

Streamgaging Toward the Future: Continuous Monitoring in the Pee Dee Watershed

Waccamaw Water Quality Data Conference 2016

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Outline

- **What is a Streamgage?**
- **The Future of Streamgages**
- **Interact with Streamgages**
- **Techniques and Methods**
- **Continuous Nitrate Monitoring**
- **Conclusions**



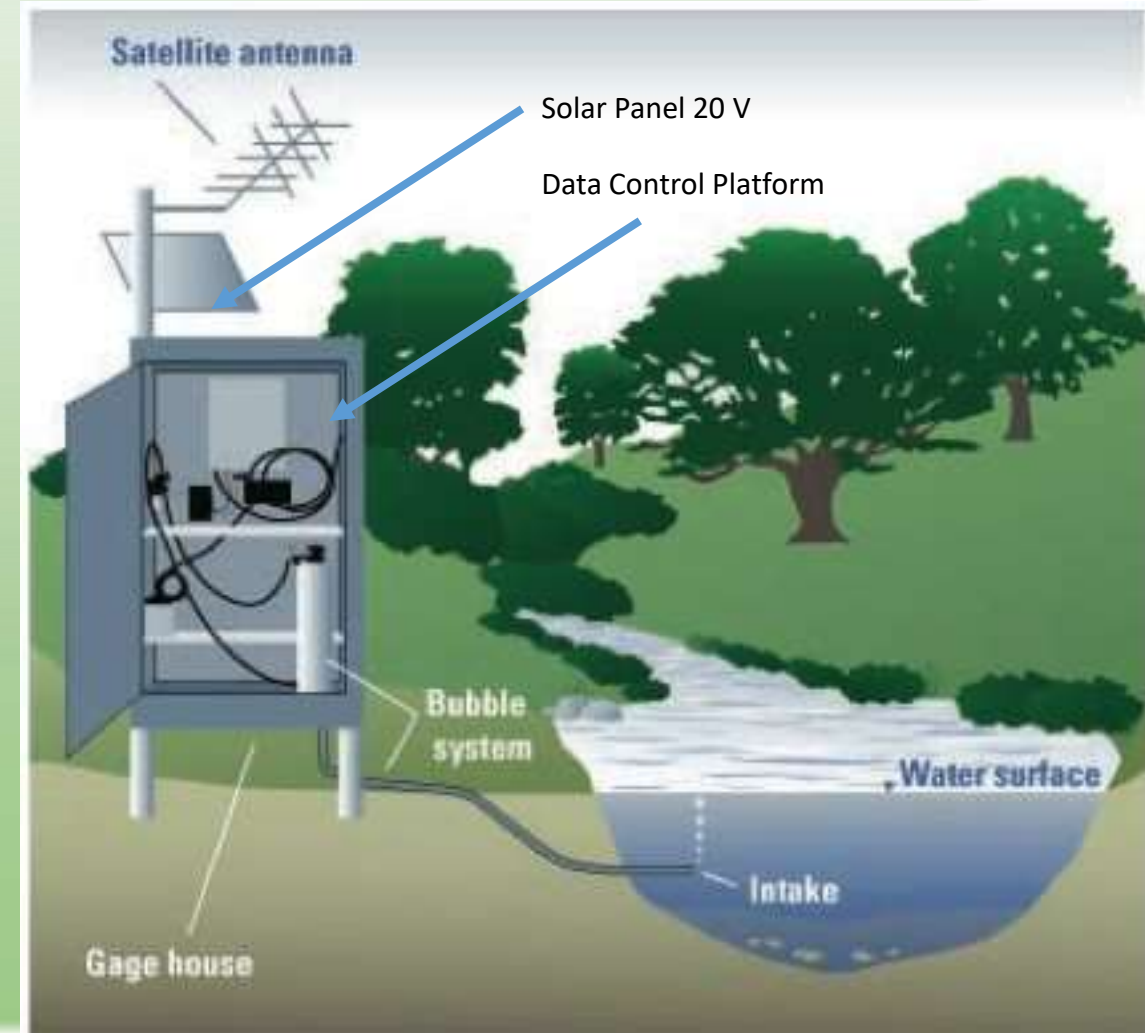
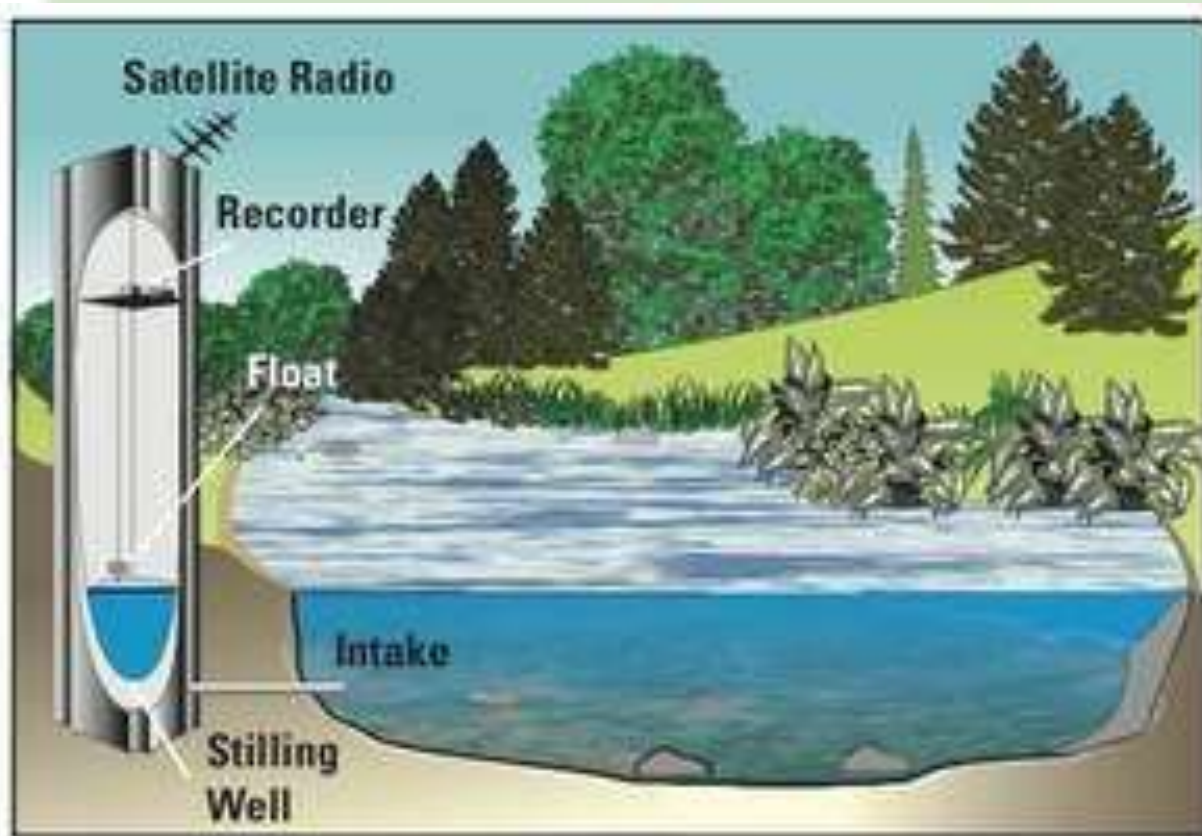
South Atlantic Water Science Center

What is a USGS Streamgage?

A **stream gauge**, **streamgage** or gauging station is a location used by hydrologists or environmental scientists to monitor and test terrestrial bodies of water.

Gage vs Gauge?! –raise your hand

24/7, 365 days of data collection



What is a USGS Streamgage?

Real time data

Streamflow

Water Quality

Meteorological

SW/GW

Examples...



USGS 02171645 REDIV CANAL AT SANTEE RIVER NR ST STEPHEN, SC

The Future of Streamgages: Historic



**USGS
02171500
Santee River
near
Pineville, SC**

The Future of Streamgages: Treehouse



USGS 02135200 Pee Dee River at Bucksport, SC (Waccamaw National Wildlife Refuge)

The Future of Streamgages: Rivercam

**Rocky Branch @
Whaley St.
Columbia, SC
(02169506)**

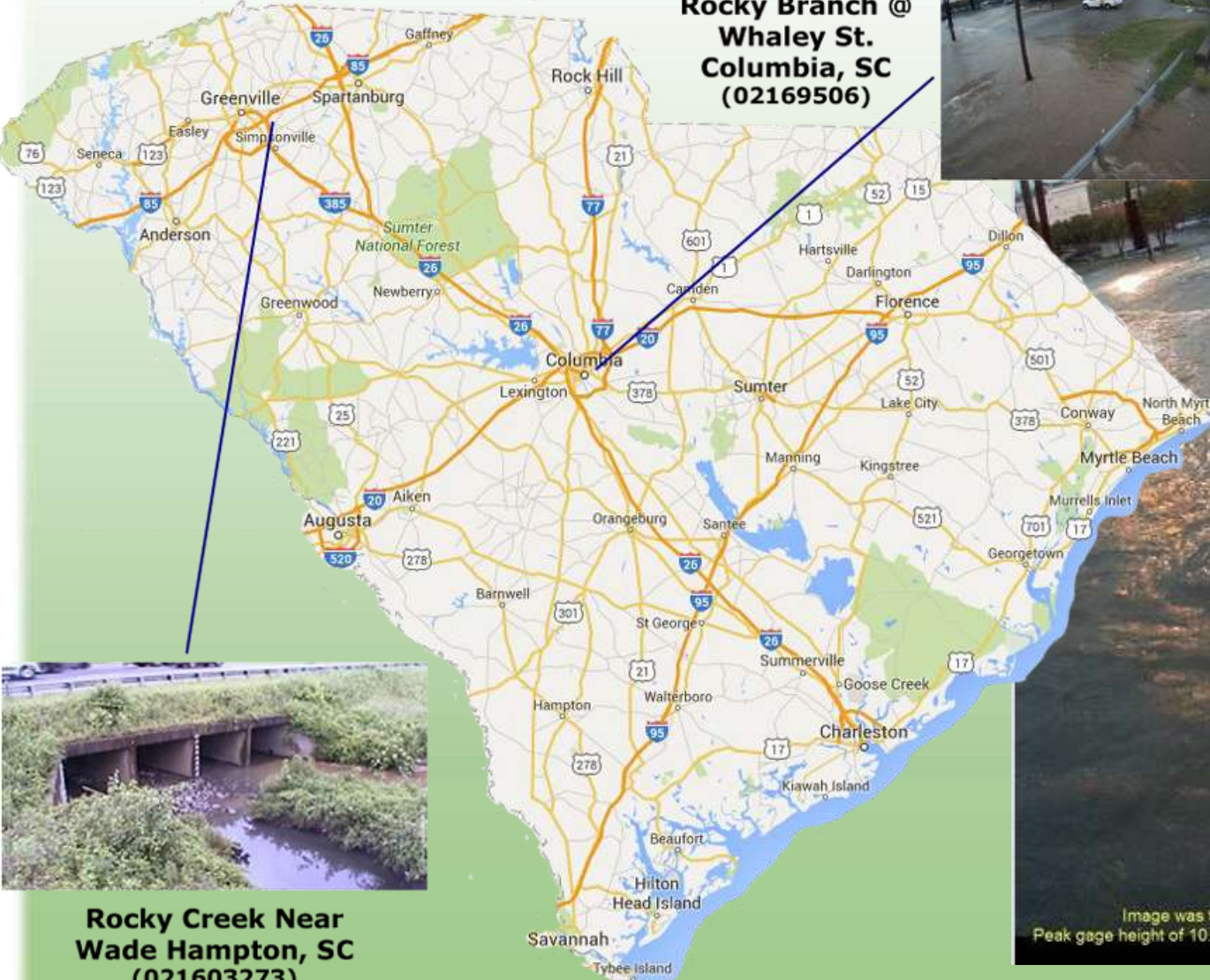


Image was taken at 18:20 EST.
Peak gage height of 10.74 feet occurred at 18:45 EST.



**Rocky Creek Near
Wade Hampton, SC
(021603273)**

USGS 02169506 ROCKY BRANCH @ WHALEY ST. AT COLUMBIA, SC

The Future of Streamgages: Fish Tracking



Tagged Fish at Streamgage 02169625 (Congaree National Park)

* Hover over the graph points to see fish quantity and time interval

* To see more detail of a specific time period, click and drag mouse over desired graph times (double click graph to reset time frame)

USGS 02169625 CONGAREE RIVER AT CONGAREE NP NEAR GADSDEN, SC

The Future of Streamgages: Continuous Nitrate



USGS 02110500 Waccamaw River near Longs, SC

Interact with Streamgages

WaterAlert



"Have Your River Text U!"
Threshold Alerting System



WaterNow

"Text Your River" LOL
On Demand Information

Interact with Streamgages WaterAlert

- 1) Go to water.usgs.gov/wateralert
- 2) Select State and Data Type
- 3) Click on the site for current data and subscription
- 4) Fill out subscription form
- 5) Reply to a one time confirmation email
- 6) Congratulations!!

WaterAlert 02110400 155 cfs, 'BUCK CREEK NEAR LONGS, SC'



USGS WaterAlert <wateralert@usgs.gov>

to me

Streamflow of 155 cfs exceeds subscriber threshold of 150 at 2016-10-18 05:15:00 EST
02110400 00060 BUCK CREEK NEAR LONGS, SC
Notification interval, no more often than: Daily

For Realtime Data at this station:

http://waterdata.usgs.gov/nwis/uv/?site_no=02110400

For Subscription Help:

<http://water.usgs.gov/hns?cxtfd:02110400>

To Sign up for New Notifications:

<http://water.usgs.gov/wateralert>

Get the latest data from your mobile phone or email:

Text 02110400 to WaterNow@usgs.gov

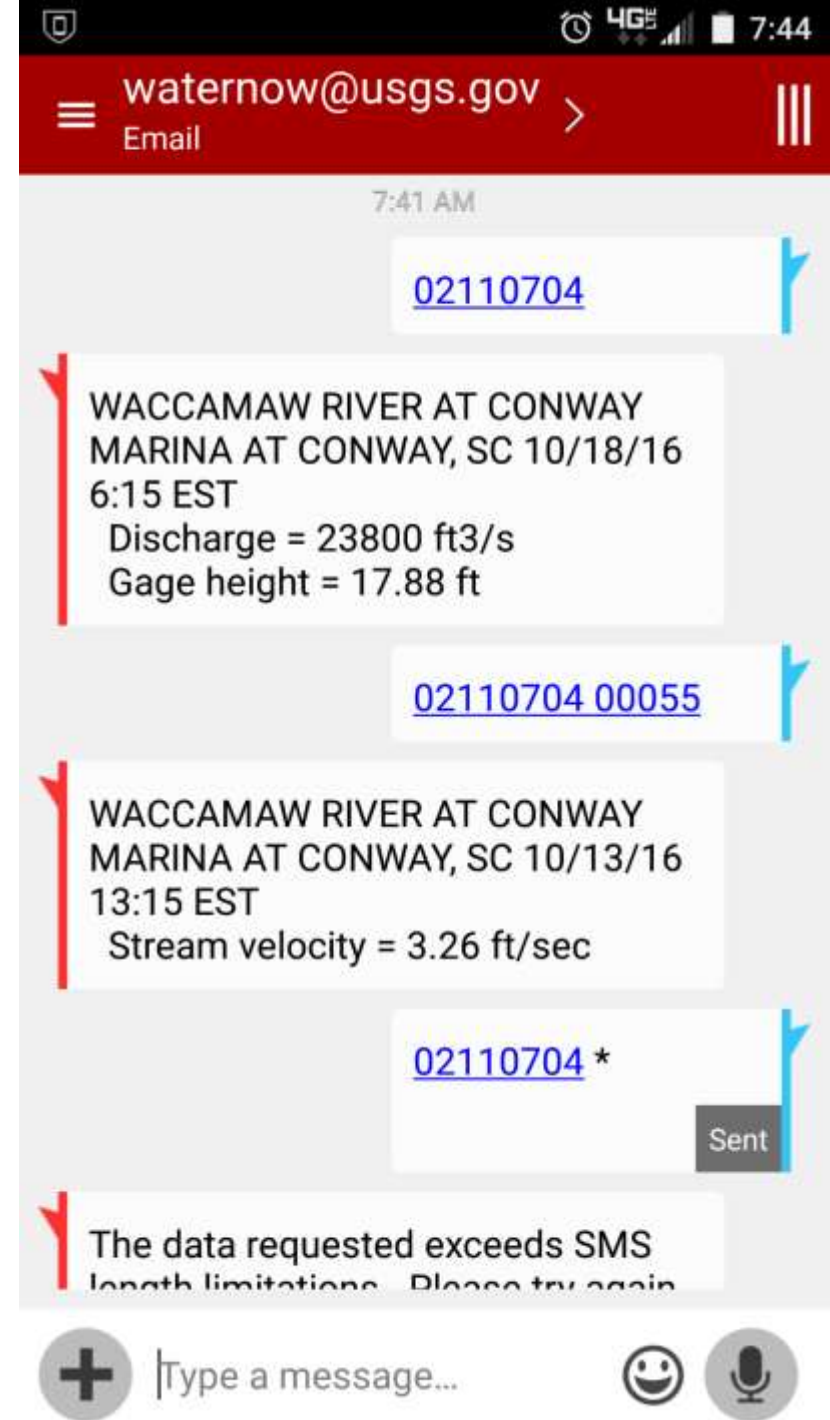
Send email to WaterNow@usgs.gov with Subject: 02110400 *

Send Questions using this link: <http://water.usgs.gov/wateralert/feedback/?id=hni-cxtfd>

Interact with Streamgages

WaterNow

- 1) Send a Text Message or Email to WaterNow@usgs.gov containing the USGS Streamgage Number
- 2) Receive a reply back with Gage Height and River Flow
- 3) Send ? For more parameters or all parameters *
- 4) Reply back with USGS Parameter Number



Techniques and Methods

Stage

Discharge

Ratings; Stage/Discharge

Ratings; Velocity/Discharge

Water Quality



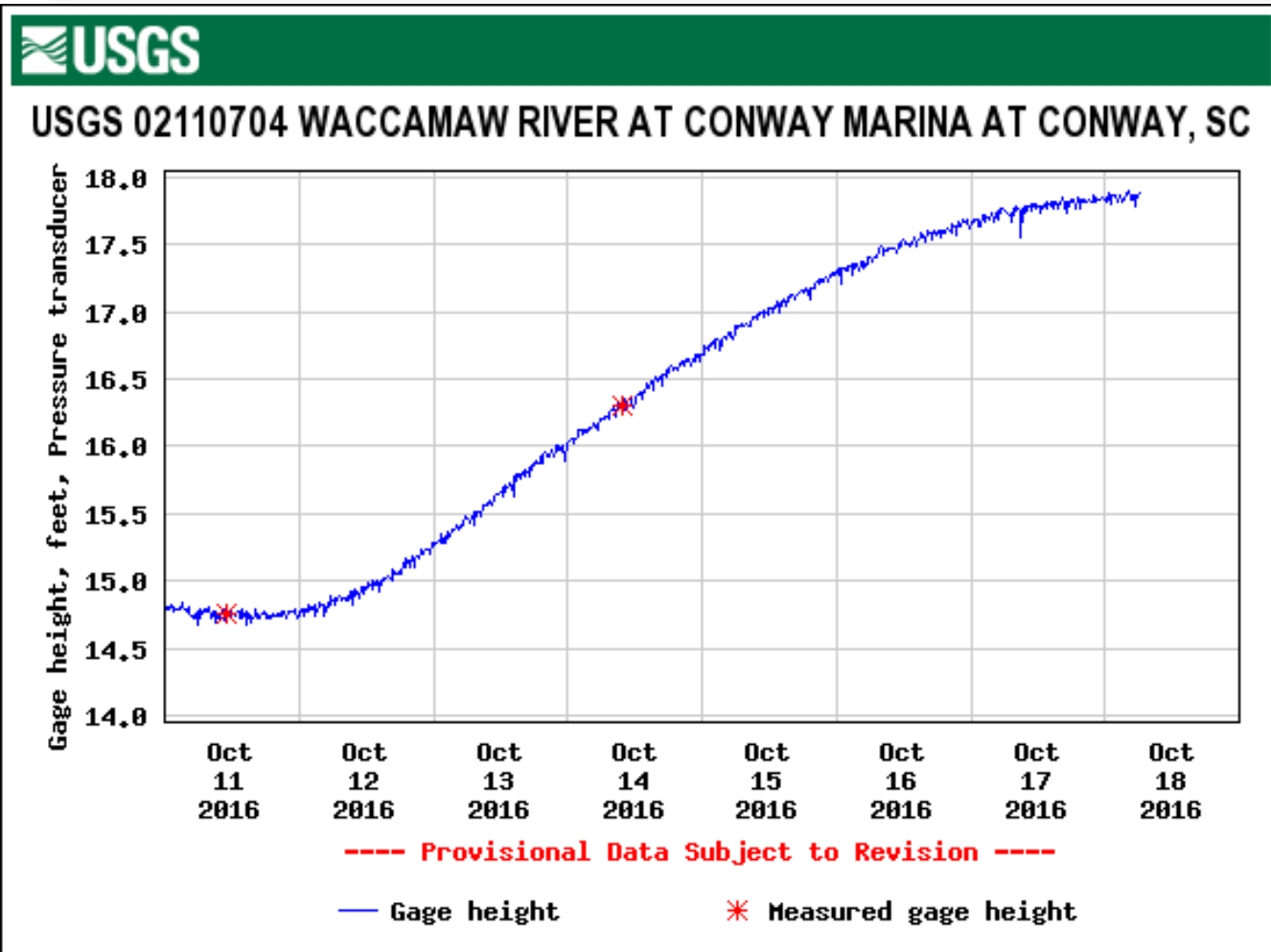
Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting



Techniques and Methods 1–D3

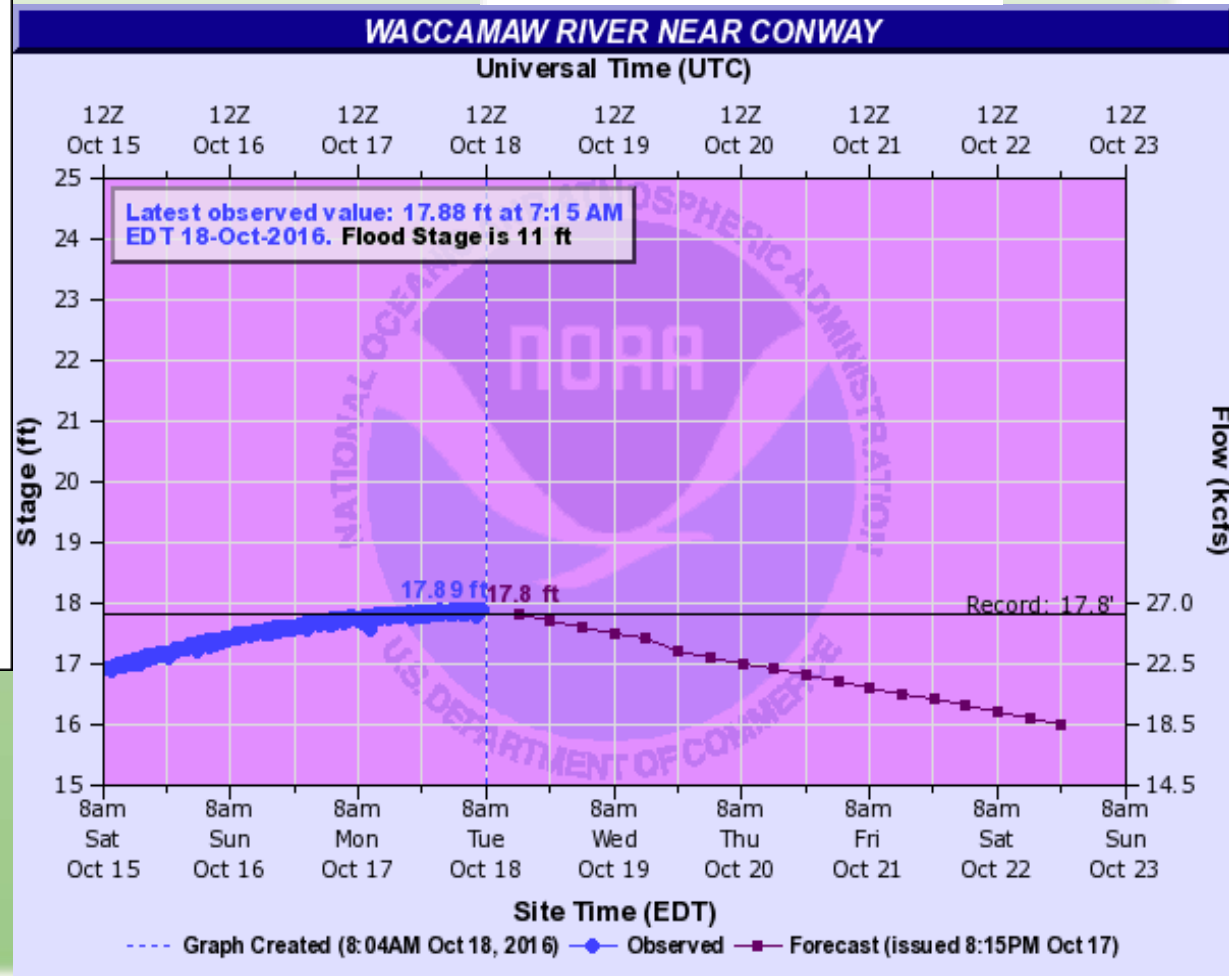
U.S. Department of the Interior
U.S. Geological Survey

TNM: Stage



Flood Categories (in feet)

Major Flood Stage:	14
Moderate Flood Stage:	12
Flood Stage:	11
Action Stage:	10



Radar

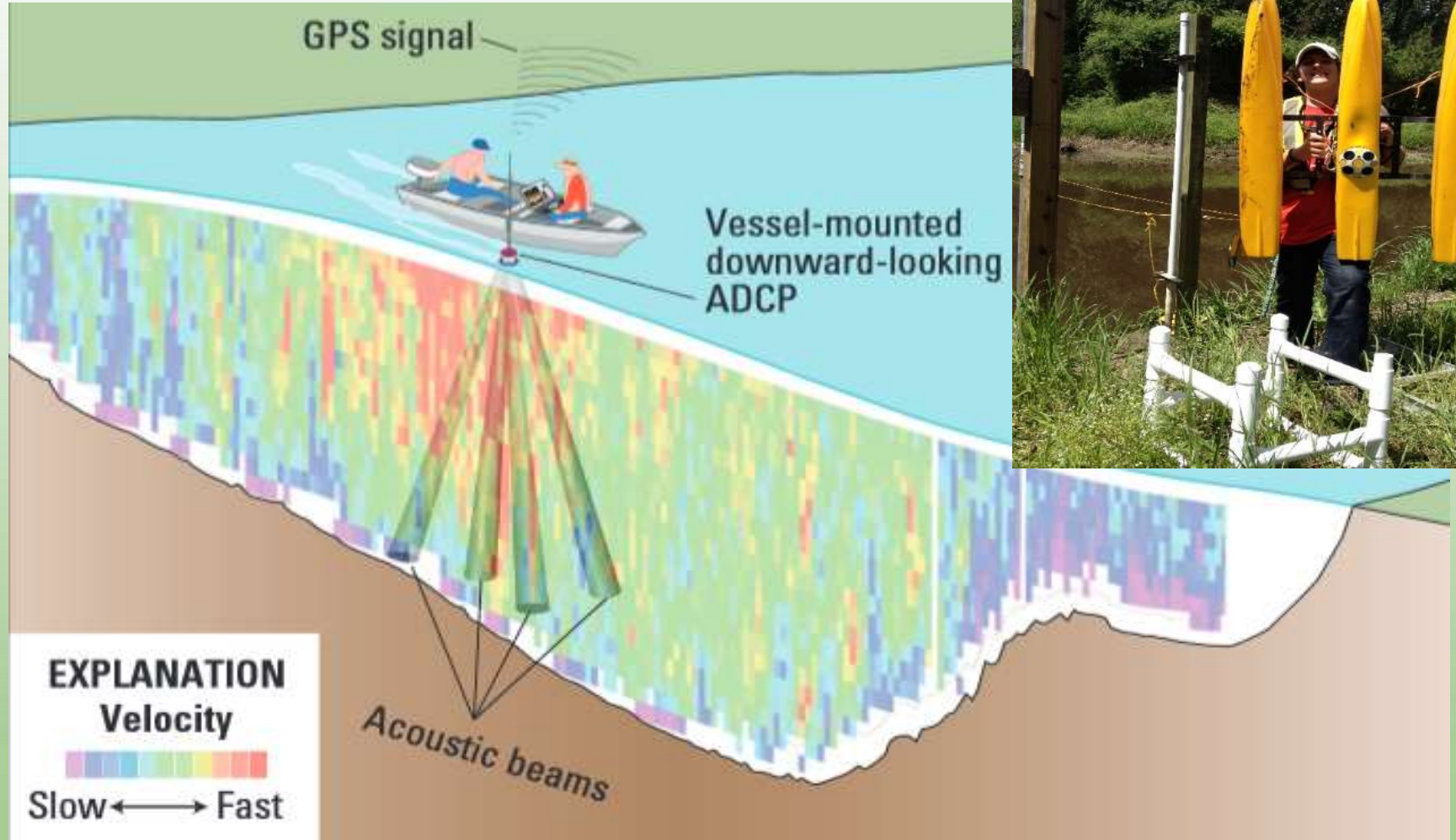
Bubblers

Encoders

TNM: Discharge



Mechanical Meters

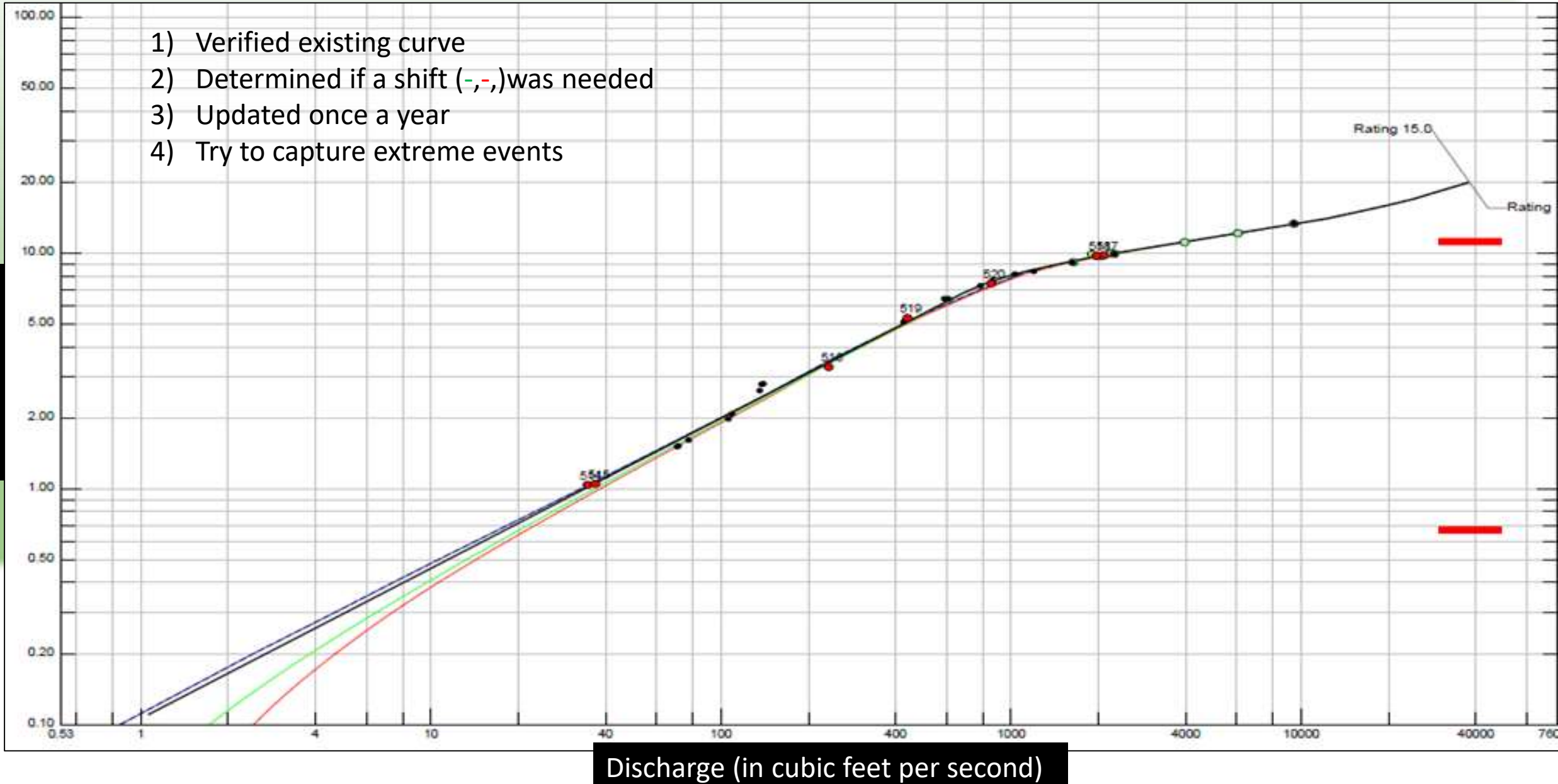


ADCP measures whole channel
ADCP uses Bottom Track and GPS to know its position
relative to velocity particles measured

TNM: Ratings; Stage/Discharge

Continuously Inferring Flow Data

- 1) Verified existing curve
- 2) Determined if a shift (-,-) was needed
- 3) Updated once a year
- 4) Try to capture extreme events



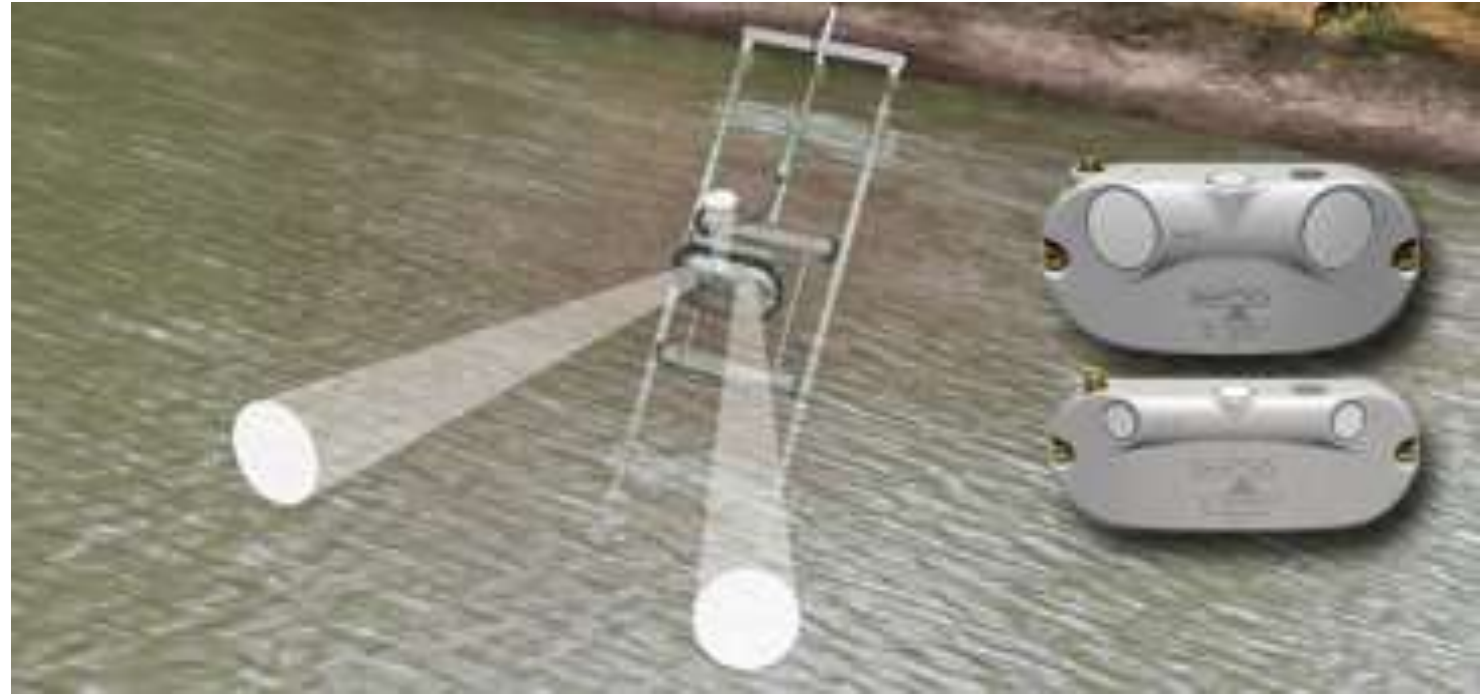
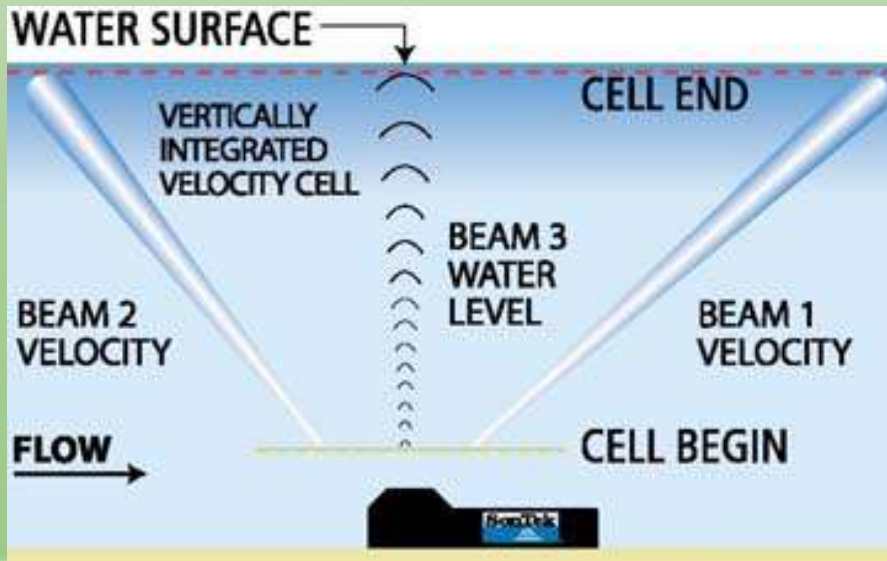
Stage (in feet)

Discharge (in cubic feet per second)

TNM: Ratings; Index Velocity

Continuously Inferring Flow Data

Index Velocity: To derive a statistically significant relationship between ADVM velocity and ADCP computed velocity. Use this derived equation to compute discharge.



TNM: Water Quality



Continuously Measured:

Temperature

Conductivity or Salinity: Electrical Conductance (saltiness)

Turbidity: Concentration of suspended particles (turbid)

pH – Acidic/Neutral/Basic

Dissolved Oxygen: Anoxic, Hypoxic, Super Saturated



Continuous Nitrate Monitoring:

Horry County SC

Waccamaw River near Longs, SC 02110500

Setting

Methods

Results

Discussion



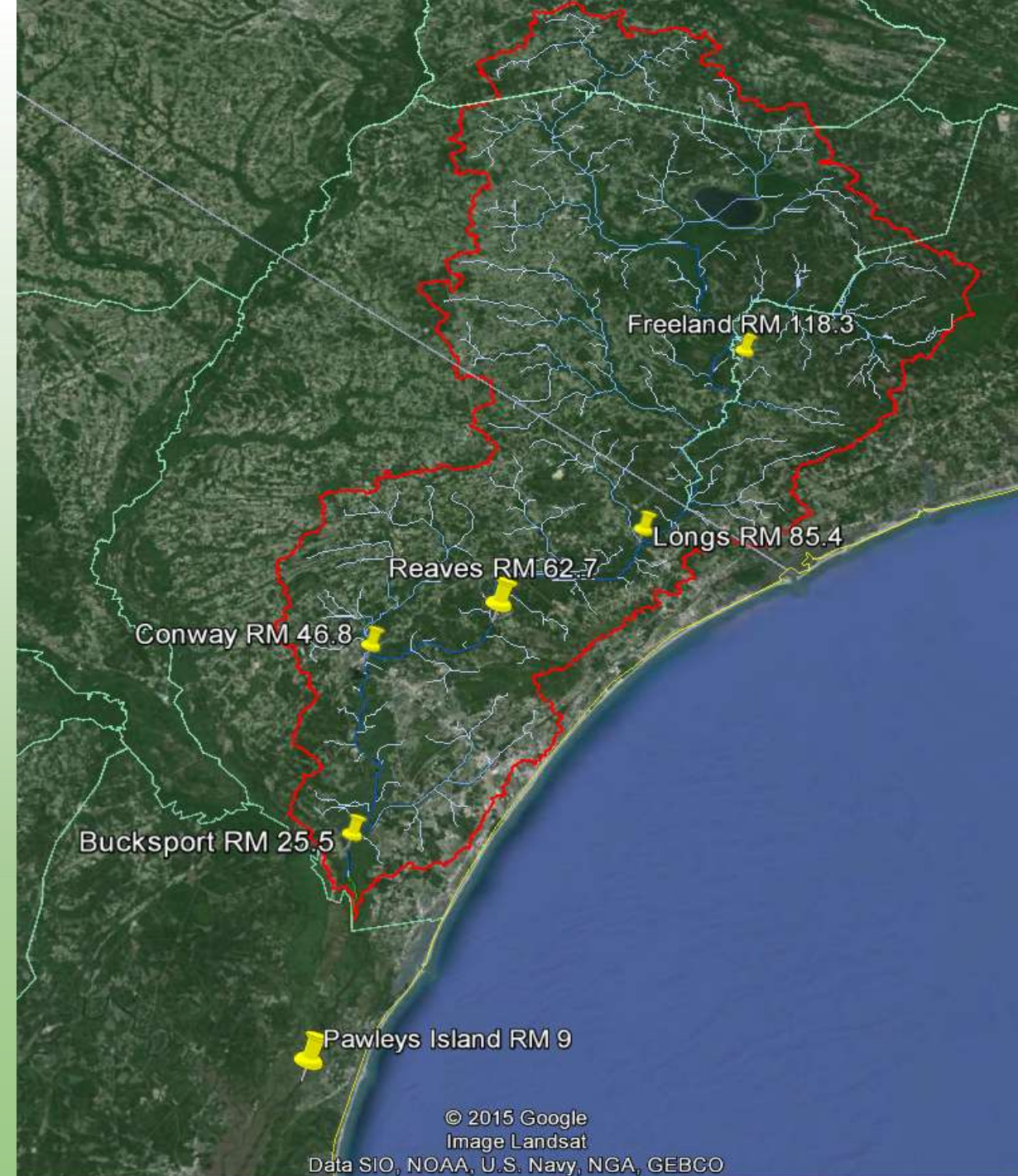
Continuous Nitrate Monitoring

Setting

Waccamaw River near Longs:
USGS 02110500



*Crabtree Swamp near Conway postponed; bridge
construction.*



Continuous Nitrate Monitoring

Setting

Waccamaw River near Longs



*Watershed has 303-D listings; Eutrophication
SCDHEC (Site ID: MD-124) Turbidity, pH rising
SCDHEC developing statewide Nutrient (N,P) Criteria for streams and estuaries*

Continuous Nitrate Monitoring

Methods

Hach Nitratax

(2mm, 2 beam UV absorbance)



Hach SC200 to Sutron Satlink DCP

(Data Collection Platform)

Analog to SDI-12 via Resistor
(Serial Digital Interface at 1200 baud)

24V, In Series

(Power consumption)



Continuous Nitrate Monitoring

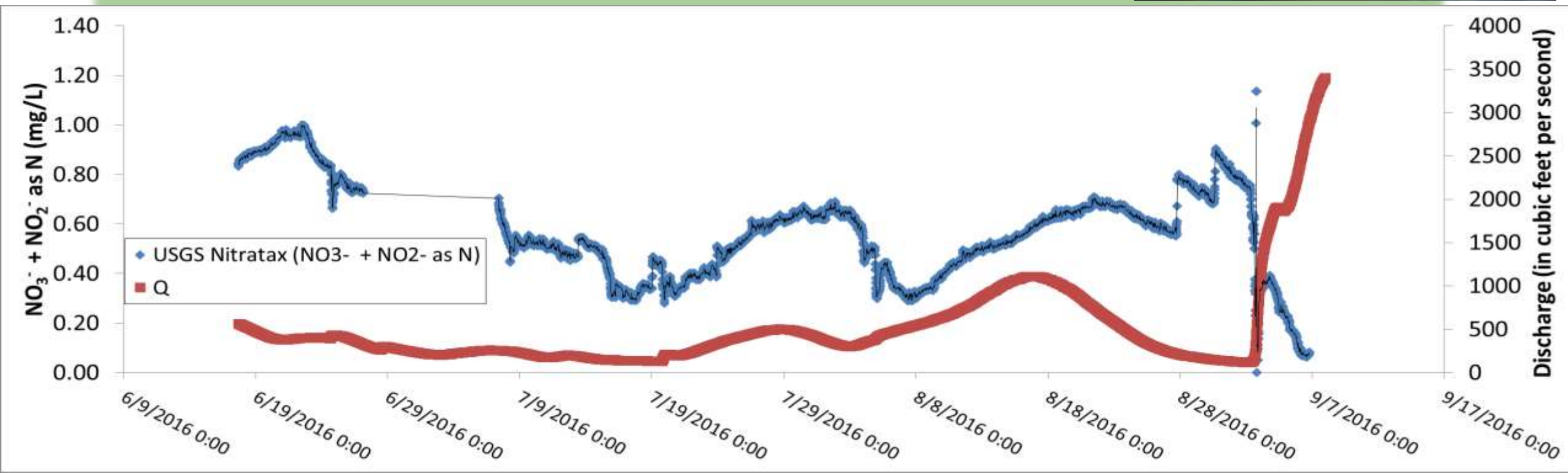
Results

Provisional Data*

Base flow trends

DO/Precip relationship

Comparison Data

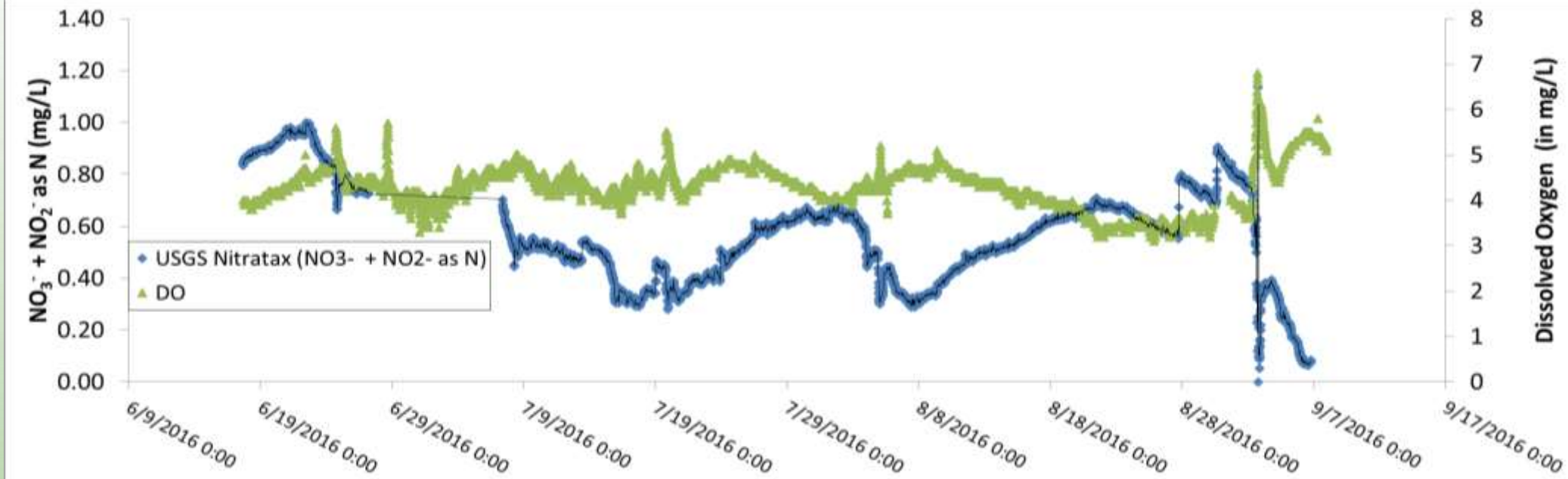


Continuous Nitrate Monitoring

Results

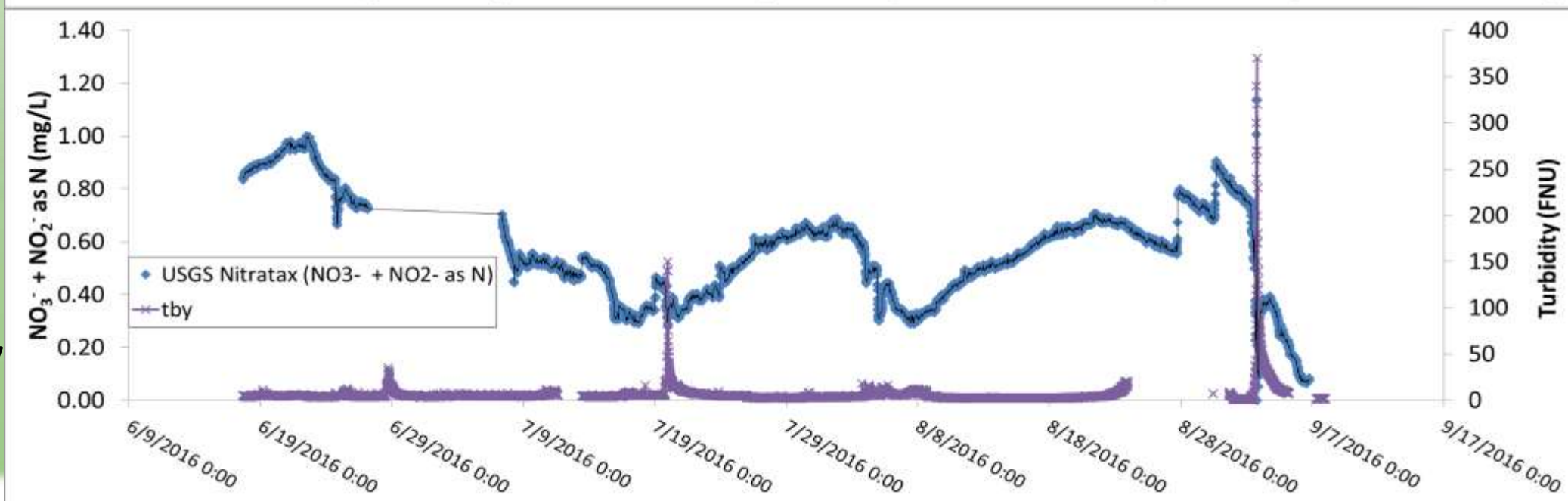
DO

Inverse



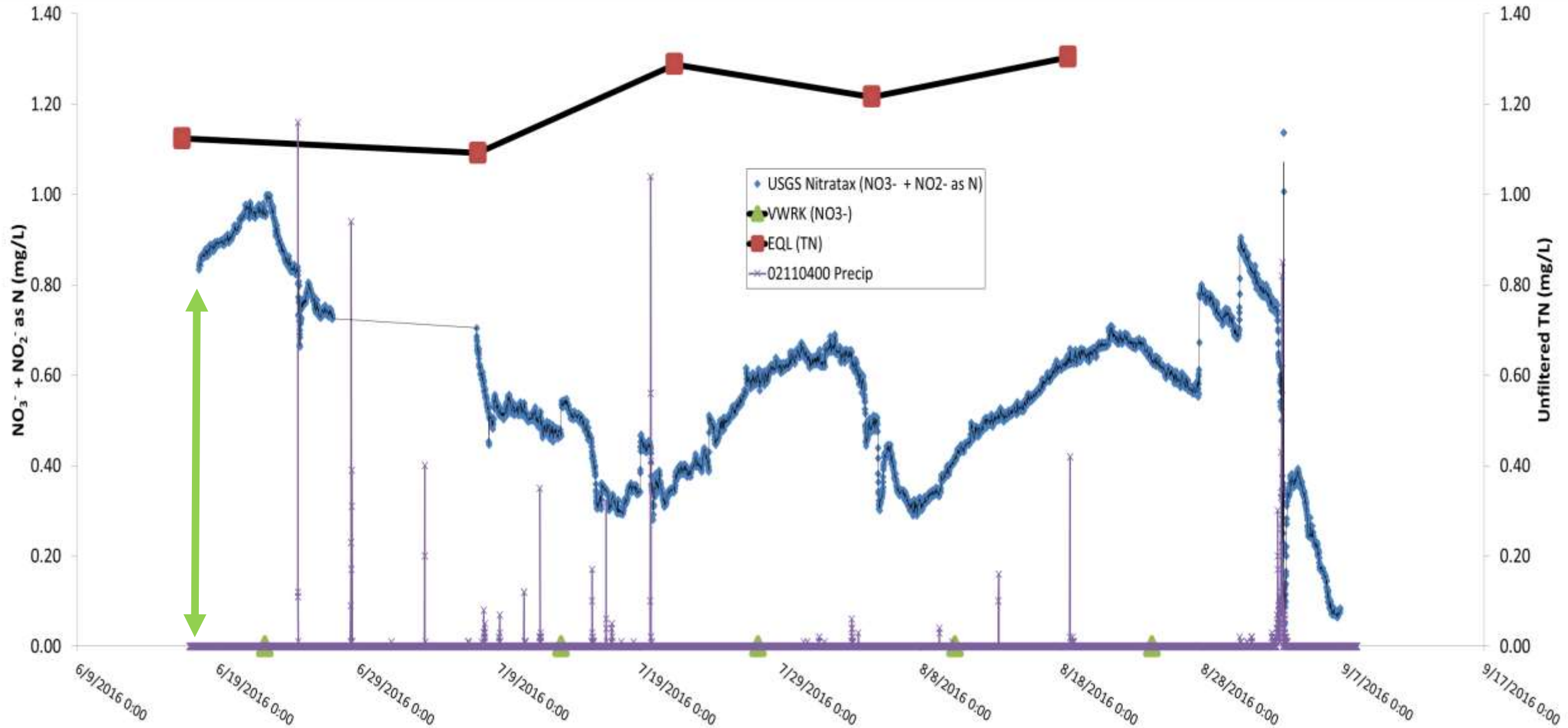
Turbidity

Event



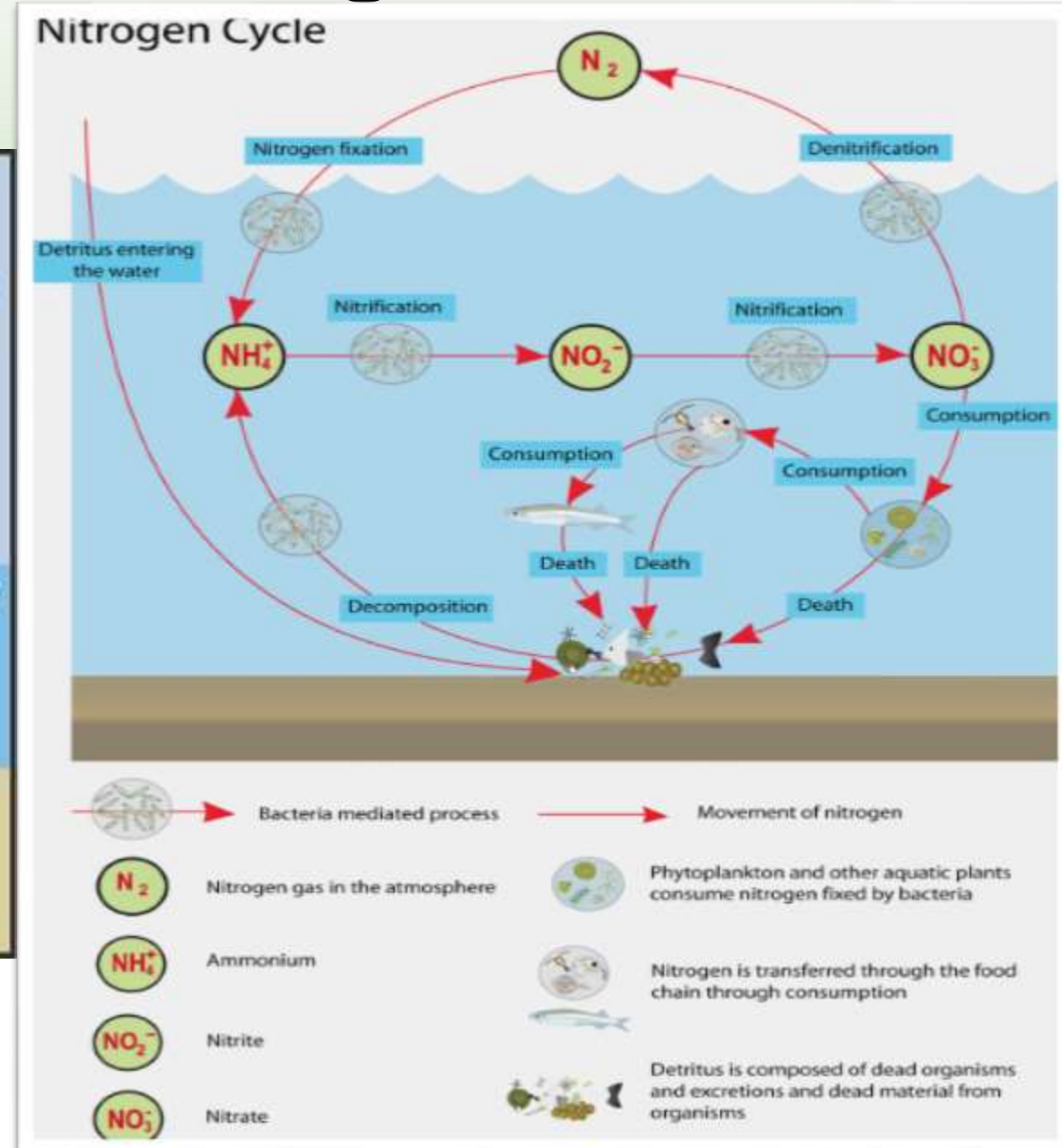
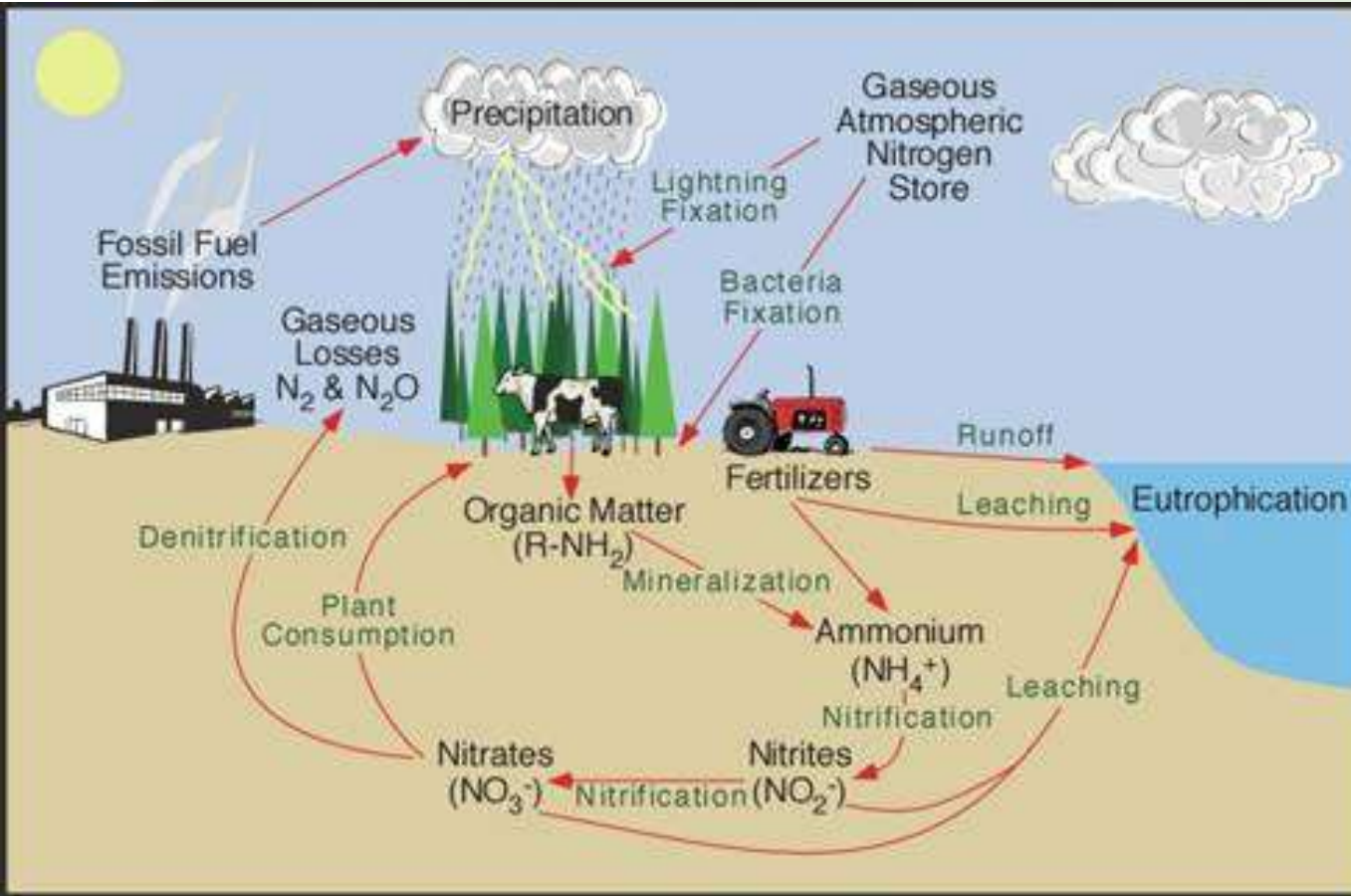
Continuous Nitrate Monitoring

Results: Environmental Quality Lab, Waccamaw Riverkeeper



Continuous Nitrate Monitoring

Discussion



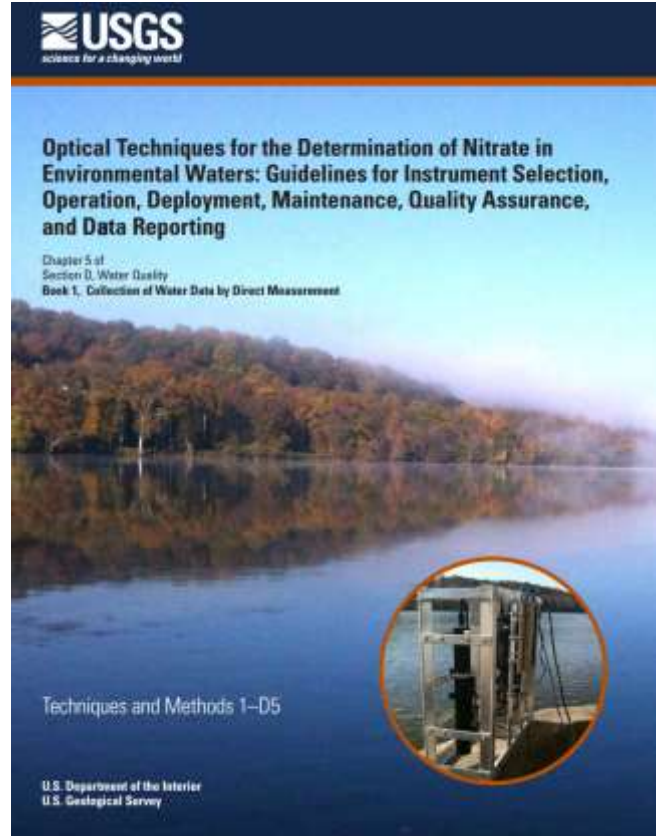
Conclusions

Need sampling, longer dataset

Table 3. Examples of challenges related to matrix effects, data quality, and logistics that can help determine the appropriate sensor selection.

[Abbreviations: DOC, dissolved organic carbon; mg N/L, milligrams N per liter; mg/L, milligrams per liter; mm, millimeter; n/a, not applicable; NTU, nephelometric turbidity units; NO₃, nitrate; UV, ultraviolet; <, less than; >, greater than]

Type	Typical values	Approach
Matrix effects		
High suspended sediment concentration/turbidity	>500 NTU	Use instruments with a shorter path length (that is, <10 mm) or deploy with a filtered flow path
High DOC concentrations	>5–10 mg/L >30 mg/L	Use instruments that measure the full UV spectrum. Use instruments that measure the full UV spectrum and use a shorter path length (that is, <10 mm).
High bromide concentrations	n/a	Use instruments that measure the full UV spectrum and include bromide compensation in algorithm.
High potential for biofouling	n/a	Use instruments with integrated or third party wipers.
Data quality		
High NO ₃ - concentrations	>20 mg N/L	Use instruments with a shorter path length (that is, <10 mm).
Low NO ₃ - detection limit needed	<0.5 mg N/L	Use instruments with a longer path length (that is, 10 mm or longer).
High NO ₃ - accuracy needed	±0.5 mg N/L	Longer path length (that is, > 10 mm), full spectrum.
Logistics		
Buoy access only	n/a	Use instruments with integrated or third party wipers and can easily be integrated into existing data-collection platforms.
Infrequent site visits	<3–4 weeks	Use instruments with integrated or third party wipers.
Ease of use	n/a	Use instruments with integrated or third party wipers and “plug and play” controllers.



Conclusions

Visit waterdata.usgs.gov for water resource information

WaterAlert, WaterNow for alerts and current conditions

Reach out to your local USGS office for methods

Stay tuned for Nitrate data online!



***DO OR DO NOT,
THERE IS NO TRY***

Discussion

Contact

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Thank you!

