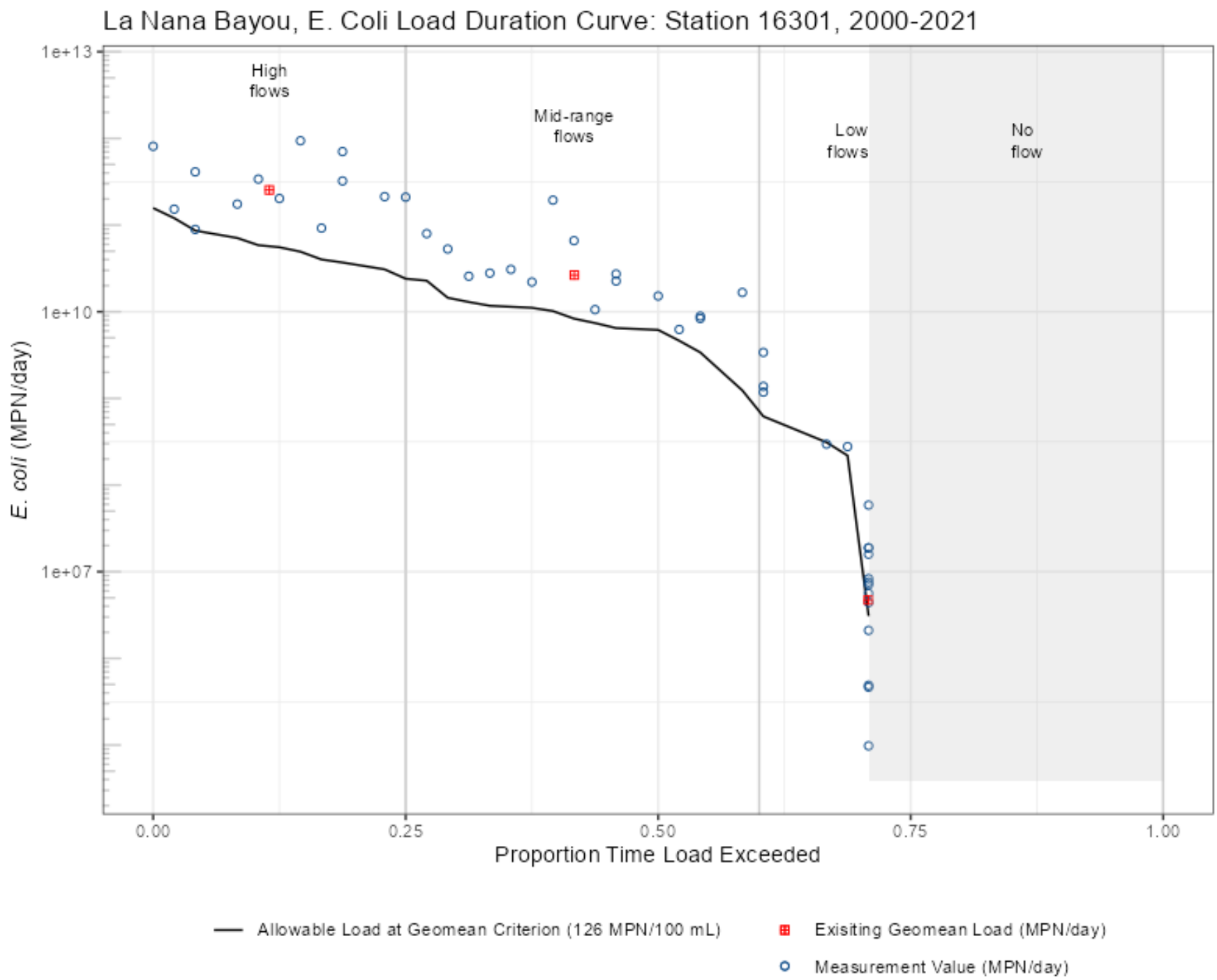
La Nana Bayou	Flow Condition		
Station: 20792	Lowest Flows	Mid-Range Flows	Highest Flows
Days per year	91.25	182.5	91.25
Median Flow (cubic feet per second)	0.3	3.6	28
Existing Geomean Concentration (MPN/100 mL)	315	405	972
Allowable Daily Load (Billion MPN)	0.925	11.1	86.3
Allowable Annual Load (Billion MPN)	84.40	2,030.00	7,880.00
Existing Daily Load (Billion MPN)	2.31	35.6	666
Existing Annual Load (Billion MPN)	211.00	6,500.00	60,800.00
Annual Load Reduction Needed (Billion MPN)	112.70	4,448.00	52,900.00
Percent Reduction Needed	60.00%	68.90%	87.00%
Total Annual Load (Billion MPN)	69,410.00		
Total Annual Load Reduction (Billion MPN)	57,484.40		
Total Percent Reduction	82.81%		


La Nana Bayou, E. Coli Load Duration Curve: Station 16301, 2000-2021
1e+13
1e+10
1e+07
E. coli (MPN/day)
High flows
Mid-range flows
Low flows
No flow
0.00
0.25
0.50
0.75
1.00
Proportion Time Load Exceeded
Allowable Load at Geomean Criterion (126 MPN/100 mL)
Exisiting Geomean Load (MPN/day)
Measurement Value (MPN/day)

La Nana Bayou	Flow Condition		
Station: 16301	Lowest Flows	Mid-Range Flows	Highest Flows
Days per year	40.15	127.75	91.25
Median Flow (cubic feet per second)	0.001	2.4	18
Existing Geomean Concentration (MPN/100 mL)	193	451	577
Allowable Daily Load (Billion MPN)	0.00308	7.4	55.5
Allowable Annual Load (Billion MPN)	0.12	946.00	5,060.00
Existing Daily Load (Billion MPN)	0.00472	26.5	254
Existing Annual Load (Billion MPN)	0.19	3,380.00	23,200.00
Annual Load Reduction Needed (Billion MPN)	0.07	2,440.00	18,100.00
Percent Reduction Needed	34.70%	72.00%	78.10%
Total Annual Load (Billion MPN)	26,580.19		
Total Annual Load Reduction (Billion MPN)	20,540.07		
Total Percent Reduction	77.27%		

Linking exceedances to sources:

Possible Sources	Range of Flow Conditions High Flow	Moist	Mid-Range	Dry	Low
Stormwater: Impervious Areas	High	High	Medium		
Upland and riparian runoff	High	High	Medium		
Sanitary sewer overflows	High	Medium	Medium		
Resuspension	High	High	Medium		
Failing/non-existent Septic	High	High	Medium	Medium	Medium
Direct deposition (wildlife, feral hogs, livestock, pets)			Medium	High	High
Illegal dumping			Medium	Medium	Medium
Point Sources				Medium	High

What Does All This Mean?

- Most of the year all portions of La Nana Bayou are above the water quality standard
- The LDC indicates that a diverse set of sources contribute to bacteria loads
  - Perhaps more so under normal to dry conditions than wet, BUT
  - General lack of water quality data collected under high flow conditions; so LDCs are not wholly representative of instream conditions
    - Why don't we have this data?
      - Low frequency of occurrence
      - Personnel safety and can't be in multiple places at once
- Requires a diverse set of solutions
  - All sources are contributors
  - Need to think about what can be done to feasibly manage each source

Decision Point:

Need to establish a singular load reduction goal for the WPP

LDCs describe needed load reductions across watershed

- Upstream Reduction Needed: 92 Billion MPN Annually
- Midstream Reduction Needed: 575 Billion MPN Annually
- Downstream Reduction Needed: 2,033 Billion MPN Annually

Recommend using downstream reduction of 2,033 Billion MPN Annually

- Cumulative of upstream loads
- Conservative approach regarding meeting reduction goals for entire watershed

Questions?

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This effort was funded through a Clean Water Act, Section 319 Nonpoint Source Pollution grant from US. Environmental Protection Agency through the Texas Commission on Environmental Quality.

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

TEXAS A&M AGRILIFE RESEARCH | EXTENSION

SUBWATERSHED DELINEATION

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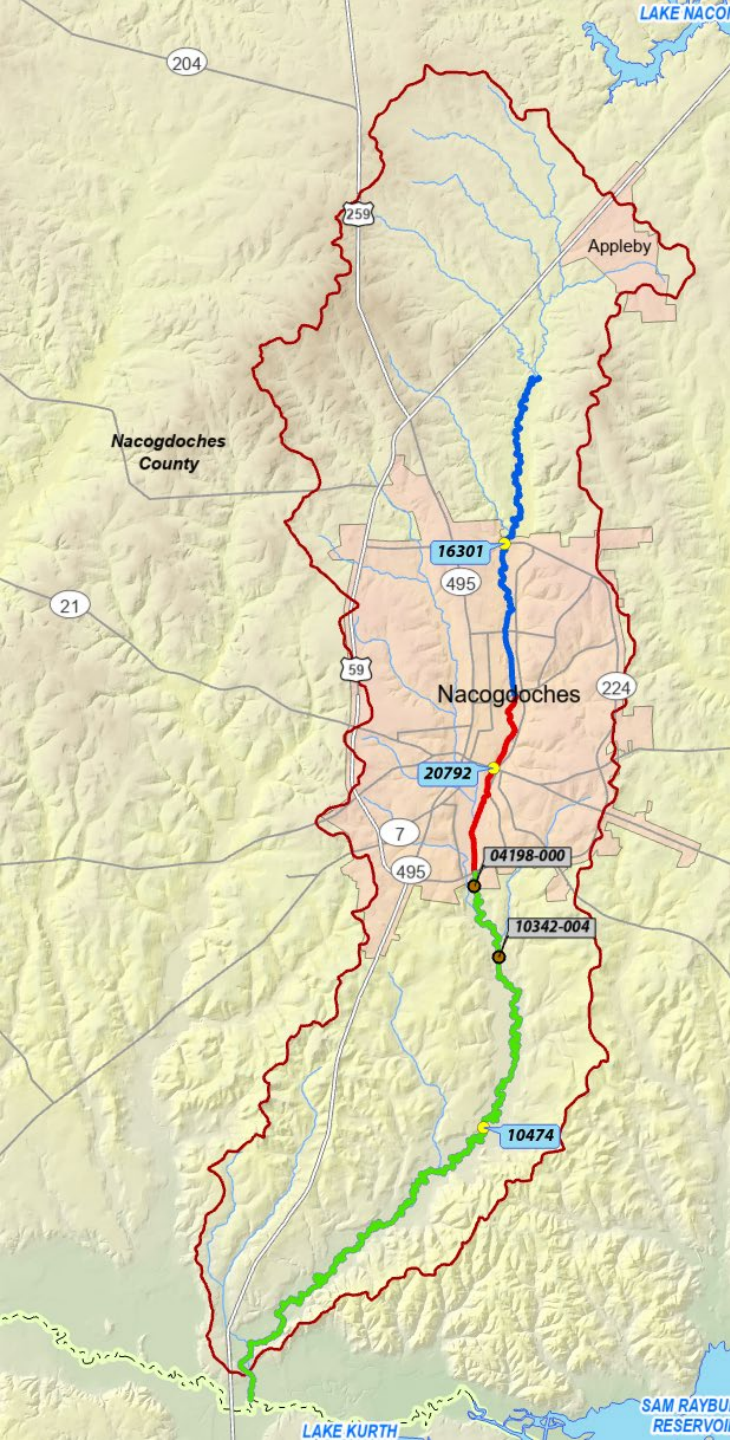
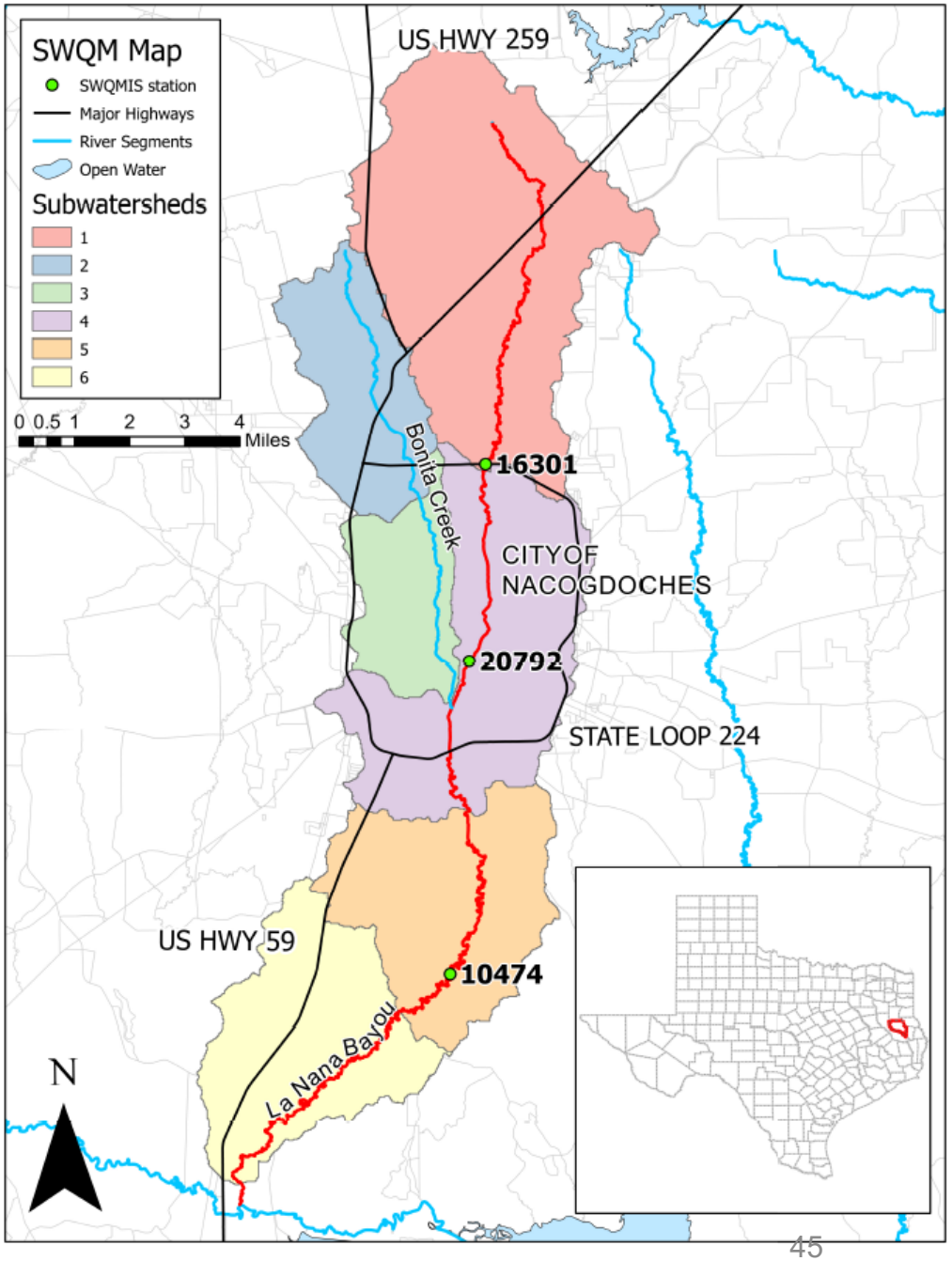


Subdividing the Watershed

- Watershed covers 53,269 acres
- WPPs are designed to recommend and prioritize management strategies for implementation
- Common approach is to create watershed subbasins
- Recommend management prioritized by subbasin

Subbasin Recommendations

- Divide into 6 watershed subbasins
- Based on hydrology and land cover/land use
  - Differentiates between rural and urban areas
- Attempted to keep relatively equal size



CHAPTER 4: WATERSHED POPULATION AND SOURCE ESTIMATES

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Initial Source Estimates

Developed based on available information

Consider need to refine estimates

Especially for animals as appropriate

- Livestock
- Pets
- Wildlife

Ask questions and provide input

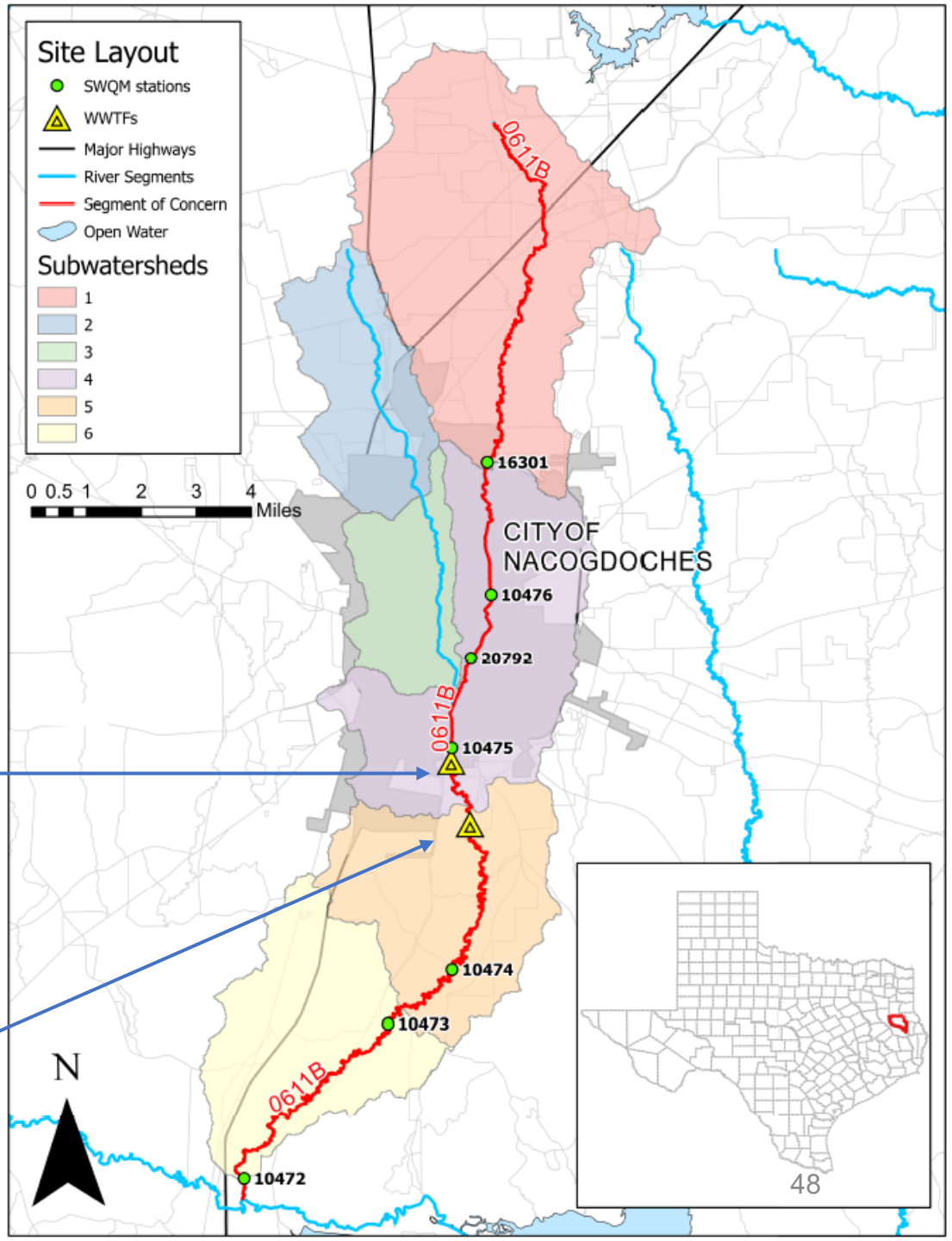
Permitted Wastewater Treatment

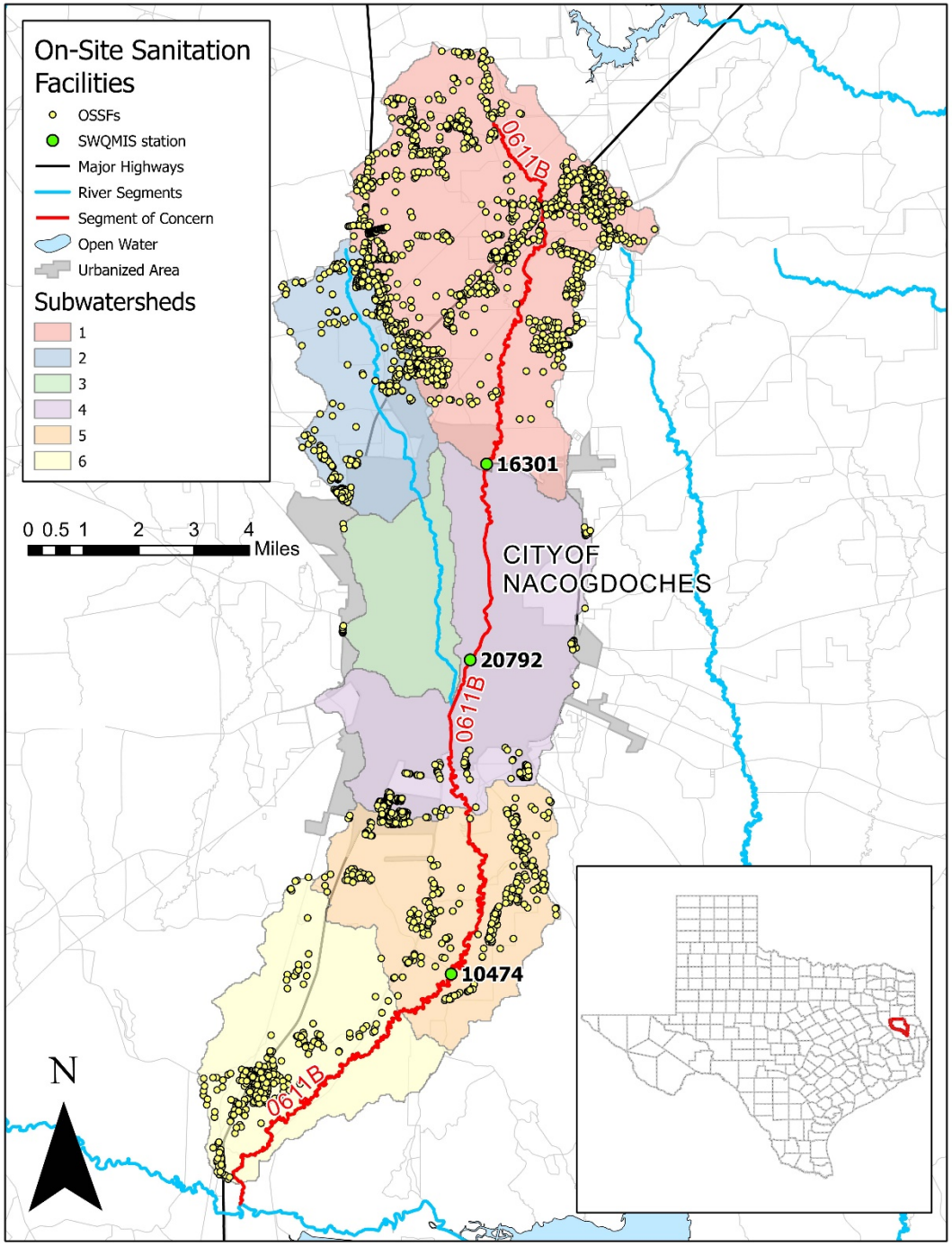
Cal-Tex Lumber

- Intermittent flow
- Industrial cooling, storm, and wash water

City of Nacogdoches

- 12.88 MGD
- Municipal wastewater





On-Site Sewage Facilities (OSSFs)

- 2,773 OSSFs estimated
- Based on Nacogdoches County 911 address data
  - Released December 26, 2019
- Points located outside of municipal service area

Cattle Population Estimate – Method 1

- Total – 2,900
  - Based on estimates from livestock statistics obtained from the United States Department of Agriculture, National Agricultural Statistics Survey
  - County-based populations scaled down to appropriate watershed area
  - Applied to hay/pastures, herbaceous, shrub/scrub land uses

Cattle Population Estimate – Method 2

- Total – 3,652
  - Based on Natural Resource Conservation Service recommended stocking rates
    - 3 ac/animal for improved pasture
    - 5 ac/animal for unimproved pasture
  - Improved Pasture = hay/pastures
    - 10,956 acres
  - Unimproved Pastures = herbaceous and shrub/scrub
    - 4,135 acres
  - Assumes that all available lands are fully stocked

Other Livestock

Horse – 98

Goat – 40

Sheep - 17

Hogs (Domestic) - 4

Based on estimates from livestock statistics obtained from the United States Department of Agriculture National Agricultural Statistics Survey

Animal Feeding Operations

- Definition: an agricultural enterprise where animals are kept and raised in confined situations and feed is brought to the animals
- Currently five AFOs exist in the La Nana Bayou watershed
- AFOs all have Water Quality Management Plans (WQMPs) developed and approved by local, state and federal conservation agencies
  - WQMPs include:
    - Required management practices (may include)
      - Nutrient management
      - Waste handling
      - Prescribed grazing
      - Alternative water
    - Maximum numbers of animals allowed

Deer

- Resource Management Unit density survey estimates density
- 56.49 acres per deer
- Applied to all land covers but barren, developed, open water
- Used average of most recent 10 years
- Estimated population: 700 deer

Feral Hogs

- Texas A&M Natural Resources Institute Method
  - 33.3 ac/hog applied to all land cover but barren, developed, open water
  - Estimated population: 1,187 feral hogs

Pet Estimates

- 11,079 dogs and 8,247 cats in the La Nana Bayou Watershed
- Based upon a nationwide survey by the American Veterinary Medical Association (2018)
- Estimated there are 0.614 dogs and 0.457 cats per US household

Thank You!

Project website:

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This effort was funded through a Clean Water Act, Section 319 Nonpoint Source Pollution grant from US. Environmental Protection Agency through the Texas Commission on Environmental Quality.

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