

Real-time Nitrate Analyzers in Southern Louisiana: Lessons Learned

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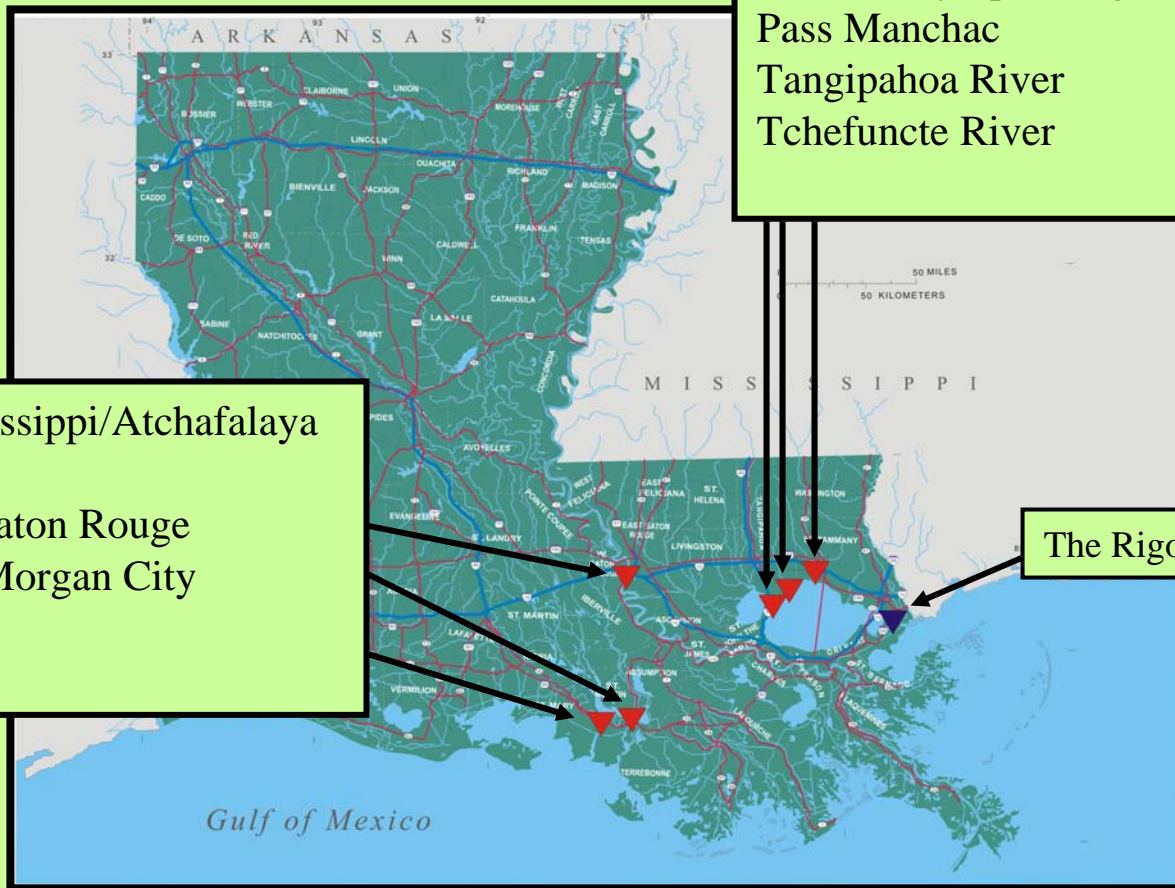
Louisiana Water Science Center
September 18, 2007

Nitrate analyzer network: A team effort in the lab, office, & field

- Kevin Grimsley
- Stan Skrobialowski
- Scott Perrien
- Todd Baumann
- Charlie Patton (NWQL)
- Pete Rogerson
- Industry reps



Site locations



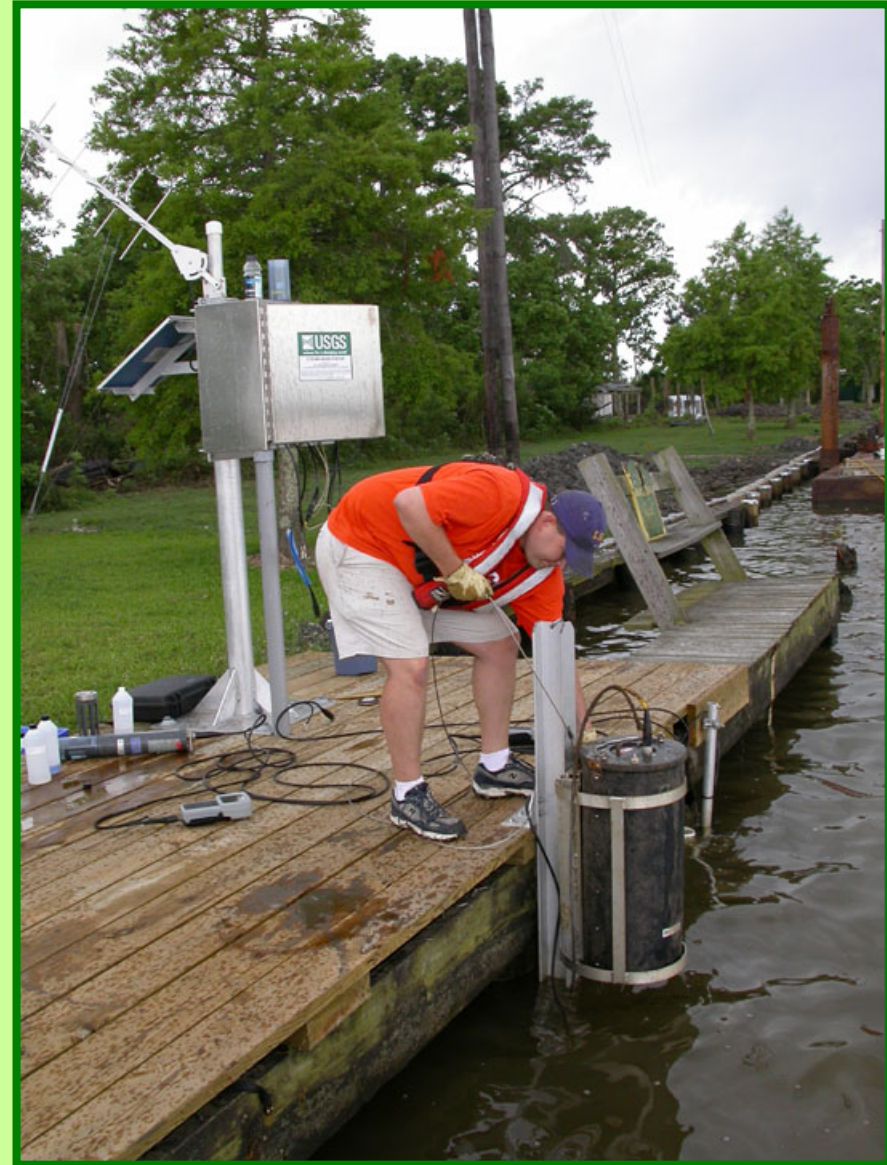
3 sites on the Mississippi/Atchafalaya system:
Mississippi R. at Baton Rouge
Atchafalaya R. at Morgan City
Wax Lake Outlet

4 sites in the Lake Pontchartrain basin
(3 currently operating for nitrate)
Pass Manchac
Tangipahoa River
Tchefuncte River

The Rigolets

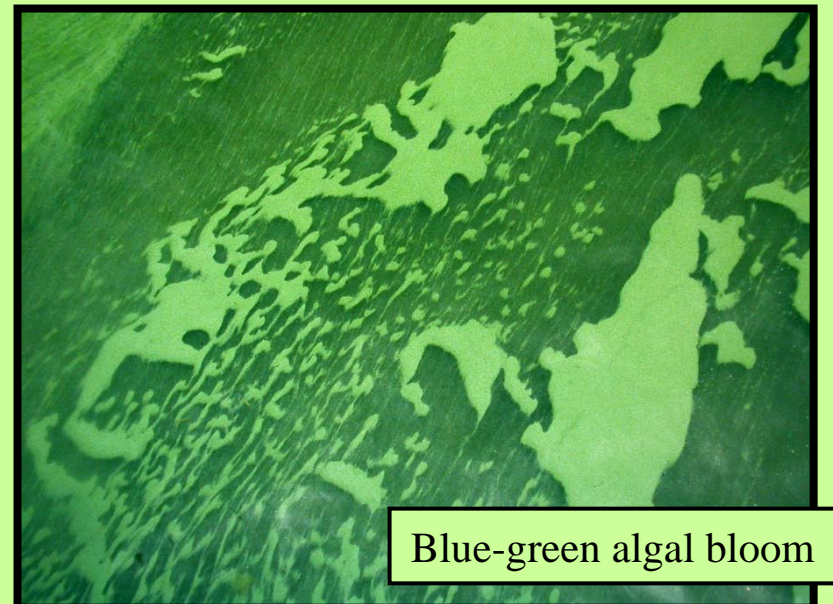
Objective

- Determine concentrations & loads of nitrate
 - Realtime, accessible to many users
 - On-site Acoustic-Doppler flow instrumentation allows direct calculation of loads in tidally affected systems
 - Site also transmits D.O., water temp, salinity, sp. cond. pH, & turbidity info



Applications

- Watershed assessments on multiple scales, from hypoxia in the Gulf of Mexico to flashy urban streams
- Assessment of BMPs
- Model calibration/verification
- Eutrophication/Nutrient budgets



Nitrate Analyzer Specifications

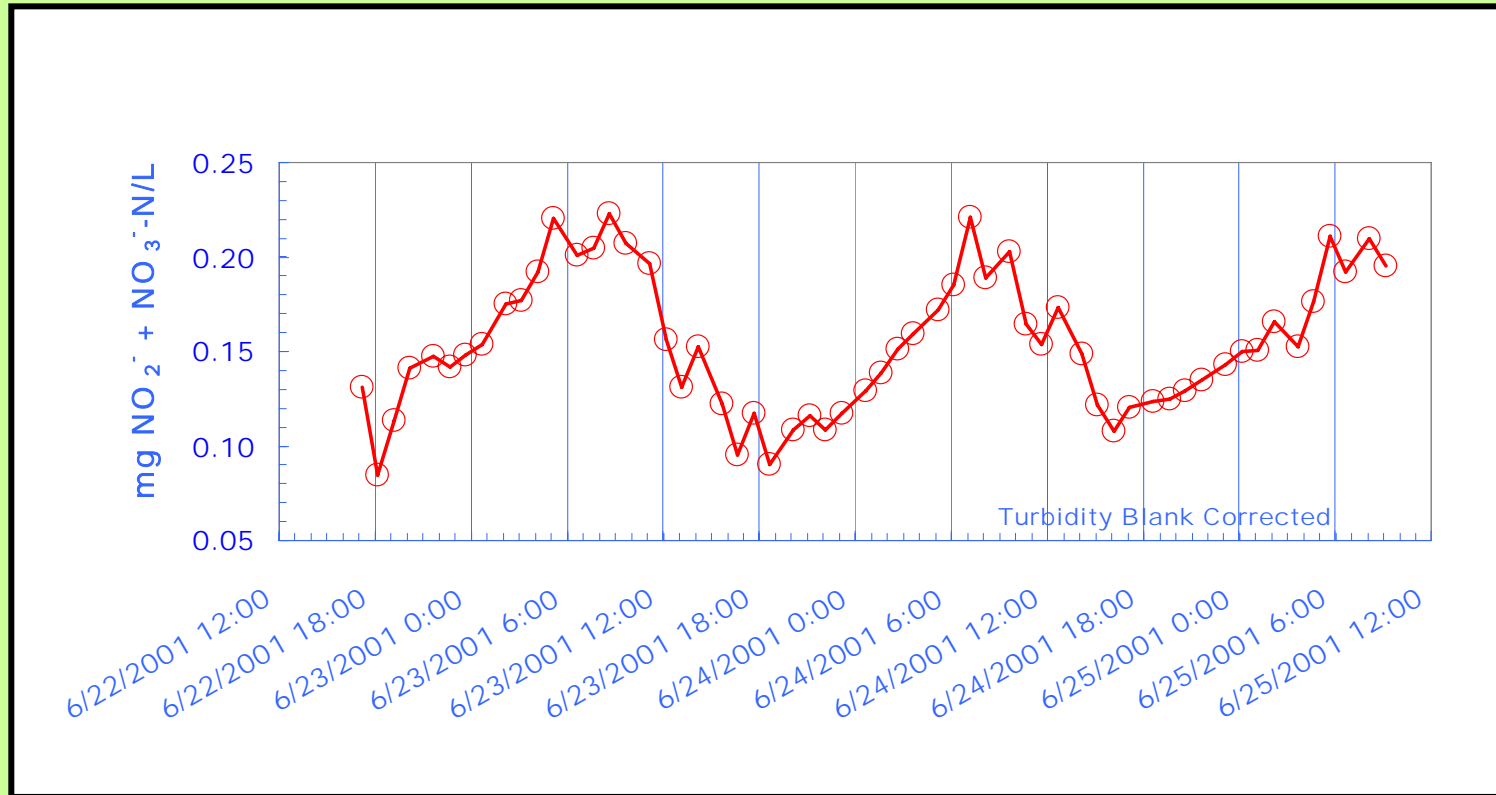
- Wet chemistry (cadmium reduction/colorimetry), not ion-selective probe
- Automatic calibration with internal standard every 12 hrs
- Interfaces with USGS hardware & software for real-time data transmission
- Collects cadmium waste

Analyzer with protective cover removed



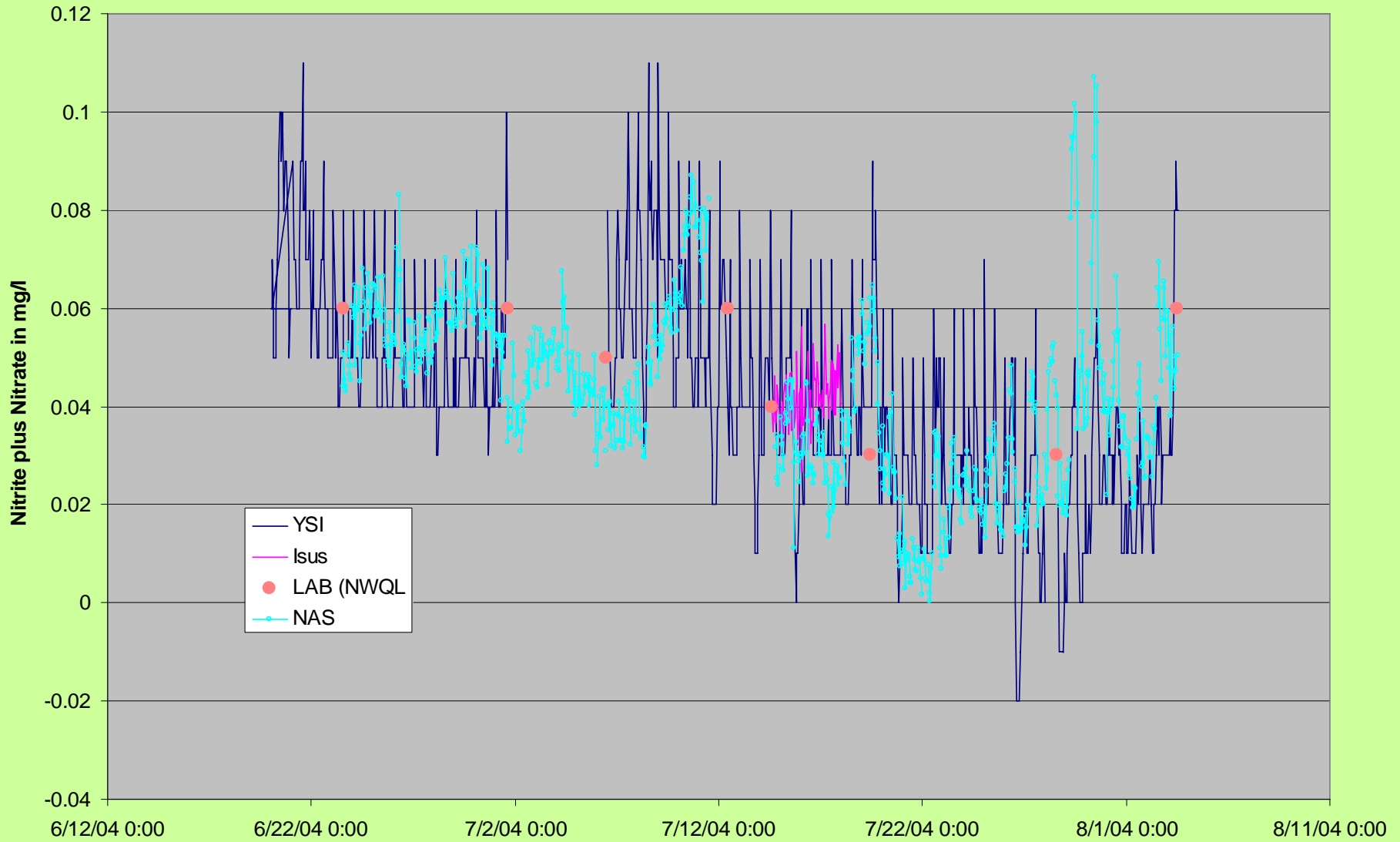
Waste bags

2001-2002: Steep learning curve



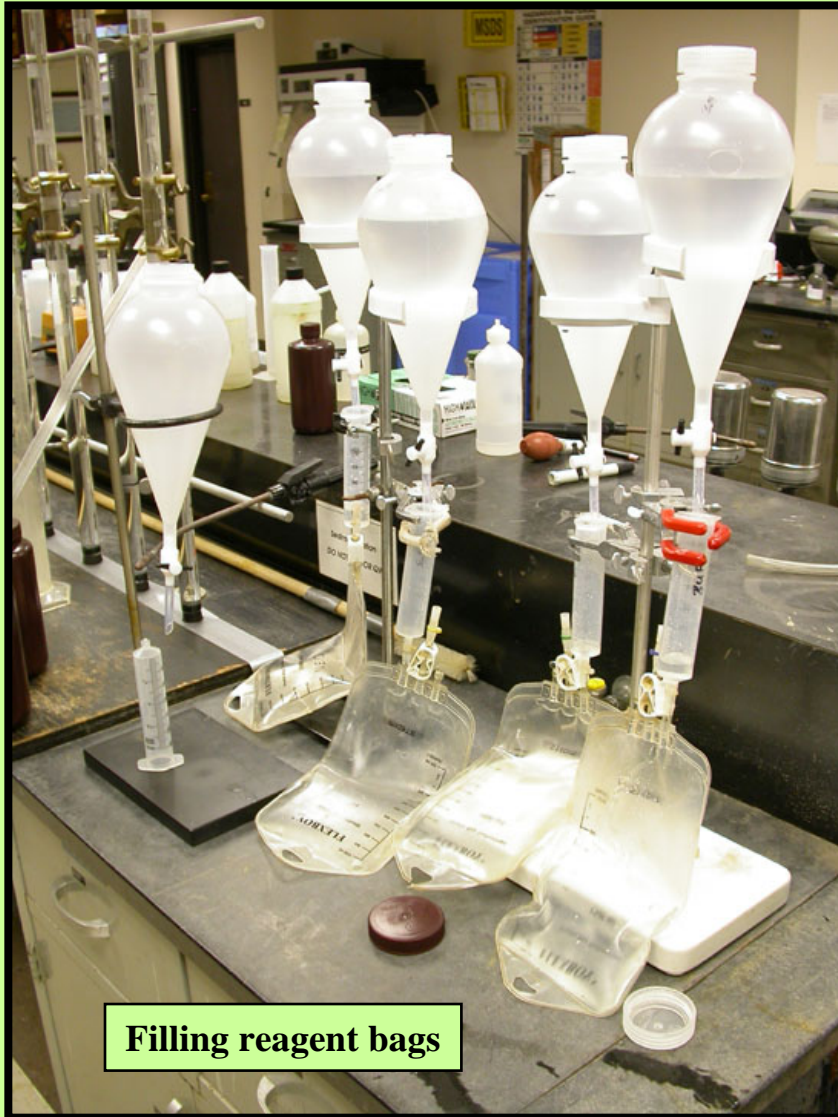
Nitrate analyzer (NAS) Field Test
Clear Creek, CO 6/22-6/25/01

Nitrite plus Nitrate at Pass Manchac Louisiana, from Monitors and NWQL



Monitor preparation:

Reagents are prepared in the office



Filling reagent bags



Predeployment test

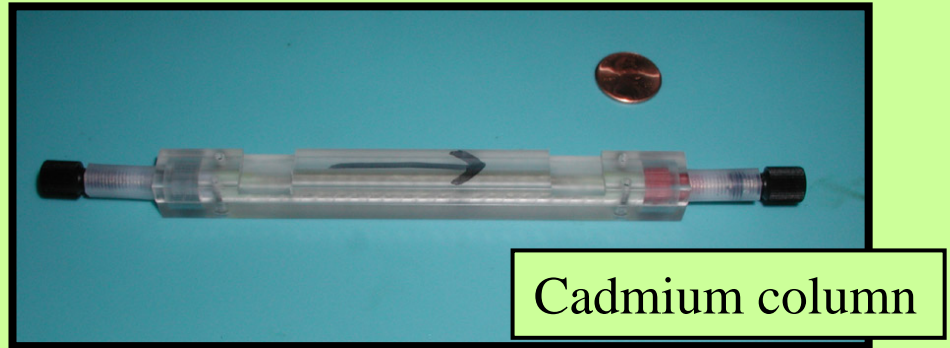
Routine operation

- Site visit scheduled for every 4 weeks: analyzer can run 2 months with readings every 2 hrs.
- QC samples collected
- All probes cleaned & calibrated
- Nitrate monitor cleaned, restocked, and given pre-deployment test
- Cadmium column checked: Usually replaced



Problems

- Hardware: Cadmium column life span typically 2 months. 4 months maximum
- Software: Most of our early site problems involved a failure to communicate



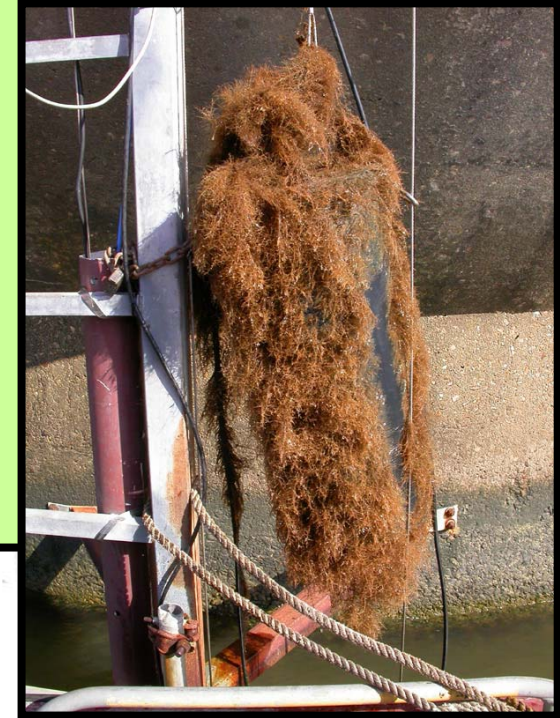
Quality Control/Quality Assurance

- Environmental check samples sent to NWQL
- Nitrate standard check sent to NWQL
- Pre-deployment tests against nitrate standard
- Cleaning & maintenance of cadmium column
- Public web-accessed data are marked “Provisional”



Biofouling

Fouling is typically worse in estuarine systems



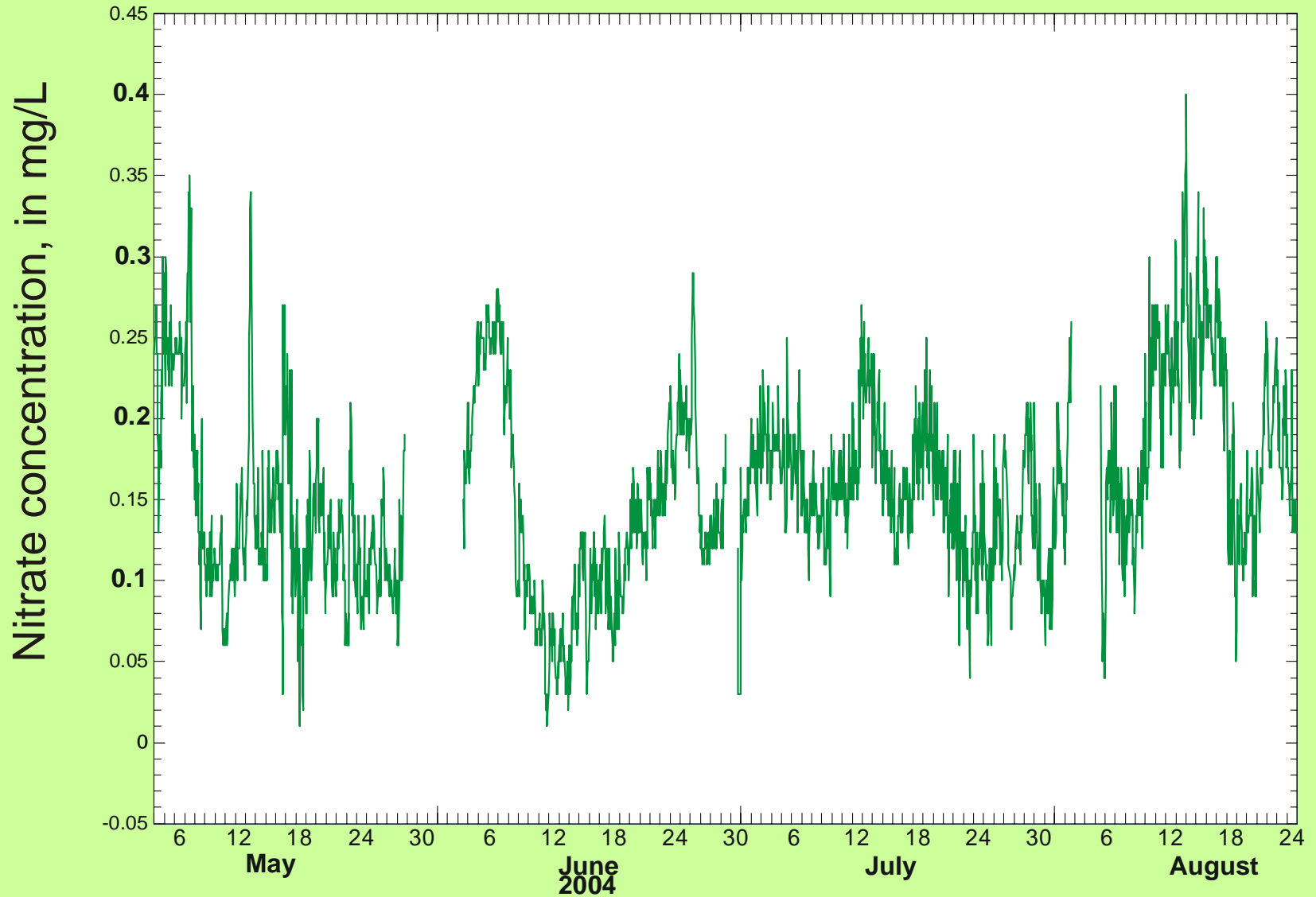
Bryozoans growing on water-quality probes

Tchefuncte River at Madisonville



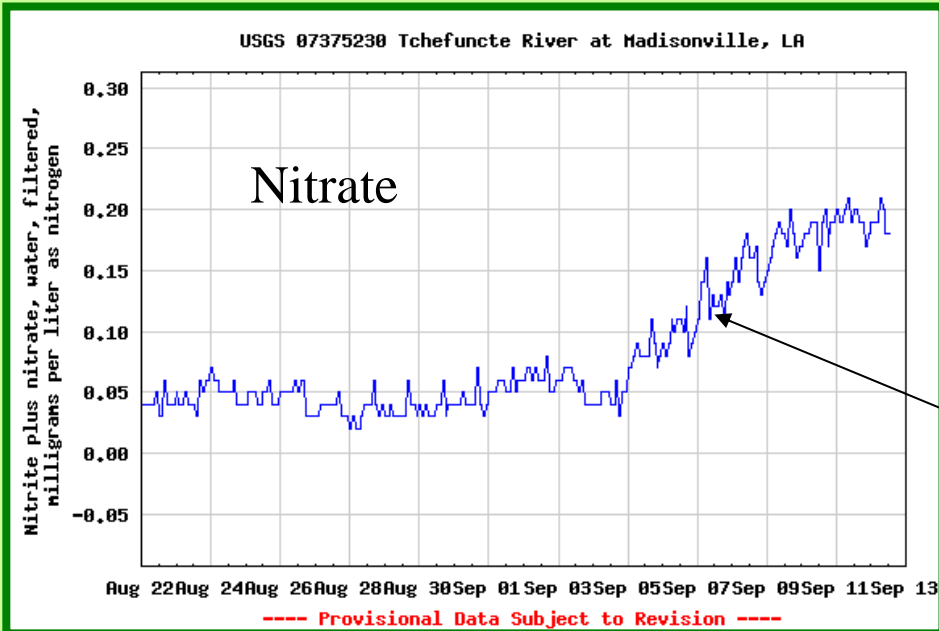
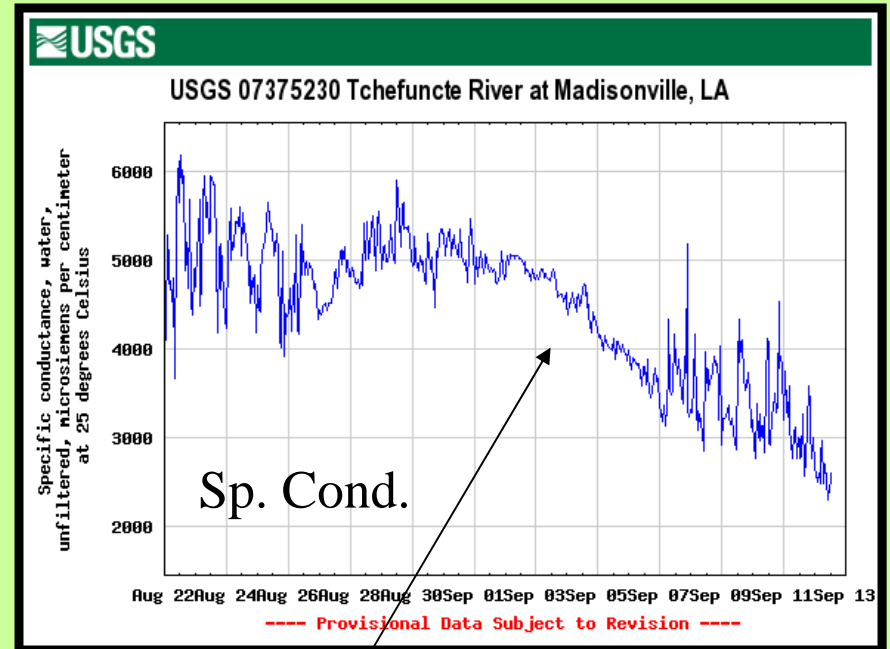
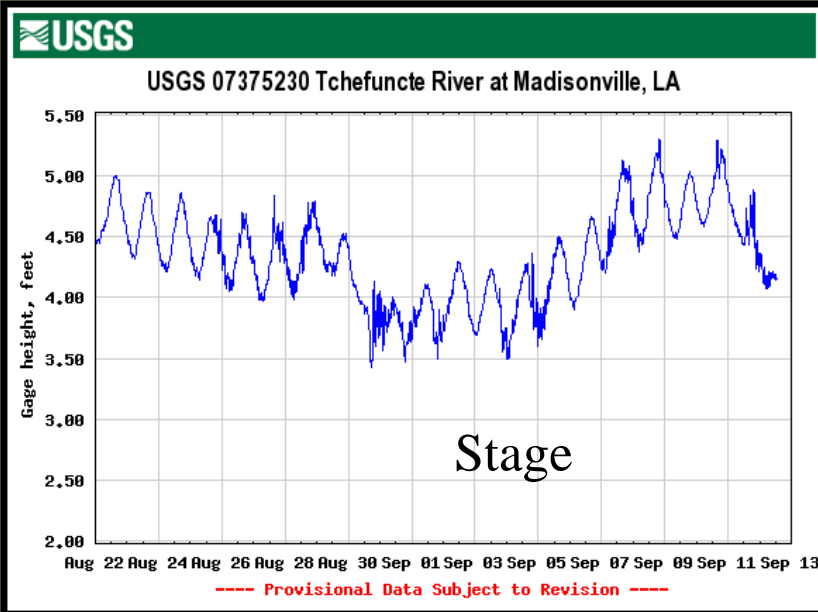
Water velocities typically less than 1 ft/sec

Tchefuncte River at Madisonville, May-August 2004



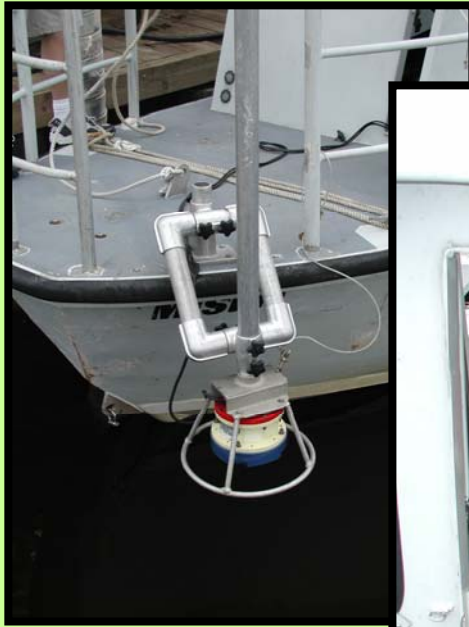
Tchefuncte R: 8/22 - 9/12/07

Comparison with other
QW parameters greatly
assists in NO3 interpretation



Sp. Cond drops –
Nitrate rises

Acoustic Doppler discharge measurements

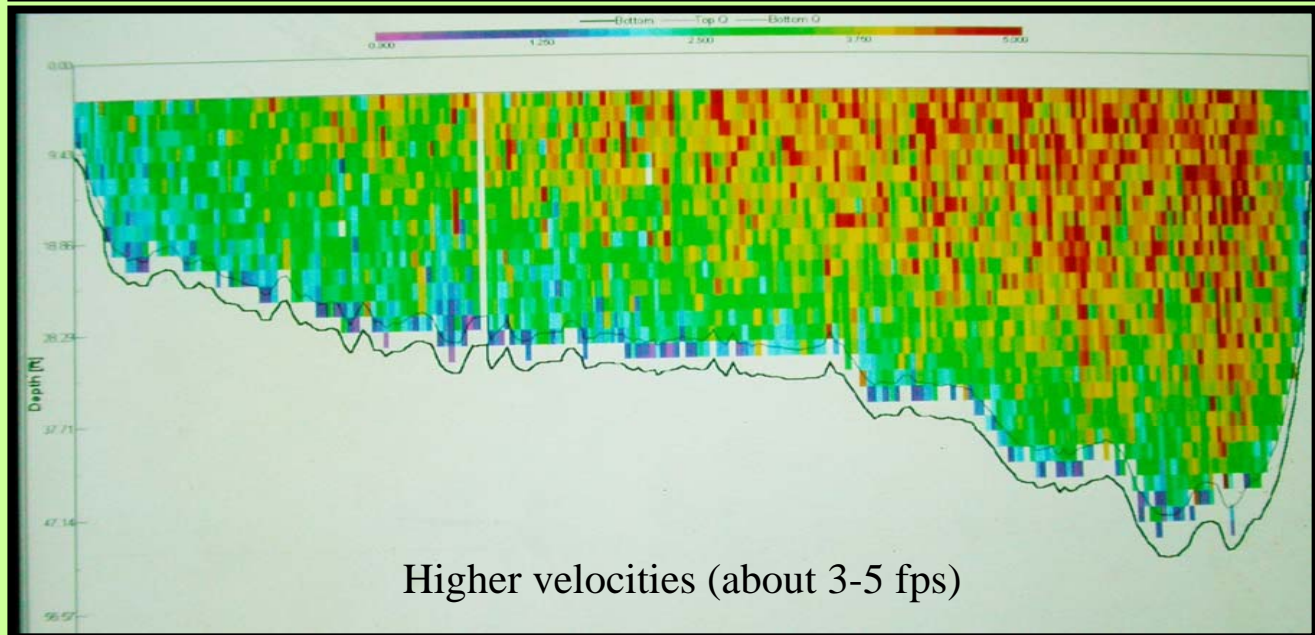
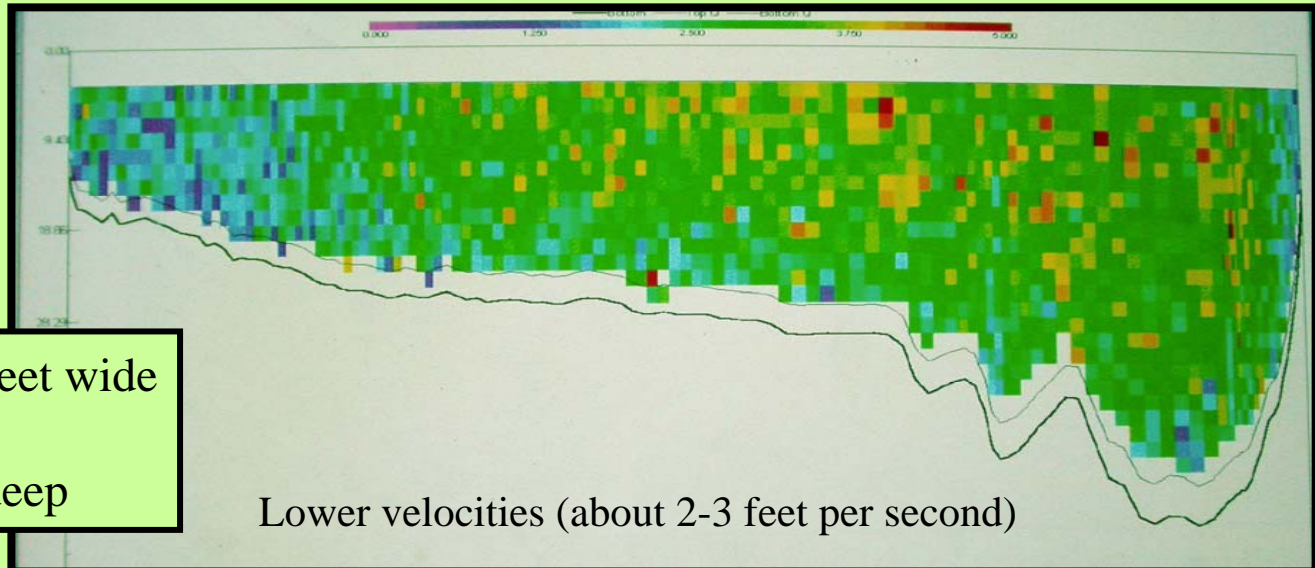


Directional-velocity instruments
Can be installed on-site to enable
accurate discharge
in tidally affected areas

Miss. R. nr. St. Francisville Doppler velocity profiles

Approx. 3500 feet wide

About 40 feet deep

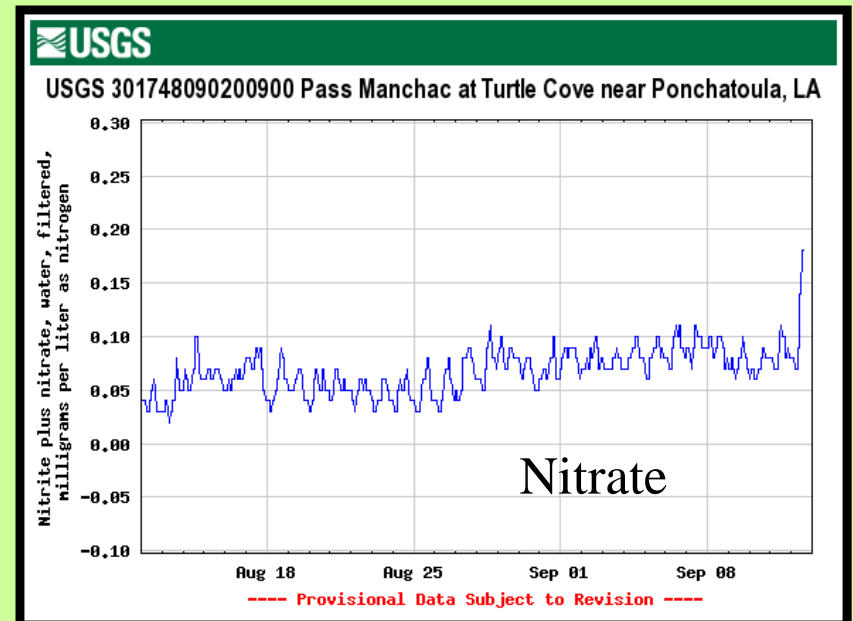
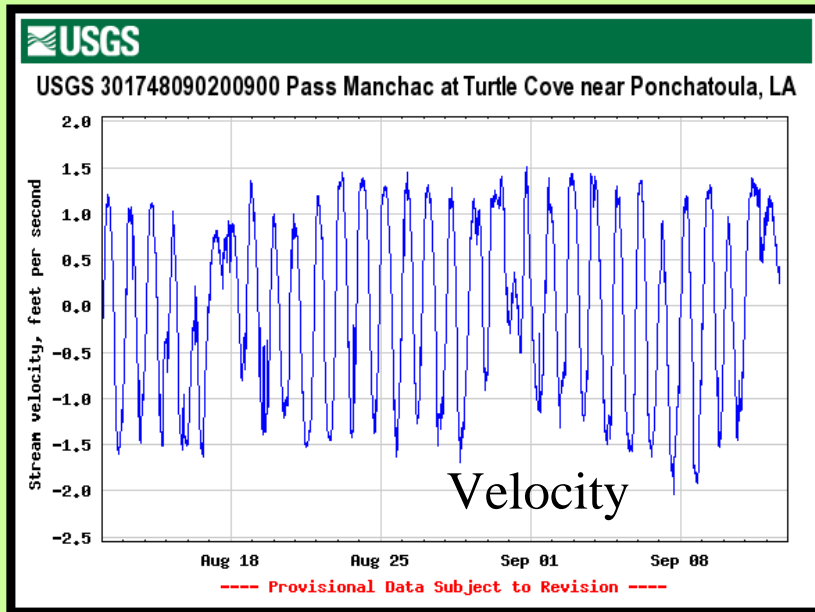
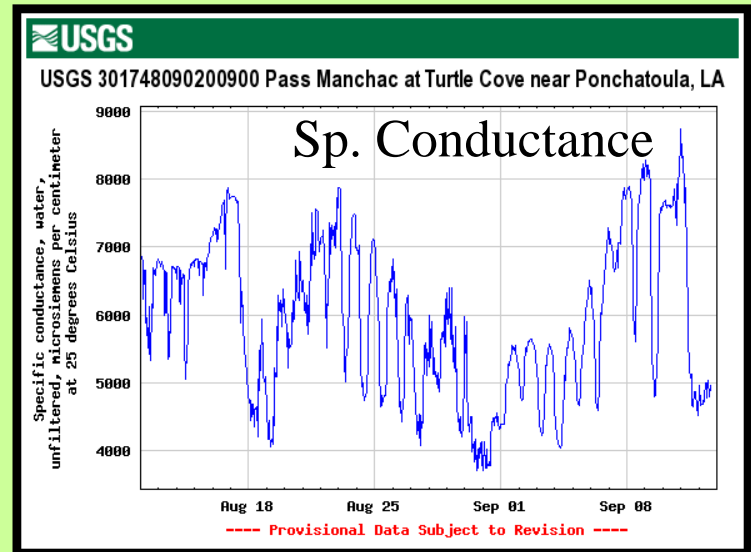
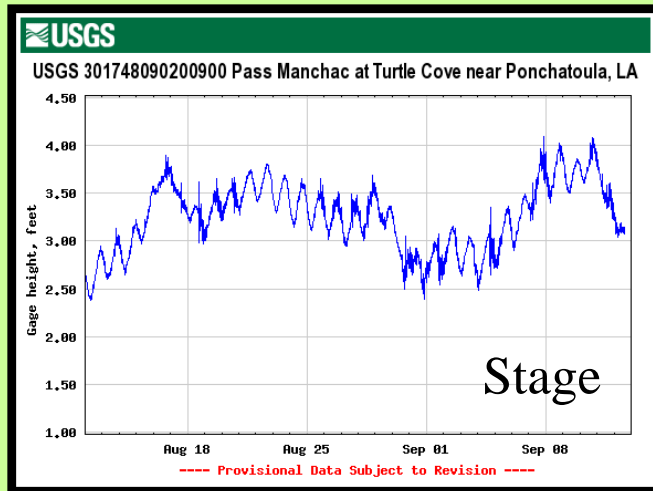


Pass Manchac



Retrieved monitor
showing partially-used reagents

Pass Manchac at Turtle Cove, 8/12-9/12/07

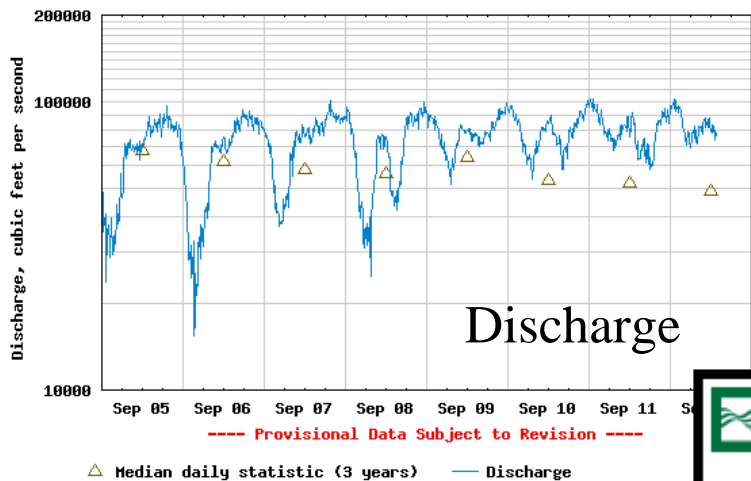


Lower Atchafalaya R. at Morgan City





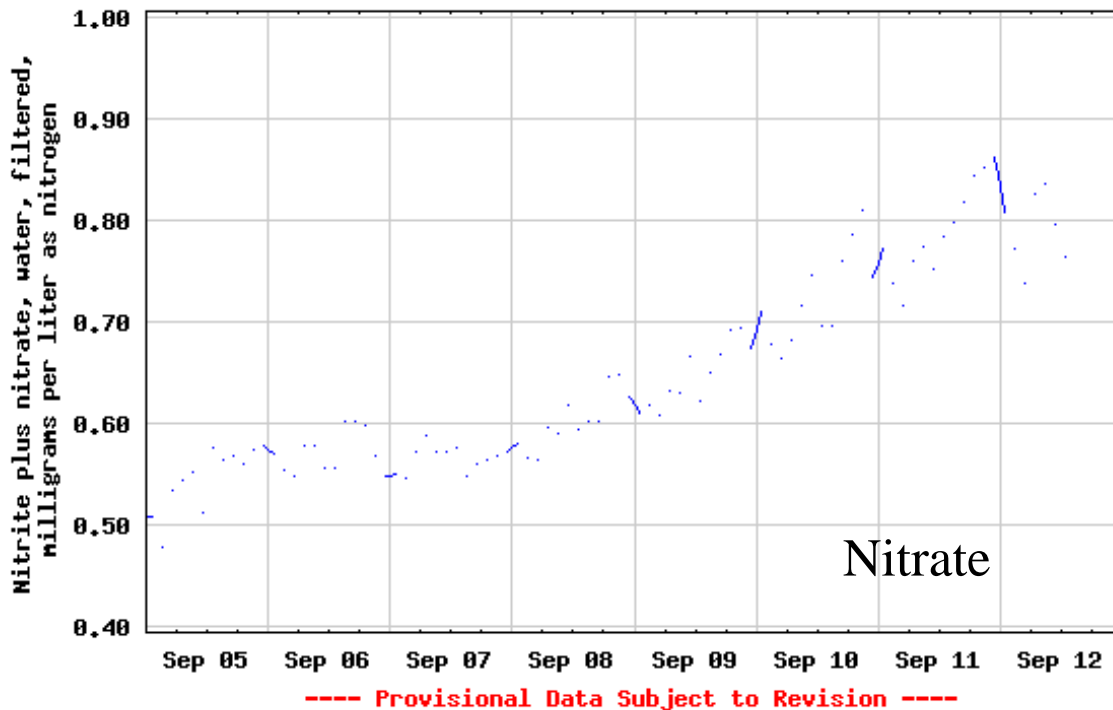
USGS 07381600 Lower Atchafalaya River at Morgan City, LA



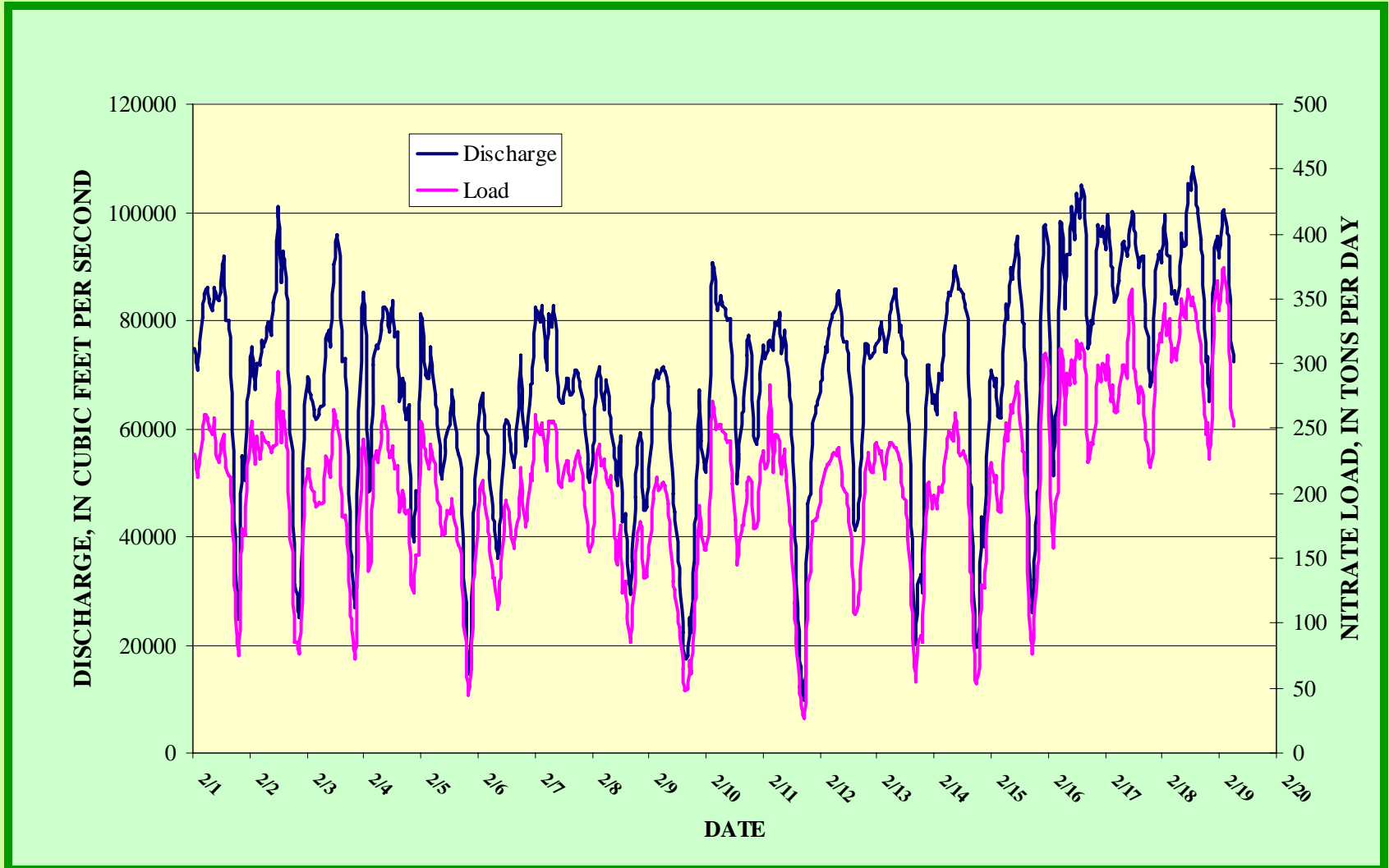
Lower Atchafalaya R.
At Morgan City.
9/05 – 9/12/07



USGS 07381600 Lower Atchafalaya River at Morgan City, LA



Atchafalaya River at Morgan City, Feb. 2003: Nitrate + Discharge = Loads



Miss R. at Baton Rouge

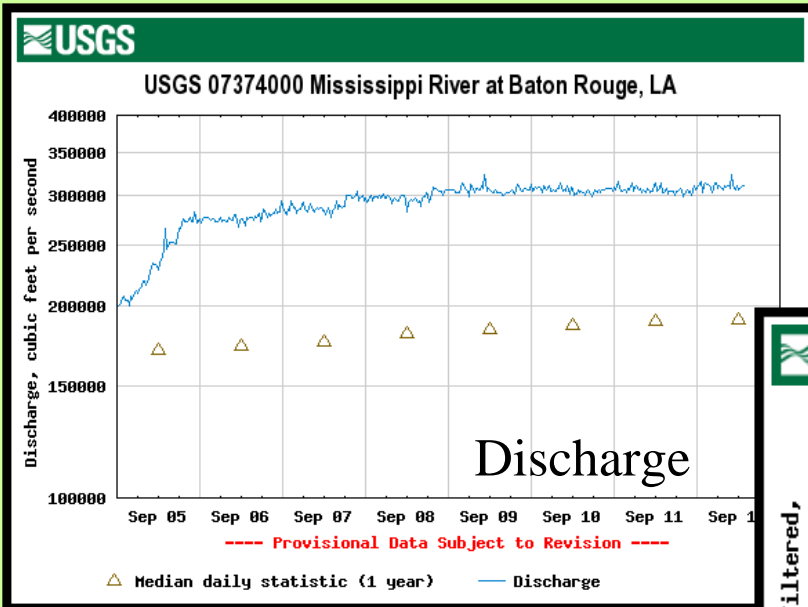


Miss. R. at Baton Rouge

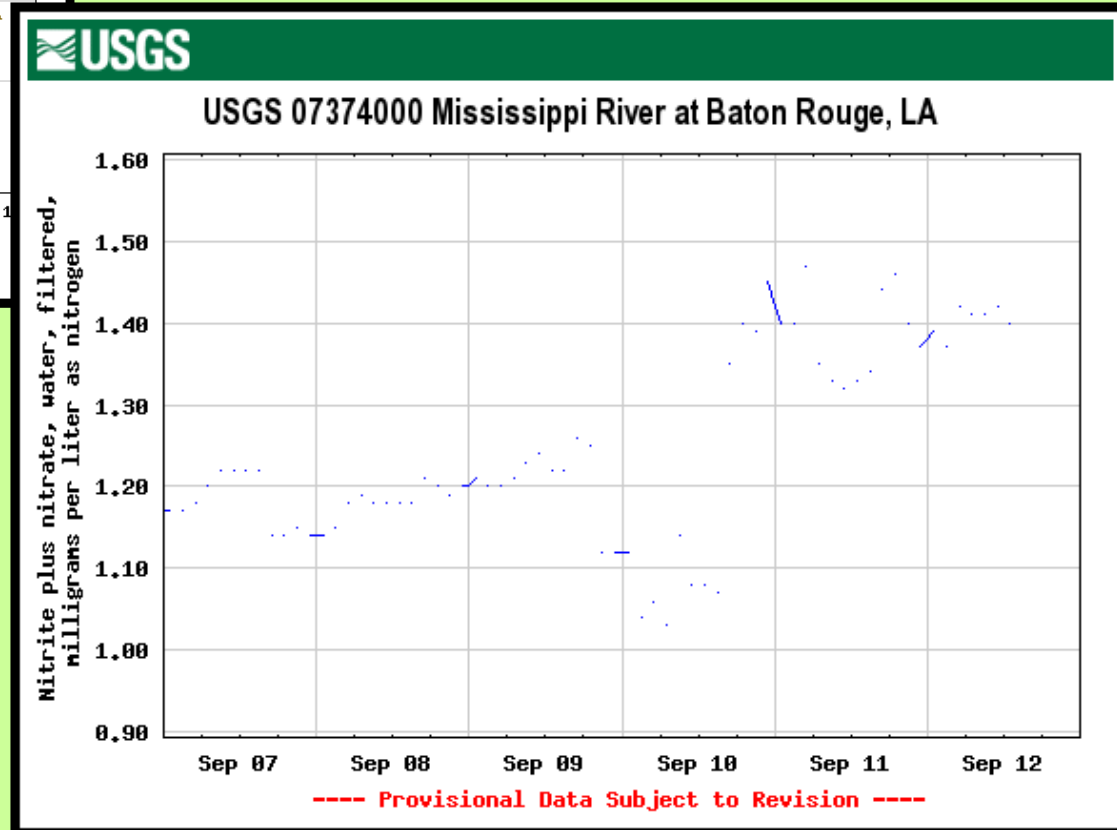


Over 30-ft. annual stage variations are a challenge for continuous monitoring

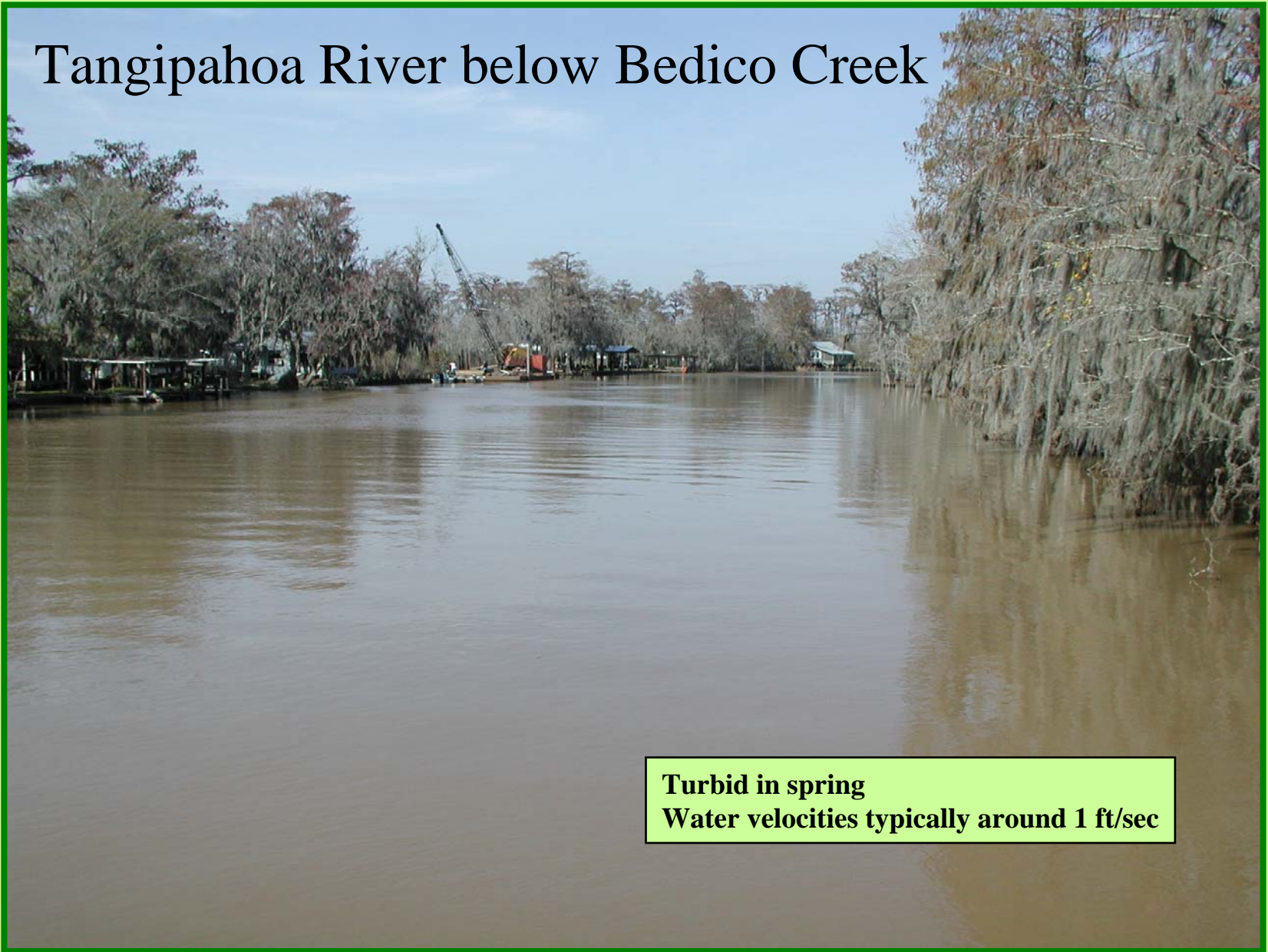
Miss. River at Baton Rouge, 9/07 – 9/12/07



Real-time nitrate loading
can be computed



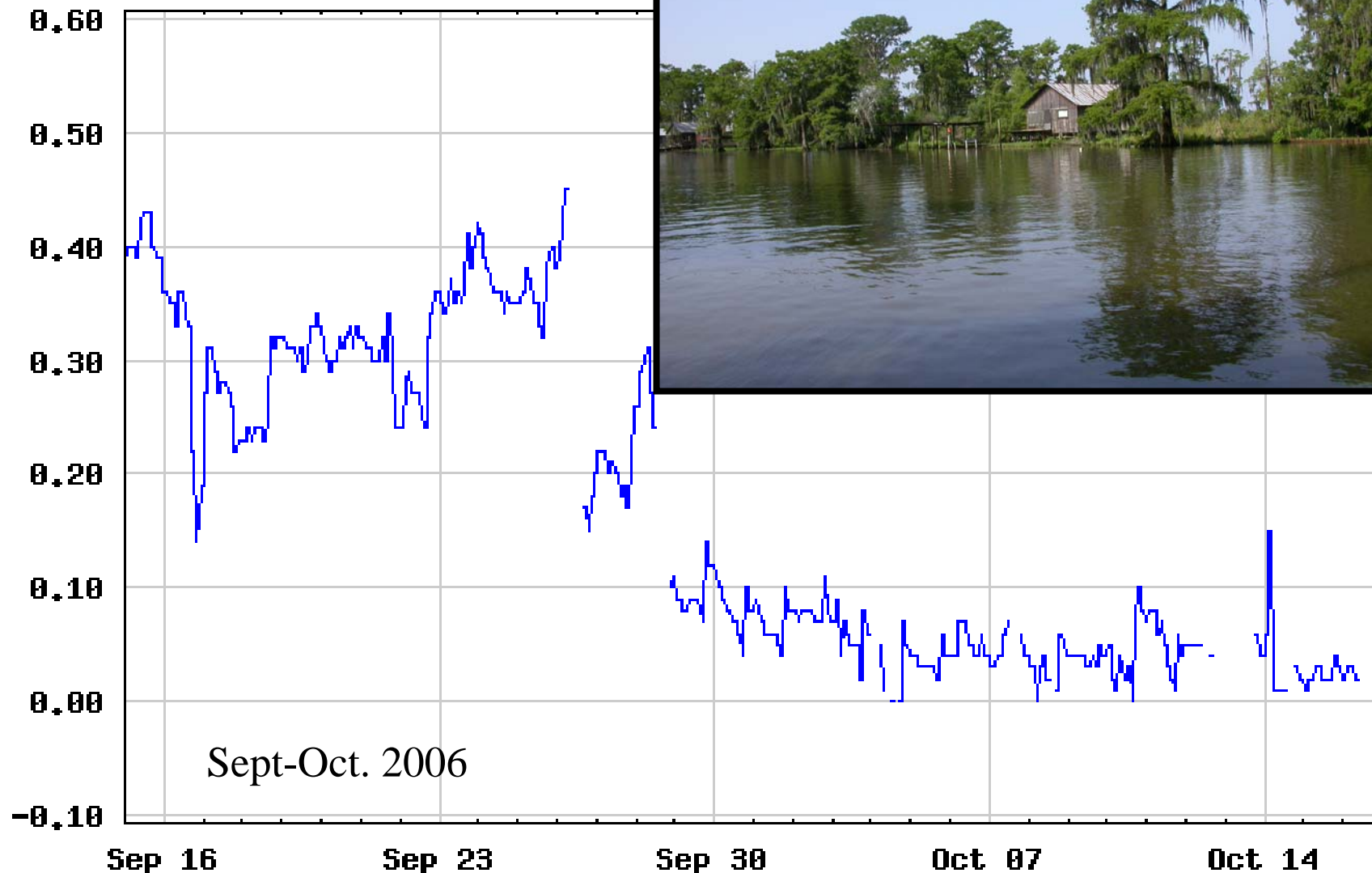
Tangipahoa River below Bedico Creek



Turbid in spring
Water velocities typically around 1 ft/sec

USGS 07375690 Tangipahoa R.

Nitrite plus nitrate, water, filtered,
milligrams per liter as nitrogen



Sept-Oct. 2006

Sep 16




Sep 23

Sep 30

Oct 07

Oct 14

Real time data on the web, as many as 12 parameters. Can display up to the past 31 days-- Graph or table format

Address  http://waterdata.usgs.gov/la/nwis/uv?dd_cd=04&format=gif&period=14&site_no=301748090200900  Go  Links >>

Available Parameters

All 12 parameters available at this site
00065 Gage height (DD 01)
00055 Stream velocity (DD 02)
00010 Temperature, water (DD 03)

Output format

Graph

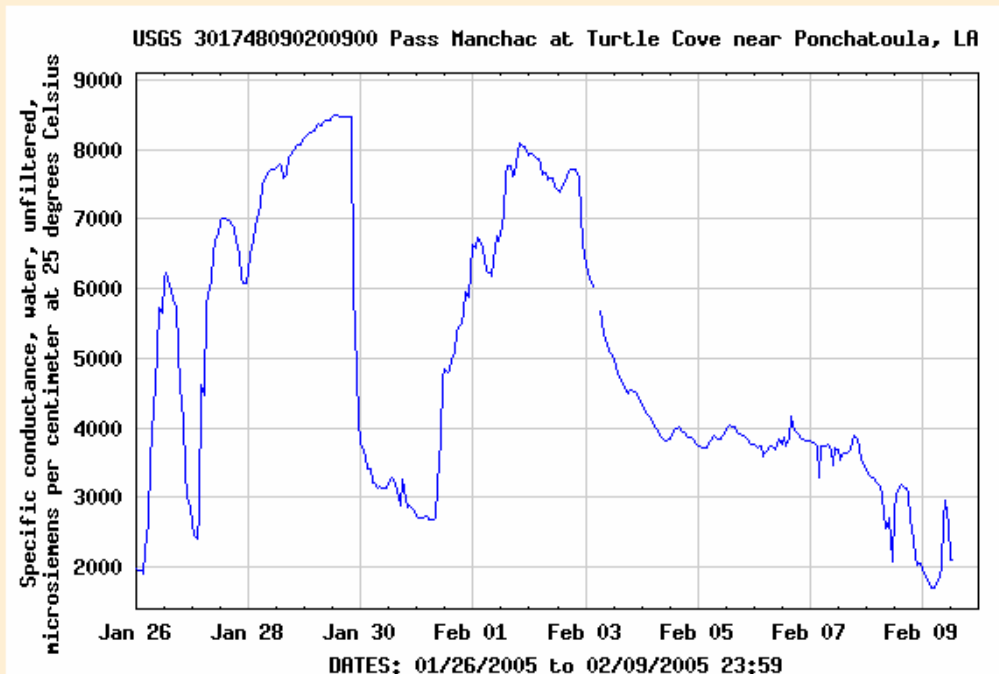
Days

14
(1-31)

get data

Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius

Most recent value: 2,100 02-09-2005 13:00

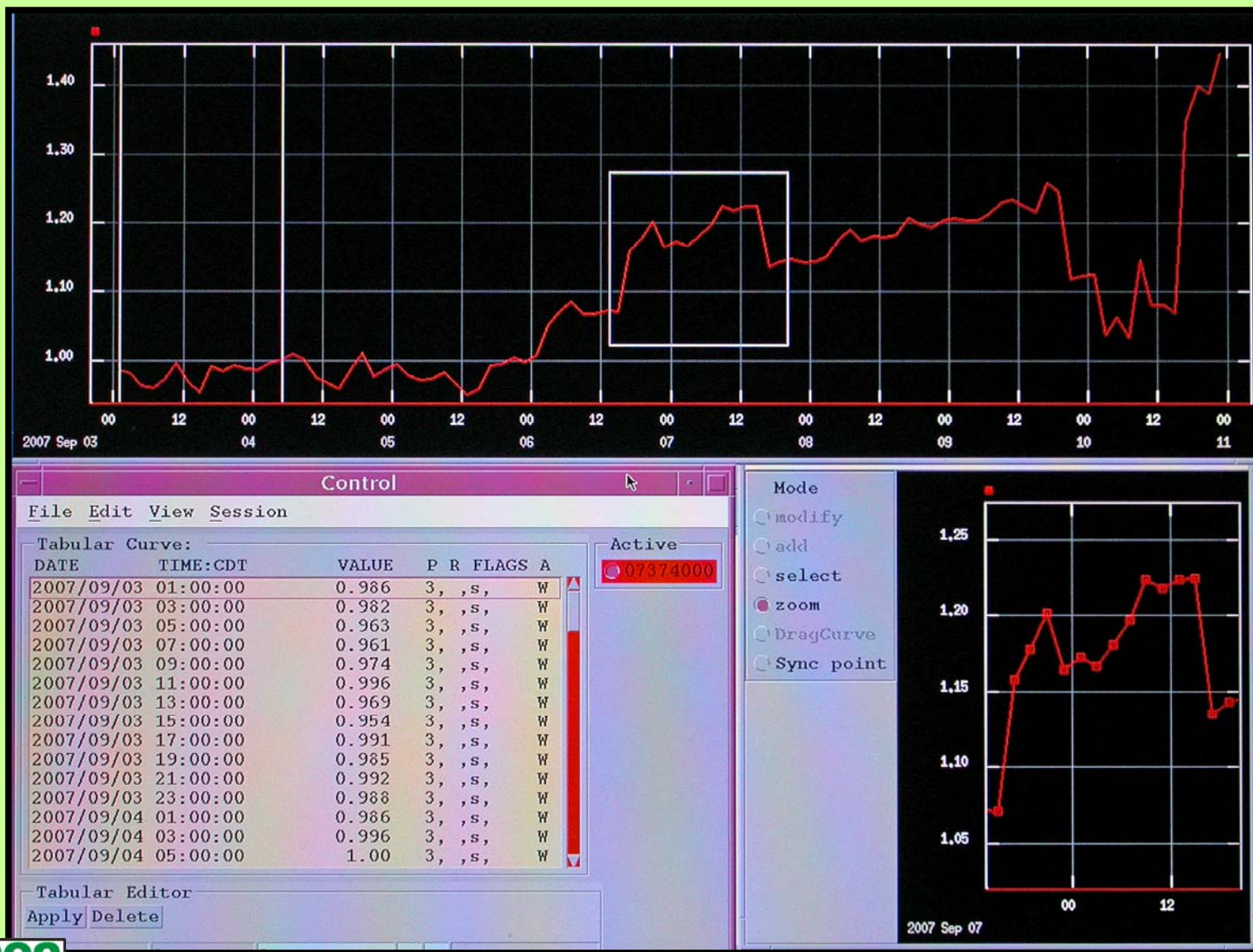


Download a [presentation-quality graph](#)

Parameter Code 00095; DD 04



Data processing: Miss R. at Baton Rouge



To view or print data from USGS La. Water Science Center home page-- graphs or tables:

- Go to the Louisiana Water Science Center homepage
<http://la.water.usgs.gov/>
- Under Hydrologic data, click on Statewide Streamflow Table
 - Scroll down to Lake Pontchartrain Basin
 - Click on:
 - 07375230 Tchefuncte River at Madisonville, LA
 - 07375690 Tangipahoa R. below Bedico Cr. nr Madisonville, LA
 - 301001089442600 Rigolets at Hwy 90 near Slidell, LA
 - 301748090200900 Pass Manchac at Turtle Cove near Ponchatoula, LA
 - - Scroll down to Mississippi-Atchafalaya River Basins
 - Click on:
 - 07374000 Mississippi River at Baton Rouge
 - 07381600 Lower Atchafalaya River at Morgan City
 - 07381590 Wax Lake Outlet at Calumet



Conclusions

- The hardware & software are indeed “Ready for Prime Time,” but a substantial investment in trained personnel, both office & field, should be expected.
- The overall quality of the data is good.
- Deployments greater than 2 years, especially in estuarine systems, take its toll on the hardware.
- The La. Water Science Center achieved its goal to instrument the Mississippi-Atchafalaya system for real-time nitrate loads, but continued operation of the network is uncertain due to lack of long-term funding.

Questions? Comments?

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Pre-deployment test:
Passed!

