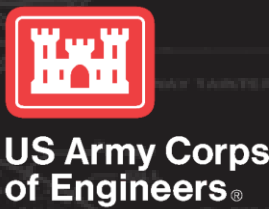




**CONNECTING
THE DOTS TO
INNOVATION**

CONOWINGO RESERVOIR MODELING STUDY UPDATE

USACE-ERDC – Jodi L. Ryder, Earl J. Hayter, and Danielle R. Tarpley
JUL 2026





OVERVIEW JUL 2026

Background

- Objectives of the effort
- Team and Partnerships

Modeling approach

- Hydrodynamics
- Nutrient water quality
- Sediment transport

Data Acquisition

- Physical sediment characterization
- Biological sediment characterization
- Other data

Model applications

- Dredging scenarios
- Extreme event scenarios

Project and reporting schedule

Questions

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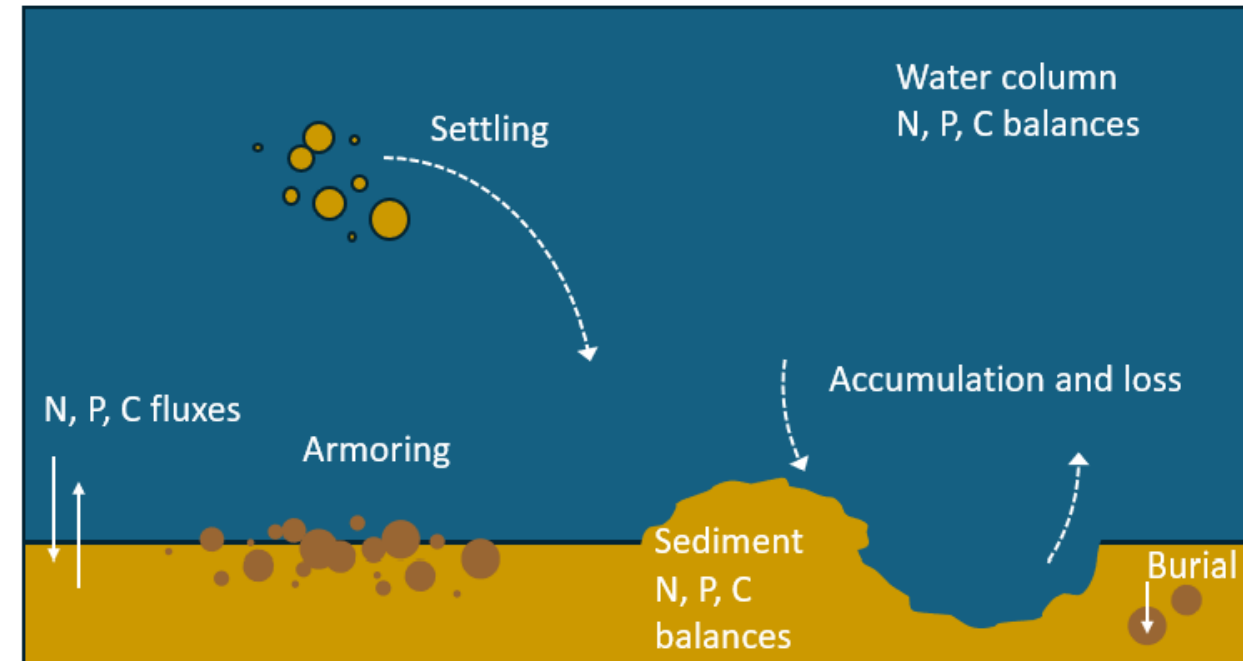
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Regional View of Conowingo Reservoir



MODEL REQUIREMENTS

- Continuous simulation of the reservoir pool including selected hydrometeorological events; (1991-2000)
- Change in hydrodynamics from reservoir infill of sediments from the CR watershed, and removal of material through dredging
- Biogeochemistry in the reservoir pool, responding to the amount and speciation of nitrogen, phosphorus, and sediment inputs from upstream and bottom sediment
- Biogeochemical changes in sediments, including burial, species changes, and water column exchanges
- Physical changes in sediment characteristics due to erosion, bed armoring, and deposition of sediment and the resulting morphological changes in the reservoir
- Dredging of the reservoir.





PROGRESS SUMMARY NEW JULY 2026 IN BLUE



Project components

Hydrodynamics
Sediment transport
Nutrient water quality

Dredge scenarios
Climate scenarios

- EFDC+ selected as model code
- EFDC+ installed on ERDC & NAVY HPC systems
- ERDC team trained and consulted on WQ modeling with DSI
- Updates made to EFDC+ vHPC to achieve agreement with EFDC+ vPC

Hydrodynamics Development

- Fine grid used to develop coarse grid (~86,490 cells)
- Boundary conditions, met conditions developed
- Preliminary test runs (PC)
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Sediment Transport Development

- Collection and physical characterization of samples
- 6 layers / 7 size classes enacted in each grid cell
- 3 mo. trial run (1 mo. spin up) on coarse grid
- Identification of flow and stage data
- [Bulk density method reconciliation](#)

Water Quality Development

- Biological characterization of samples
- Development of parameterization strategy
- Link watershed HSPF to boundary conditions
- [Identification of WQ calibration data](#)

Dredge and Climate Scenario Development

- [5 discussion sessions with PDT and technical review panel](#)
- [Climate scenarios close to finalization](#)
- [Dredge scenarios to be informed by climate results](#)



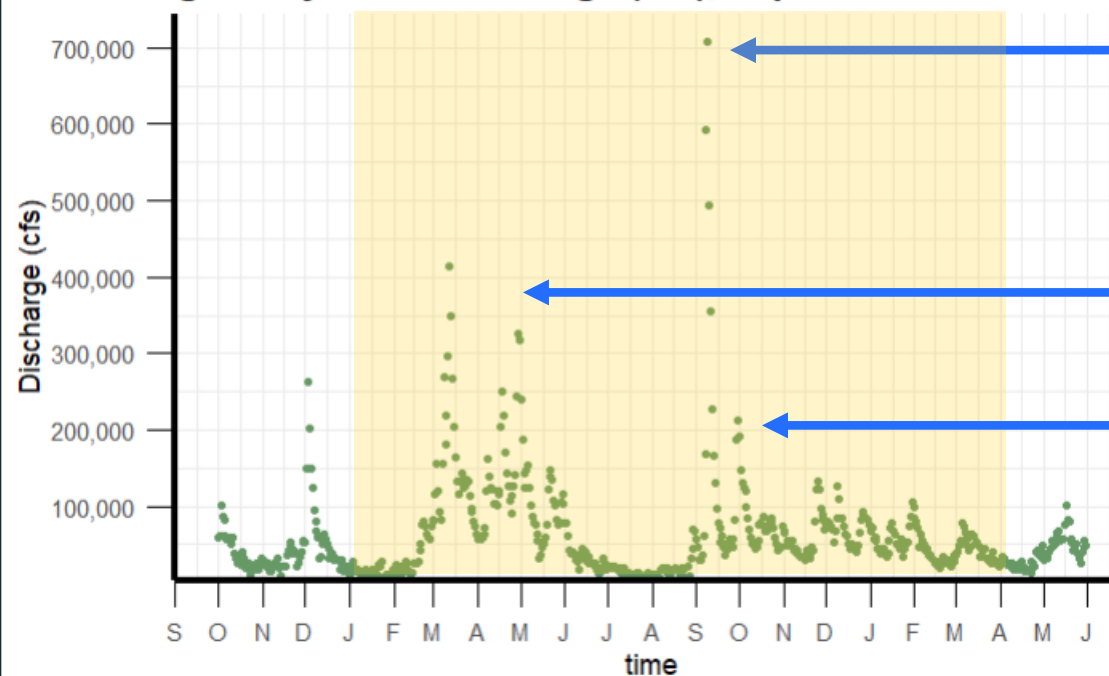
CLIMATE SCENARIO PLAN NEARING FINAL SELECTION



Baseline Time Period	Included Storms	Scenario Time periods
January 2011-Spring 2012	<ul style="list-style-type: none"> High freshet spring flows Tropical Storm Lee (September 2011) Unnamed tropical storm (October 2011) 	2025
		2055

Run under WIP 3 conditions in anticipation of their achievement by 2055

Conowingo Daily Mean Discharge (cfs), Sept 2010-June 2012



TS Lee
Peak Discharge ~709,000 cfs

High freshet

Unnamed October storm



DREDGING SCENARIO SELECTION TO BE FINALIZED AFTER CLIMATE RUNS



Scenario	Volume	Location	Geometry	Flow conditions and time period*
1	3 MCY	Upper Reservoir	Deep hole	<ul style="list-style-type: none"> Average flow conditions Dredge once Simulate 18 months
2	6 MCY	Reservoir		
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- Upper and lower reservoir sites differ in sediment characteristics
- 3 MCY ~ annual deposition
- 6 MCY ~ annual feasibility limit
- Deep hole geometry to optimize trapping and retention
- Average flow conditions
- Specific locations limited by no-dredge zones
- Climate scenario runs will be used to make final location selections

Hypothesis to be tested with the dredging model runs

- Dredging a greater volume of sediment will result in higher reductions in nutrient and sediment loads in both the upper and lower sections
- Dredging in the lower reservoir will result in greater nutrient reductions to the bay at each volume



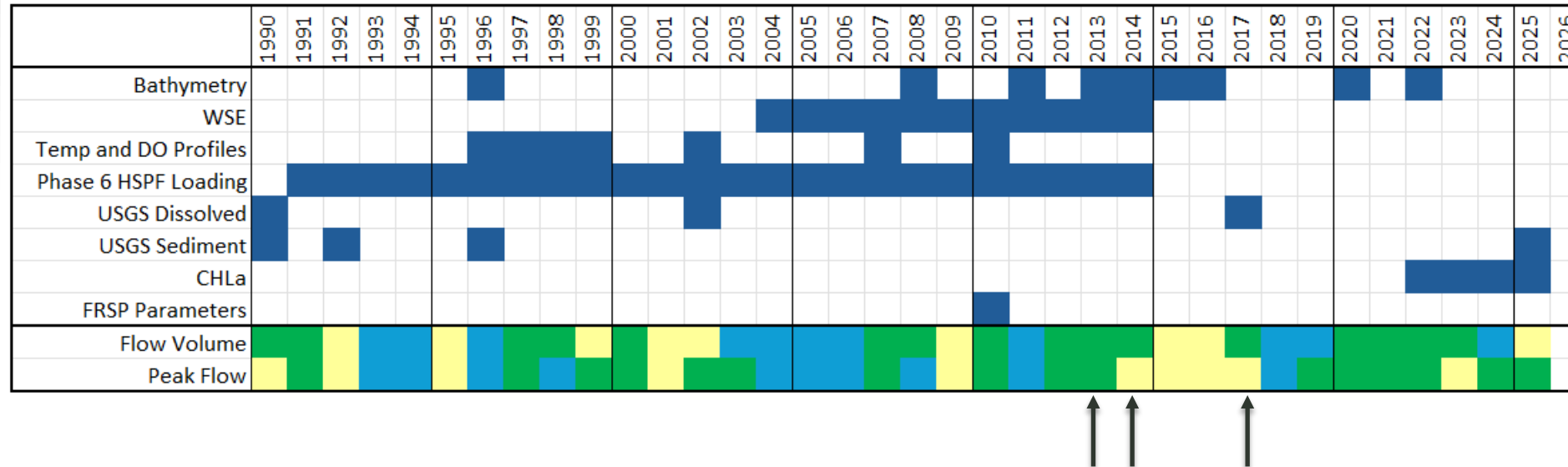
NEW DATA SINCE APRIL 2026



Item	Source	Application
Baltimore Water Supply Intake	MDE	Water Balance
Bedrock Elevation	PASDA	Sediment thickness limits for dredging
Water Quality Observations	USGS	Calibration/Validation
Sediment Quality Observations	USGS	Calibration/Validation
2014+ Bathymetry	Constellation via Gomez and Sullivan	Dredging development
Chlorophyll-a Observations	Constellation via Gomez and Sullivan	Validating seasonal dynamics



BASLINE YEAR SELECTION POTENTIALLY 2014



1996 is the best Pre-TS Lee year in terms of applicable data for calibration/validation.

2014 is the best Post-TS year to use as a baseline for Post TS Lee calibration/validation.

2014 will let us directly leverage bathymetry, water surface elevations, and Phase 6 loading.

2014 and 2017 are very similar letting us use dissolved nutrient data from 2017 for validation.

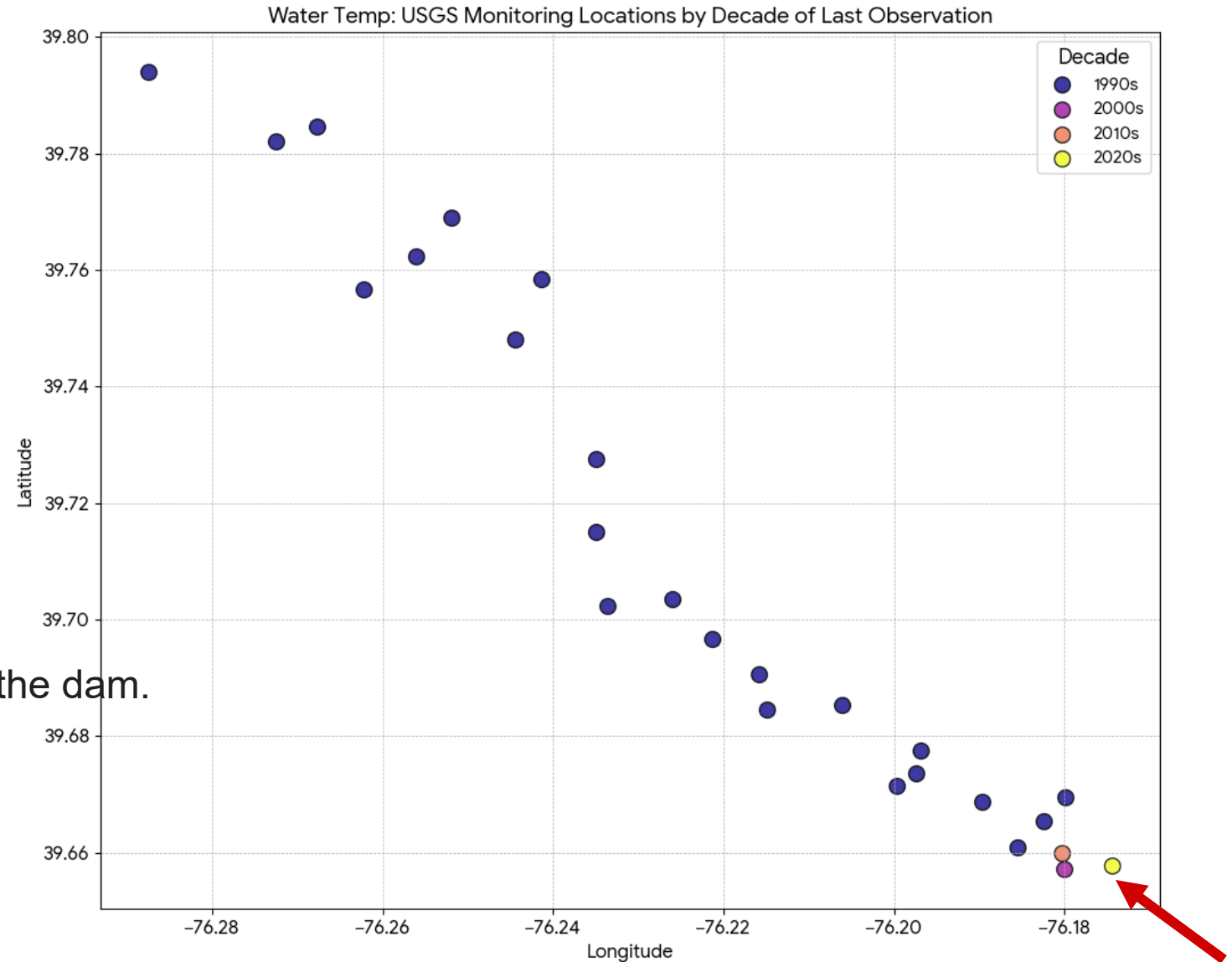
1997 is similar to 2014 and 2017 so may use the temp and DO profiles from that year as well.

*Excludes USGS-01578310 located immediately downstream of the Conowingo Dam



THE FOLLOWING PLOTS SHOW THE MOST RECENT DATA RECORDED FOR EACH SITE BY PARAMETER.

There are 25898 recorded values
But only 1046 are not downstream of the dam.

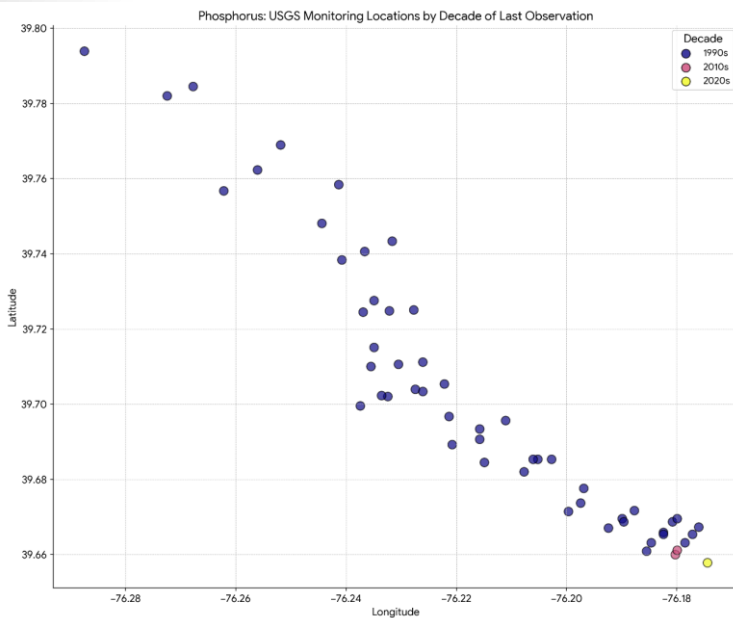
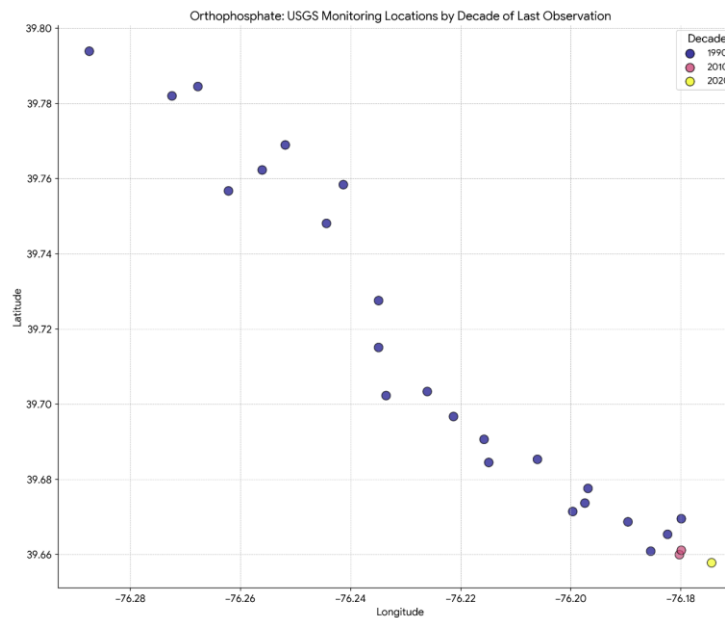
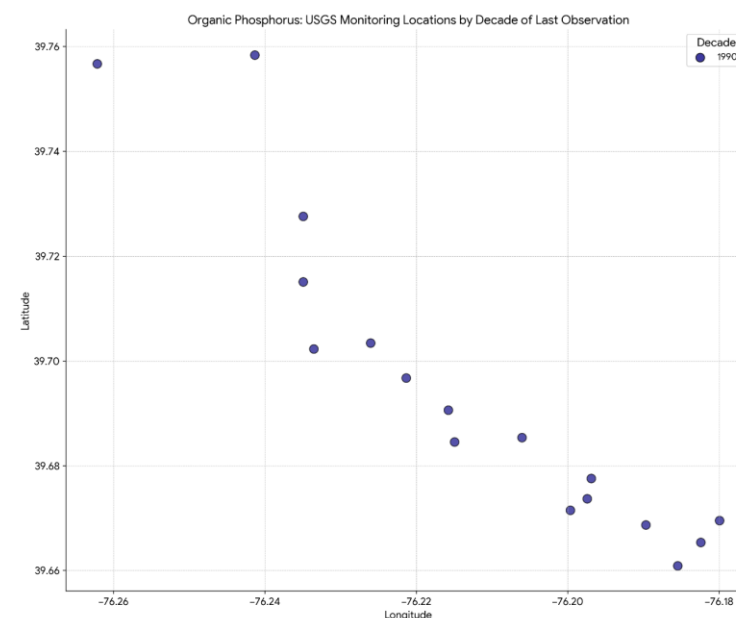


This site is downstream of the
dam so not particularly useful

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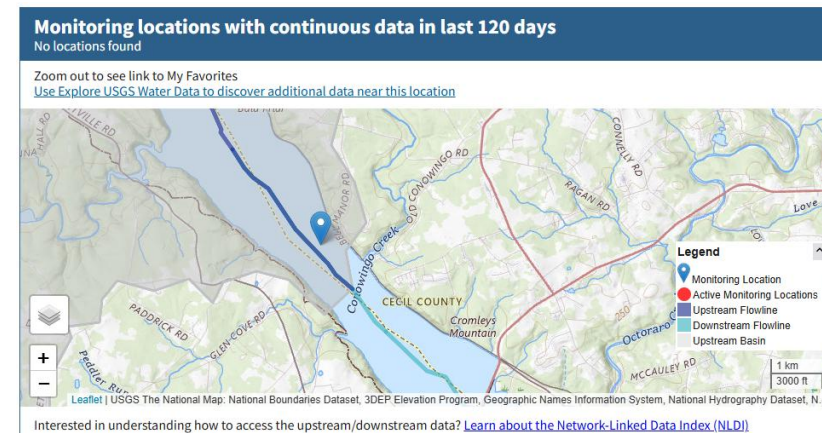


TOTAL PHOSPHOROUS, ORTHOPHOSPHATE, AND ORGANIC PHOSPHOROUS



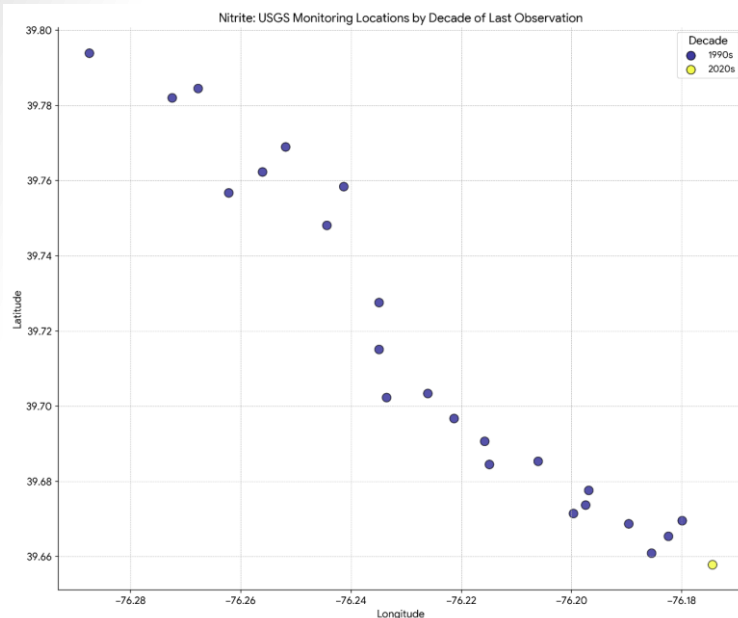
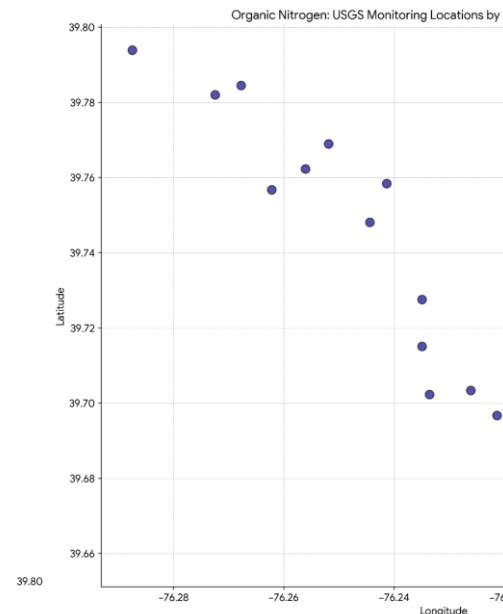
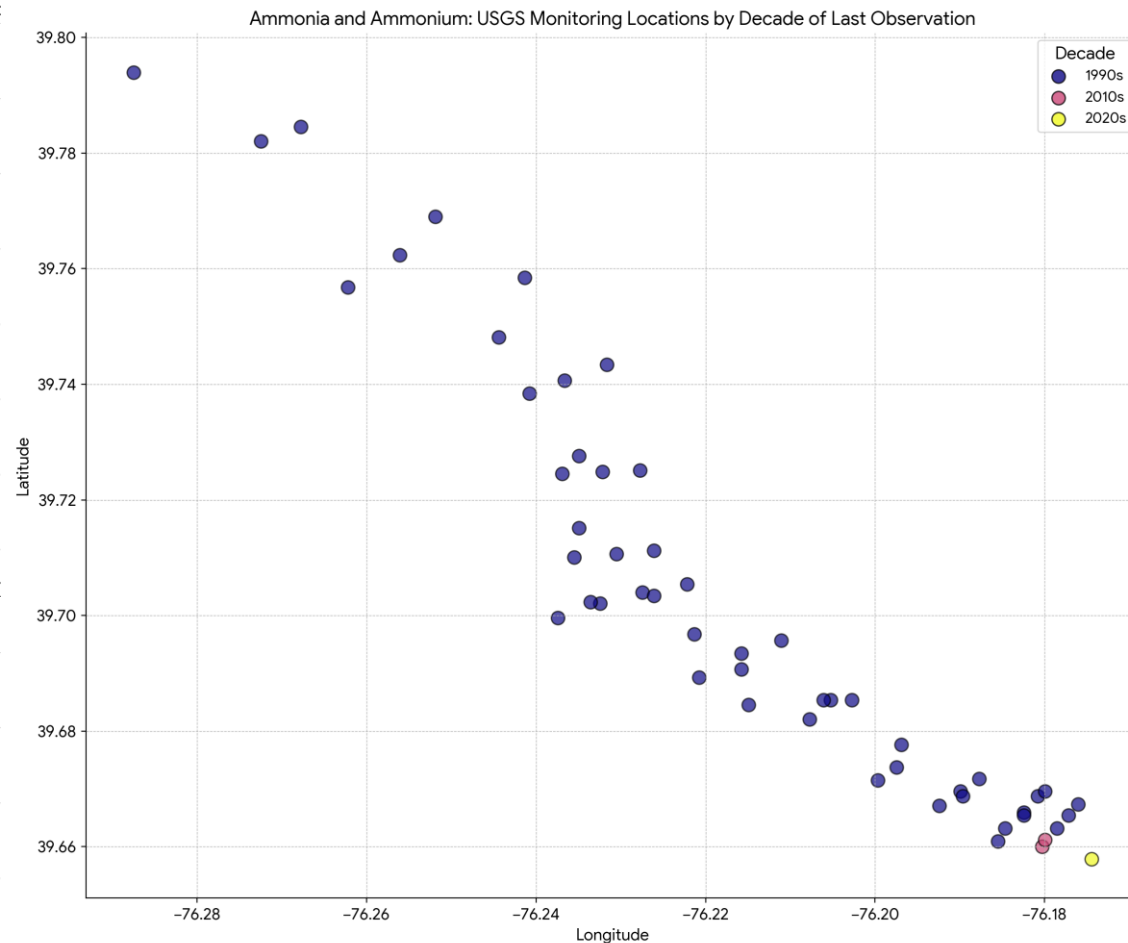
The pink dot is a series of bank measurements made in 2017 at site USGS-393936076104901

There are also lots of data at this site in 1990.





NITRATE, NITRITE, ORGANIC NITROGEN, AMMONIA AND AMMONIUM



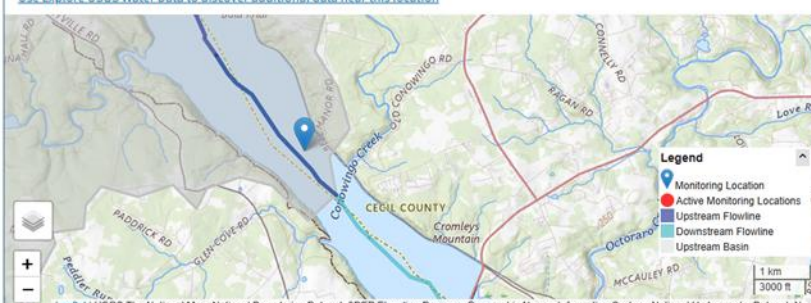
Most recent data is
from same site in
2017

Monitoring locations with continuous data in last 120 days

No locations found

Zoom out to see link to My Favorites

Use [Explore USGS Water Data](#) to discover additional data near this location



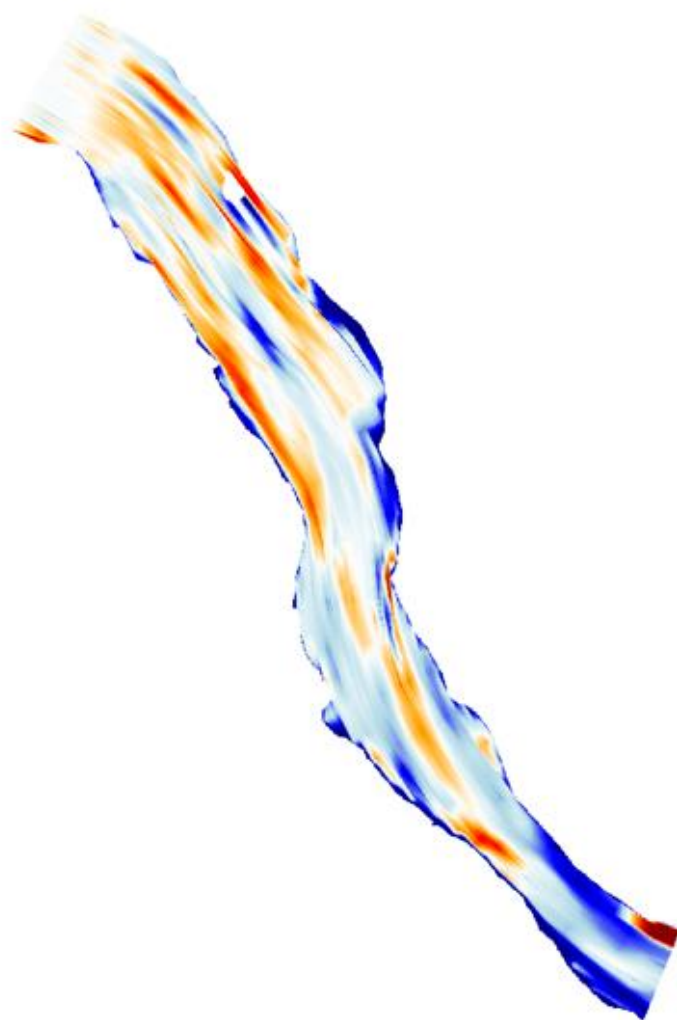


HISTORICAL BATHYMETRY AND SEDIMENT DEPTH



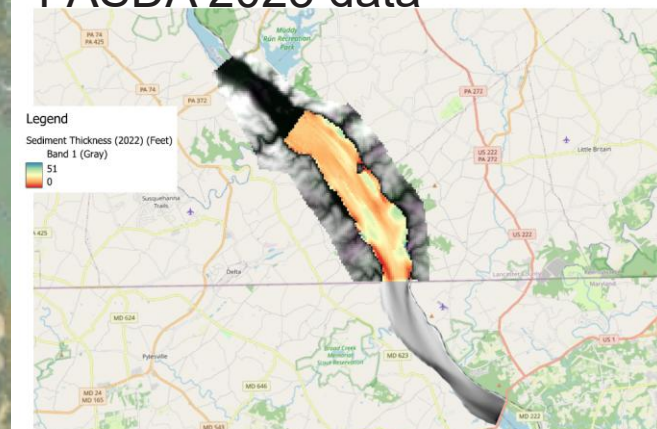
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Cumulative Bathymetric Change: 1996 to 2022



- Currently working to determine bedrock limitation on dredged deep hole in various parts of reservoir

PASDA 2023 data



*Use with caution.
Interpolated data from sparse cores

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SEDIMENT CARBON ANALYSIS

Repeat 300 ml trial –

- Most have finished after 1 reoxygenation

2L BOD bottles

- Had to restart
- Reoxygenated 2X
- 3 of 4 sites agreeing well with 2025 tests

10 L Carboy

- Agreeing well with 2L version

Differences from 2025

- After 7 days switched to ~3 day Temp, pH, DO
- Reoxygenating at 2mg/L DO
- Darkened lab
- Self-Stirring BOD instrument





CURRENT PROJECT AND REPORTING SCHEDULE



Task	Start Date	Due Date
Data Acquisition	10/1/2024	5/30/2025
Development of the CRMS		
Hydrodynamics	10/1/2024	7/31/2025
Nutrient Water Quality	1/1/2025	12/30/2025
Sediment Transport	1/1/2025	12/30/2025
First Meeting of Advisory Expert Panel		Nov-25
Identify Description of Dredging and Extreme Event Scenarios		May-26
Development of the Simulation of Dredging Scenarios in Model		
Dredging 1	8/1/2025	12/30/2026
Dredging 2	8/1/2025	12/30/2026
Infill 1	8/1/2025	12/30/2026
Infill 2	8/1/2025	12/30/2026
Reduce Sediment loading to Chesapeake Bay	8/1/2025	12/30/2026
Development of Simulation of Extreme Event Scen.	8/1/2025	12/30/2026
Project Deliverables		
Tech Note-lab	9/1/2025	9/30/2026
CRMS Presentation	12/1/2025	9/30/2026
CRMS User Manual	12/1/2025	9/30/2026
Tech Note-Dredging Scenarios	10/1/2026	3/31/2027
Tech Note-Extreme Event Scenarios	10/1/2026	3/31/2027
Model Code & Input Files will be delivered	10/1/2026	3/31/2027
CRMS User Workshop	4/1/2027	4/30/2027
DRAFT Tech Report	1/1/2027	5/1/2027
Review Draft Tech Report by Expert panel/PDT	5/1/2027	5/31/2027
Final Tech Report (Revise based on review comme	6/1/2027	6/30/2027
ERDC Management Review of Final Tech Report	6/1/2027	9/30/2027
Publication of Tech Report	10/1/2027	12/31/2027

Next 2
Quarters

→ Drafted

→ Outlined



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October 2026



U.S. ARMY



**US Army Corps
of Engineers®**



ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER





PROGRESS SUMMARY: OCTOBER 2026 IN BLUE



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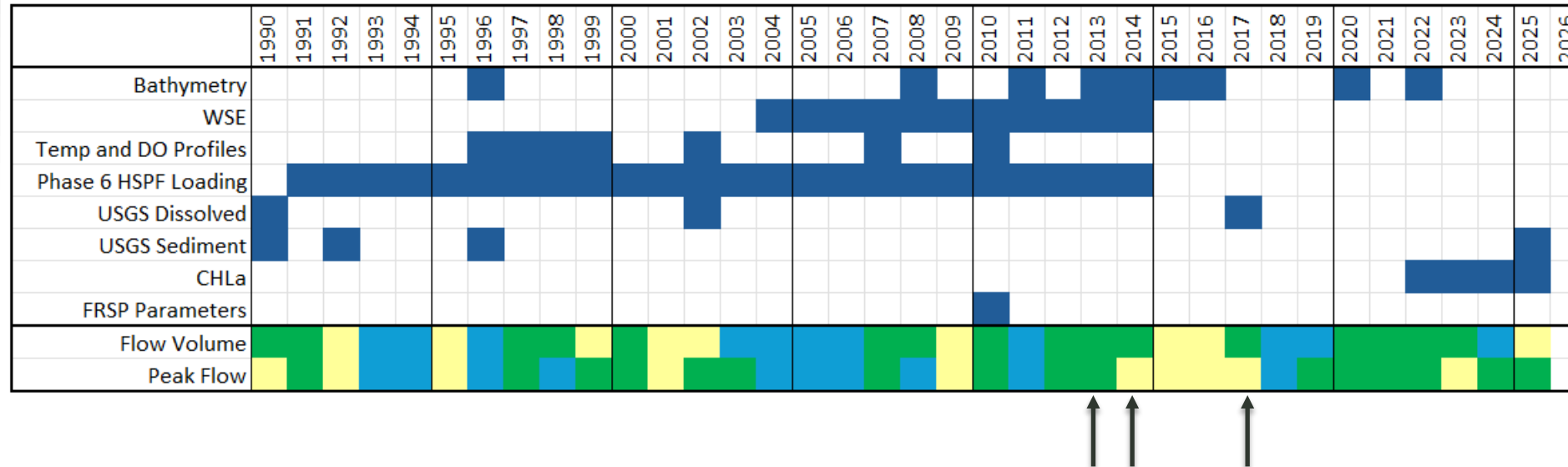
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SELECTION OF 2014 AS DREDGING BASE CASE



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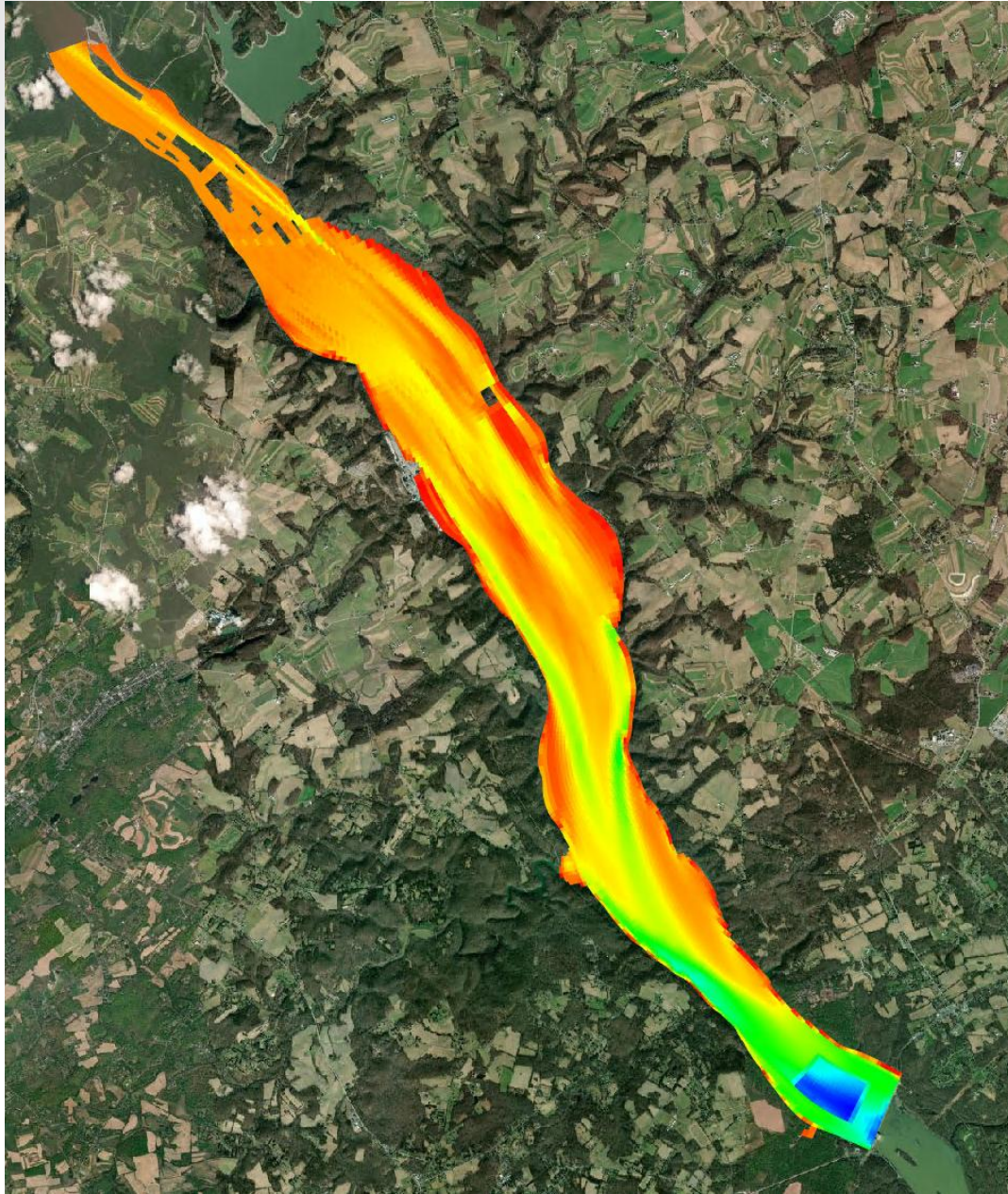
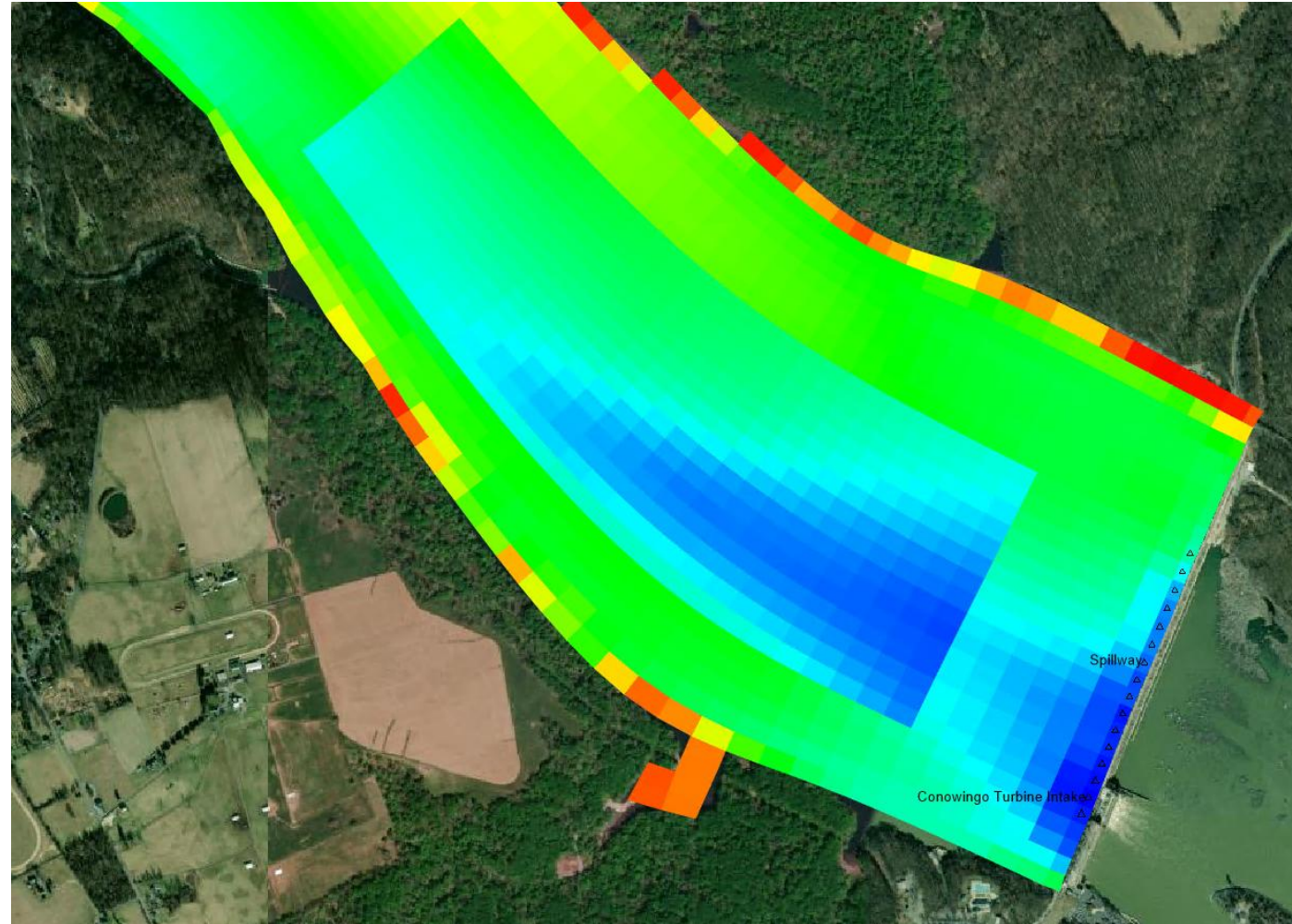
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LOWER RESERVOIR 6 MCY SITES

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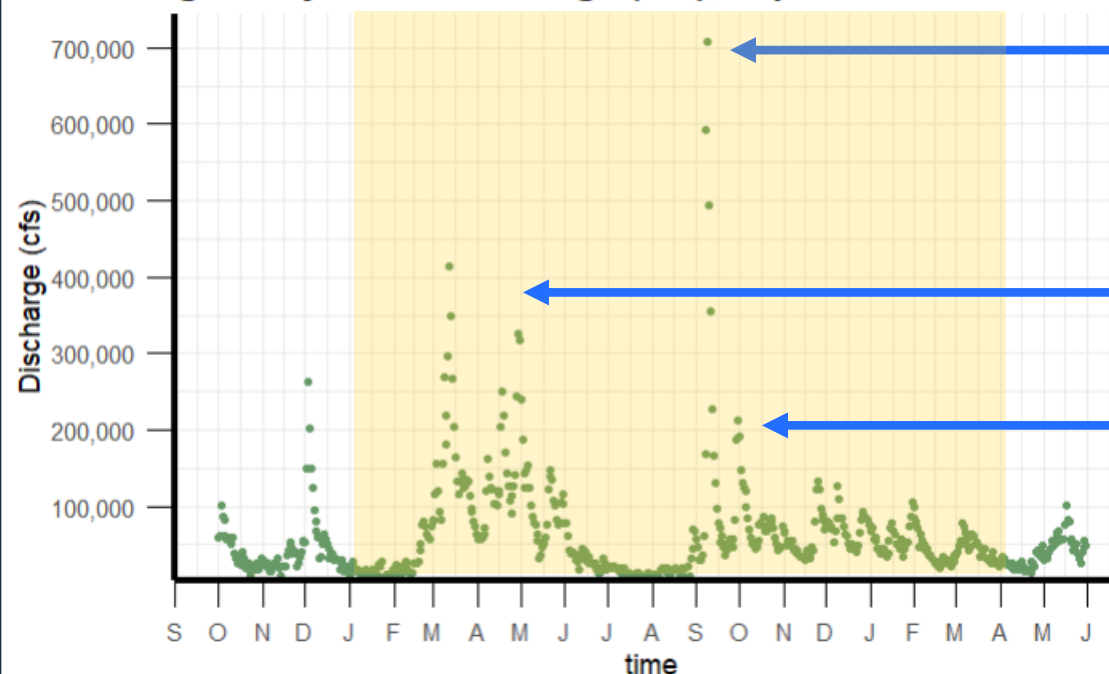


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Unnamed October storm

Phase 6 HSPF watershed loads for 2025 and 2055 anticipated Nov 2026-Feb 2027