# Spring Creek Segment 1008
# Upper Panther Branch Segment 1008B
# Willow Creek Segment 1008H

# Data Review & Analysis

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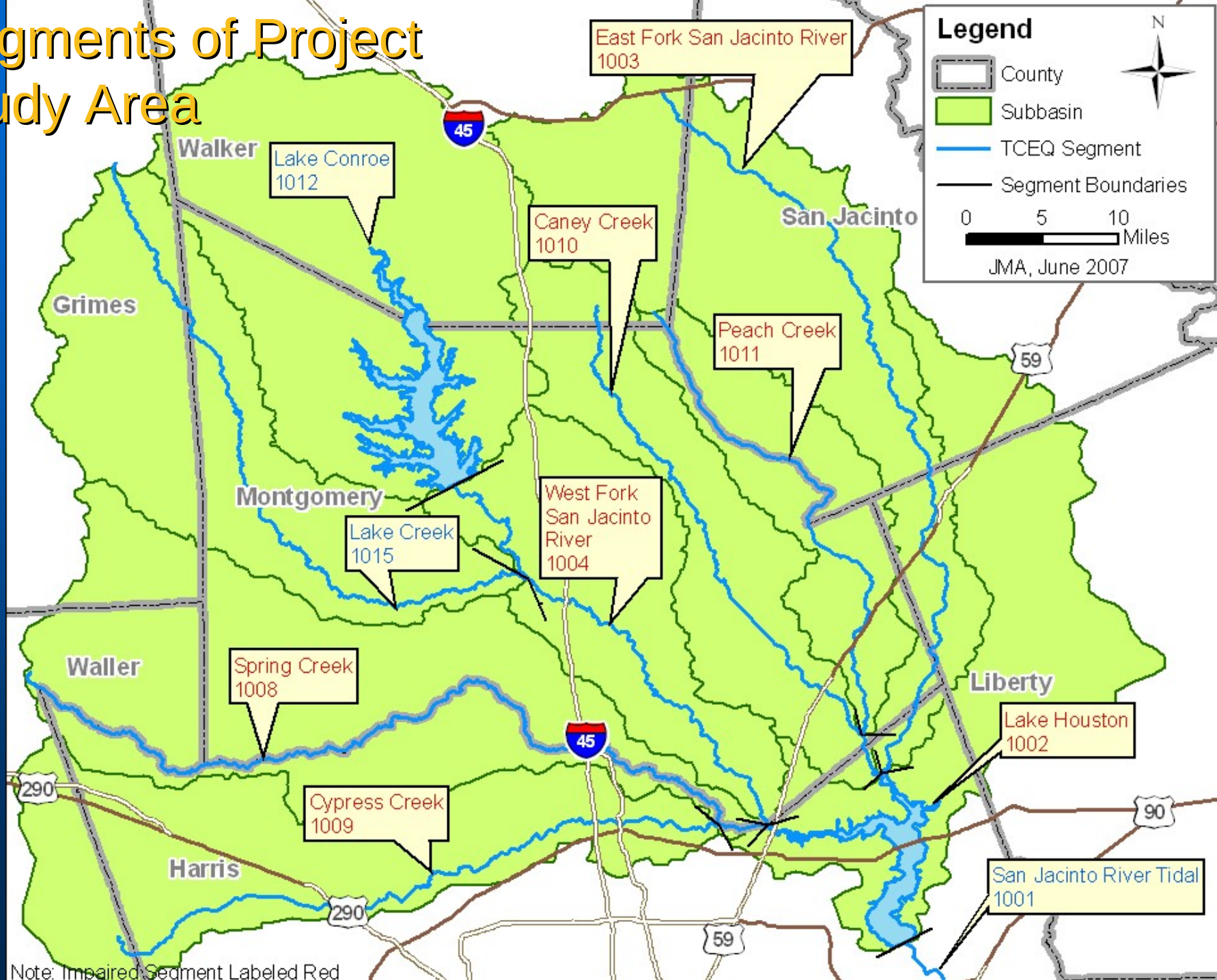
# Introduction

- Several stream segments of San Jacinto River Basin above Lake Houston identified as impaired
- TCEQ divides segments into assessment units (AU) to refine spatial resolution
- Stream segment is considered impaired when geometric mean of *E. coli* exceeds criterion of 126 org/100mL

# Sources of Bacteria

- Treatment plants when not operated properly
- Septic tanks
- Storm water
- Animal waste

# Segments of Project Study Area




Note: Impaired Segment Labeled Red

# I.
# Historical Data Review

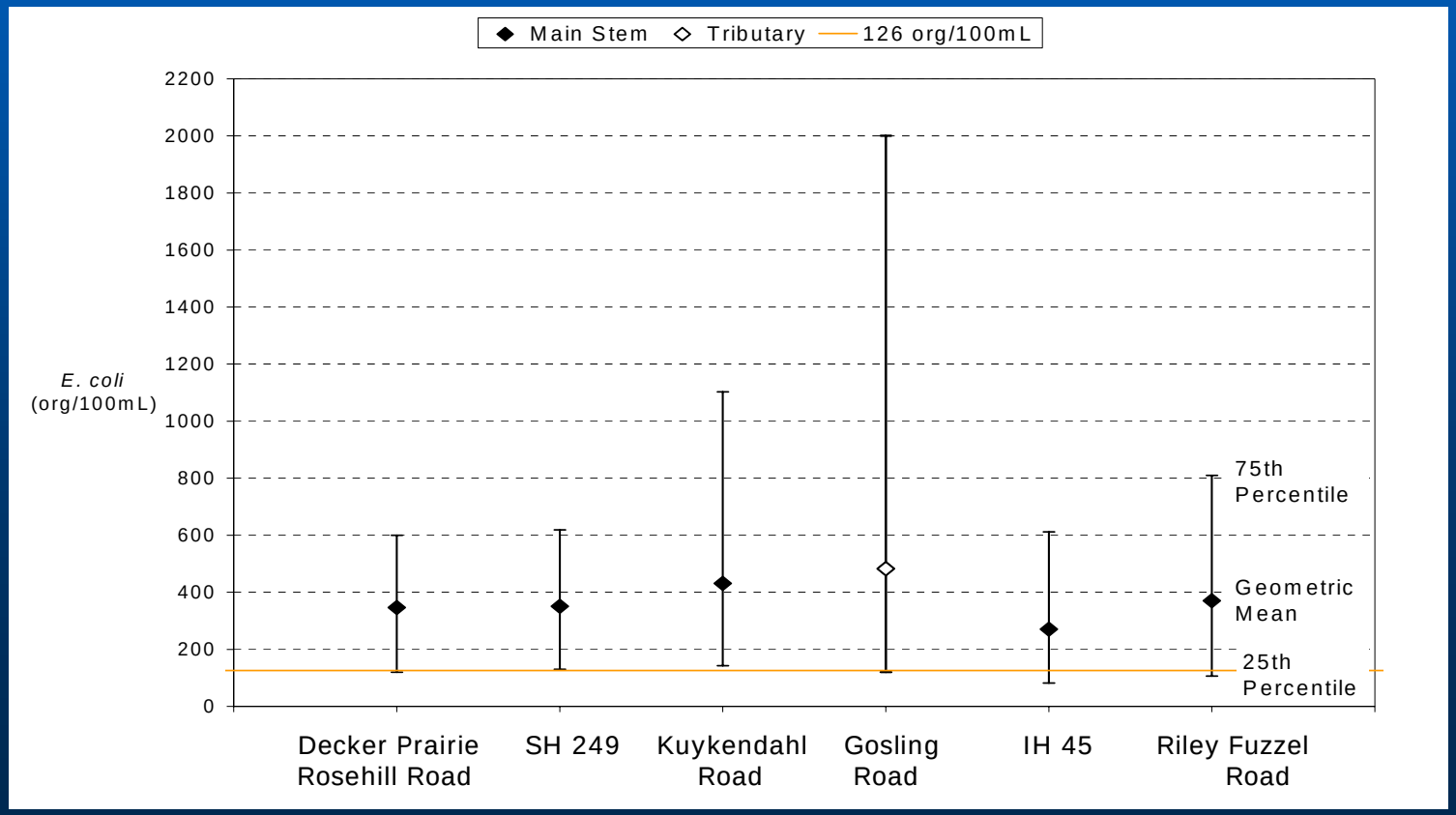
# Spatial and Temporal Analysis

- Spatial analysis – do concentrations change over length of stream?
- Temporal analysis – do concentrations in the stream change over time?
- Both can help locate sources of bacteria

# Spatial Analysis

- Lake Houston and tributaries
  - Bacteria counts exceed geometric mean criteria in many assessment units
  - No clear trends over length of stream

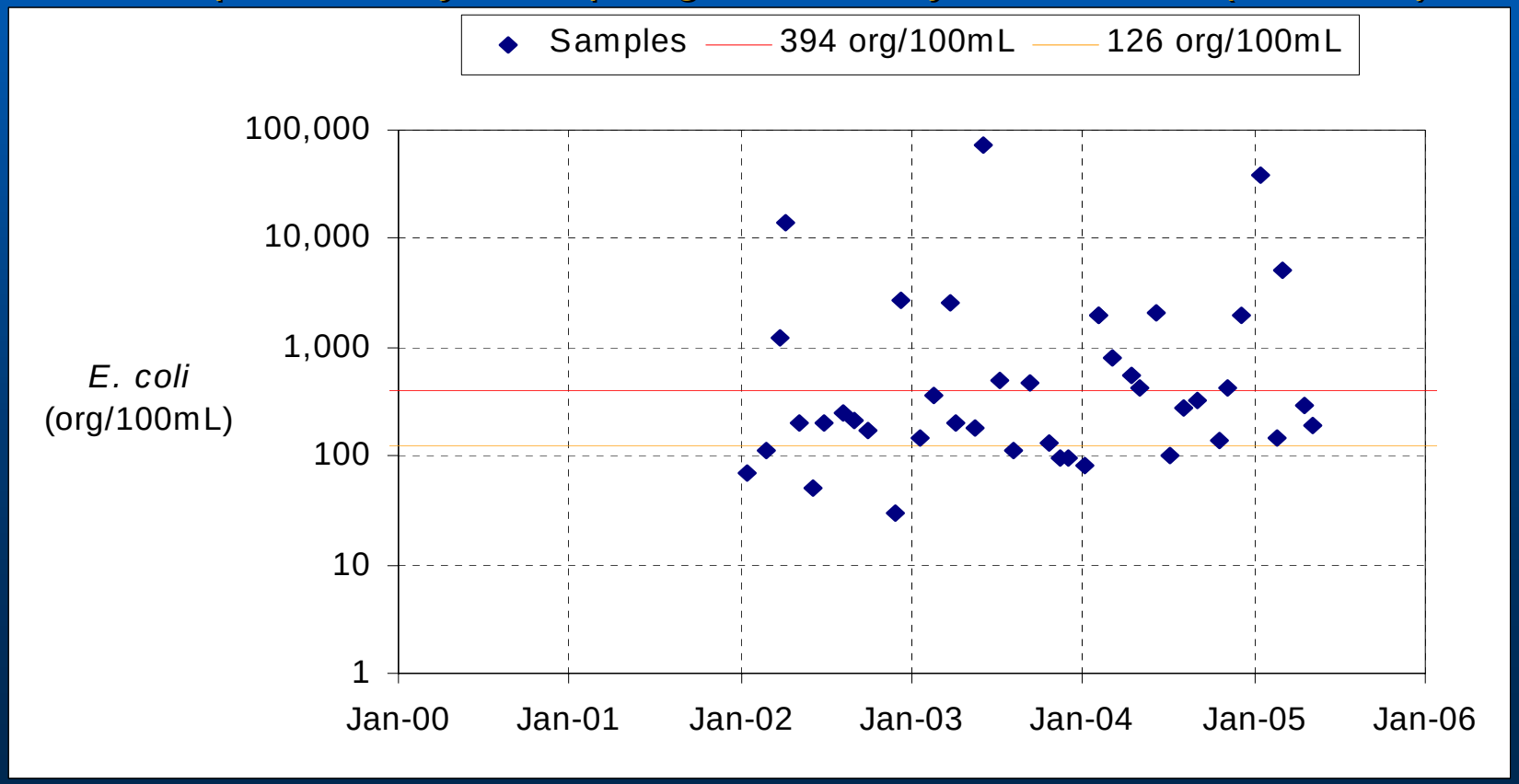
## Spring Creek Spatial Analysis



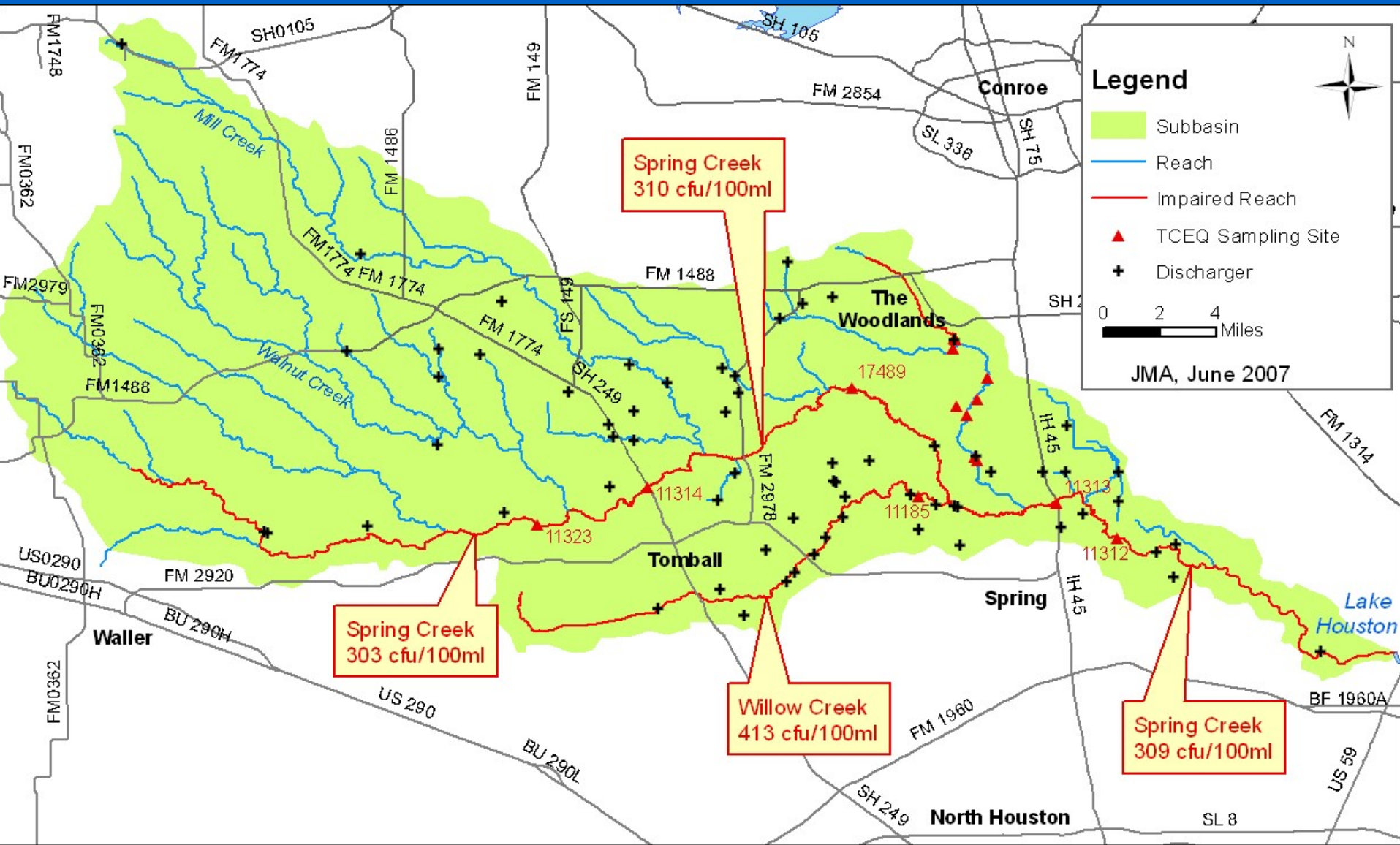
# Temporal Analysis

- Lake Houston & Tributaries
  - Bacteria counts from 10 to 10,000 org/100 mL
  - No trend over time
  - Most samples exceed 126 org/100 mL

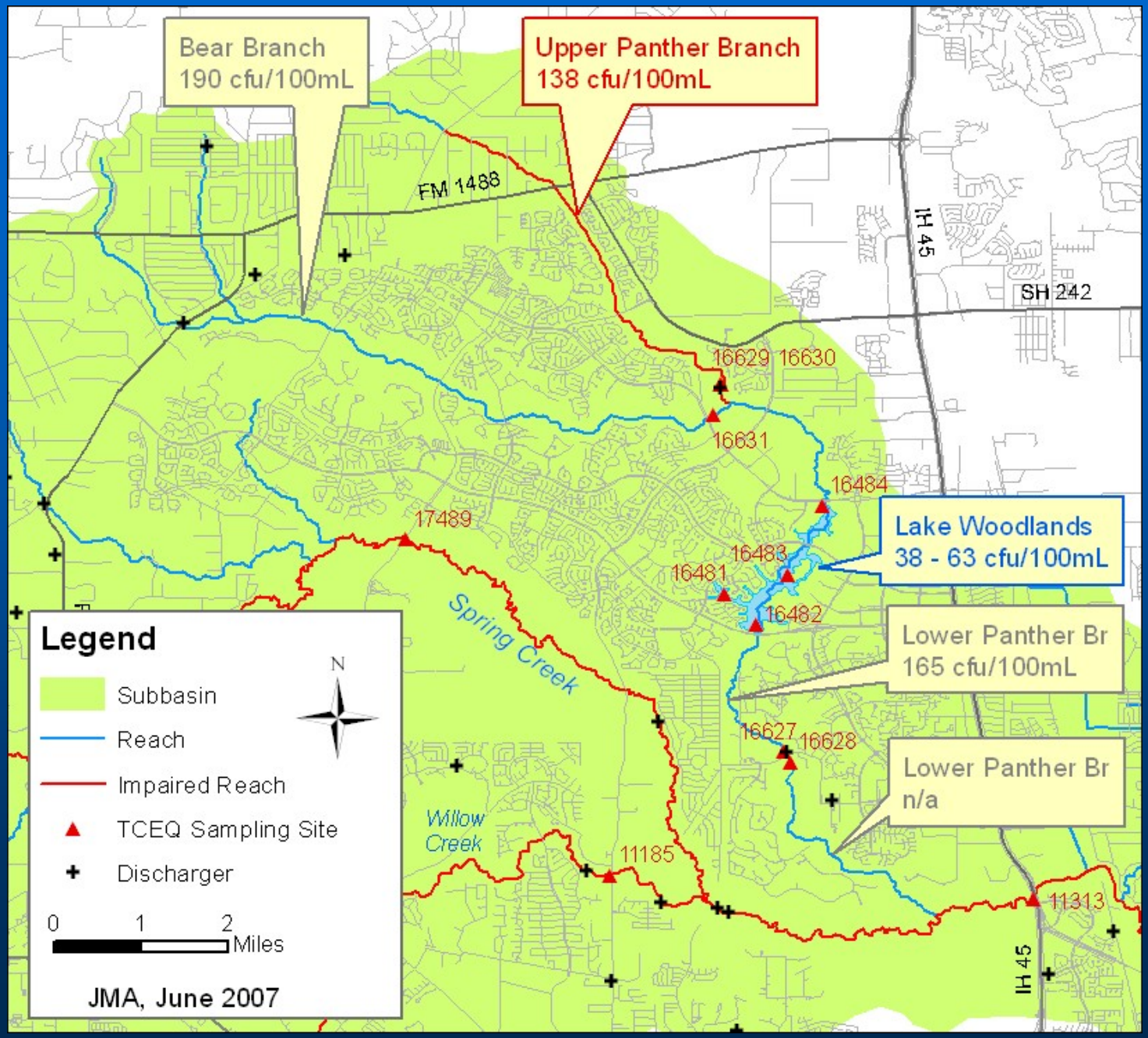
Temporal Analysis: Spring Crk at Kuykendahl Rd (#17489)



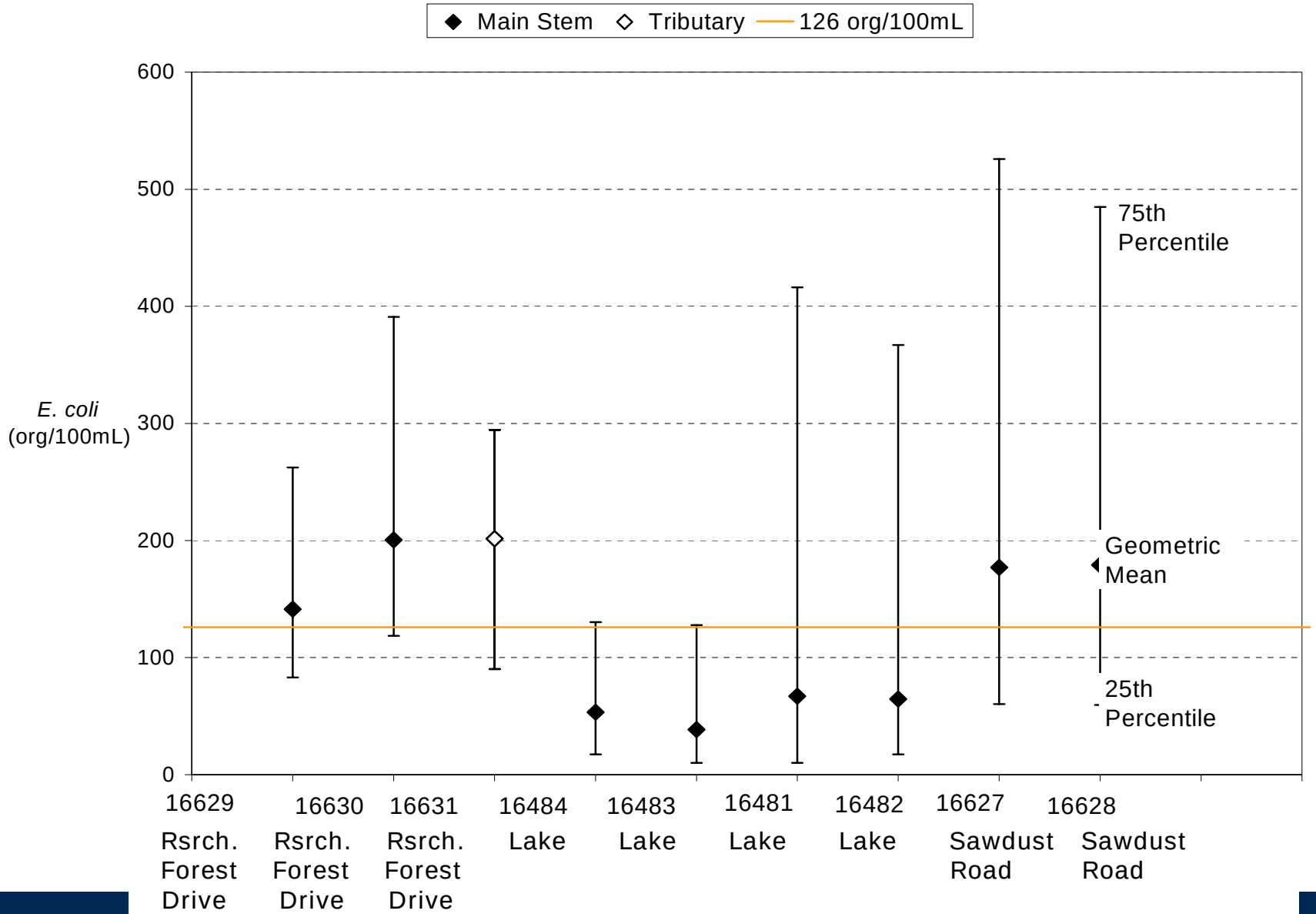
# Spring Creek Study Area



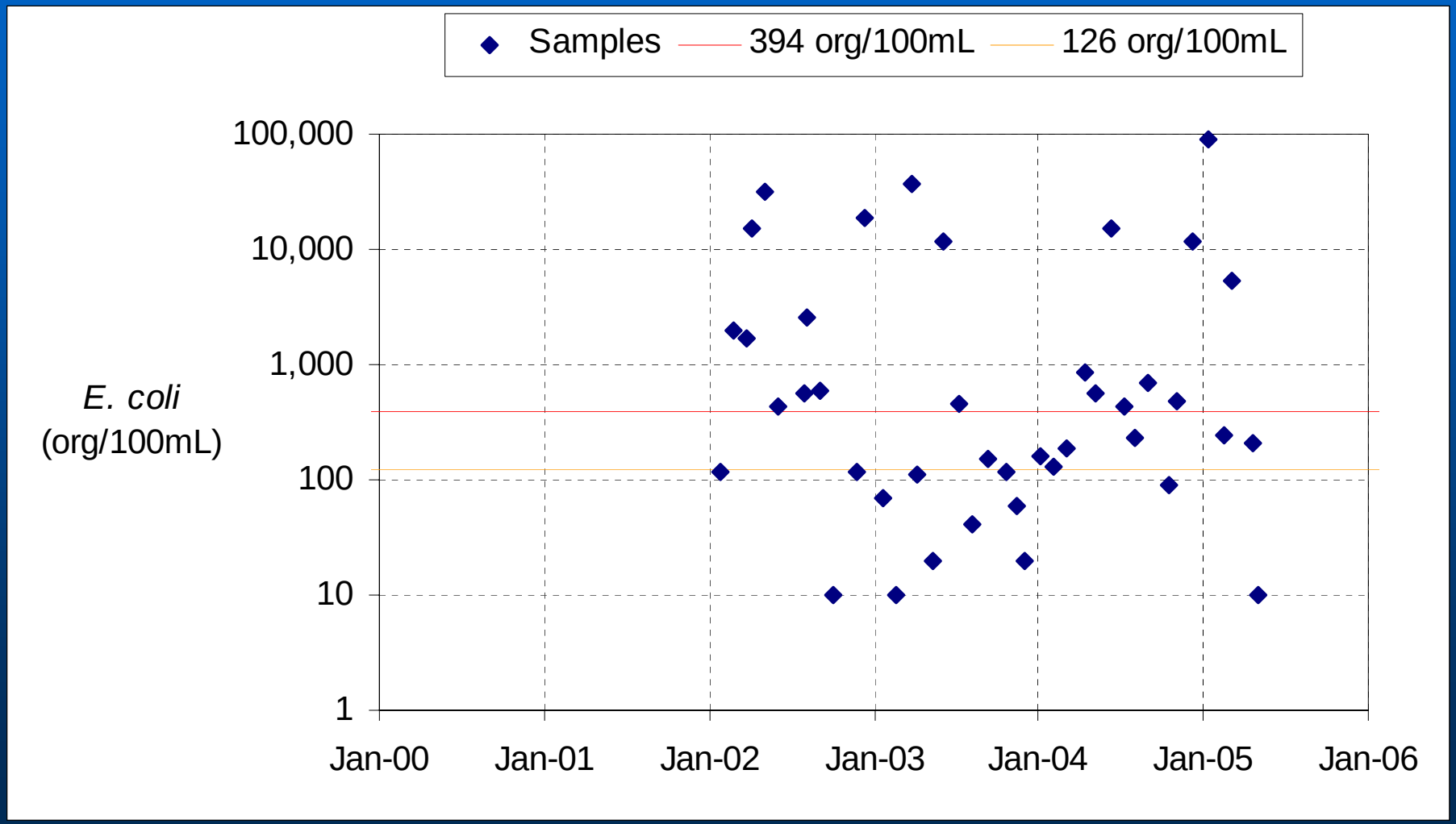
# Panther Branch Study Area



# Panther Branch Spatial Analysis



# Temporal Analysis: Willow Crk at Rosling Rd (#11185)



# II.
# Additional Monitoring Data

# Monitoring Objectives

- How much data do we need?
- Where do the bacteria come from?
- Definitions
  - Synoptic = simultaneous conditions over a broad area
  - Spatially Intensive = detailed sampling along stream channel

# Synoptic Sampling Surveys

- Samples to be collected under baseflow conditions
- Identify source areas, longitudinal trends, extent of impairment
- Routine monitoring stations and additional sites
- Two surveys on each study segment.
- General schedule for these events November 2007 to June 2008.

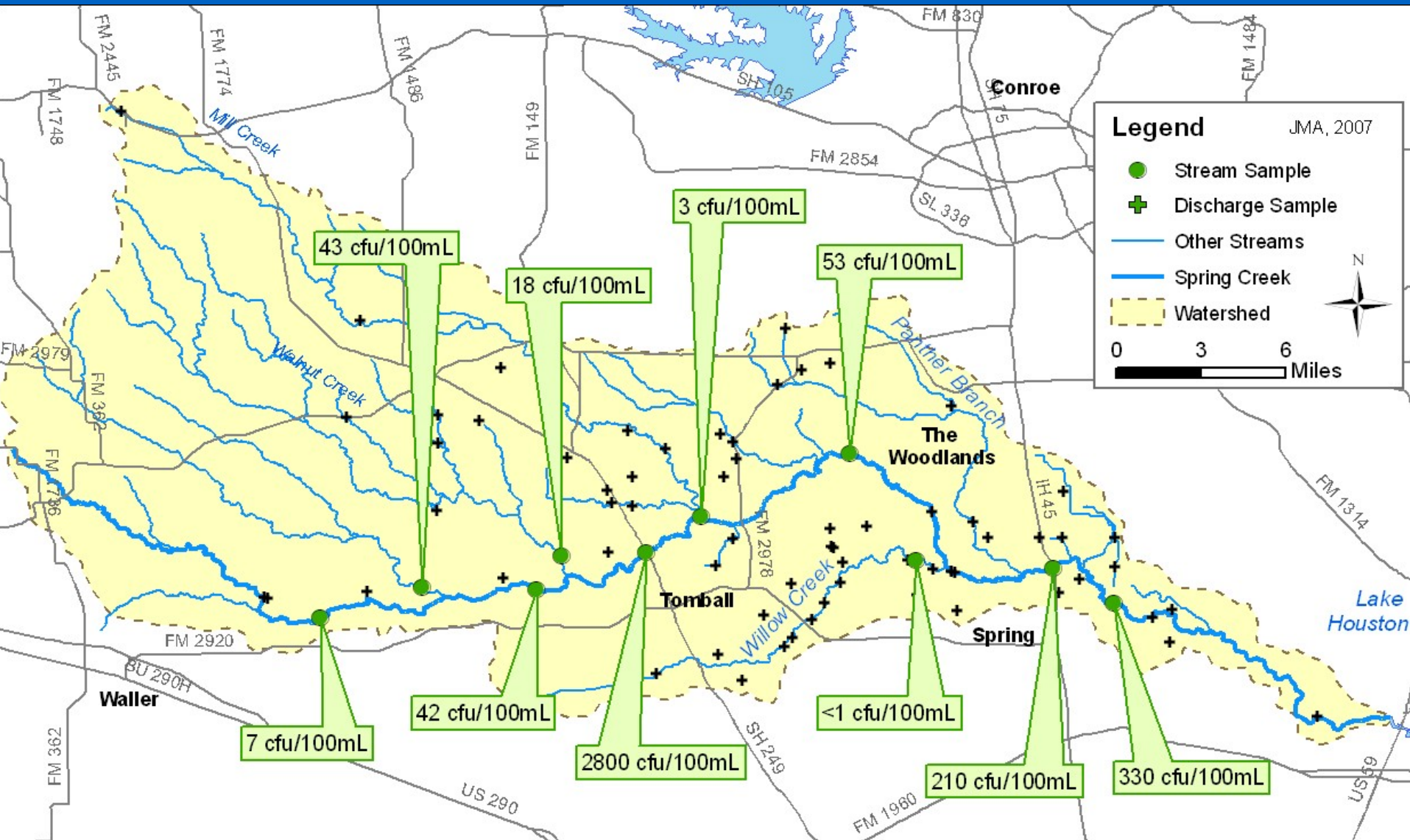
# Spatially-Intensive Source Studies

- Upper East Fork San Jacinto River, Segment 1003; Stewarts Creek, Segment 1004E; Willow Creek Segment, 1008H; and Spring Gully, Segment 1009 D
- Evaluate specific source locations in detail
- Baseflow Conditions
- Numerous sampling points, eg, 1000-ft intervals
- Sample pipes, outfalls, tributaries
- Extrapolate to similar areas in study area

# Spring Creek at IH-45

# Spring Creek at Kuykendahl Rd.

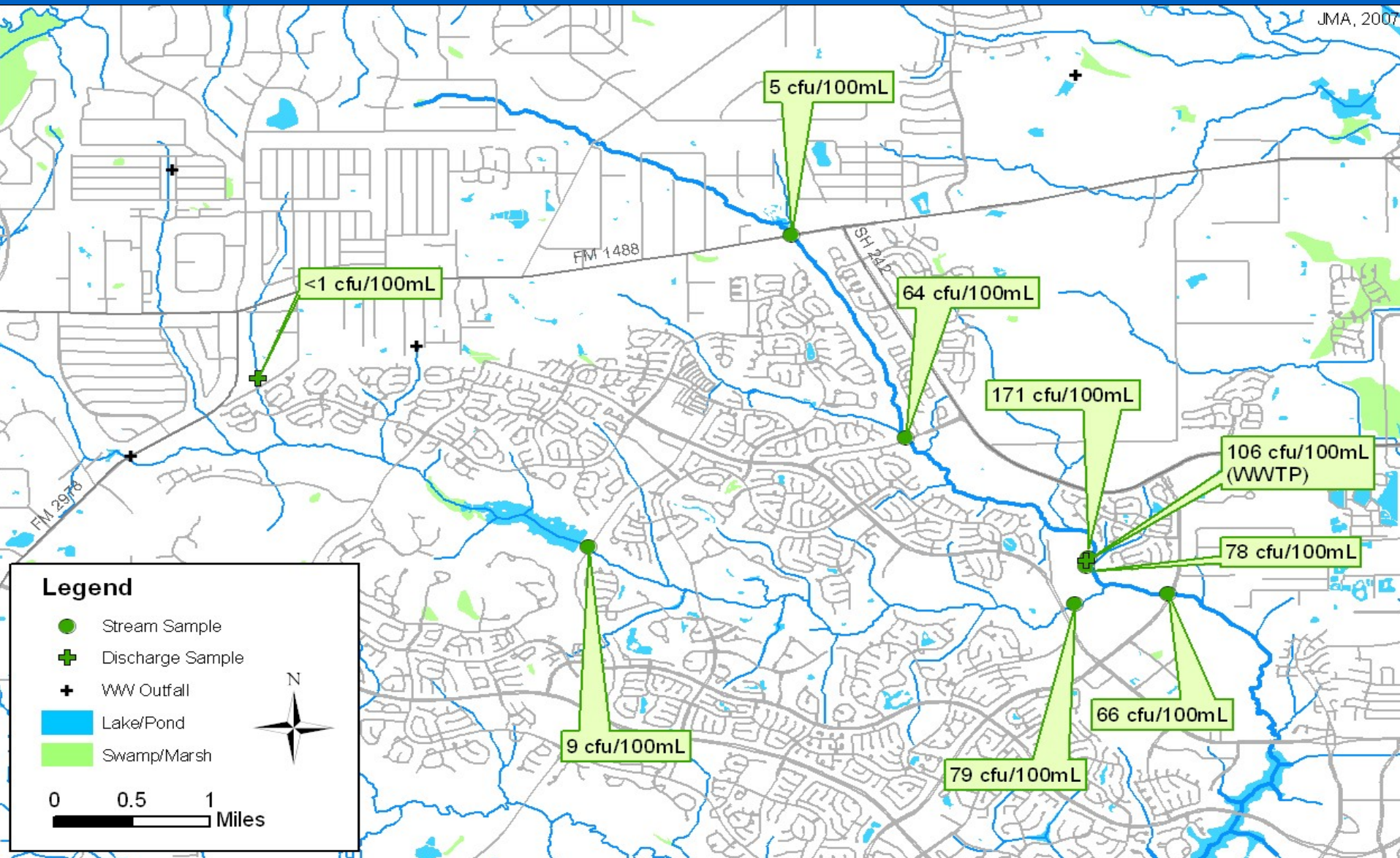
# Spring Creek Synoptic Sampling Map



# Upper Panther Branch at San Jacinto Plant

# Lower Panther Branch at Sawdust Rd.

# Panther Branch Synoptic Sampling Map

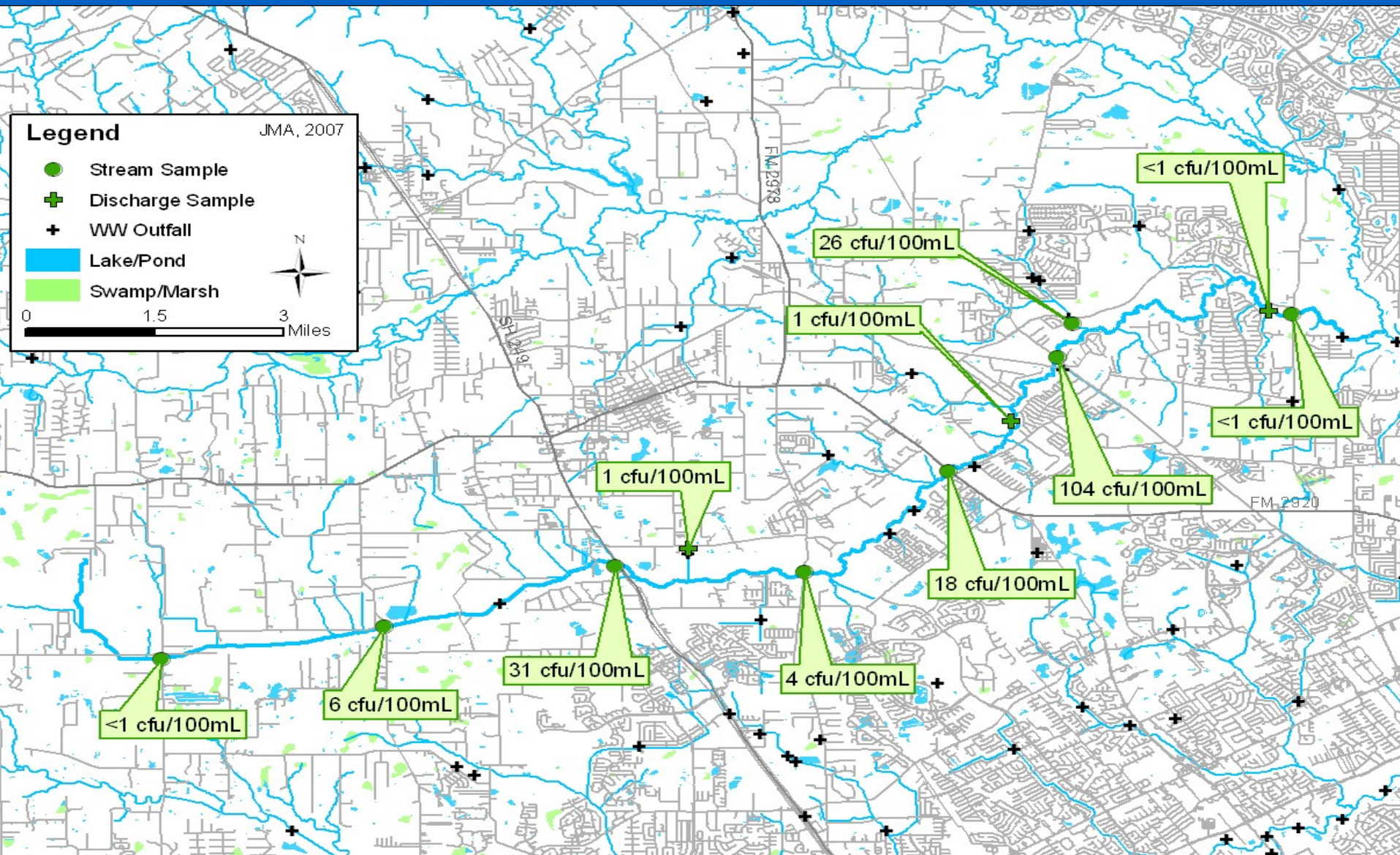


# Willow Creek at Gosling Rd.

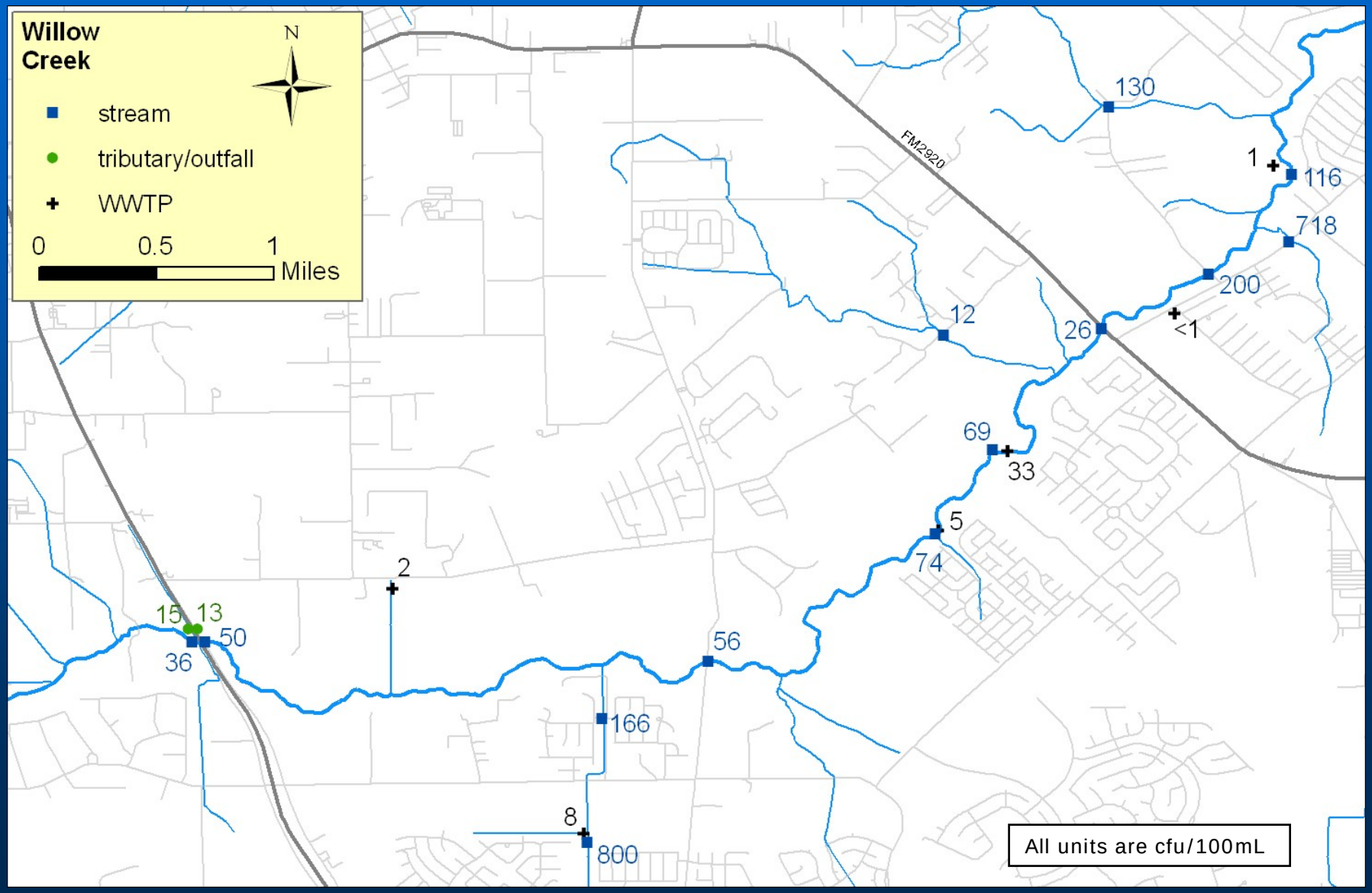
# Willow Creek

# Willow Creek

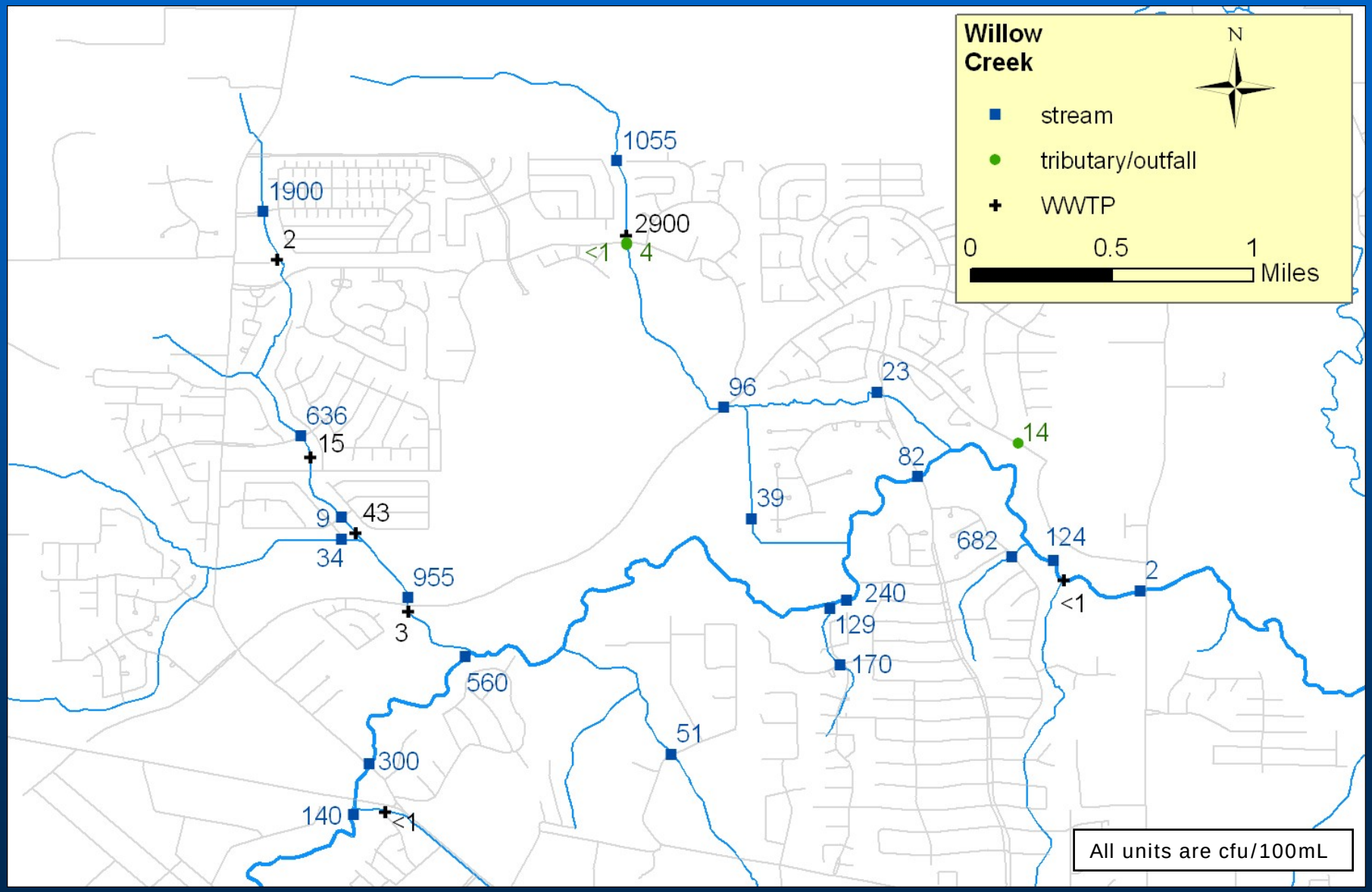
# Willow Creek Synoptic Sampling Map



# Willow Creek Intensive Survey Map West



# Willow Creek Intensive Survey Map East



# Willow Creek Wet Weather Results

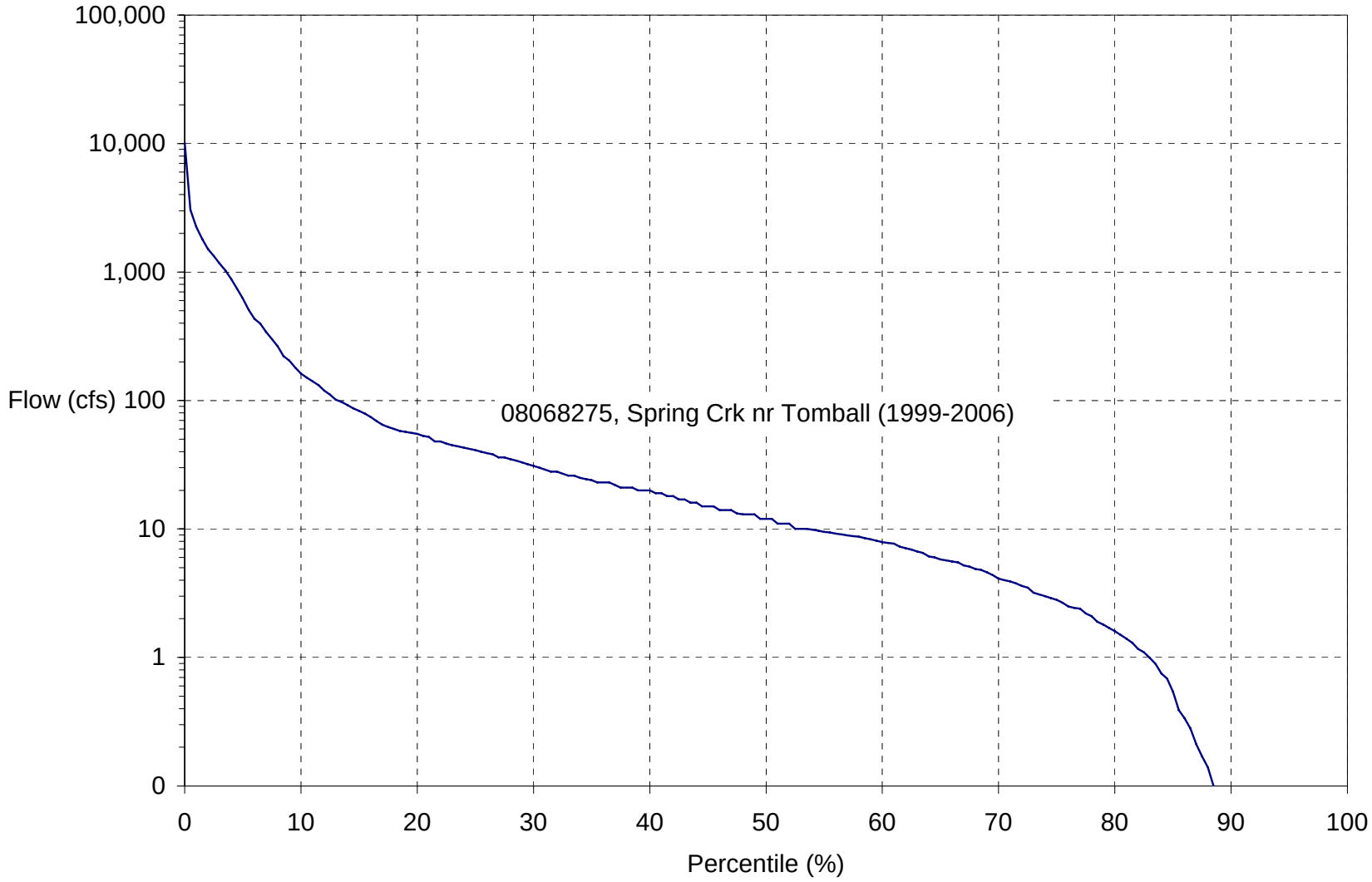
| Station | Station Description | Station Type | Permit # | Permitted Flow (MGD) | Sample Date | Sample Time | *E. coli* (cfu/100mL) | Flow (mgd) | Flow (cfs) | Temp (C) | Cond (µS/cm) | Total Cl2 (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10616 | City of Tomball | WWTF | 10616-002 | 1.5 | 12-Feb-08 | 13:48 | 2 | 1.2 | 1.9 | 19.1 | 1010 | < 0.05 |
| 12044 | Harris Co. MUD #368 | WWTF | 12044-001 | 1.6 | 12-Feb-08 | 14:16 | 1 | | | 21.1 | 896 | > 3.5 |
| 13942 | Inline Utilities Inc. | WWTF | 13942-001 | 0.25 | 12-Feb-08 | 14:43 | 8500 | | | 19.3 | 642 | 0.2 |
| 14421 | Harris Co. MUD #401 | WWTF | 14421-001 | 0.60 | 12-Feb-08 | 15:48 | 73 | 0.012 | 0.018 | 20.1 | 1670 | 0.4 |
| 12643 | Pinewood Community LP | WWTF | 12643-001 | 0.10 | 12-Feb-08 | 16:15 | < 1 | 0.054 | 0.084 | 20.7 | 682 | 3.0 |
| 11404 | Dowdell PUD | WWTF | 11404-001 | 0.95 | 12-Feb-08 | 16:38 | 74 | 0.142 | 0.22 | 22.1 | 1335 | 0.9 |
| 13619 | Aqua Utilities Inc. | WWTF | 13619-001 | 0.04 | 12-Feb-08 | 17:07 | 240 | 0.017 | 0.027 | 18.3 | 653 | 0.25 |
| 13487 | Timbercrest Community LP | WWTF | 13487-001 | 0.20 | 12-Feb-08 | 16:39 | 31 | | | 18.5 | 552 | 2.4 |
| 11630 | Harris Co. MUD #1 | WWTF | 11630-001 | 1.5 | 12-Feb-08 | 16:16 | 230 | | | 19.6 | 973 | 0.8 |
| 12519 | Aqua Utilities Inc. | WWTF | 12519-001 | 0.10 | 12-Feb-08 | 16:00 | 220 | | | 18.5 | 740 | 0.5 |
| 14475 | NW Harris Co. MUD #19 | WWTF | 14475-001 | 0.70 | 12-Feb-08 | 15:54 | 6 | | | 17 | 1154 | 0.3 |
| 12153 | NW Harris Co. MUD #19 | WWTF | 12153-001 | 0.25 | 12-Feb-08 | 17:03 | 68 | | | 19.8 | 1151 | > 3.5 |
| 10910 | Northhampton MUD | WWTF | 10910-001 | 0.75 | 12-Feb-08 | 17:35 | 4 | | | 19.6 | 988 | 1.3 |
| 11185 | Willow Creek at Gosling Road | Stream | n/a | n/a | 12-Feb-08 | 17:24 | 7800 | 72 | 112 | 15.9 | 250 | < 0.05 |
| 92924 | Blind Duplicate, Sta. 11185 | Stream | n/a | n/a | 12-Feb-08 | 17:29 | 6500 | 72 | 112 | 15.9 | 250 | < 0.05 |

# III.
# Determination of TMDLS and ALLOCATIONS

# Flow Duration Curves

- A flow duration curve (FDC) is a graph of daily average streamflow versus the percent of days that the average streamflow value is exceeded
- FDCs are typically developed using daily flow data
- Common tool in hydrology studies

# Spring Creek Flow Duration Curve

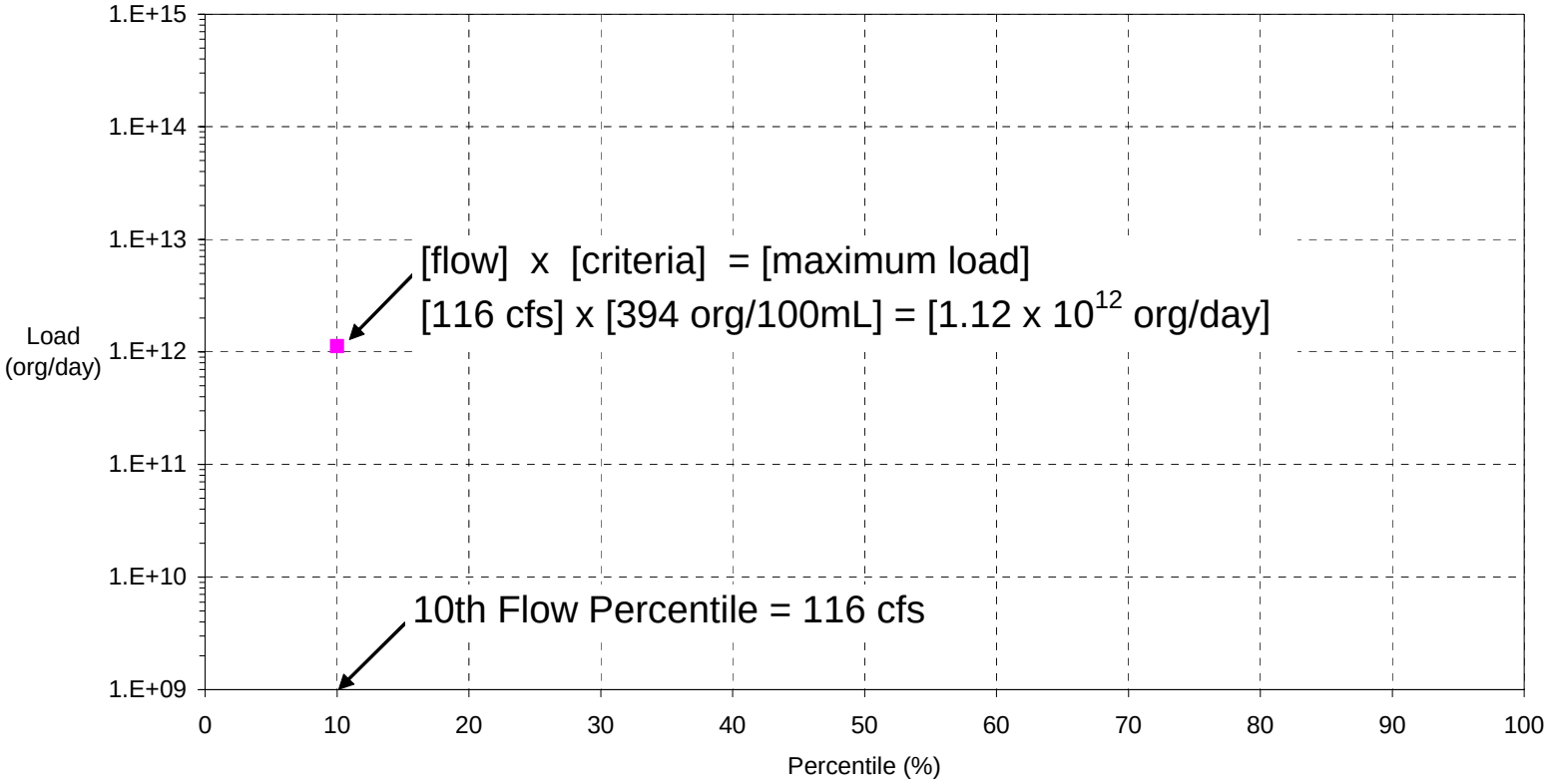


# Load Duration Curves

- Bacterial loads are the product of each grab sample bacteria concentration and the corresponding mean daily streamflow rate
- The greatest exceedances typically occur under high flow conditions
- Plot sampling data as loads, compare to criteria, to develop LDC

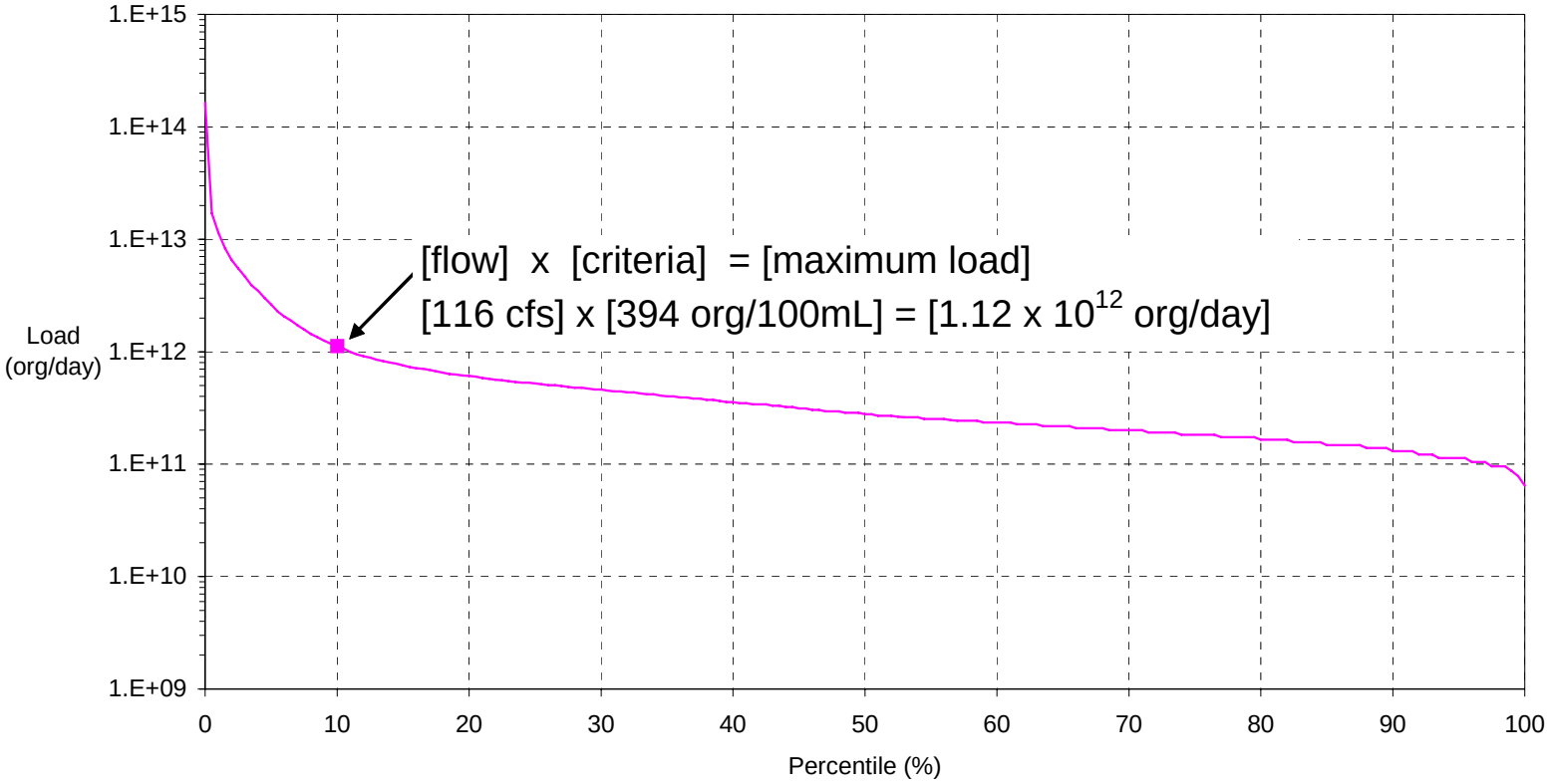
# Hypothetical LDC

Step 1: Plot Allowable Load for a Flow Percentile



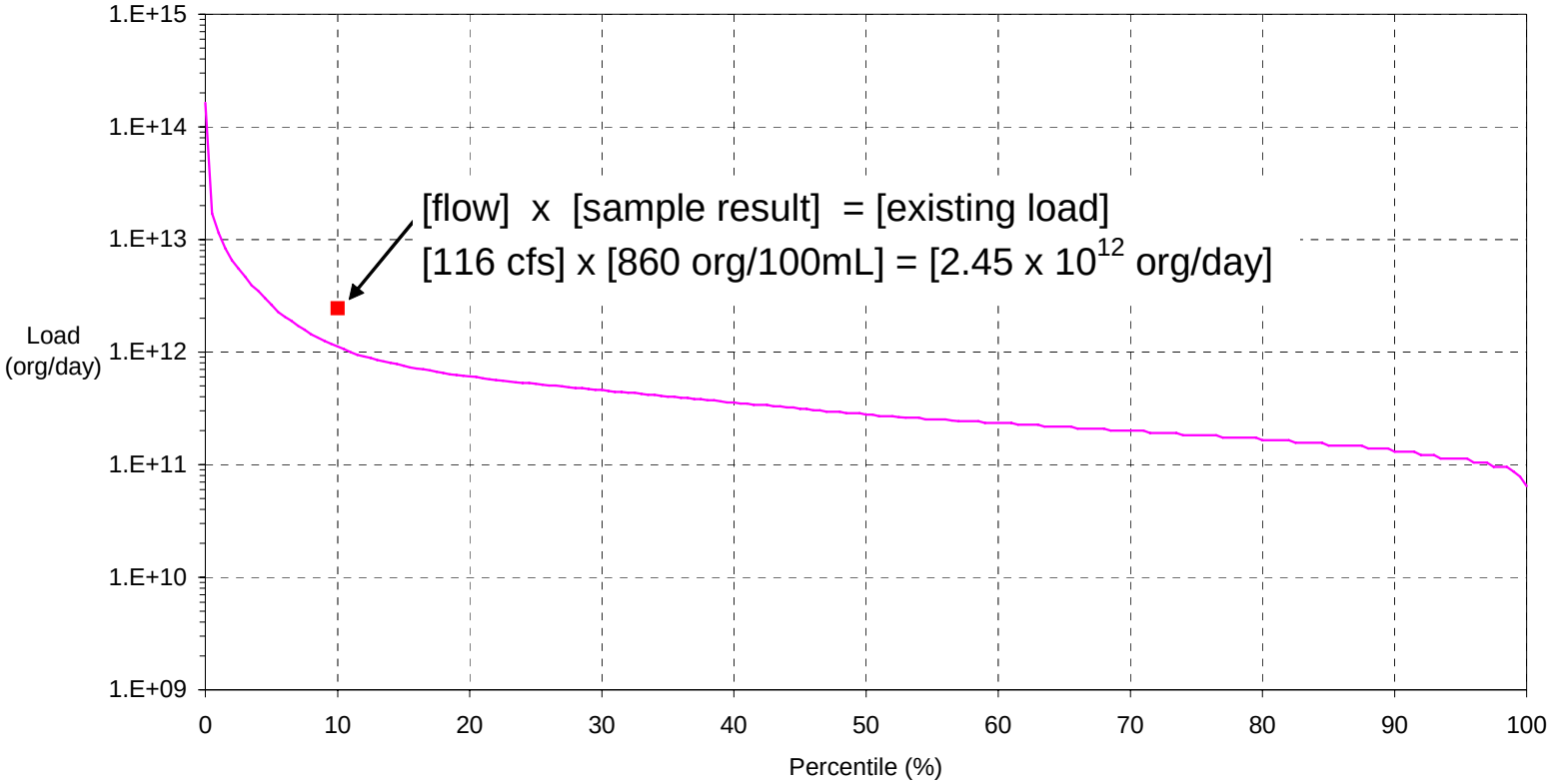
# Hypothetical LDC

Step 2: Plot Allowable Load for each Flow Percentile



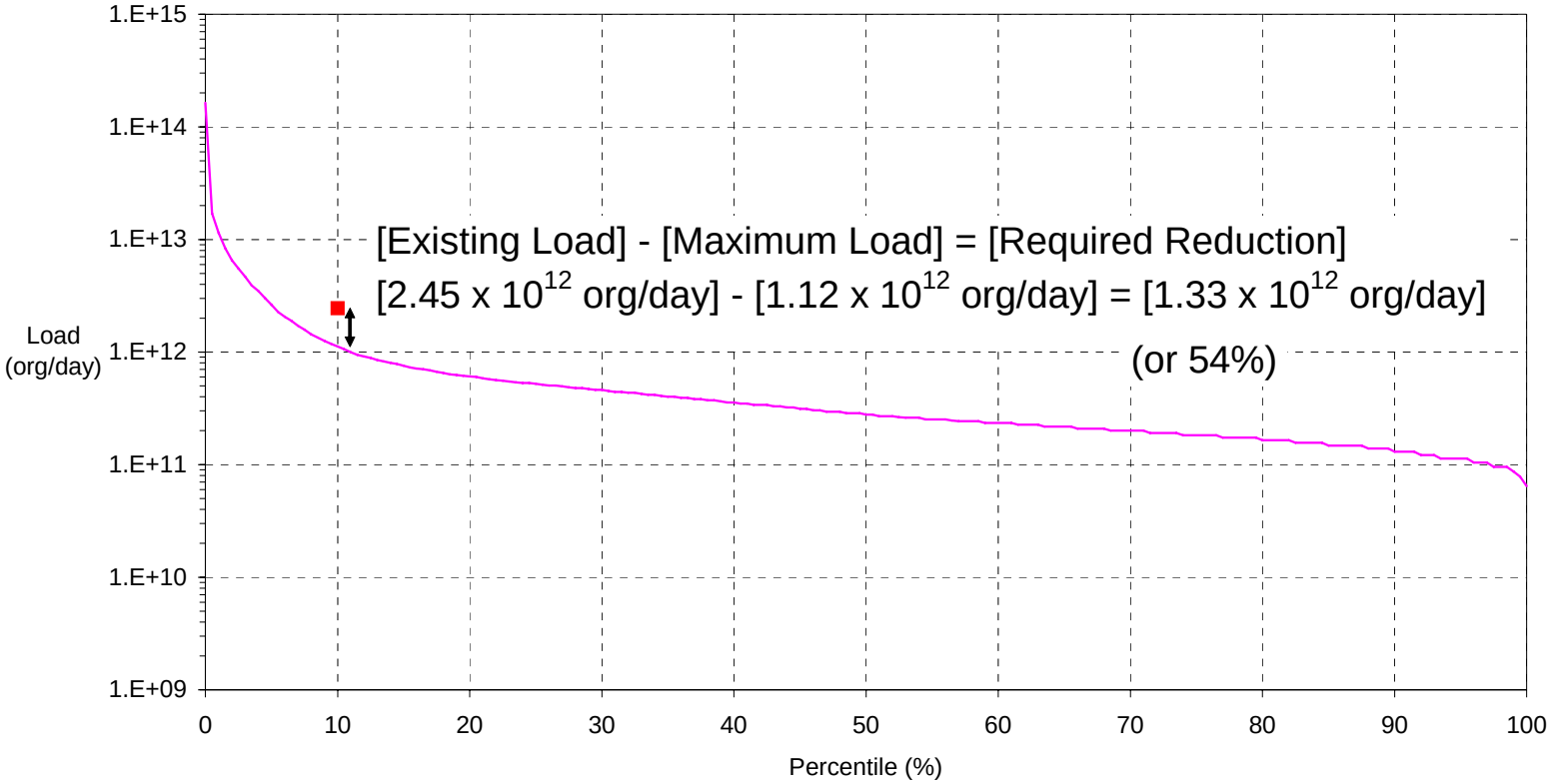
# Hypothetical LDC

Step 3: Plot a Sampling Result
(on 21 January 2004, the flow was 116 cfs and the bacteria concentration was 860 org/100mL)

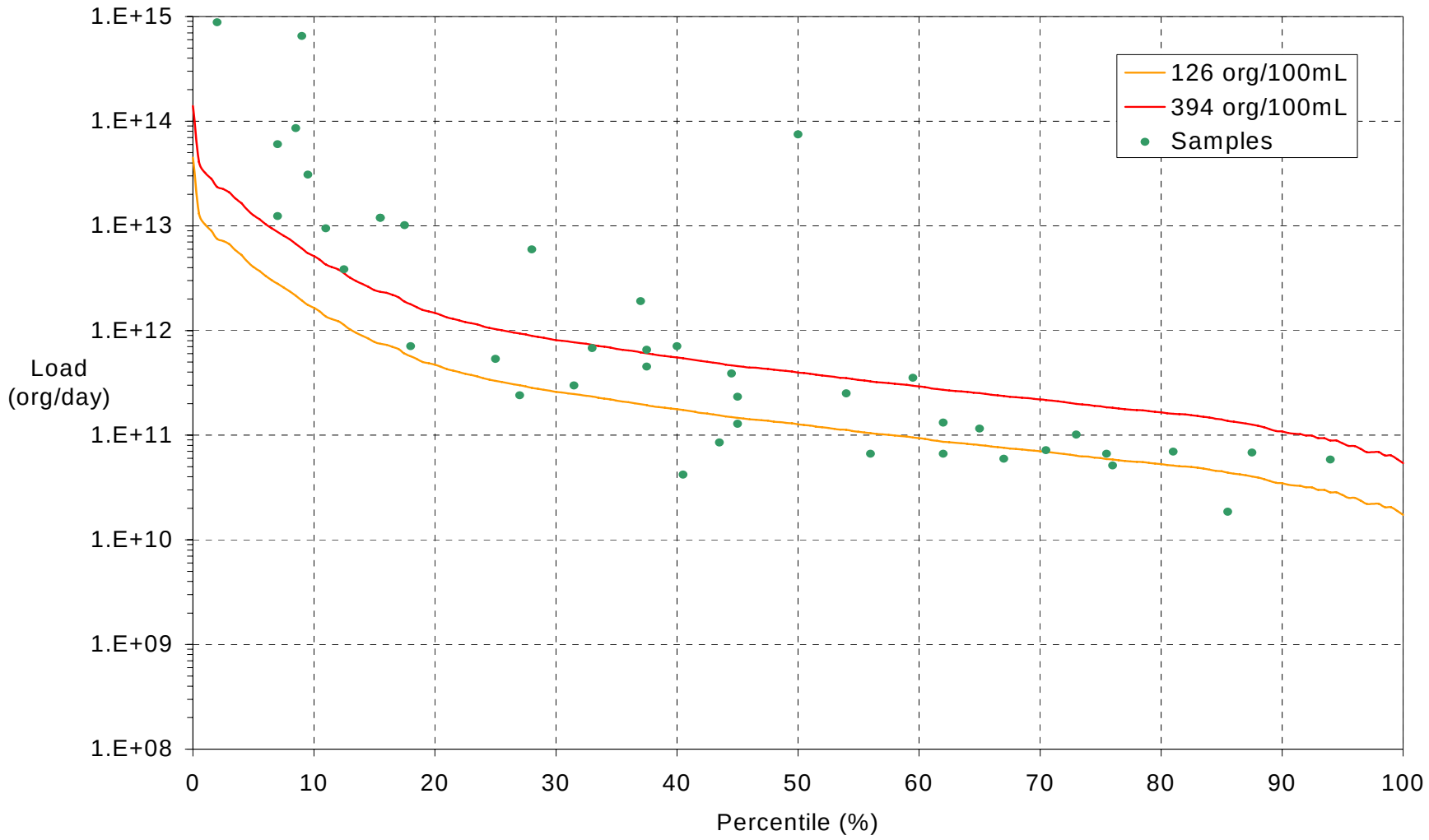


# Hypothetical LDC

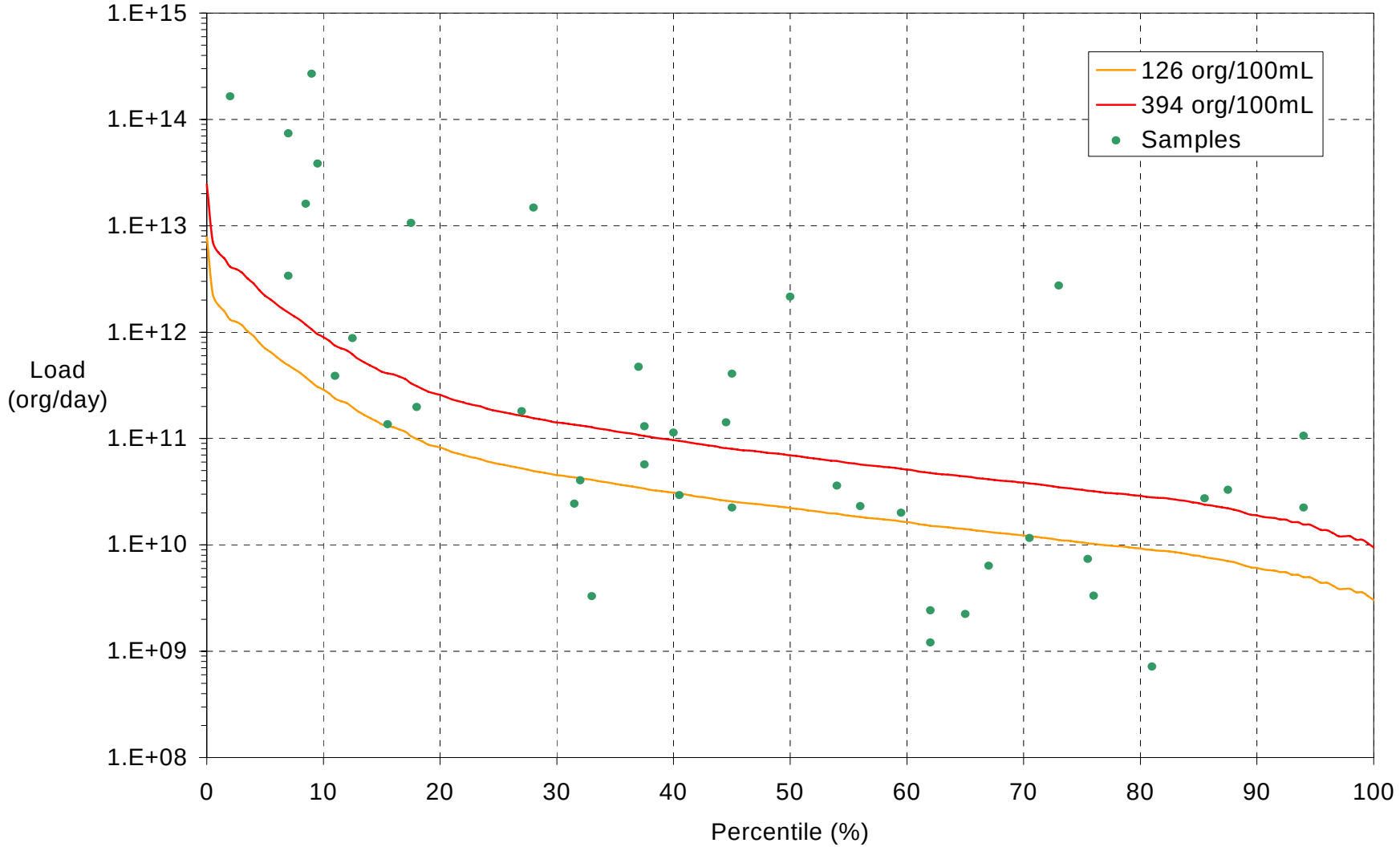
Step 4: Determine Load Exceedance
(for 21 January 2004 only)



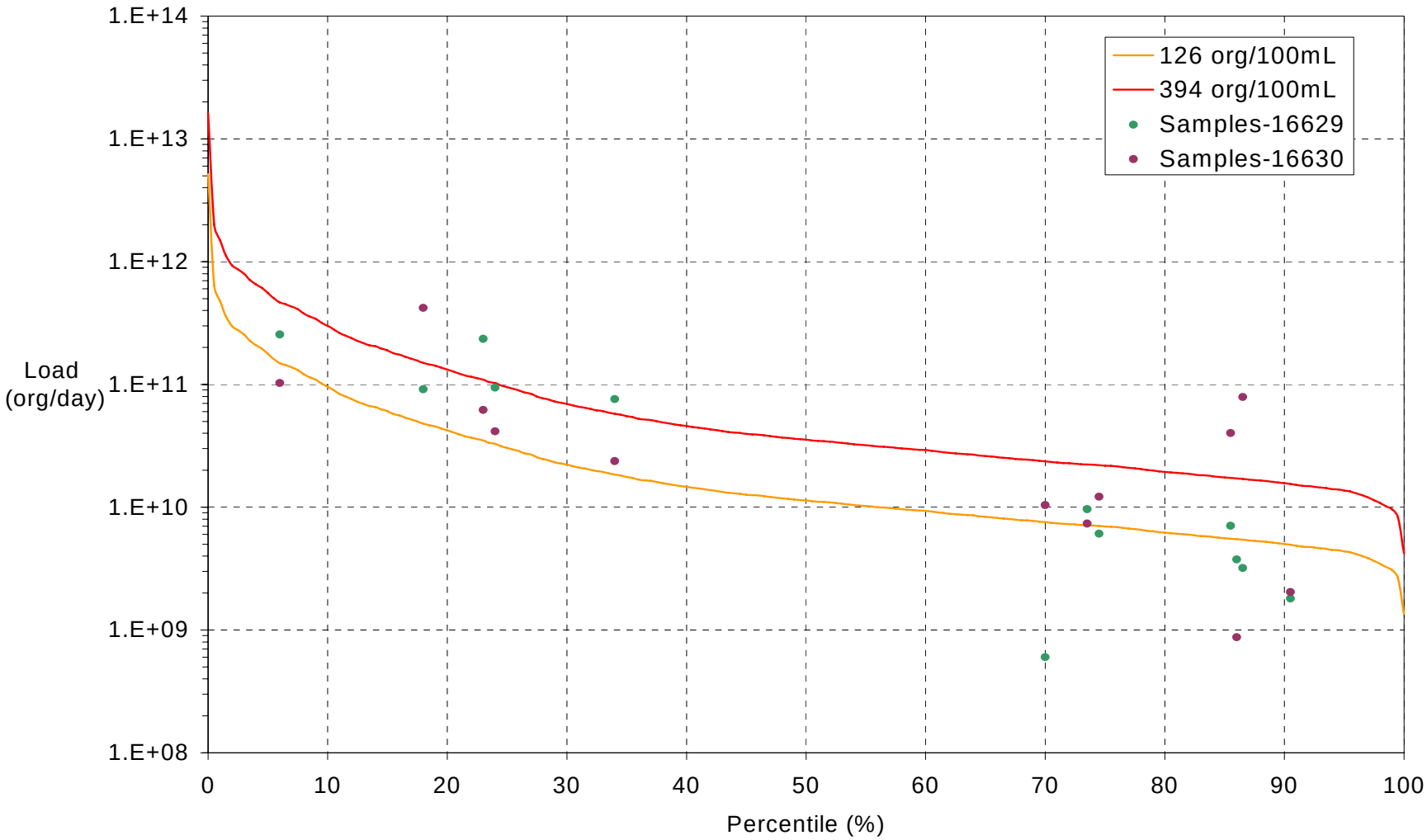
# LDC for Spring Crk at Kuykendahl Rd (#17489)



# LDC for Willow Creek at Rosling Rd (#11185)



# LDC for Upper Panther Branch (#16629-30)



# Why does this Matter?

- LDC shows if sampling data indicates compliance or exceedance
- For exceedance of criteria, need to develop an allowable load allocation
- Potential sources are addressed in implementation plan

# Allocation Categories

- Two primary source categories
  - Wasteloads (WLA) - any source flowing into a waterway and covered by a permit
    - wastewater treatment plants
    - discharges of runoff from municipal areas covered under stormwater permits (MS4s)
  - Loads (LA) - remaining diffuse sources of pollutants that are not covered by permit
    - runoff from rural or urban areas outside of permitting jurisdictions

# Wastewater Treatment Facilities

- Potential to contribute significant bacteria loads if complete disinfection is not achieved
- Loads may be most noticeable under low flow conditions, during which some streams may be effluent dominated
- Also possible for treatment plants to contribute significant loads under wet weather conditions
- Increased loading due to stormwater inflow and infiltration may result in poorer plant performance

# Spring Creek Wastewater Treatment Facility Summary

- 65 permitted facilities
- Total current flow 17 MGD (27 cfs)
- Total Permitted flow 43 MGD (67 cfs)
- WWTP flows account for 100% of the stream flow at the 99$^{th}$ percentile regime (low flow), 39% of the flow at the 50$^{th}$ percentile (median flow)

# Runoff Sources

- Urban areas have human, pet, and wildlife waste sources
- Rural areas may have livestock waste sources
- Natural areas have wildlife waste sources
- Larger loads often associated with urban areas because there is more runoff from storms
- Septic Systems

# TCEQ Website for Project Information

http://www.tceq.state.tx.us/implementation/water/tmdl/82-lakehouston.html