Forestry BMPs: Are They Really Effective in Protecting Water Quality?

TEXAS FOREST SERVICE
The Texas A&M University System

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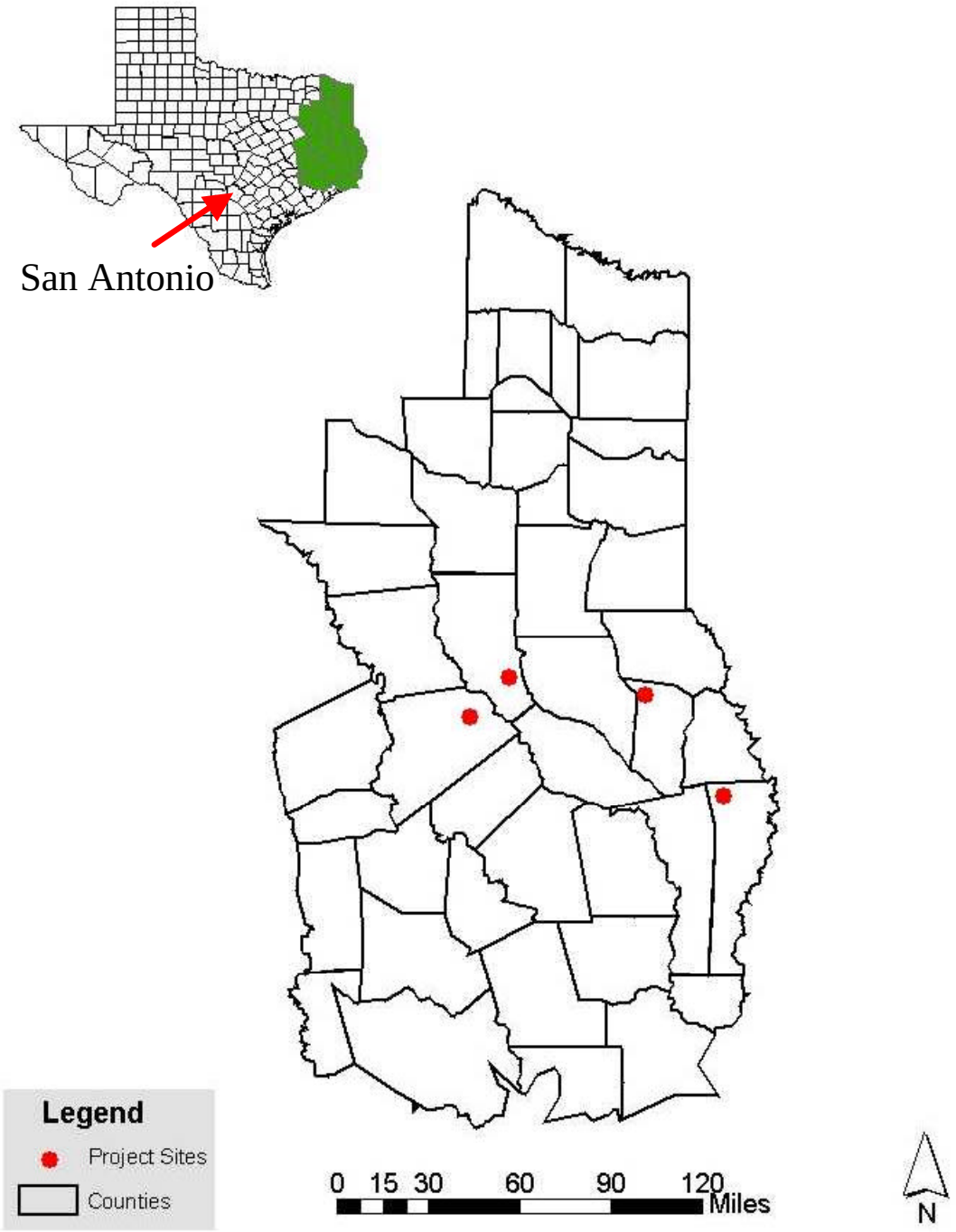
Why Are We Doing This Project?

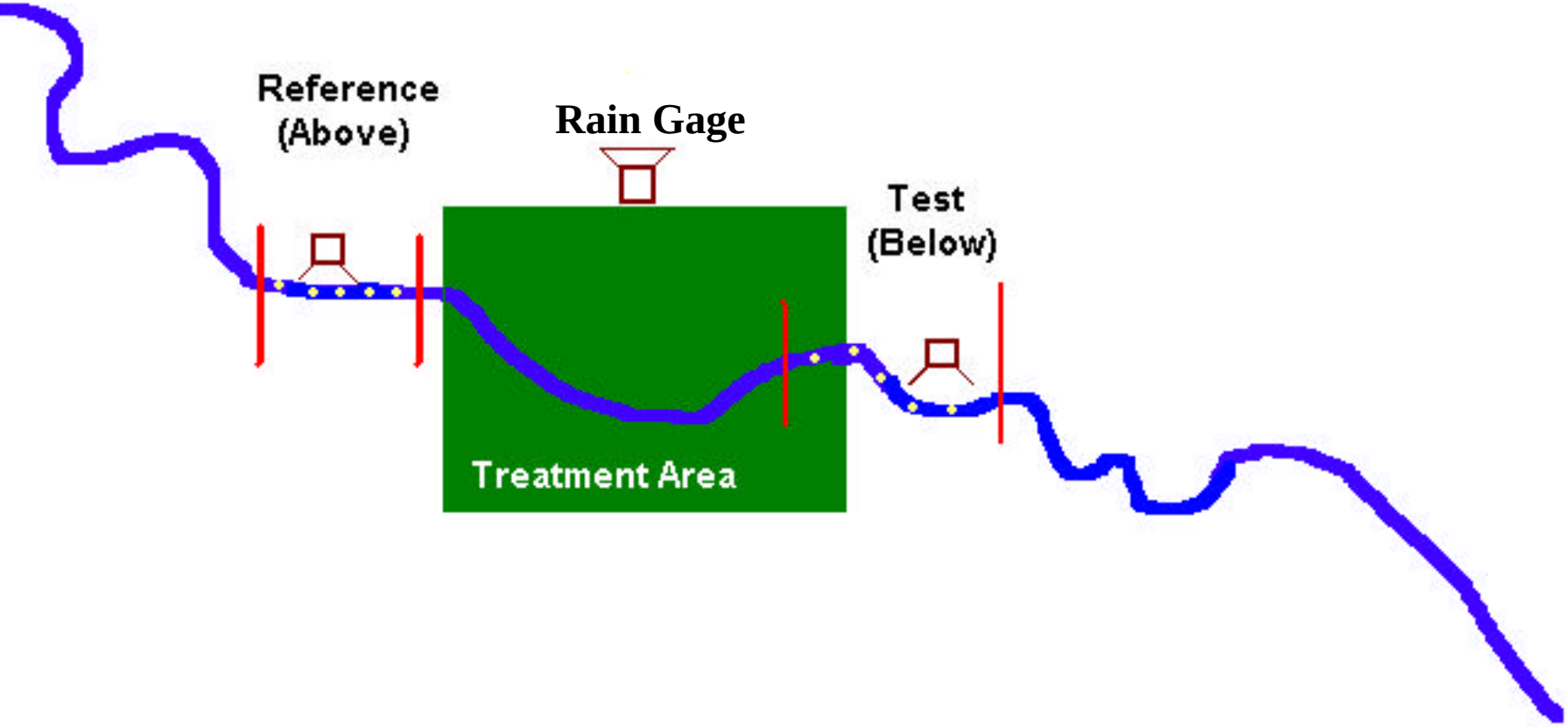
- Determine the effectiveness of Forestry BMPs
- Very few monitoring projects designed to look at entire operation
- Provide additional data on East Texas streams
- Increase knowledge of BMPs
- Reauthorization of Clean Water Act

Project Design

- BACI design (before - after / control - impact)
- 4 “worst case scenario” sites near Lufkin, Texas
- 2nd and 3rd order perennial streams
- Sites under operational, intensive forest management
- Watershed control – no outside influences
- Biological and physiochemical monitoring


San Antonio
Legend
Project Sites
Counties
0 15 30 60 90 120
Miles
N

Site Layout



Project Timeline

Key Dates

July 2003: Project Begins

September 2003: Biological monitoring (Pre)

May 2004: Biological monitoring (Pre)

September 2004: Biological monitoring (Pre)

November – April 2005: Treatment - Harvest

May 2005: Biological monitoring (Post)

June - August 2005: Treatment - Site Prep

September 2005: Biological monitoring (Post)

January 2006: Treatment - Reforestation

May 2006: Biological monitoring (Post)

September 2006: Biological monitoring (Post)

May 2007: Biological monitoring (Post)

September 2007: Biological monitoring (Post)

October 2007: Final Report

Technical Advisory Committee

- Discussed Methodology and Procedures for the TX BMP Effectiveness Monitoring Project
- Committee provided “technical expertise” on the direction and implementation of the project

Participants include:

TFS	ARS	TIFPC
TSSWCB	TNC	IP
EPA	NETMWD	SFASU
TCEQ	NCASI	
TPWD	TLC	

Sampling Parameters

Biological

- Habitat assessment
  - Physical Characteristics
- Bioassessment
  - Benthics
  - Fish

Physiochemical

- pH
- DO
- Conductivity
- Temperature
- Turbidity
- TSS
- Phosphorous / Nitrogen

Biological Sampling

- Conducted twice a year (spring and fall)
- Consist of Habitat, Benthics, and Fish

Benthics

- D-frame kick net

Fish

- Electroshocker and Seine

Biological Results

- Results show very healthy aquatic ecosystems
  - 87 total benthic species (28 found at all sites)
  - 37 total fish species (12 found at all sites)
  - First documentation ever of a potentially endangered fish species (Sabine shiner) in this area
  - Intermediate – Exceptional Aquatic Life Use values
  - Common benthics: Damsel/Dragonflies, Water Beetles, Mayflies, Crawfish
  - Common fish: Topminnows, shiners, creek chubs, pirate perch, lamphrey, mad toms

Biological Sampling - Benthics

Dragonfly

Stonefly

Mayfly

Midgefly

Caddisfly

Biological Sampling - Fish

Spotted Sunfish

Yellow Bullhead

Spotted Bass

Preliminary Analysis

Pre Treatment vs. Post Treatment

- Similar # of species collected before and after treatment
- ALU scores remained constant after treatment
- Slight increase in % intol/tol fish species ratio after treatment
- No change in major biological metric scores after treatment

Physiochemical Sampling

Grab

- Collect monthly data on all physiochemical parameters

Stormwater

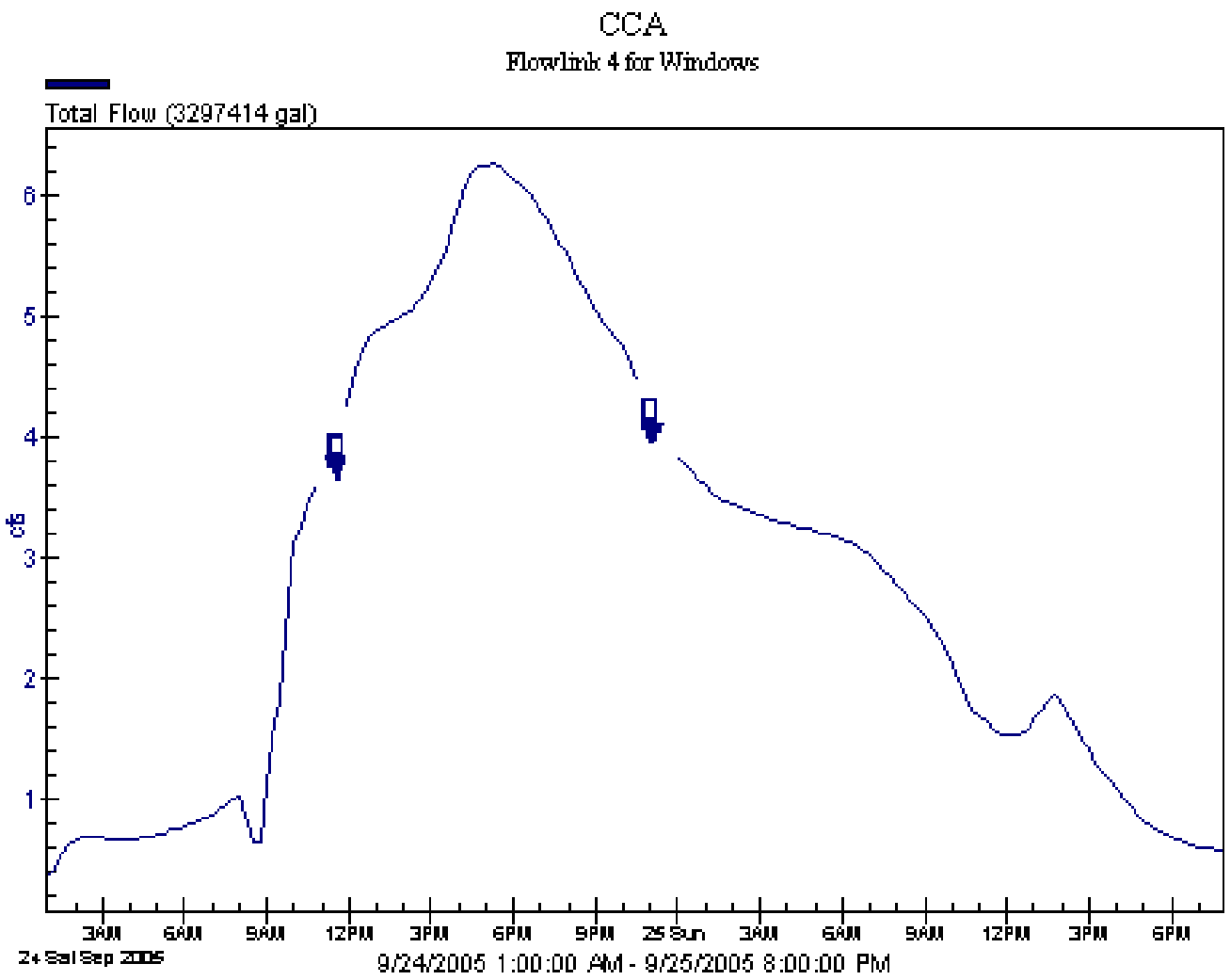
- Flow weighted composite sampling
- ISCO 4230 Bubbler Flowmeter and 3700 Water Sampler
- TSS, TN, TP, Turbidity (sediment and nutrient loading)

Continuous

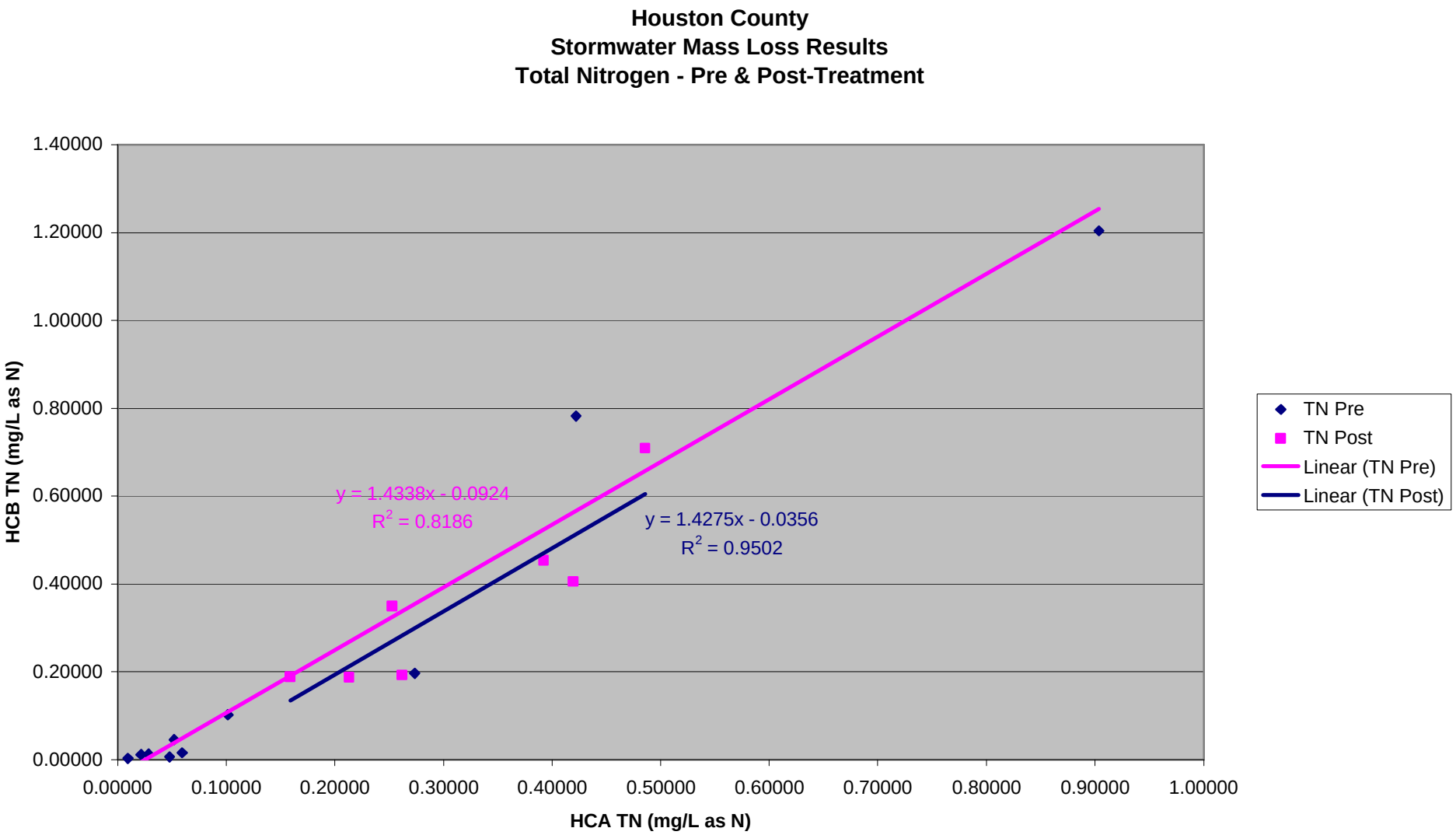
- Continuous logging portable Hydrolabs
- Measures 24 hour averages (DO, pH, temp, cond.)

Stormwater Equipment

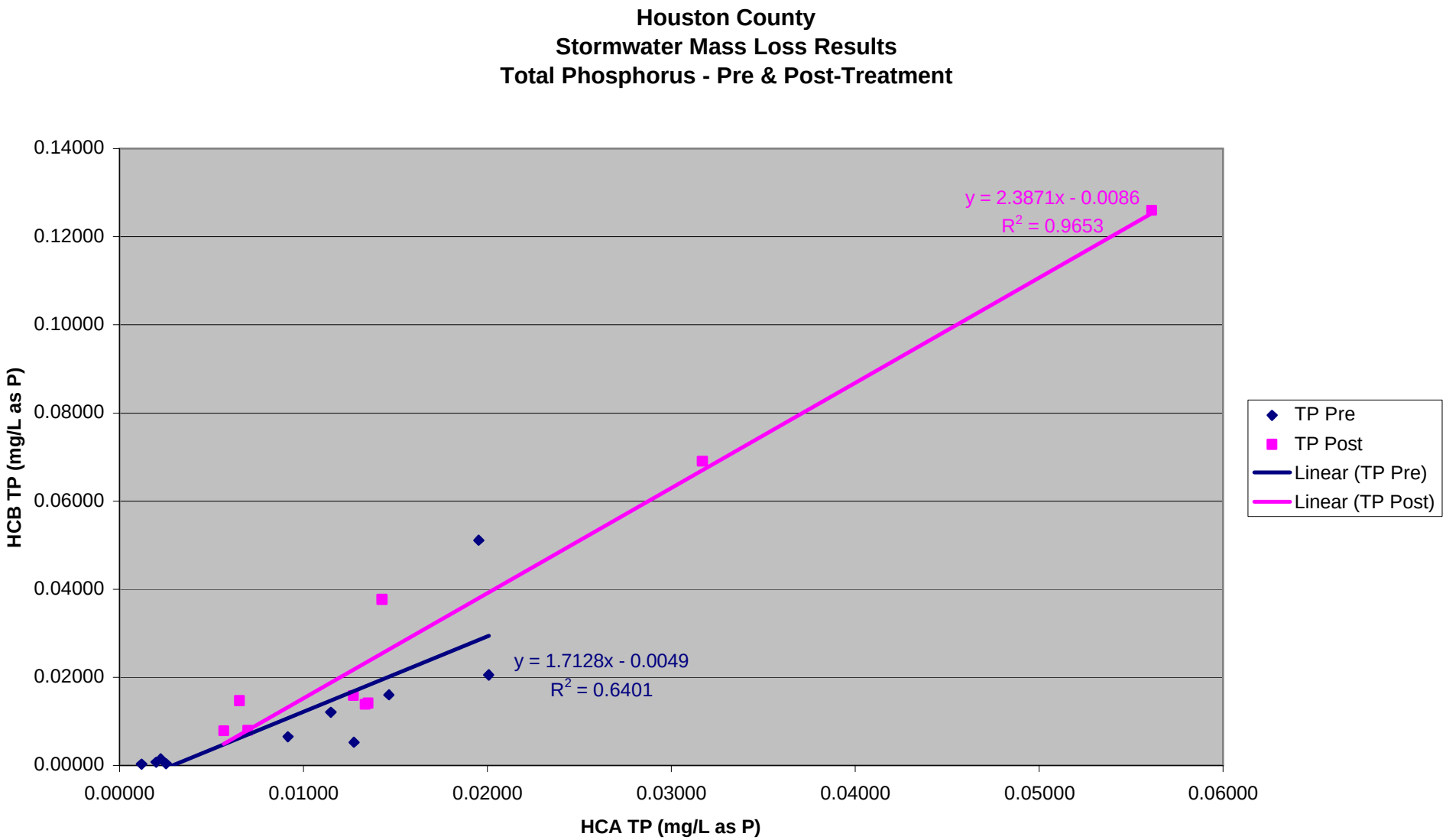
Storm Hydrograph



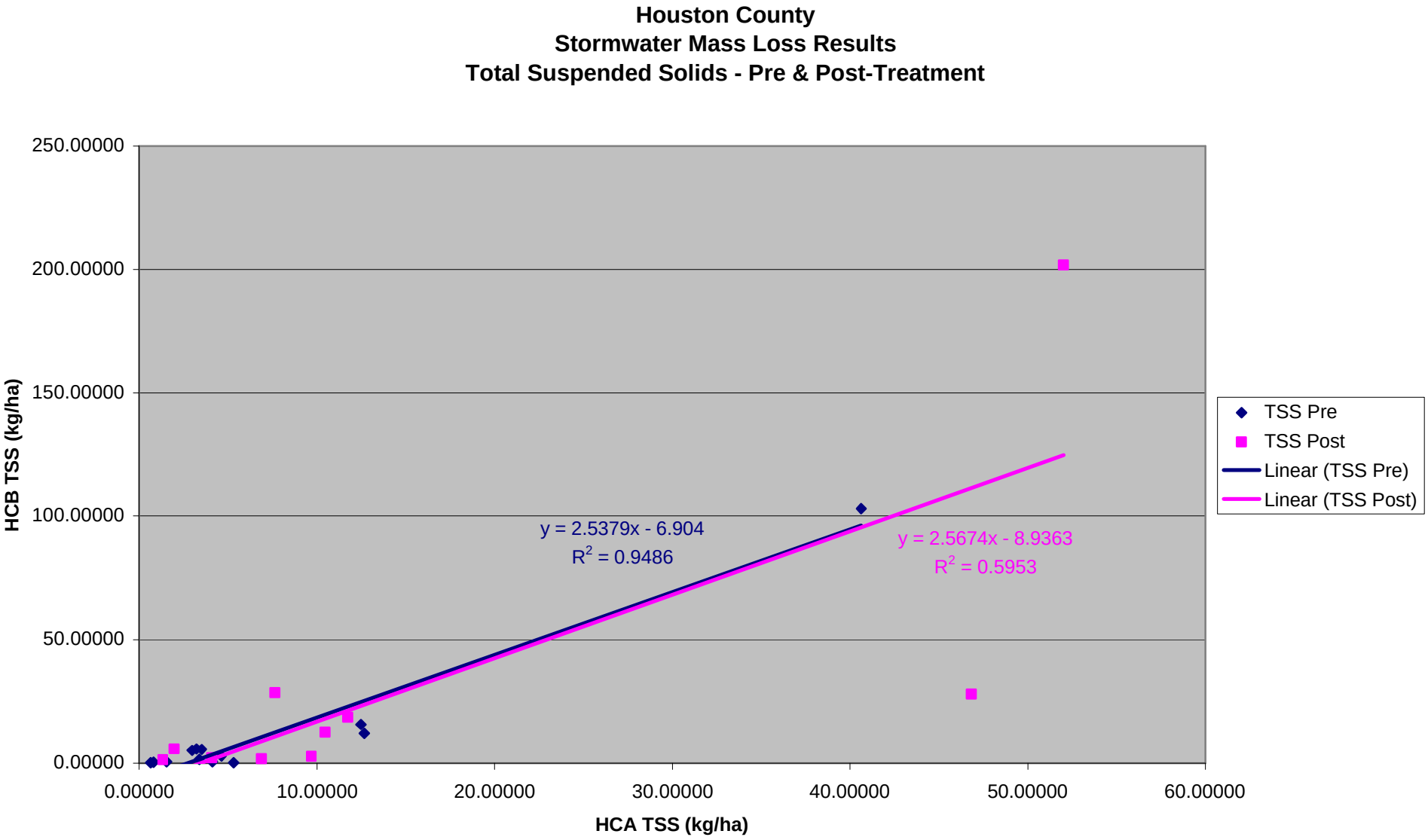
Stormwater Results – Total Nitrogen



Stormwater Results – Total Phosphorous



Stormwater Results – Total Suspended Solids



Physiochemical Results

- Results show very good stream water quality
  - Nutrient concentrations are low or almost undetectable
    (Hurricane Rita had no major effect)
  - TSS is strongly correlated to Turbidity
    (correlation stronger in storm samples)
  - Relatively high dissolved oxygen levels in streams
    (11.0 mg/L in winter, 6.0 mg/L in summer)
  - Temperature and DO are correlated

Preliminary Analysis

Pre Treatment vs. Post Treatment

- Sediment losses are similar before and after treatment
- Nutrient conc. remain low or undetectable after treatment
- No change in stream flow (probably due to drought)
- No change in DO, pH, temperature, conductivity

Conclusion

BMPs, when applied properly, are effective in protecting aquatic biological communities and maintaining pre treatment physiochemical properties, thus protecting water quality