

Continuous measurements of new water-quality parameters using in-situ optical sensors at the Little Falls Pumping Station

Presented to the Potomac River Basin
Drinking Water
Source Protection Partnership

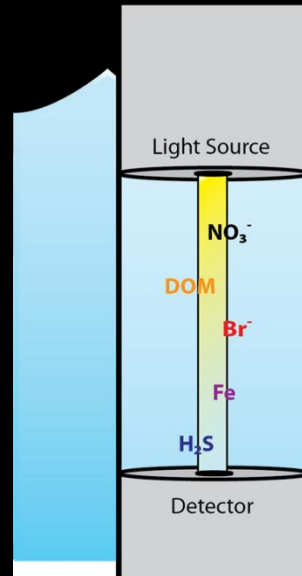


Funding provided by: USGS National Water-Quality Assessment (NAWQA) Program
Aquatic Real-Time Carbon Network

In-situ Monitoring: The Lab on a Chip



UV PHOTOMETER



FLUOROMETER

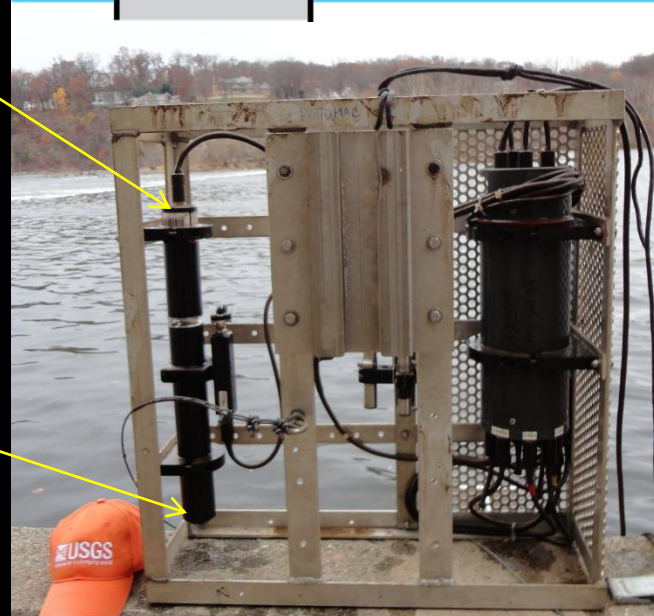
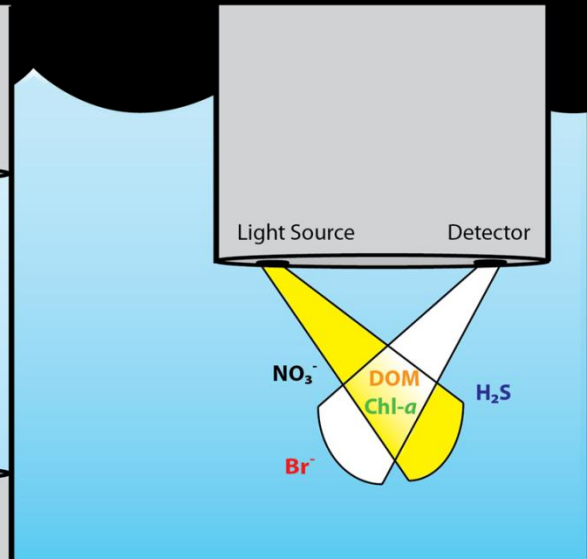


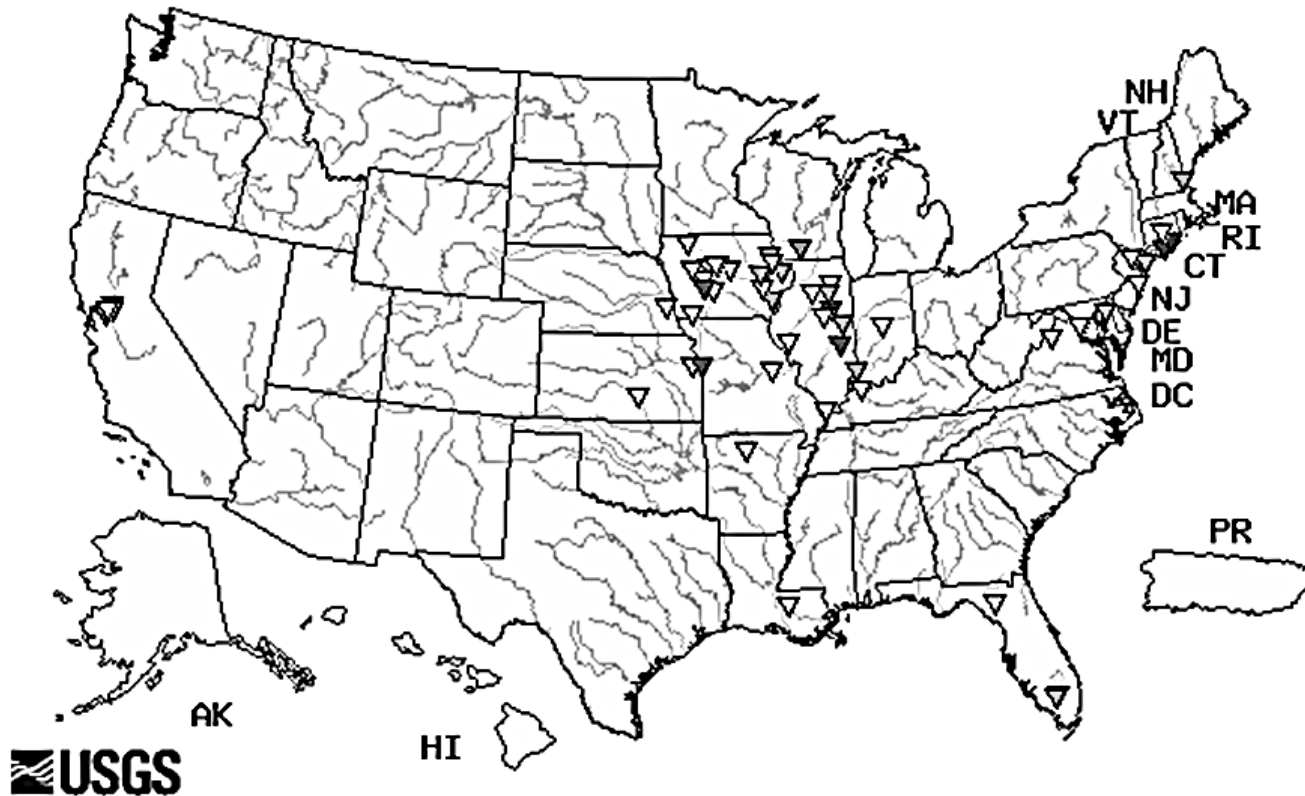
Image of
equipment at
Little Falls
Pump Station
near
Washington, D.C
USGS ID:
01646500

Fluorescent Dissolved Organic Matter
(F**DOM**)

Expanding Optical Sensor Network

- USGS aquatic real-time monitoring of organic matter and nitrate supported by NAWQA, Climate Effects Network, WEBB, and USGS Climate and Land Use R&D
- FDOM, optical nitrate, turbidity, chlorophyll-*a*, CO₂, etc.

September 12, 2013 07:33ET



In-situ Optical Nitrate Sensor

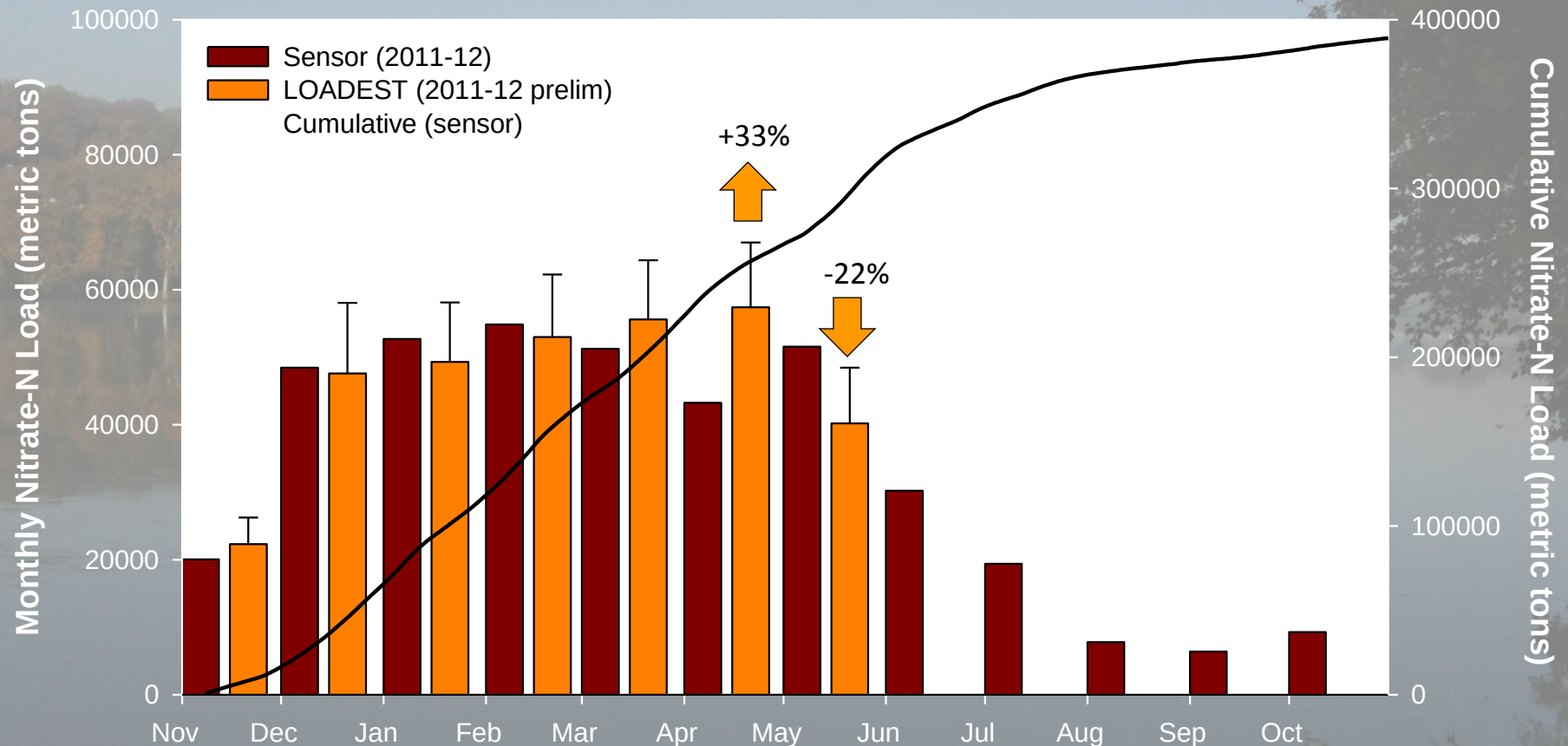
<http://waterwatch.usgs.gov/wqwatch/>

Practical Application

- Load accuracy
- Surrogate relationships
- Sampling frequency
- Periodic cycling
- Early warning system

Accuracy of load estimates

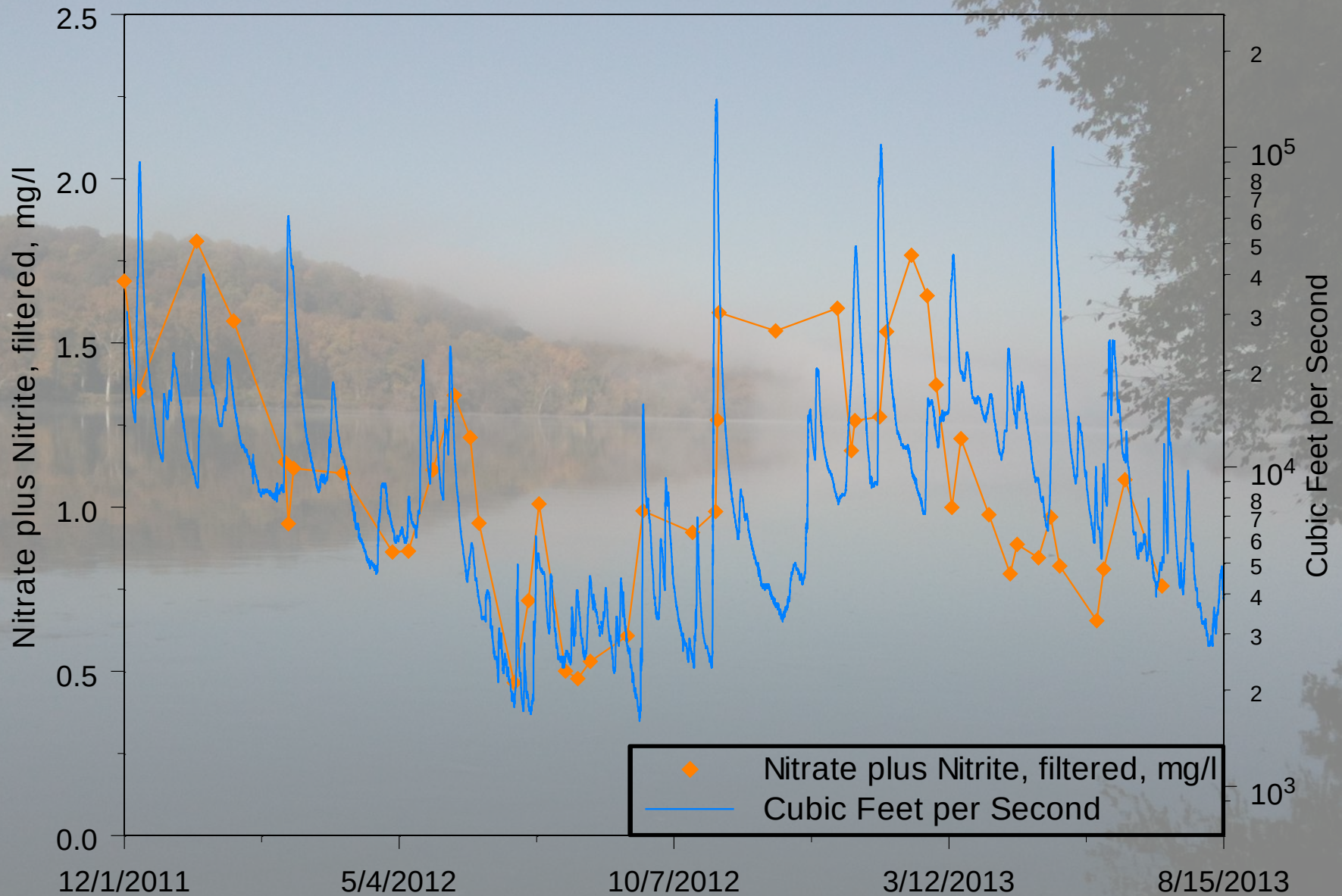
- Some differences in sensor monthly loads vs. preliminary LOADEST values
- Uncertainty is much lower with continuous data ($\pm 5\%$ vs. $\pm 20\%^*$)



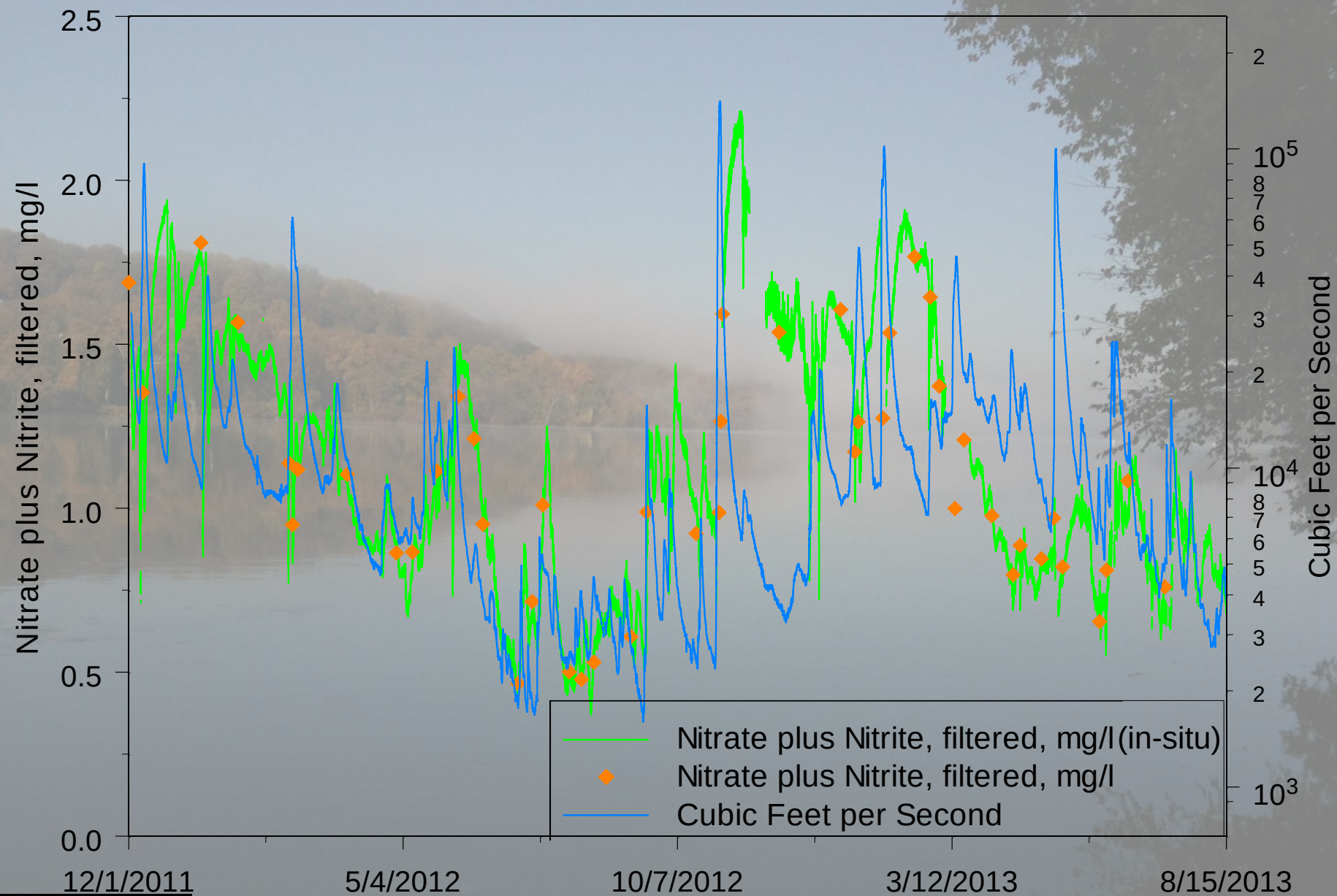
LOADEST data from St. Francisville, continuous data from Baton Rouge;

http://toxics.usgs.gov/hypoxia/mississippi/flux_estimates/delivery/index.html; * <http://www.gulfhypoxia.net/>

Nitrate plus Nitrite values with Discharge: Potomac river near Chain Bridge

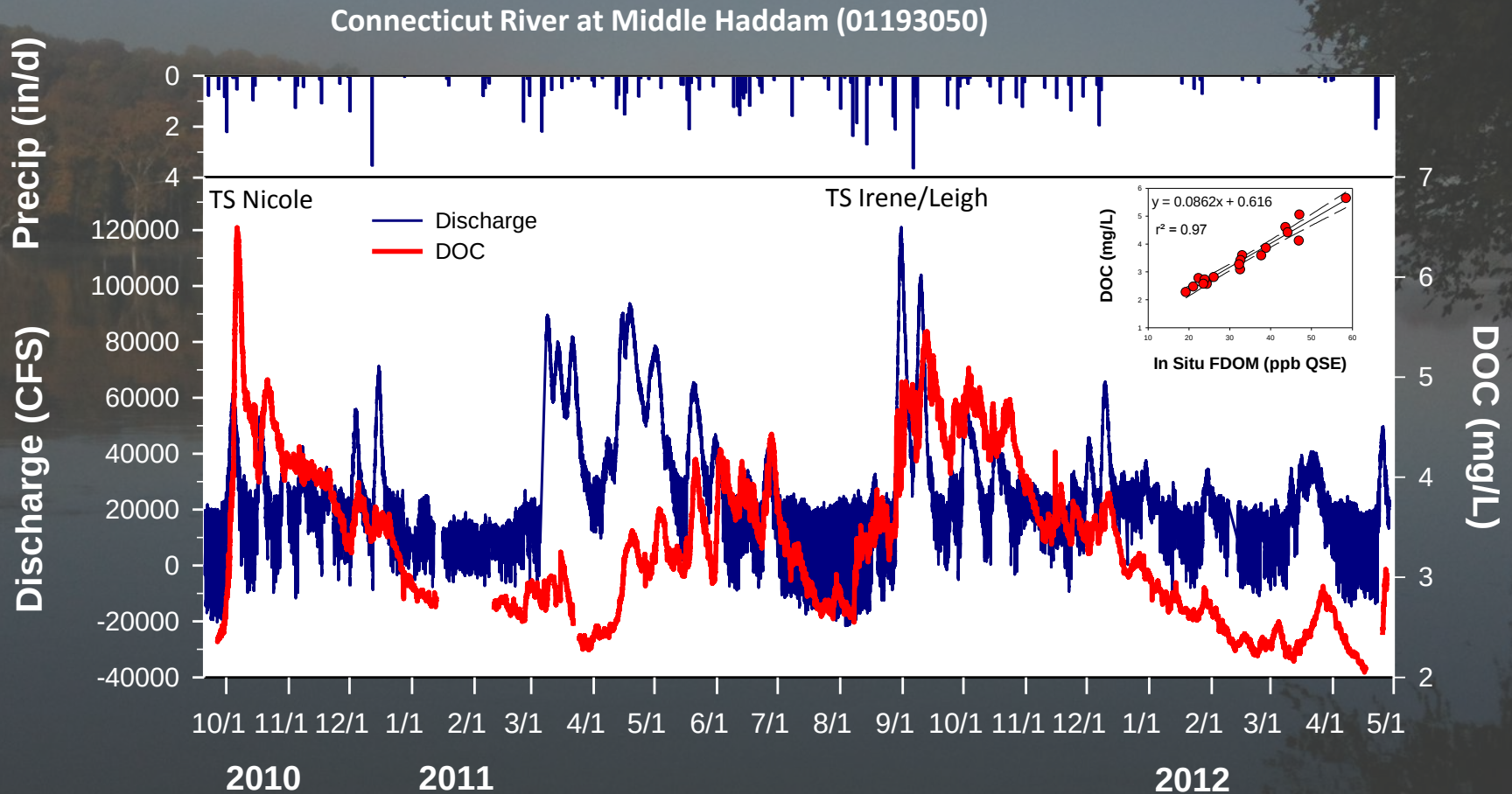


Nitrate plus Nitrite values with Discharge: Potomac river near Chain Bridge



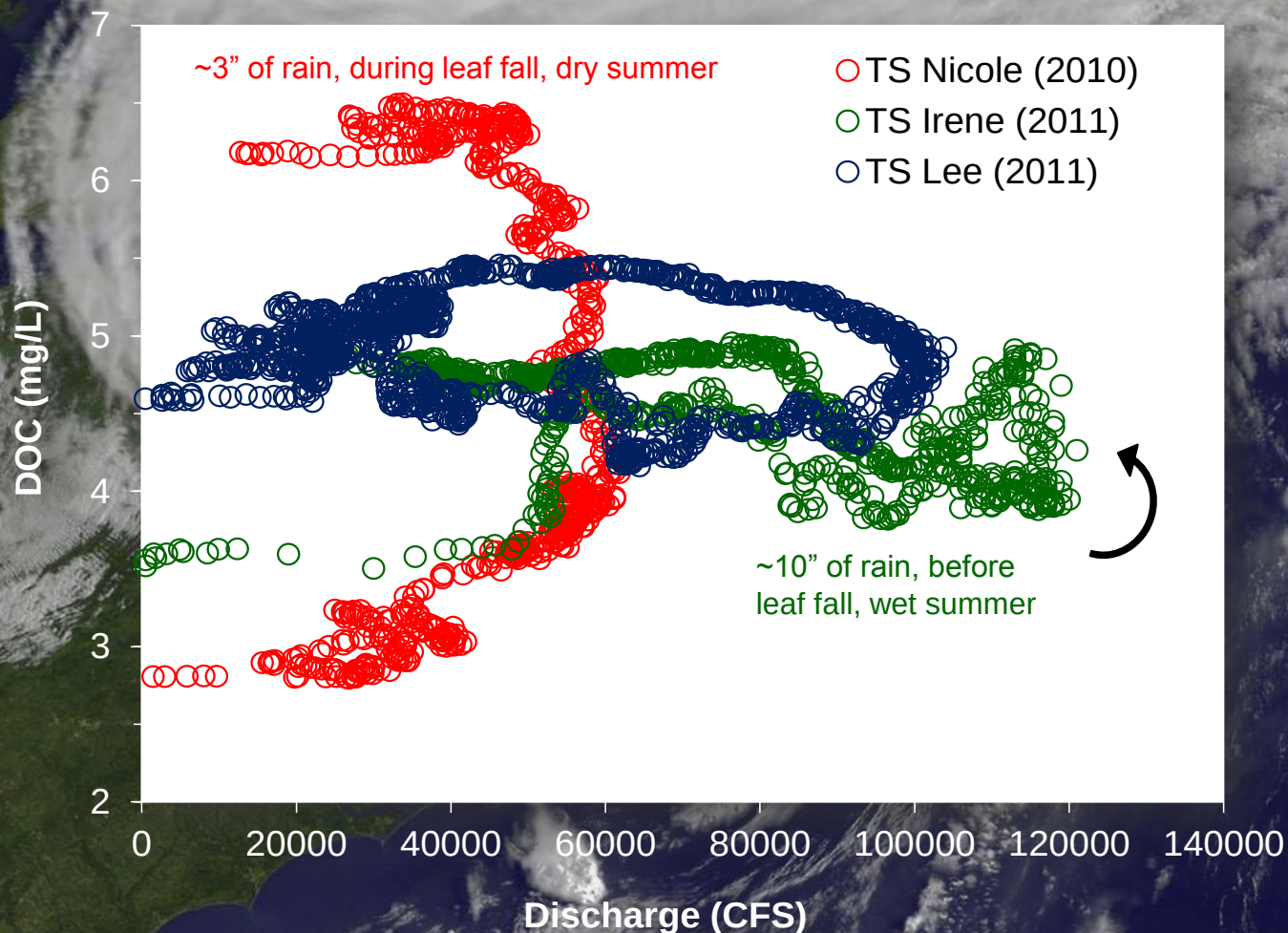
DOC transport during large events

- Large DOC response after leaf fall and muted responses during snowmelt
- Variability from storm to storm, snowmelt periods, etc.



DOC transport during large events

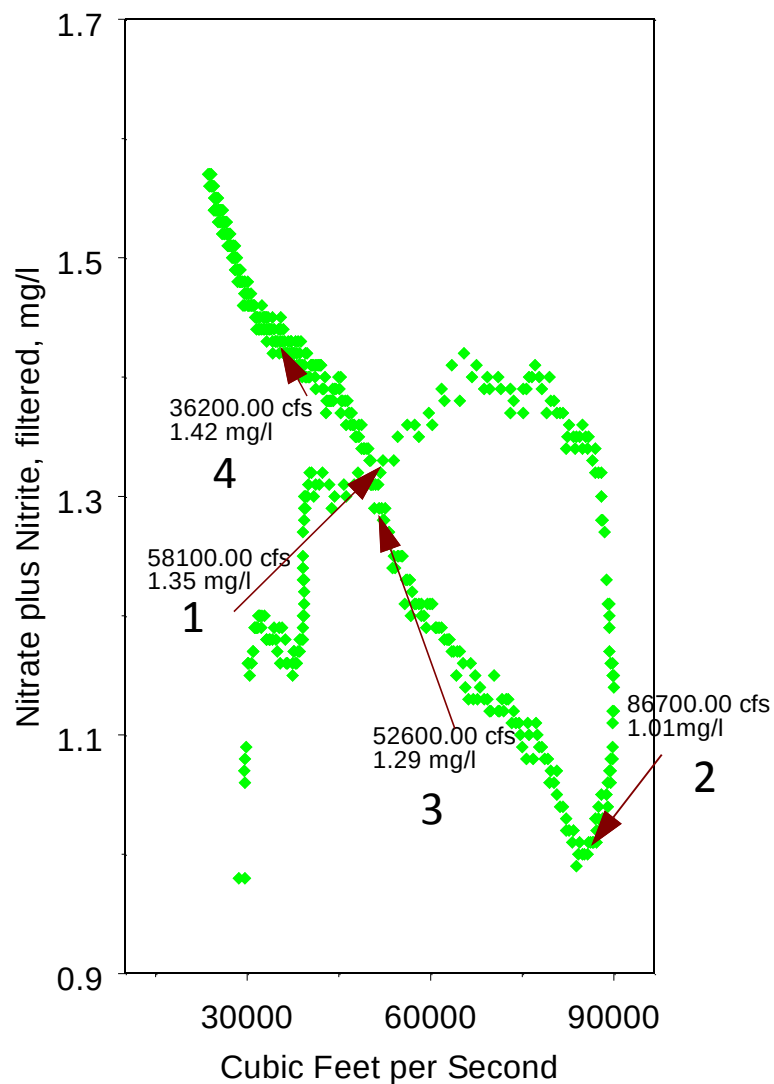
Differences in C-Q hysteresis during extreme events in the Connecticut River due to antecedent moisture, DOM availability, or threshold effects?



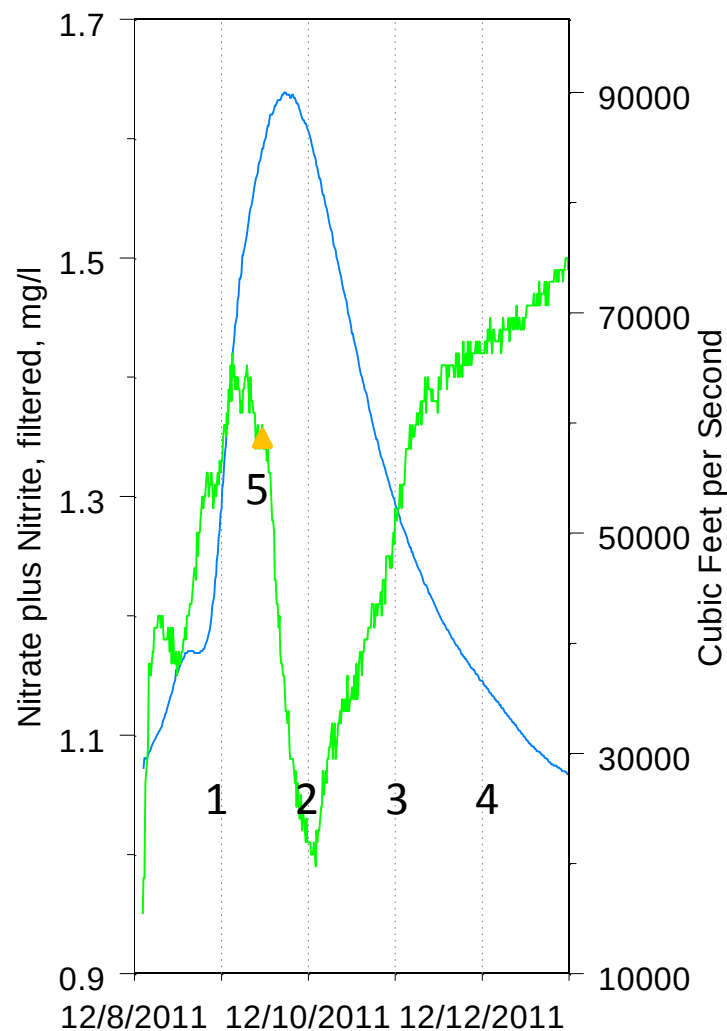
TS Irene, Aug/Sept 2011 (NASA/NOAA GOES Project)

Slide courtesy of Brian Pellerin
CA WSC Sacramento: bpeller@usgs.gov

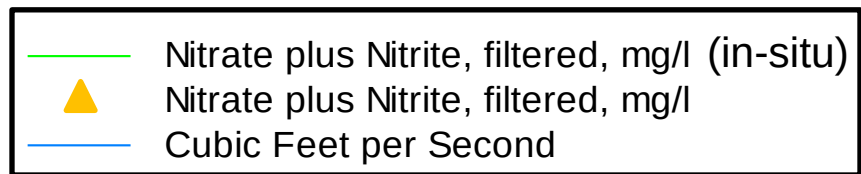
Hysteresis pattern during storm event flow: In-situ data from Potomac at Little Falls



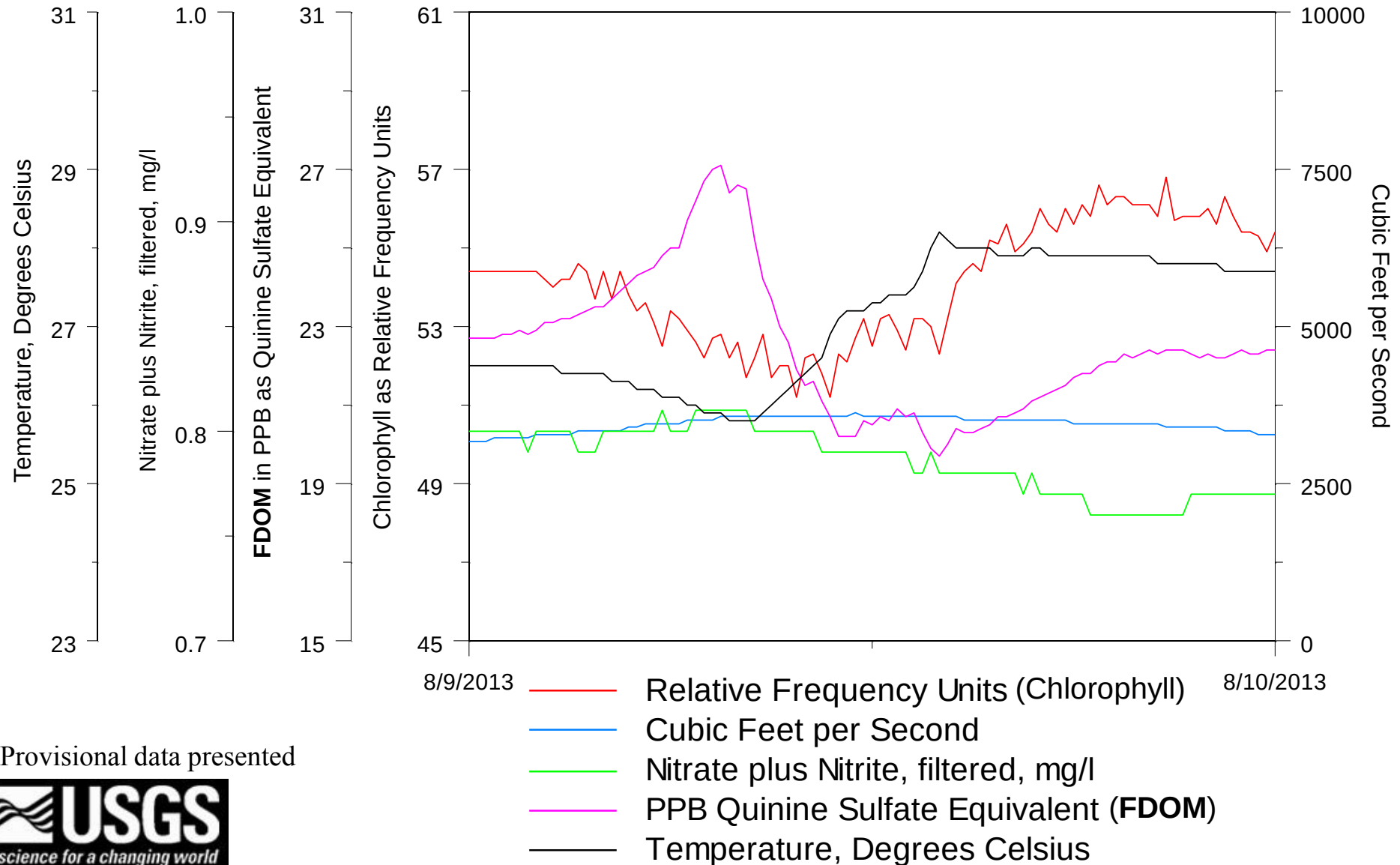
1 = 12/09/2011, 2 = 12/10/2011,
3 = 12/11/2011, 4 = 12/12/2011,



5 = 12/09/2011 @1330: 1.35 mg/l



Diurnal Cycle with an abrupt increase in CDOM: Provisional in-situ data from Potomac at Little Falls



Input from C&O Canal into the Potomac River 0.8 km upstream from monitoring station at Little Falls Pump Station



In-situ monitoring could provide

- more accurate load estimates
- the ability to establish surrogate relationships
- knowledge of how concentrations change during storm event flows
- insight into periodic cycling of concentrations
- early warning of contaminate plumes

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