

York County sites: Super Gages

- Provides real-time data specifically designed to improve understanding of watershed processes (e.g. land use effects, floods, droughts, ecosystem processes)
- Measures basic physiochemical parameters that a streamgage and a water-quality gage provide (i.e. stage/discharge, water temperature, specific conductance, pH, dissolved oxygen, turbidity)
- Often has "next generation" sensors like optical nitrate and could include other parameters like colored dissolved organic matter (CDOM), algal pigments (chlorophyll), or other optical measurements
- Extends information about basic and next-generation parameters by computing chemical concentrations from basic streamgage parameters
 - For example: suspended sediment or total phosphorous concentrations from turbidity, total nitrogen concentrations from nitrate, chloride form specific conductance
- Collects and computes various constituents at high frequency (typically at 15-minute intervals, transmits every hour)
- York: Established to monitor York County progress towards satisfying existing regulations and meeting regulatory goals: Chesapeake Bay Program (CBP) (EPA), State TMDLs, progress determined by Bay Model



York County Monitoring Program

• York is 6/11 Supergage Sites (and growing) across four counties (York, Lebanon, Dauphin, Lancaster)

Multi-level cooperators (local County, State, and Federal)

Sites (in order going south through York):

Fishing Ck nr Goldsboro, 17.5 mi²

W. Conewago Ck at Manchester, 510 mi²

Codorus Ck. nr. Saginaw, 277 mi²

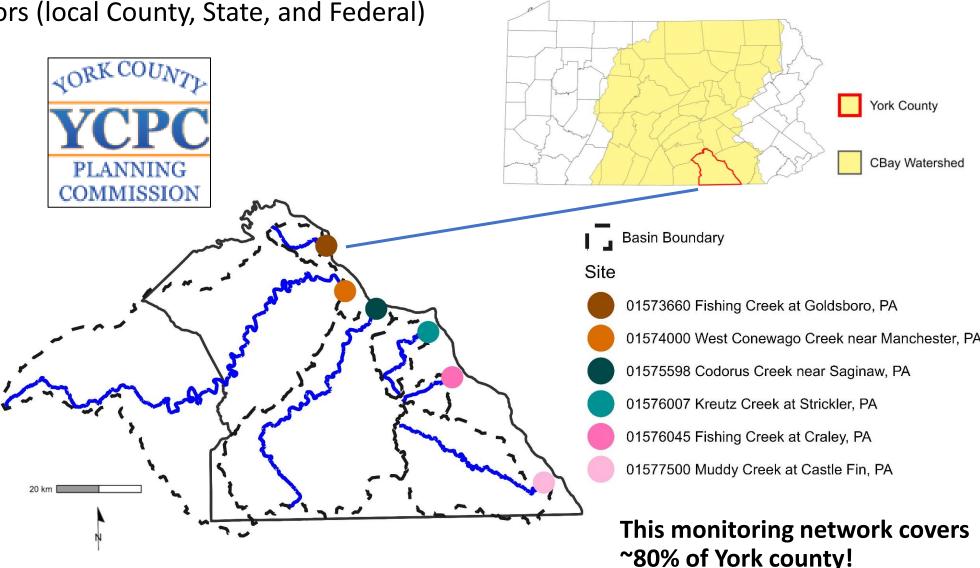
Kreutz Ck nr Wrightsville, 32.3 mi

Fishing Ck at Craley, 15.8 mi^2

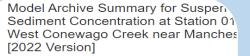
Muddy Ck at Castle Fin, 133 mi²

Bold = NTN stations









log10 transformation, turbidity predictor

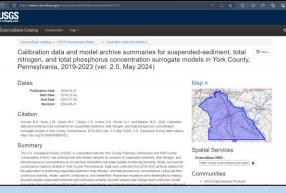
ant consequences with data starting star or 2010-10-01. This is the first many account of the star of

All Available Data

Model Statistics, Data, and Plots

logSSC = + 0.575 * logTURB + 0.498

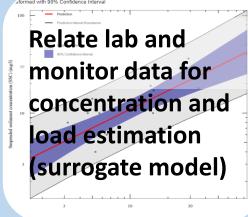
Variable Summary Statistics





























Monitor

Surrogate Regression Models

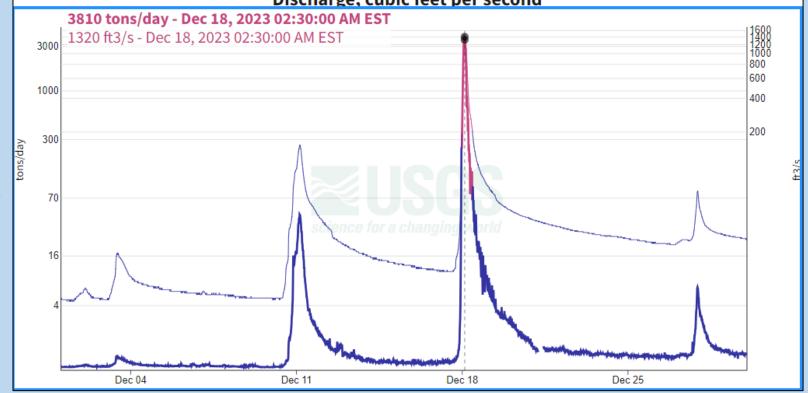
- Basis of all other products, "Show your work" step
- Focus on Suspended Sediment Concentration (SSC), Total Nitrogen Concentration (TN), Total Phosphorus Concentration (TP)
 - Currently using combinations of turbidity, nitrate, seasonal terms, flow
- Display data: Publish in a "Model Archive Summary", apply to the continuous monitor data and create additional time series on <u>public-facing</u> NWIS station pages
- Calculates instantaneous concentrations and loads, daily mean loads, annual loads; loads are the end goal

Fishing Creek at Craley, PA - 01576045

June 6, 2023 - June 5, 2024

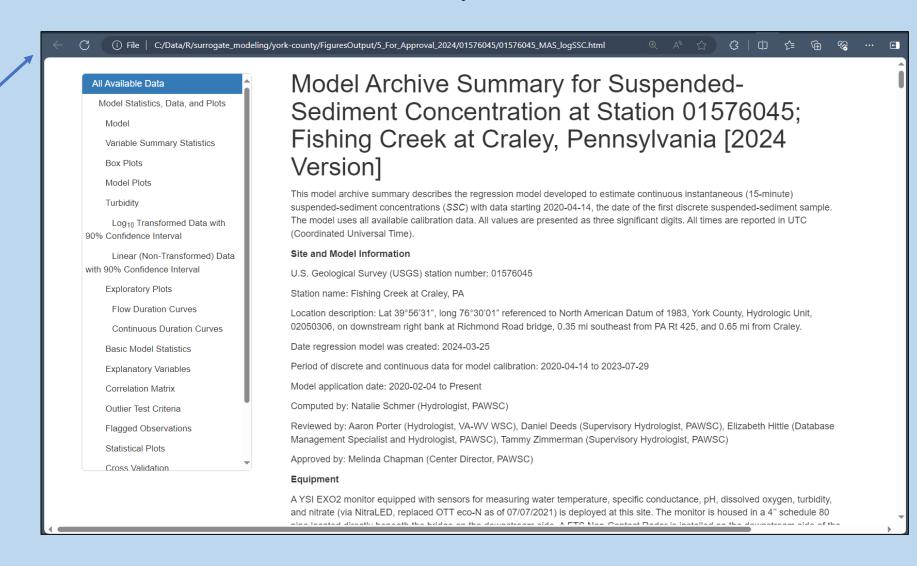
Suspended sediment load, water, unfiltered, computed, the product of regression-computed suspended sediment concentration and streamflow, short tons per day

Discharge, cubic feet per second





- Published in a publicly accessible USGS database (ScienceBase)
- Done in R Markdown
 - Consistent, reproducible across all projects and sites,
 - Can control formatting, produces HTML file that can be opened in a browser
- Includes
 - 1. Formula for the relation of sensor and sample, with statistics and plots that describe the relation
 - Relation calibration data (how does sensor relate to sample)
 - 3. Once published, applied to data on the web





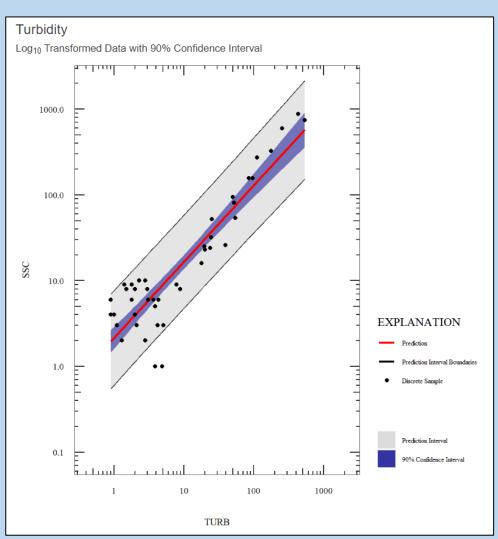
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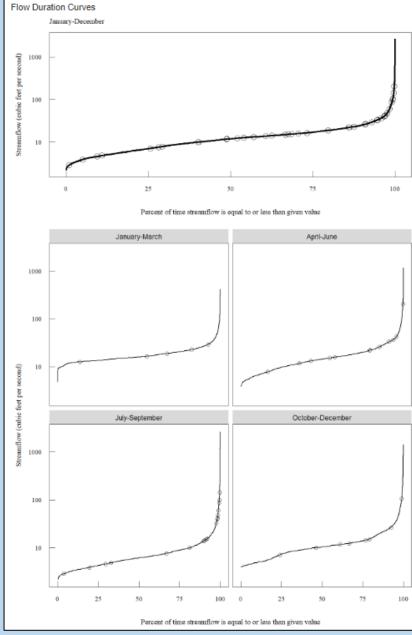
Basic Model Statistics

Model	$log_{10}SSC = + 0.89 * log_{10}TURB + 0.332$
N	45
Transformation	log ₁₀
Intercept	0.332
Slope	0.89
Coefficient of Determination (R²)	0.827
Adjusted Coefficient of Determination (Adj. R²)	0.823
Root Mean Square Error (RSME)	0.319
Mean Squared Prediction Error (MSPE)	80.2
Predicted Residual Error Sum of Squares (PRESS)	4.73
Duan's Bias Correction Factor (BCF)	1.24



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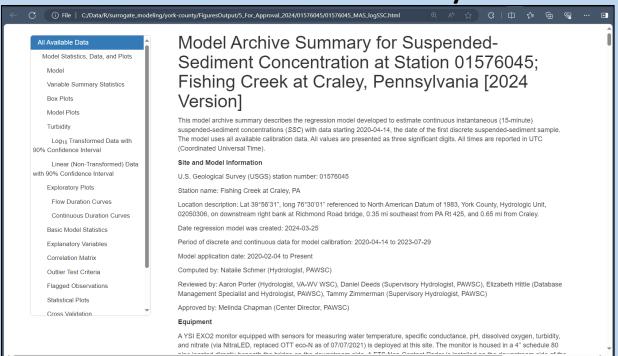
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Model-	Calibrat	ion Data	Set									
pairing is ba			5-minute date-time nn is the exact san						on			
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date	sample date	log10SSC	log10TURB	ssc [♦]	TURB [♣]	computed log10SSC	computed SSC	residual [‡]	normal quantiles	Flagged [‡]	%fines	%sand [⊕]
2020- 04-14 17:00:00	2020-04- 14 17:00:00	0.778	0.633	6	4.3	0.895	9.72	-0.117	-0.339		100	0
2020- 04-24 19:00:00	2020-04- 24 19:00:00	0.699	0.591	5	3.9	0.858	8.91	-0.159	-0.654		100	0
2020- 05-06 17:30:00	2020-05- 06 17:30:00	0.778	0.491	6	3.1	0.769	7.26	0.00923	-0.0555		100	0
2020- 06-03 16:00:00	2020-06- 03 16:00:00	1	0.362	10	2.3	0.654	5.57	0.346	1.27		70	30
2020- 06-19 14:45:00	2020-06- 19 14:45:00	0.778	0.568	6	3.7	0.837	8.5	-0.0591	-0.167		83	17
2020- 07-16 11:30:00	2020-07- 16 11:30:00	1	0.447	10	2.8	0.73	6.64	0.27	0.798		87	13
2020- 09-15 13:00:00	2020-09- 15 13:00:00	0.778	-0.0458	6	0.9	0.291	2.42	0.487	1.81		54	46
2020- 10-14 17:30:00	2020-10- 14 17:30:00	0.778	0.255	6	1.8	0.559	4.48	0.219	0.587		69	31
2020- 10-29 13:00:00	2020-10- 29 13:00:00	0.954	0.146	9	1.4	0.462	3.58	0.493	2.22		74	26
2020- 11-19	2020-11- 19	0.301	0.114	2	1.3	0.433	3.35	-0.132	-0.459		100	0

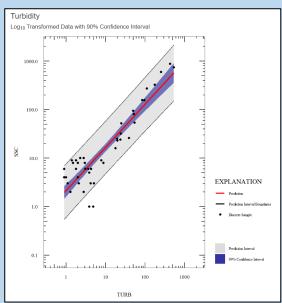
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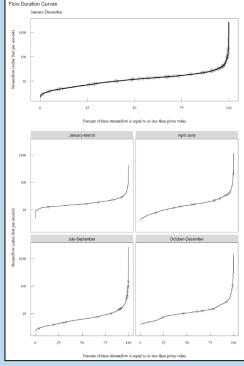




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date ‡	sample ;	log10SSC [‡]	log10TURB	ssc ‡	TURB [‡]	computed log10SSC	computed +	residual [‡]	normal quantiles † Flagged †	Silines ‡	%sand [‡]
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Turbidity
Log₁₀ Transformed Data with 90% Confidence Interval

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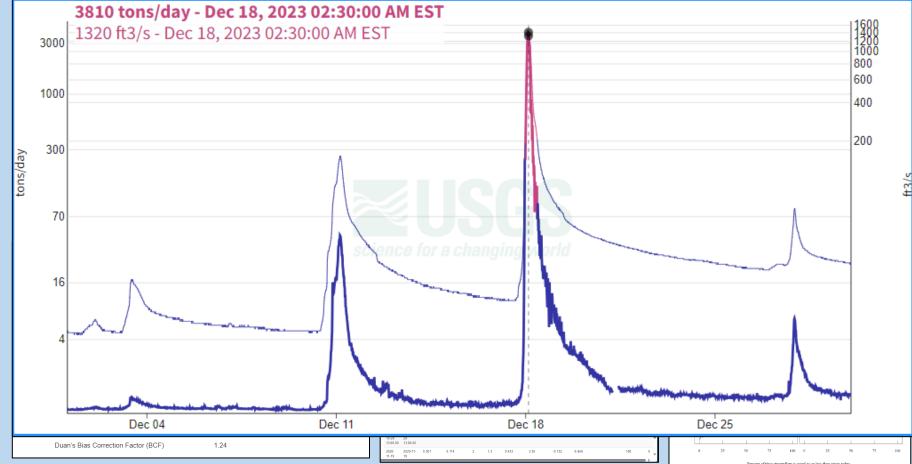


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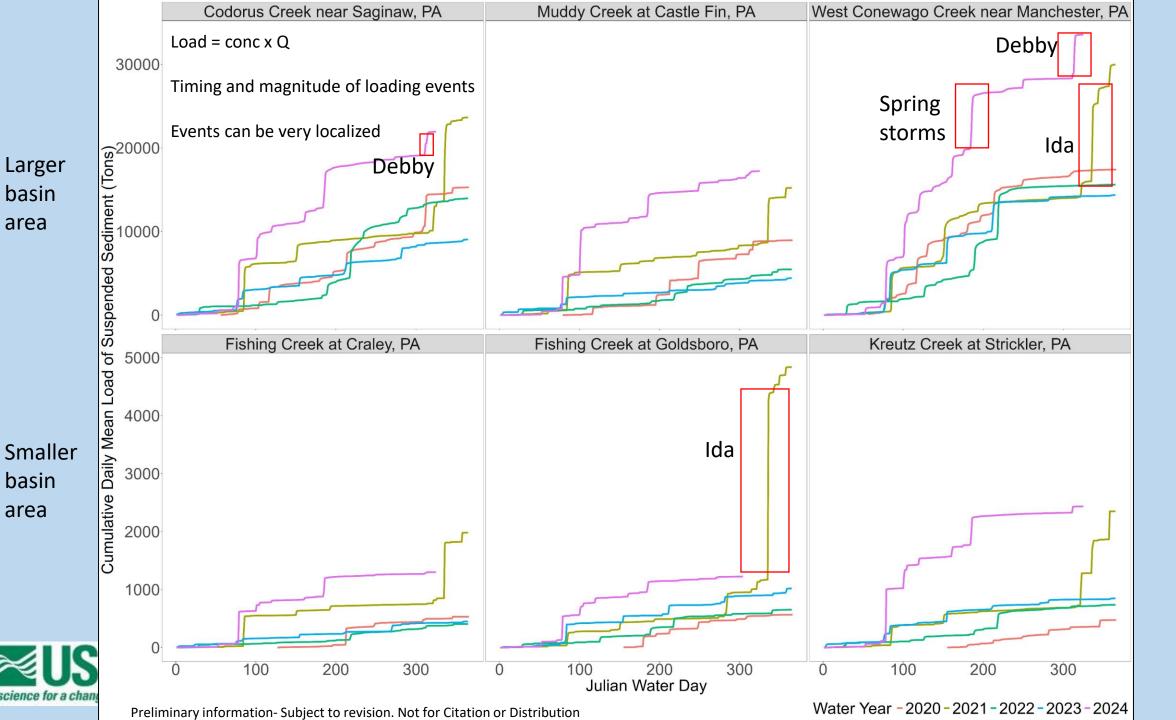


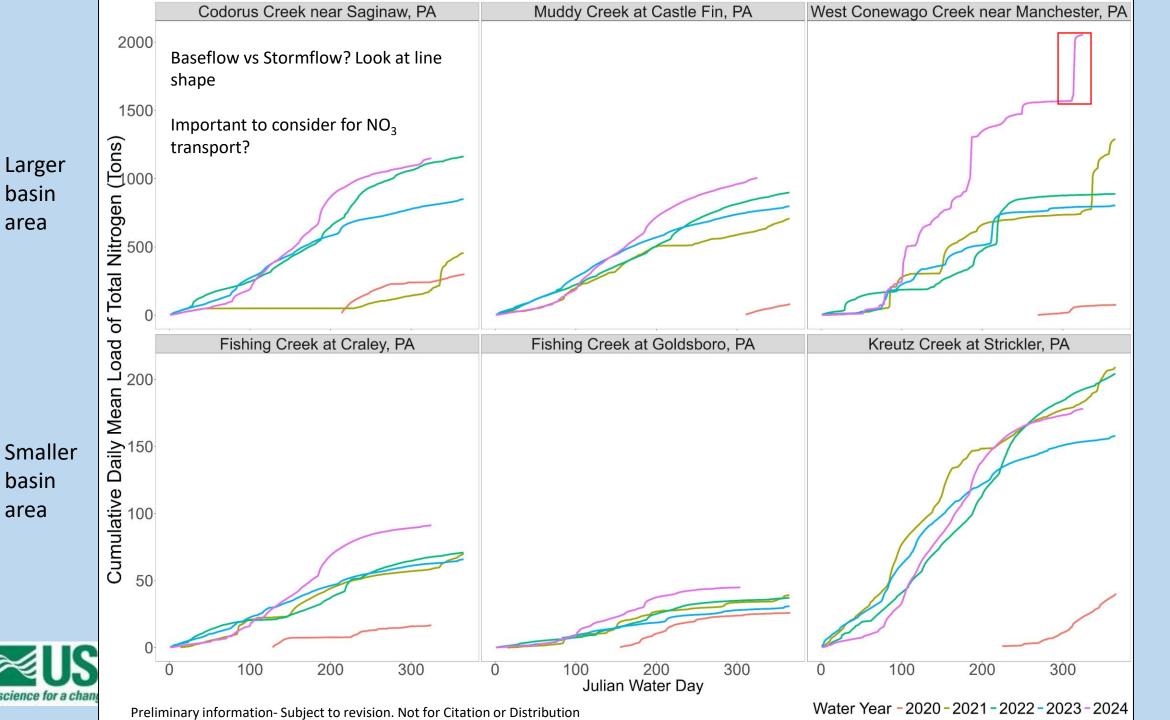
Data to date (as of yesterday!)



Loads







Codorus Creek near Saginaw, PA Muddy Creek at Castle Fin, PA West Conewago Creek near Manchester, PA Some steps and some smooth 150 Cumulative Daily Mean Load of Total Phosphorus (Tons) Fishing Creek at Craley, PA Fishing Creek at Goldsboro, PA Kreutz Creek at Strickler, PA 0 200 Julian Water Day 100 200 300 300 300 100 100 200 Ó Water Year -2020 -2021 -2022 -2023 -2024 Preliminary information- Subject to revision. Not for Citation or Distribution

Larger

basin

area

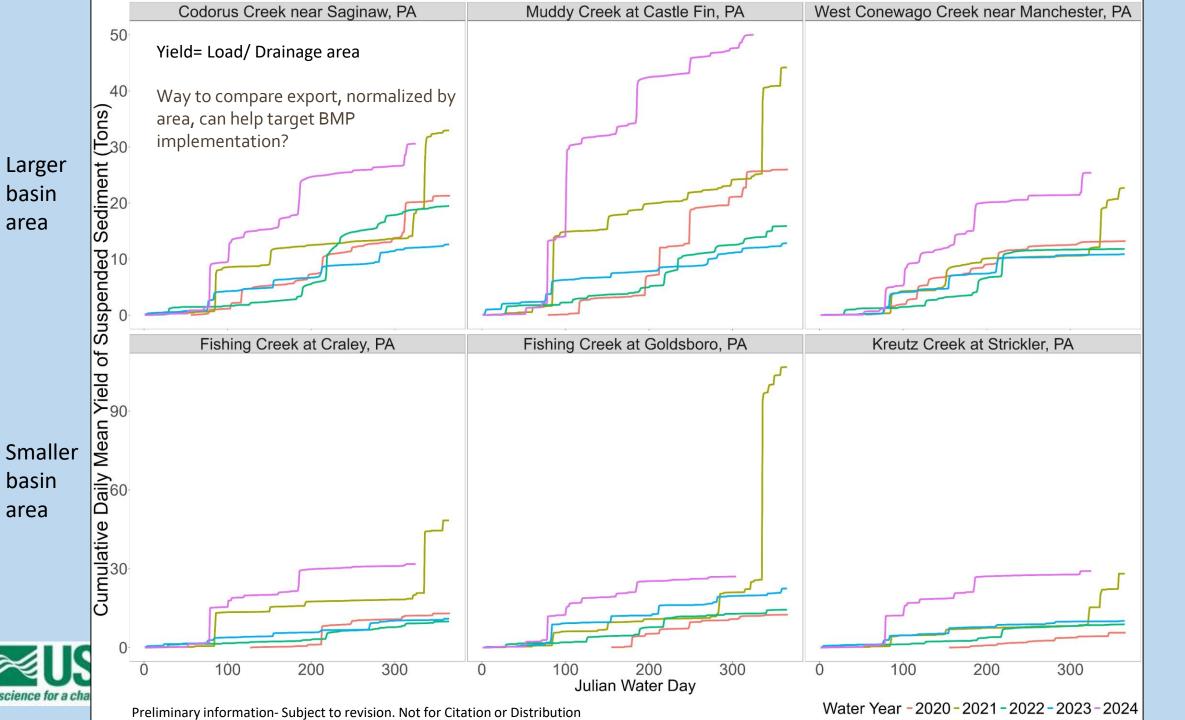
Smaller

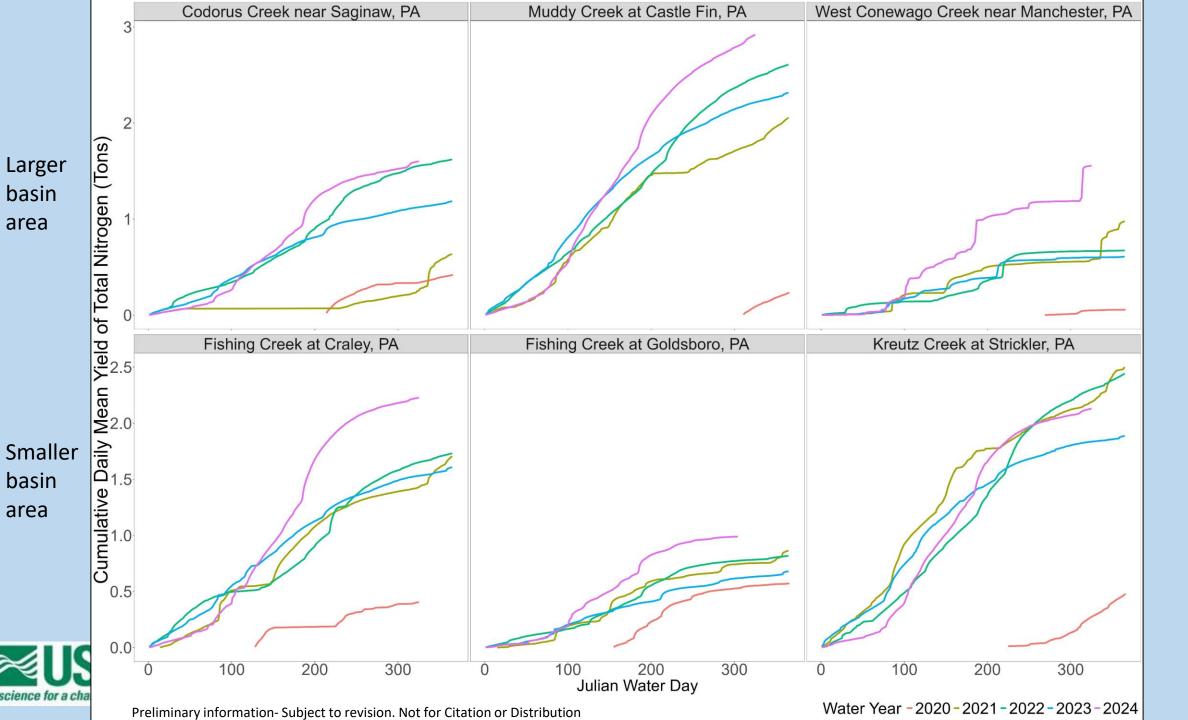
basin

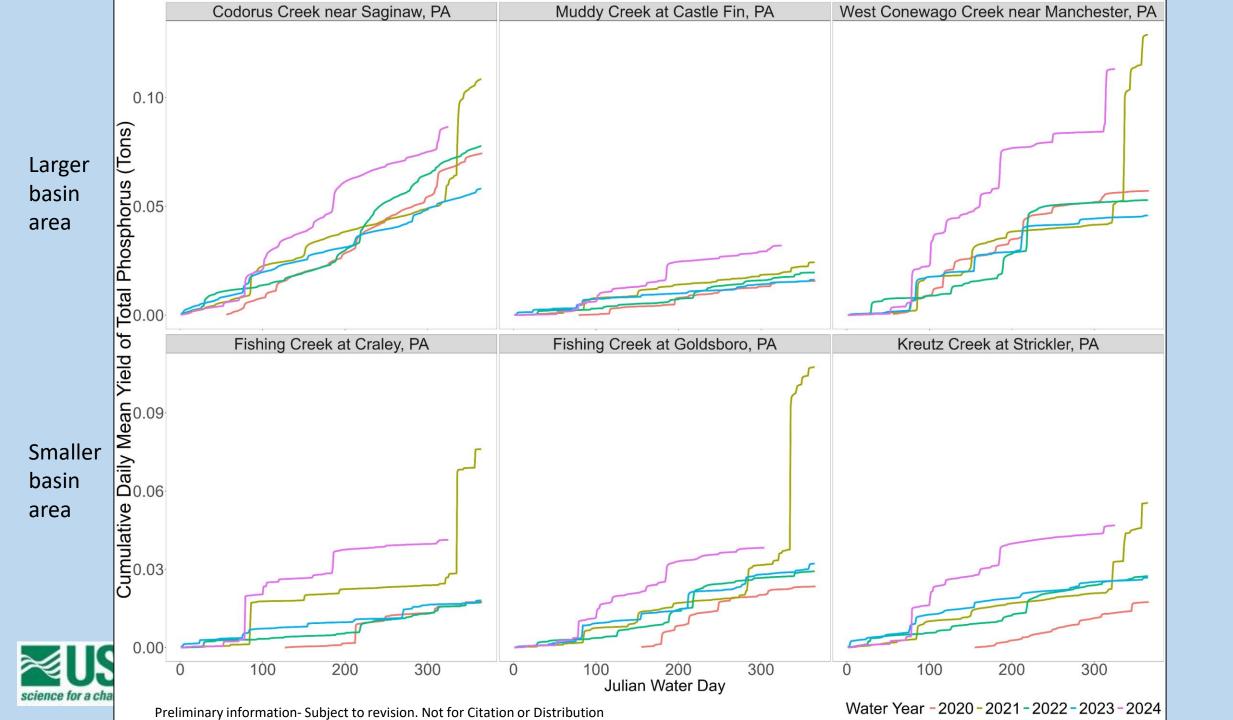
area

Yields



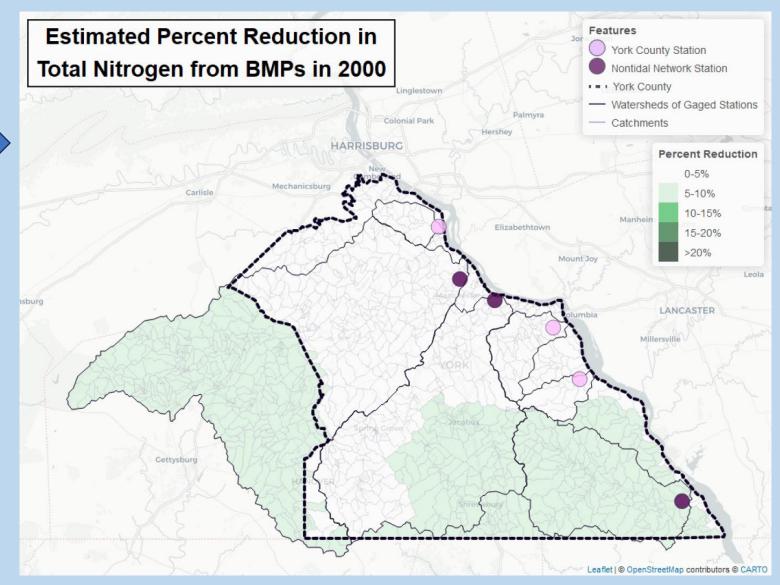






Next Steps- Additional Data

- BMP data- Where are they, how long have they been there, and how effective are they?
 - Use CAST as supporting data for estimating reduction?
- Baseflow separation for nitrate/ dissolved constituent transport
- High-res land use
- Permitted discharges
- Ecosystem analysis- GPP/ ER modeling (stream metabolism)





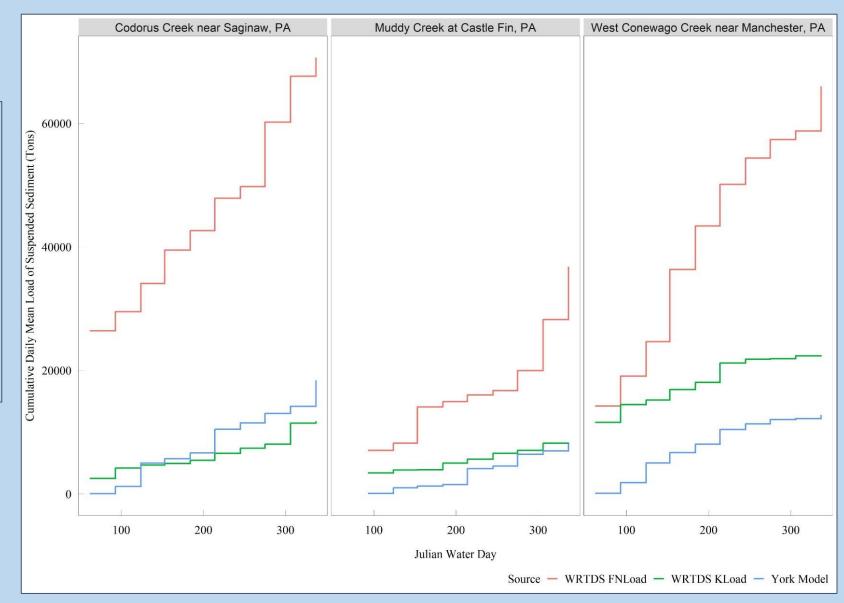
Animation: Eli Whitehead-Zimmers, USGS-PAWSC

Next Steps- Additional Data

Compare to NTN Loads

York County could be used as a calibration or verification point for:

- Bay Model on the county-scale (6 sites cover ~80% County drainage)
- NTN Loads via WRTDS and WRTDS-K on the site level as site-specific calculations.





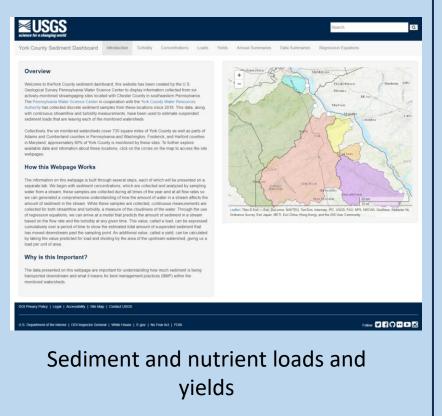
Next Steps: Products

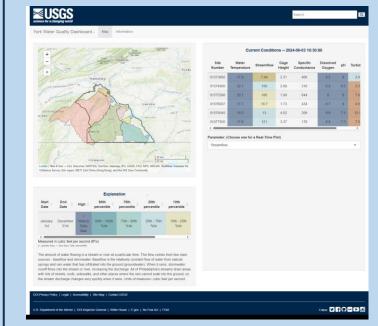
 Stakeholders need additional tools and data presentation options besides reports. Stakeholders want data presented in a way that facilitates their decision-making and offers additional ways of interaction. They also want products that are accessible and easy to understand for wider audiences....

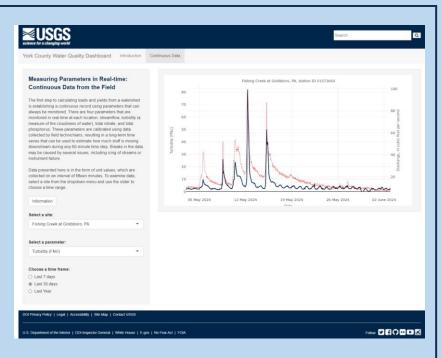


Communication Products: Dashboards

- Highly customizable, can include plots, maps, text, links, interactive maps and plots
- Various programs to make them already exist (e.g R Shiny)







Water quality and streamflow from gage equipment- instantaneous data and statistical summaries

Dashboards: Matthew Conlon, USGS-PAWSC



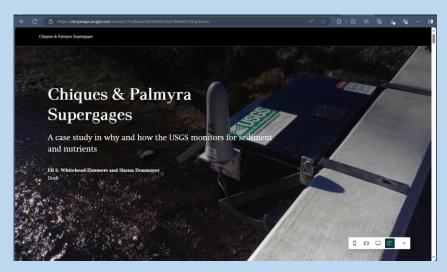
Communication Products: Geonarratives

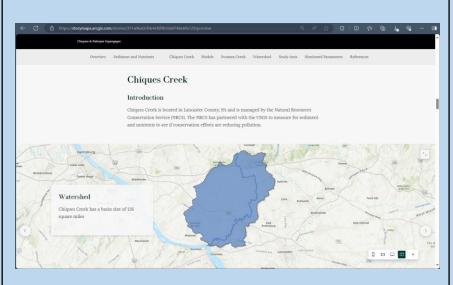
- Highly customizable, can include plots, maps, text, links, interactive maps
- Various platforms (e.g. ArcGIS Online)
- Could be more appropriate for educational purposes

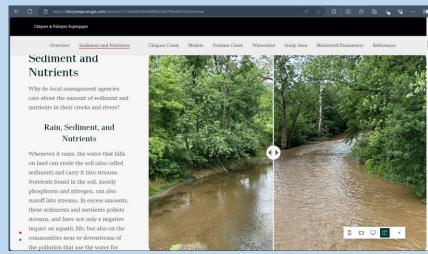
"Chiques and Palmyra Supergages" In progress

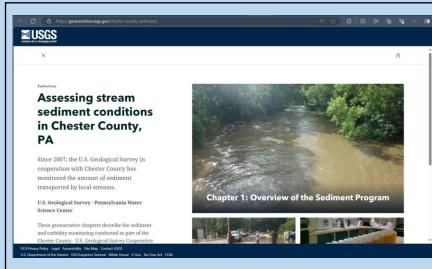
Published: <u>Assessing stream</u>
<u>sediment conditions in Chester</u>
<u>County, PA | U.S. Geological Survey</u>
<u>(usgs.gov)</u>, Marissa Rossi, USGSPAWSC











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Natalie Schmer, nschmer@usgs.gov

Acknowledgements:

USGS field samplers and gage operators: (Dylan Baumbach, James Colgin, Victor Cortes, Hilary Dozier, Heather Eggleston, Lee Eicholtz, Cameron Ensor, Nicholas Santoro, Connor Souchek, Jake Wacker, Mitchell Weaver, Eli Whitehead-Zimmers)

York County Planning Commission

