UMCES Conowingo Project – Field/Lab Measurements and Modeling

UMCES

Contract Imminent????

Conowingo Pond Questions

1. Can we ignore nutrient regeneration within the pond? Does it matter if the particles are in the pond or in the estuary since nutrient regeneration occurs in both places?
2. How reactive are the particulates in the bottom sediments? Are bottom sediments more or less reactive than the particles crossing the dam under low to moderate flow? Note – N and P chemistry have very different controlling mechanisms
3. What are the hydraulic characteristics of “normal” and scour particulates?
4. Where to the particulates go in the bay?

Upstream Inputs

- Inputs to Conowingo Pool – P Characterization
- N and P release during decomposition experiments

Conowingo Dam Particulate Efflux

- Particle settling behavior
- Form and potential reactivity of P
- Decomposition experiments to assess N and P bioavailability

Reservoir Processes

<u>Biogeochemistry</u>

- Net exchange of N and P
- Pore water/solid phase characterization
- Spatial distribution of organic matter reactivity
- Grain size, porosity, non-reactive carbon (coal)

Impact on Bay Processes

<u>Biogeochemistry</u>

- P release as a function of salinity/redox
- N decomposition rates
- SFM modeling of results

<u>Transport/Deposition of Particulates</u>

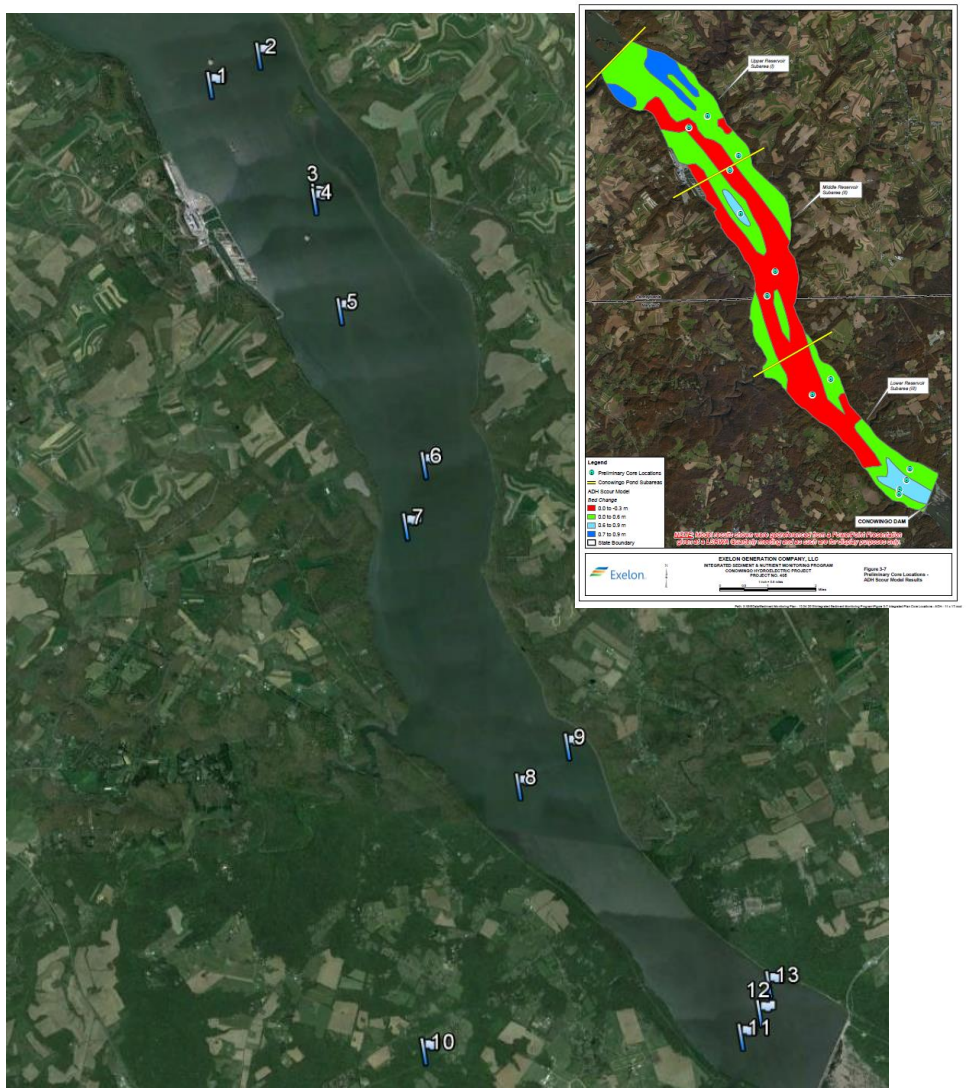
- Event-based sampling of particle distributions and physical forcing
- Radionuclide identification of “new” deposits
- Modeling of particle sedimentation

Proposed Project

- USGS/Exelon/DNR – yield and character of particulates entering/leaving reservoir. High/low flows, scour, etc……
- Cornwell – Reactivity of reservoir, suspended sediment inputs and outputs, sediment-water exchange in reservoir and bay (experiments)
- Sanford – Settling behavior of material leaving Conowingo Dam + Field Studies in Bay
- Palinkas – short-lived nuclides to identify flood deposits in bay. Sediment dating
- Testa/Kemp – sediment flux modeling of reservoir and bay nutrient biogeochemistry
- Ming Li – ROMS model of sediment deposition in upper bay

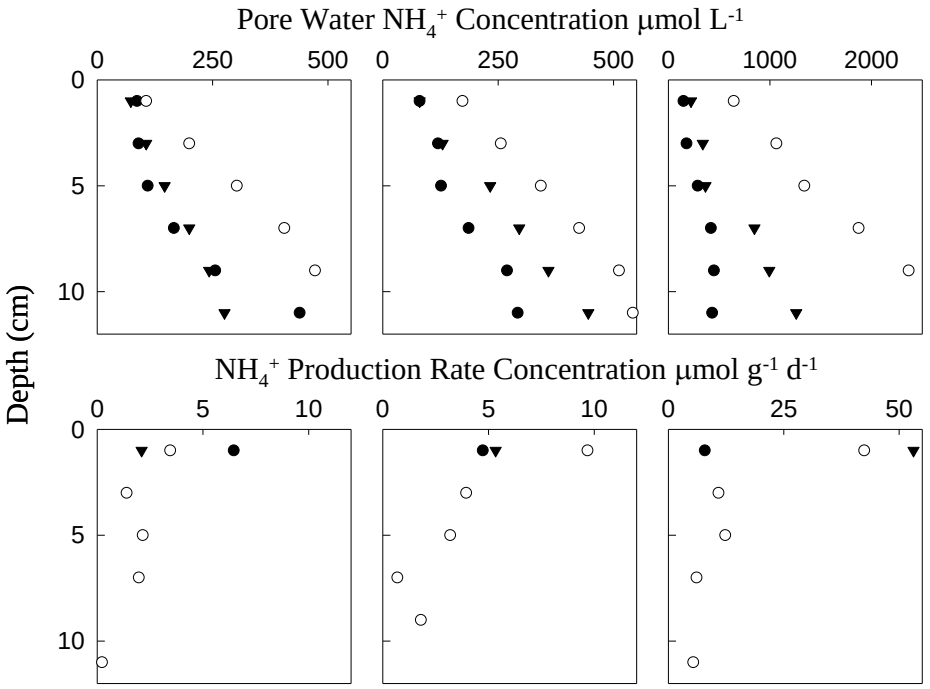
Long Cores – January 2015?

- Cores will be ~ 3 m long
- One core/site for geotech work
- One core for UMCES
- Pore water-solids-nuclides
- Sediment decomposition rates – ΣCO_2, CH_4, NH_4^+, …

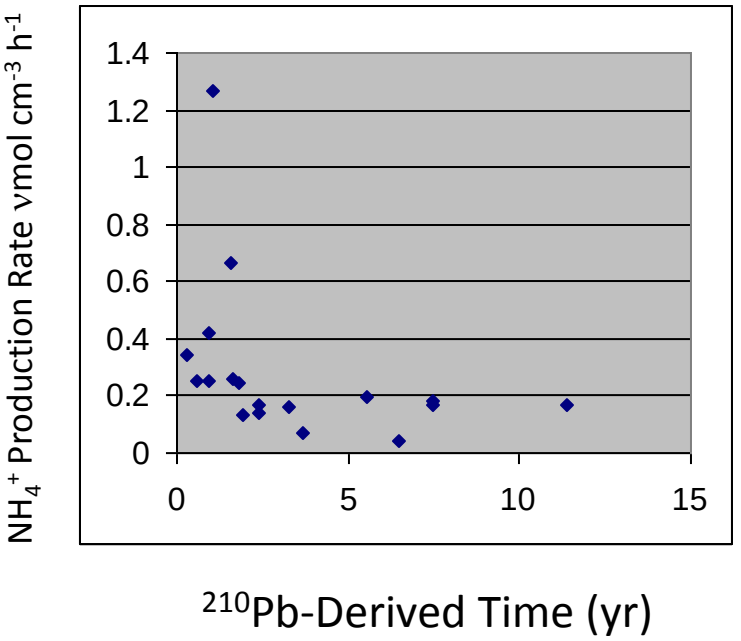


Example Decomposition Data

Everglades December 2013



Lake Champlain – UMCES/Hydroqual



Data from 3 depths at 5 sites.
CO_2 and CH_4 fluxes similar

Decomposition Experiments ≥ 6 months of incubation

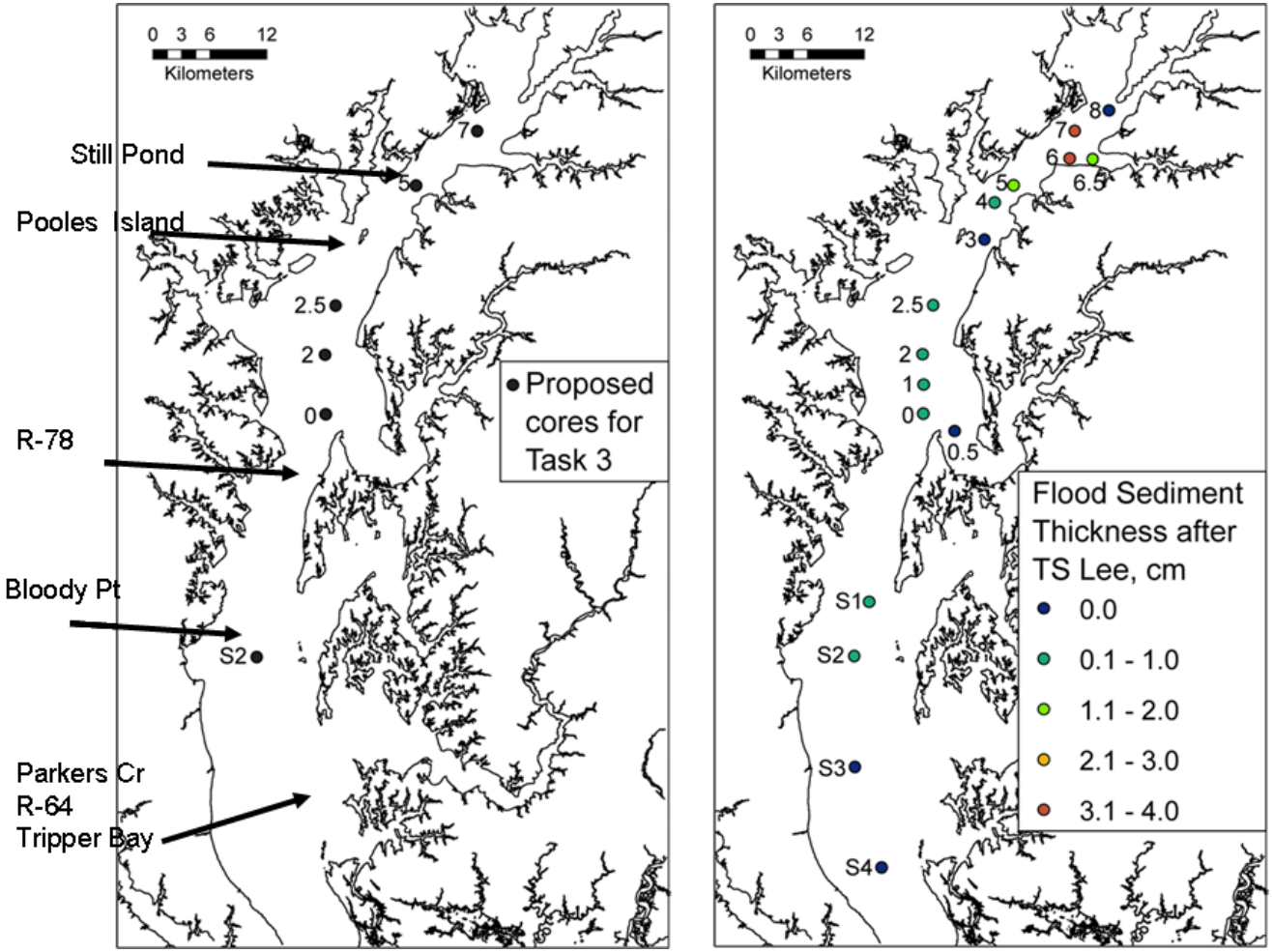
Material Incubated

- Deep sections from long Conowingo cores
- Near surface core sections from core flu work
- Particulates entering the reservoir – upstream river + creeks
- Particulates leaving the reservoir
- ~250 incubations, ~6 time points, ~5 analytes. Minimally 7,500 analyses.

Approach

- Sediment added to anaerobic vials, follow time course of solutes and gases
- Most incubations at 25°C, some experiments at lower temps
- ± SO_4^{2-}, NO_3^-, Cl^- Will use synthetic water to control terminal electron acceptors

Coring Transects: Experiments and Pre/Post Flood Monitoring

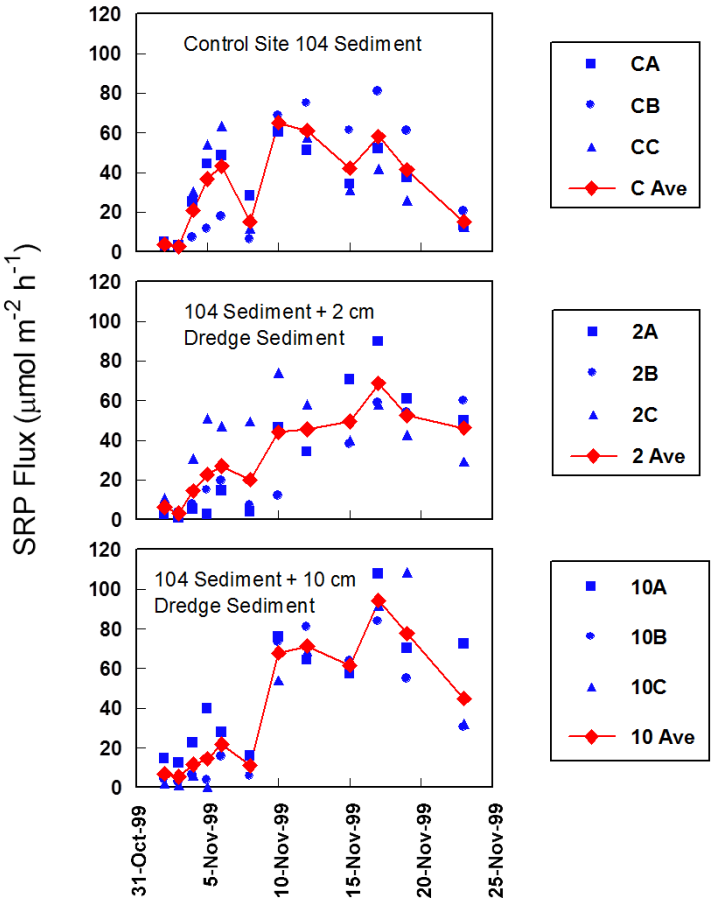


Conowingo sediment addition/simulation

Experimental Approach

- Add Conowingo sediment to the surface of intact Chesapeake Bay cores across salinity/redox gradients (summer)
- Follow P and N releases over time.
- 4 sites, 2 fresh(er), 2 saline, one with low oxygen

Experiments With Added Sediments



Time Frame

- **Program start – now**
- **Winter 2015 – long core program**
- **Early spring 2015-spring 2015: sediment-water exchange program**
- **Spring freshet/events – begin March 2015? Settling behavior, biogeochemistry**
- **Summer 2015 – estuarine core experiments**
- **Modeling –throughout**
- **Most data – by early spring 2016**
- **Draft Final Report – Oct/Nov 2016**
- **Project completion – Dec 2016**