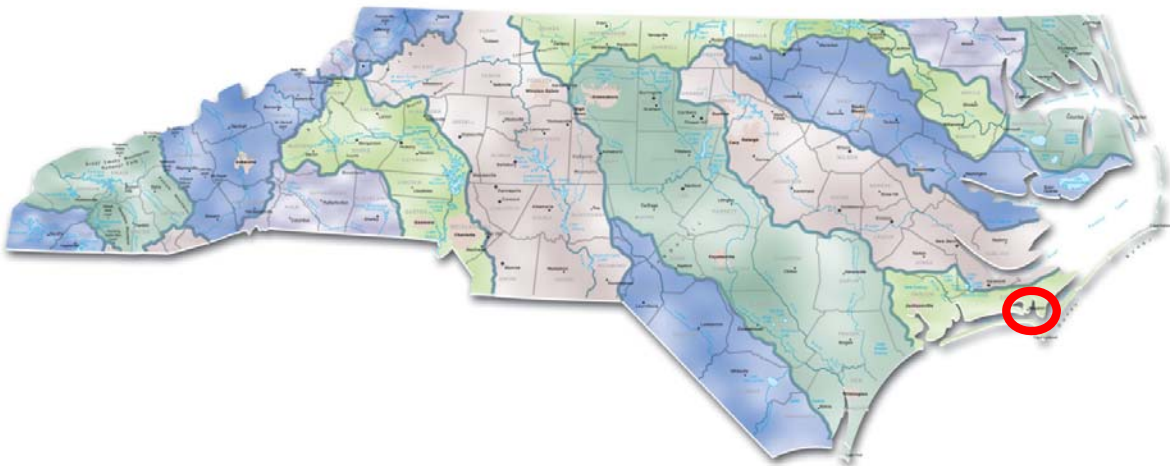


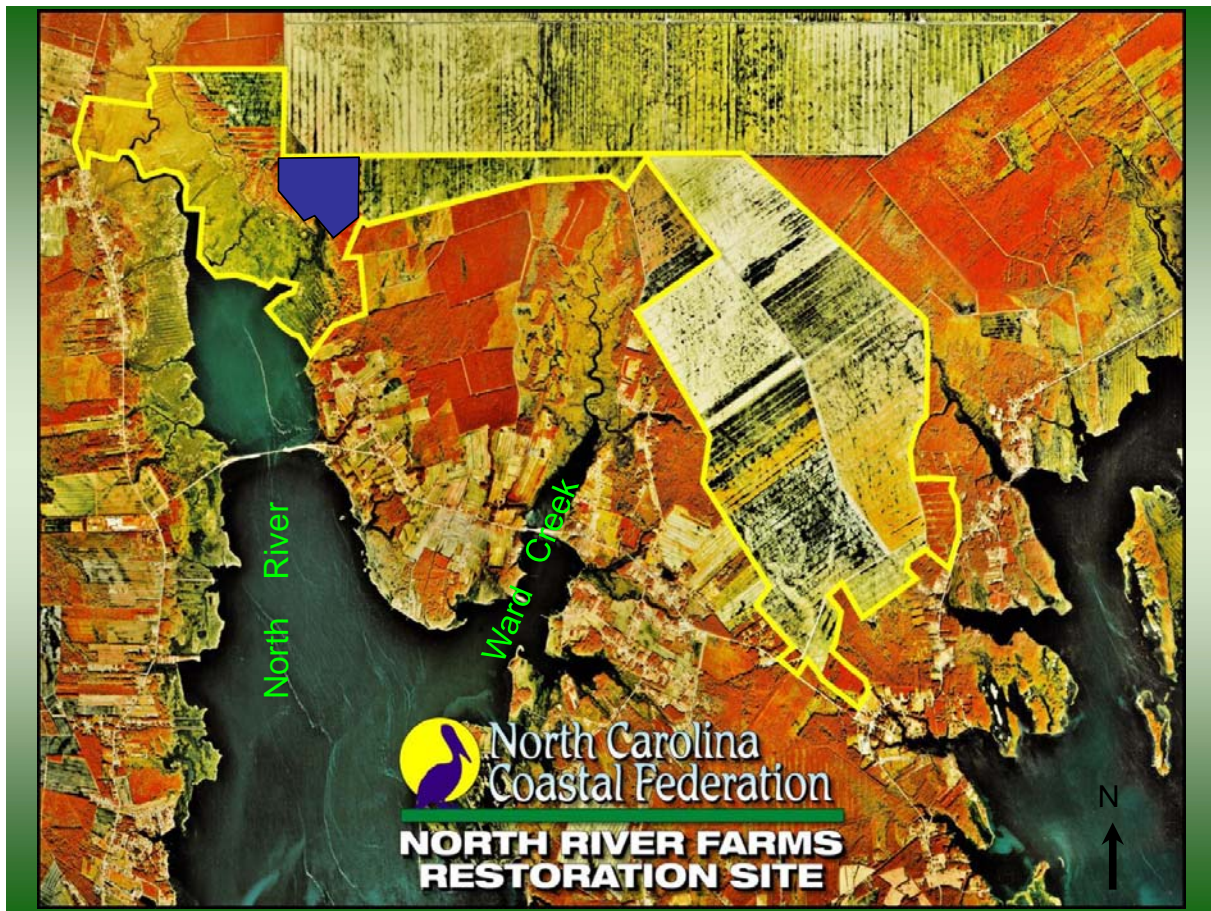
Nitrate Mass Balance in a Restored North Carolina Salt Marsh

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Michael R. Burchell II



Site Location





Restoration Goals

- Improve water quality in the North River
- Restore habitat
- Provide design guidance for future salt marsh projects in coastal North Carolina



Construction



Restoration



Research Questions

- How much nitrogen is retained or released by a restored salt marsh?
- Are there seasonal, daily, or tidal trends in nutrient release or retention?
- Is there a relationship between nutrient retention or release and the type of organic matter present in the stream?

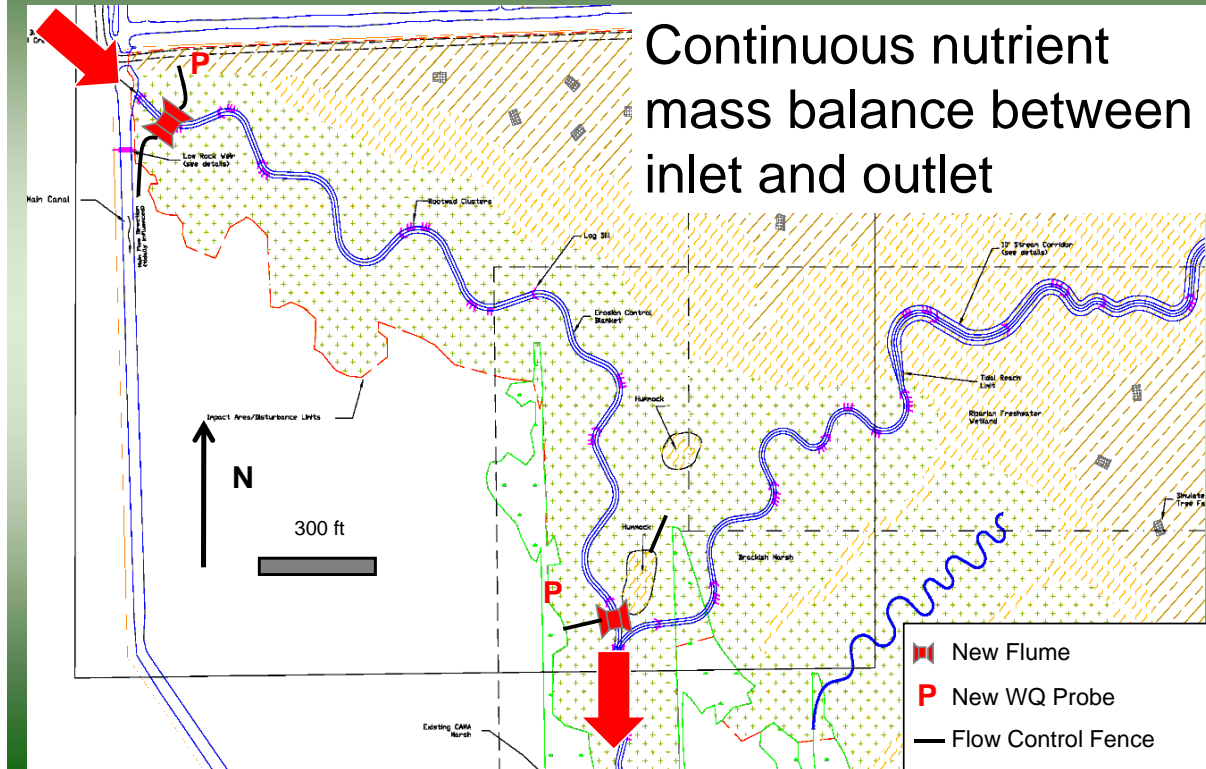


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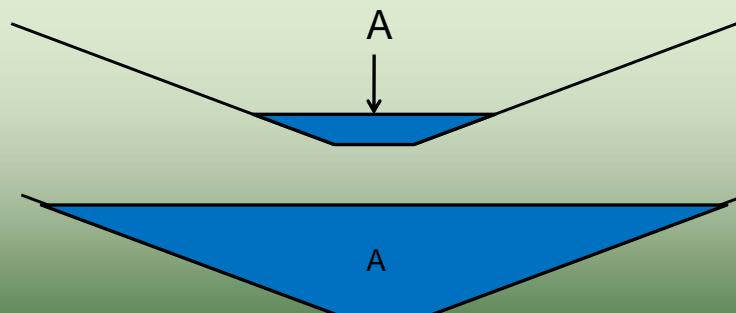
Methods



Flow Calculations

$$Q = V \times A$$

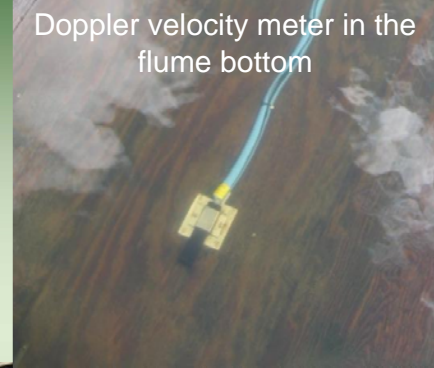
- Q: flow
- V: velocity
- A: cross-section area



Continuous Flow Monitoring

- Doppler velocity meter records velocity and water depth in flume
- Average velocity and water depth recorded every 15 minutes
- Use manual stream gaging to relate Doppler velocity to actual flow in the flume

Doppler velocity meter in the flume bottom

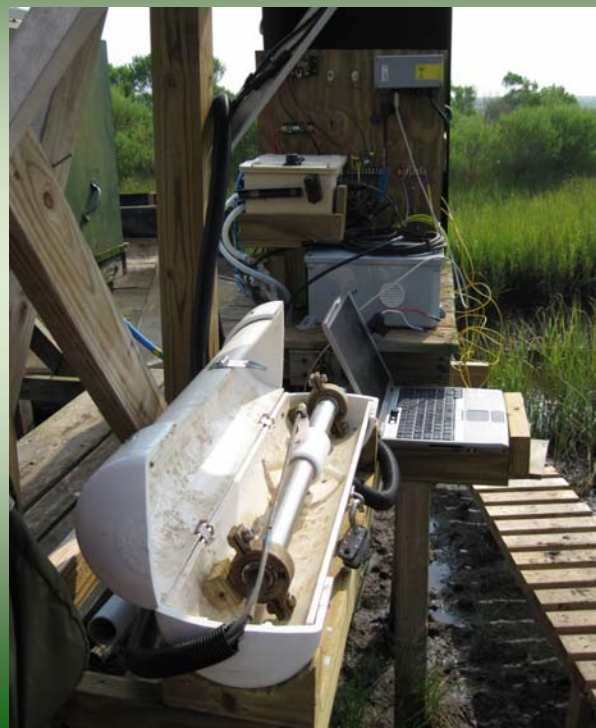


Manual Stream Gaging



Continuous Nitrate Monitoring

- Monitored using UV-visual spectrophotometer
- Absorption spectrum measured every 15 minutes



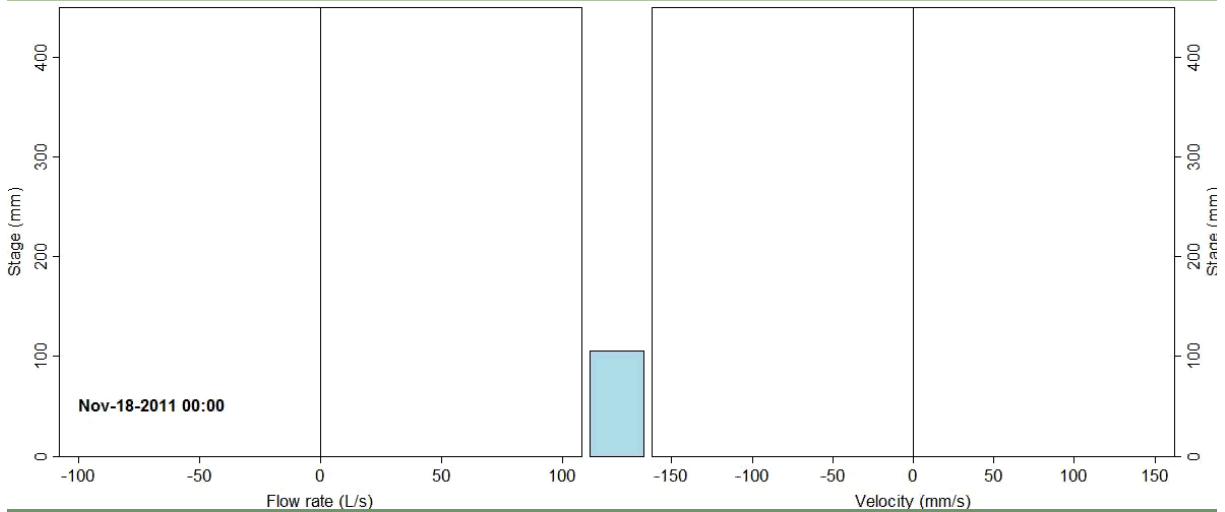
- Preventing/reducing window fouling
- Calibration using samples collected by automatic samplers

[illegible]

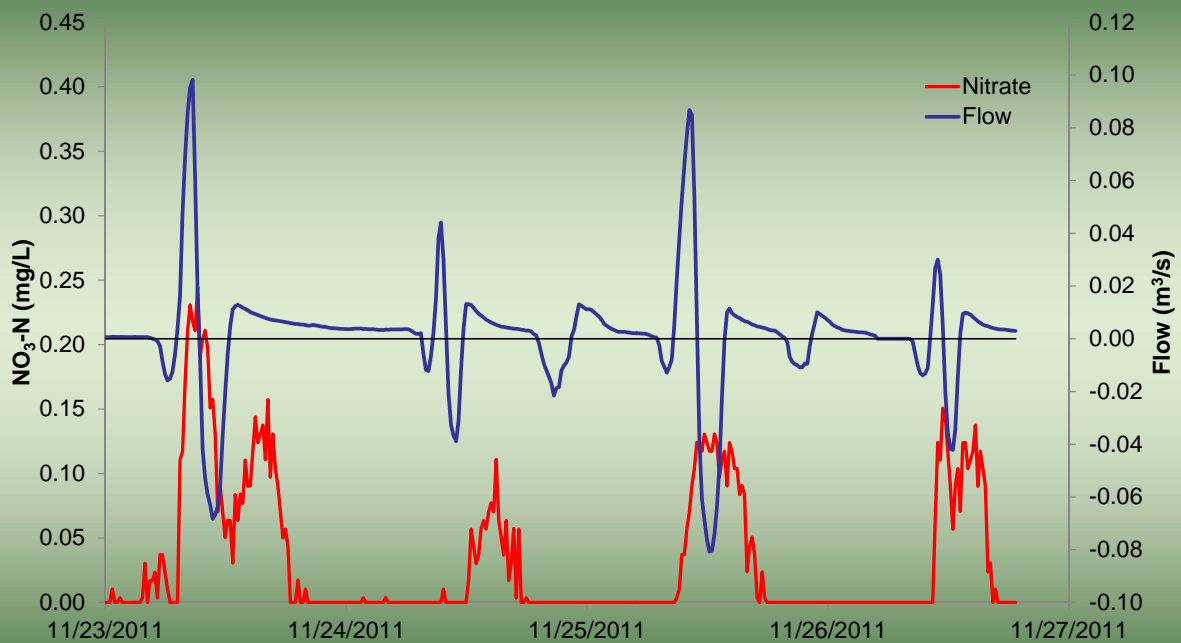
Tidal Flow – Upstream Flume

Flow Rate (L/s)

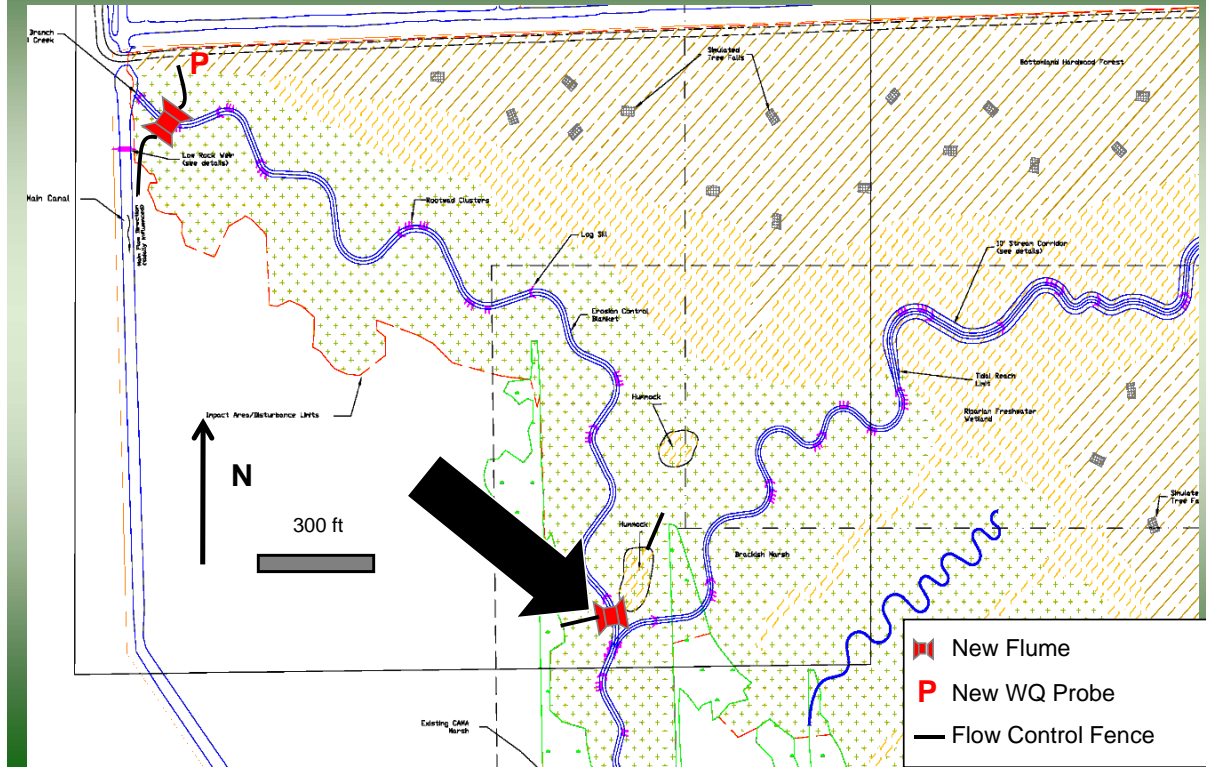
Velocity (mm/s)



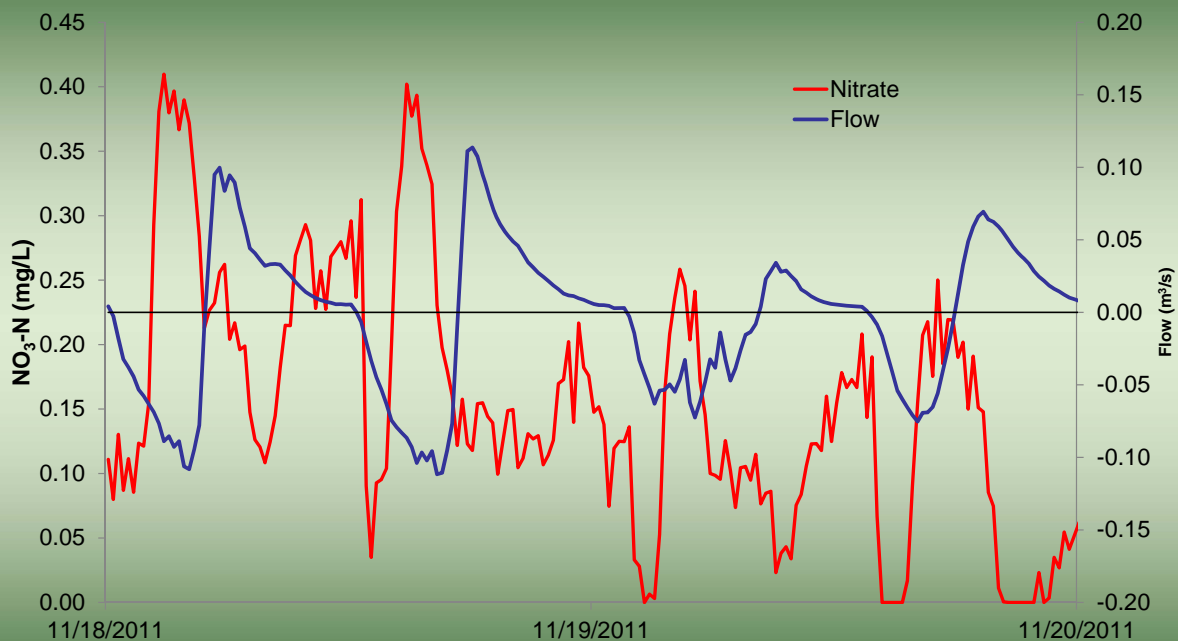
Upstream Flume



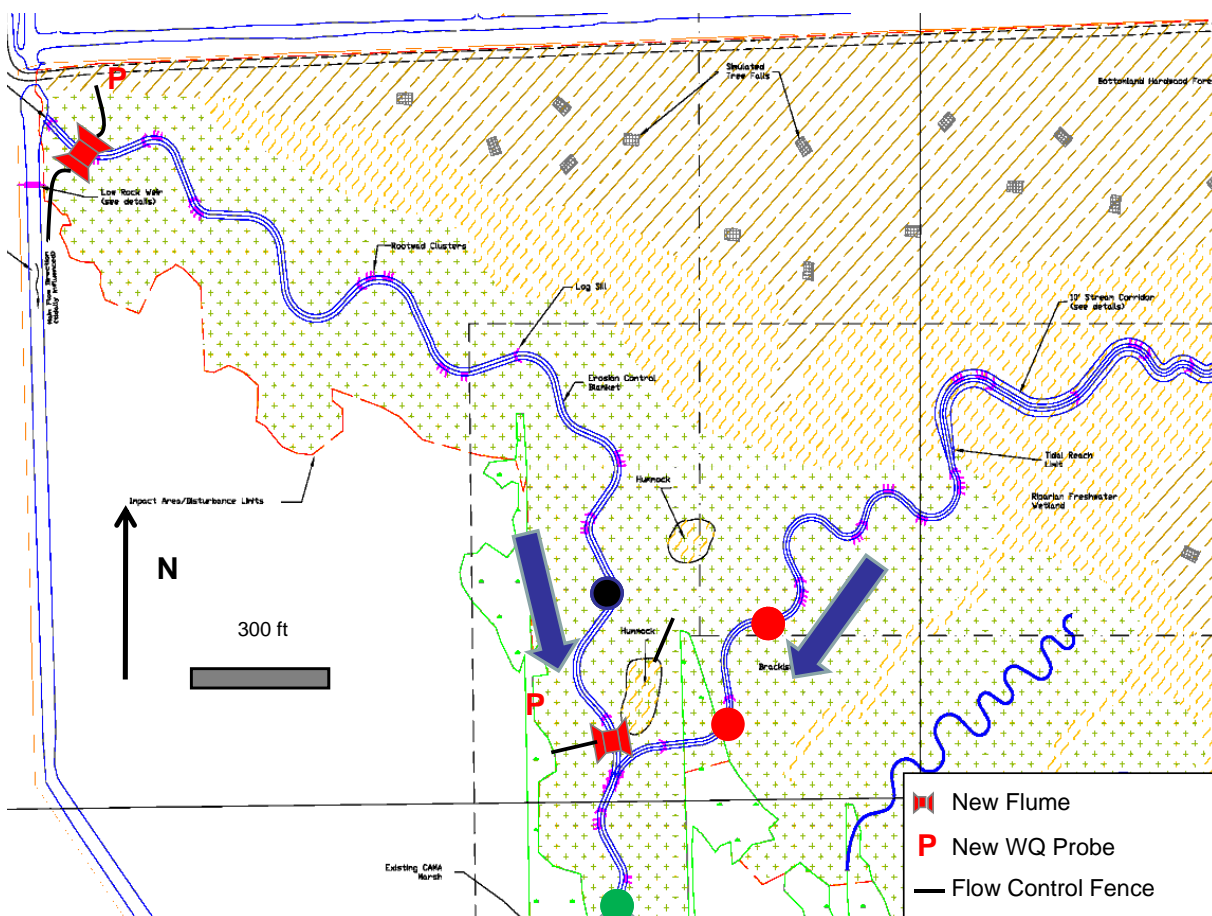
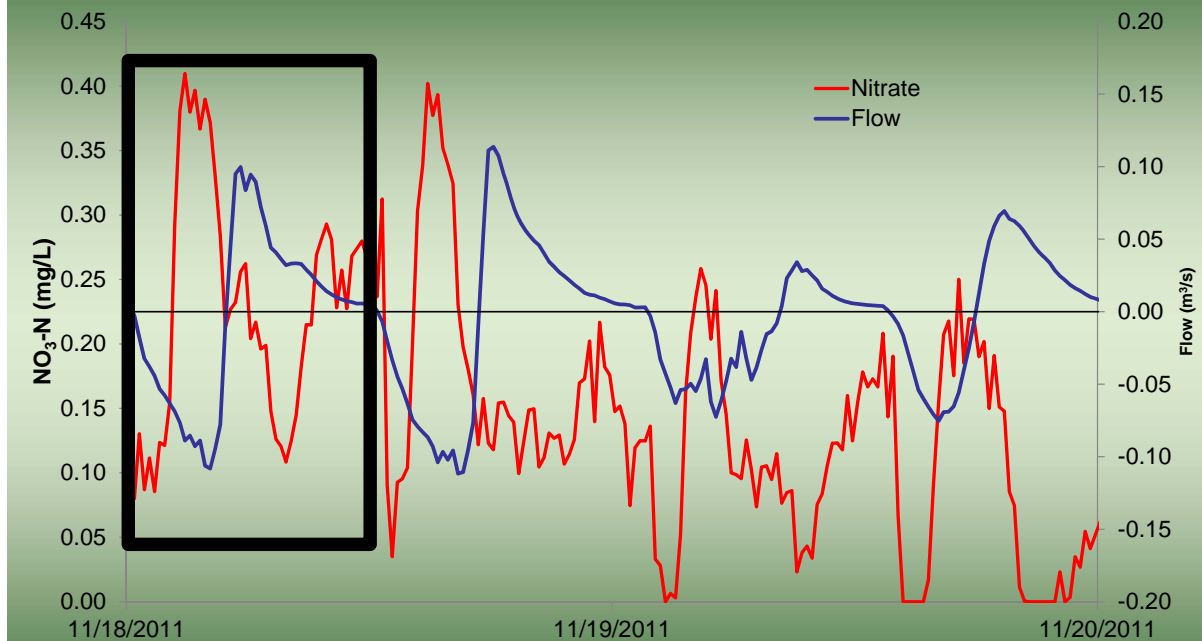
Downstream Flume



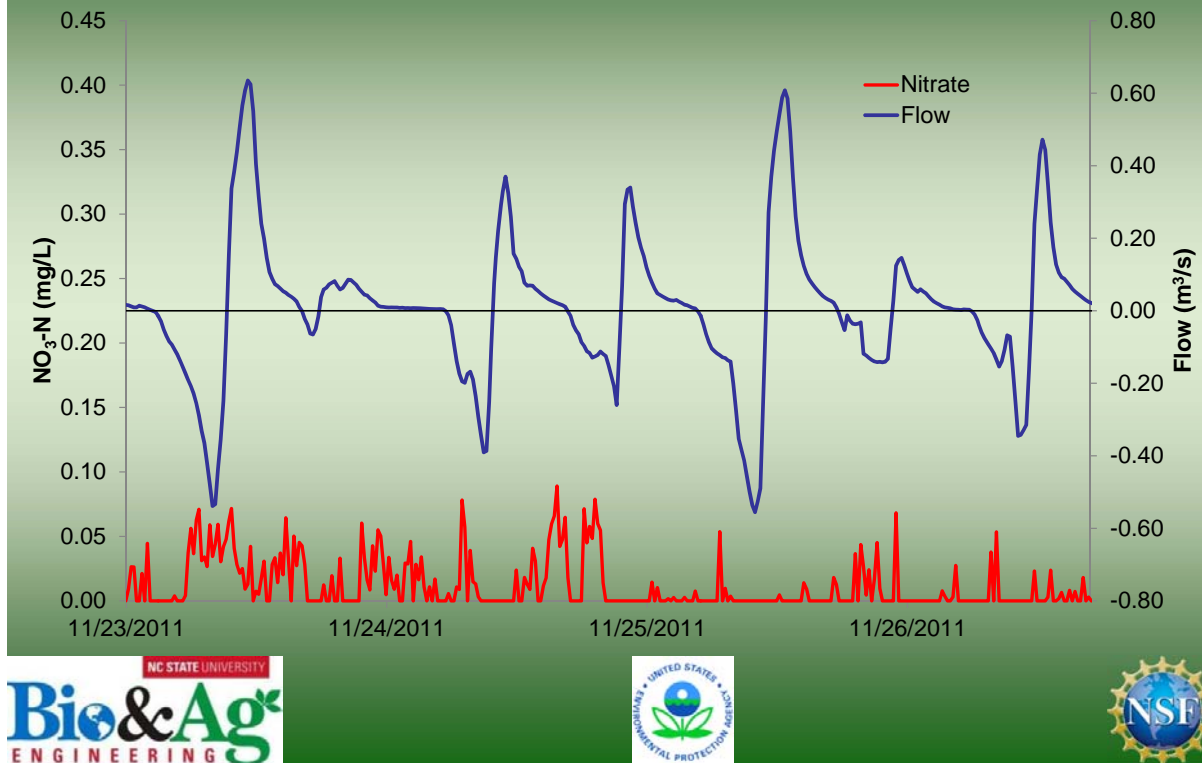
Downstream Flume – Nitrate Input



Downstream Flume – Nitrate Input



Downstream Flume – Tidal Flow

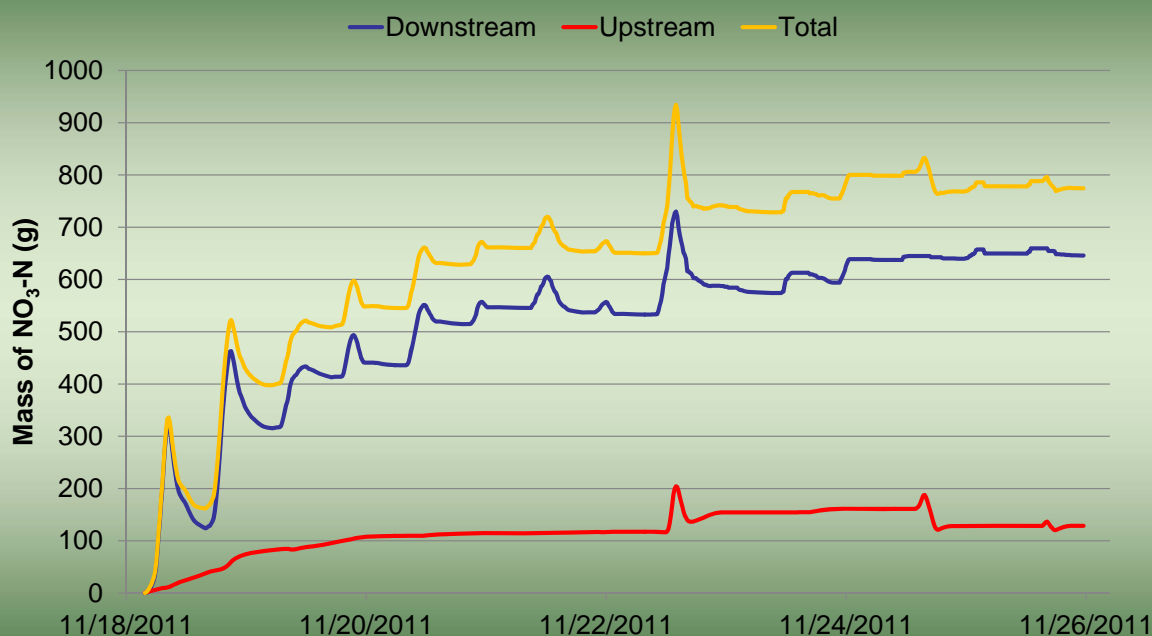


Mass Balance



Positive Mass Balance = Retention
Negative Mass Balance = Release

Mass Balance



Mass Balance Summary

- Percent of $\text{NO}_3\text{-N}$ retained = 46%
- Mean $\text{NO}_3\text{-N}$ concentration = <0.1 mg/L
- Median $\text{NO}_3\text{-N}$ = <0.1 mg/L
- Missing:
 - Ammonium
 - Organic nitrogen

Conclusions

- $\text{NO}_3\text{-N}$ input comes from upstream and downstream
- High $\text{NO}_3\text{-N}$ retention when the concentration and flow are low

Future:

- Long term mass balance
- Capture events with higher nitrate concentrations and flows



Acknowledgements

- North Carolina Coastal Federation
- United States Environmental Protection Agency
- North Carolina Sea Grant/North Carolina Water Resources Research Institute
- North Carolina Ecosystem Enhancement Program
- NSF Graduate Research Fellowship Program

Equipment and Field Help:

- Brad Smith
- Yo-Jin Shiau
- Camille Langlais
- Phil Harris
- Kris Bass
- Spencer Davis
- Evan Corbin
- Jacob Wiseman
- Guillaume Lellouche

Collaborators:

- Dr. Chris Osburn
- Molly Mikan
- Jennifer Dickson-Brown

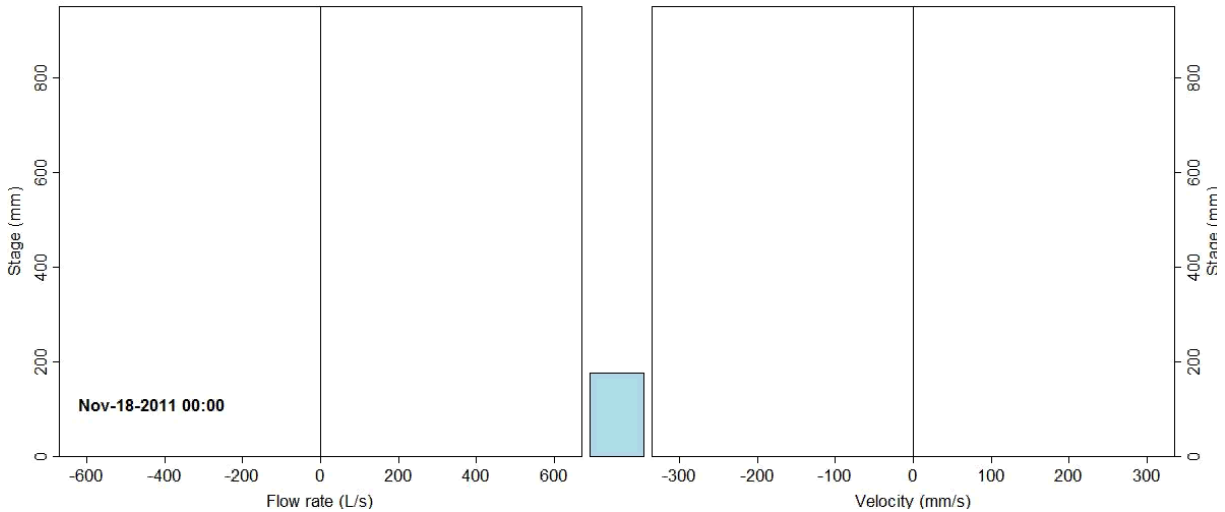


Questions?

Video of tidal fluctuations at the downstream flume:

Flow Rate (L/s)

Velocity (mm/s)



Other Research

- Continuously monitor:
 - DOC
 - pH
 - Conductivity/Salinity
 - Dissolved Oxygen
 - DOM Fluorescence
- Gas fluxes
- Stream stage using machine vision and web cams

