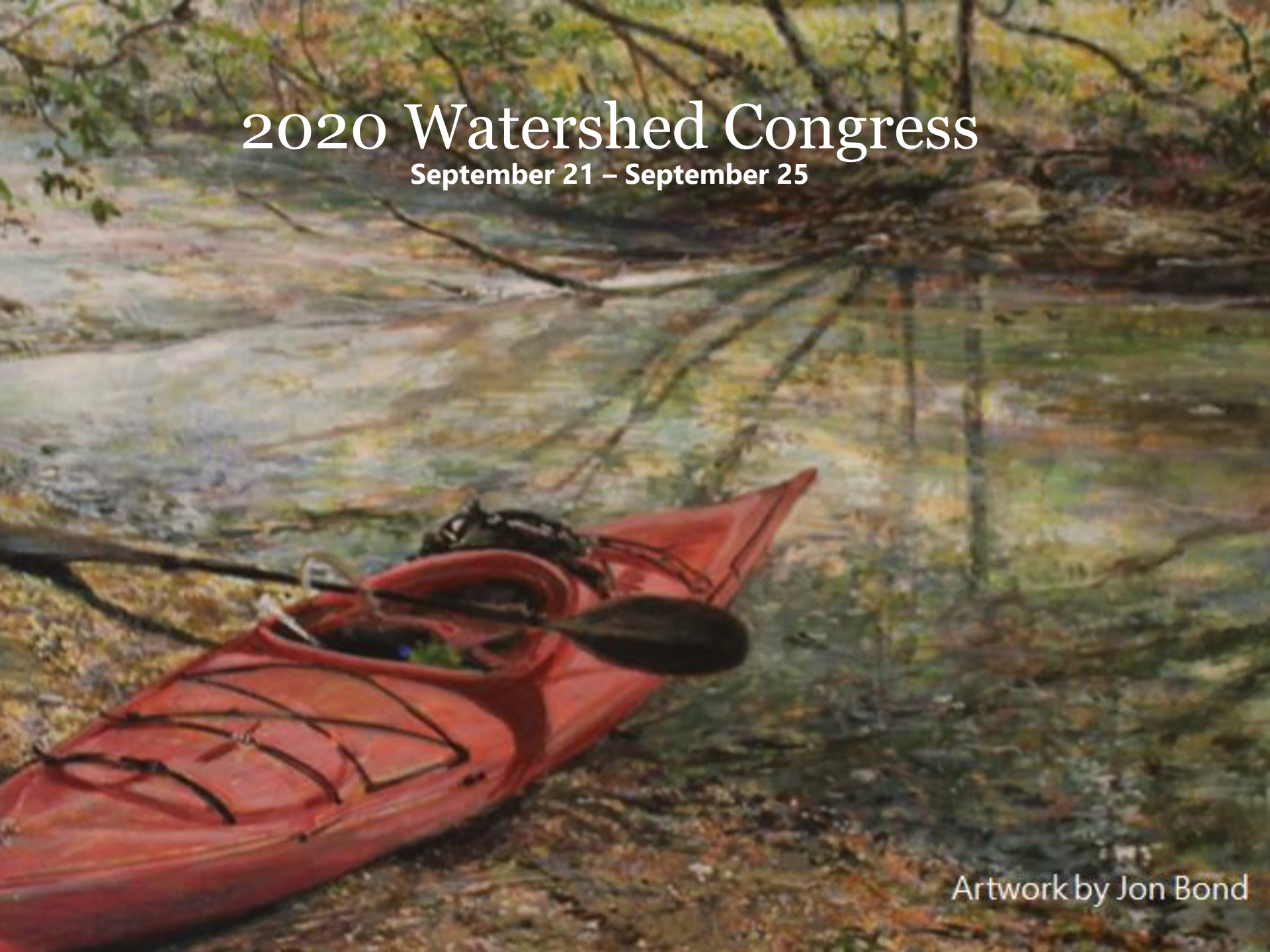
2020 Watershed Congress
September 21 – September 25
Artwork by Jon Bond

Watershed Congress Organizers

The 2020 Watershed Congress is presented by the **Delaware Riverkeeper Network,** its partner organizations, and private individuals.

Current Partners:

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Engagement During Sessions

- **Presentation Sessions -** During these sessions, questions will be asked after the presentation by our speakers. **We will be using the Question & Answer (Q&A) feature** to take questions for presenters so please post questions you may have there.
- **Q&A Sessions -** During these sessions, our presenters will be answering questions about their pre-recorded presentations (available in the 2020 Watershed Congress playlist on the Delaware Riverkeeper Network's YouTube channel). Participants should have watched the prerecorded videos prior to attending. **We will be using the Raise Hand feature** to take live questions. The Chat feature will be open for sharing resources with others.
- **Panel Sessions -** Our panelists will be answering questions throughout these sessions. We will begin with some prepared questions for our panelists, but we also hope to present your questions to our panelists. **We will be using the Q&A feature** to take questions for presenters so please post questions you may have there.

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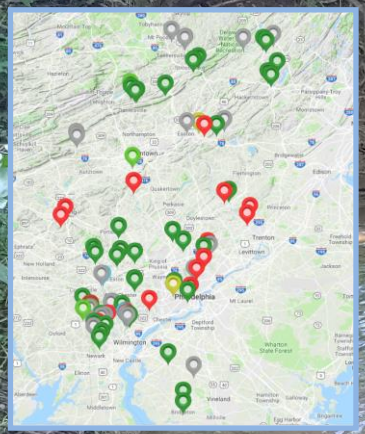
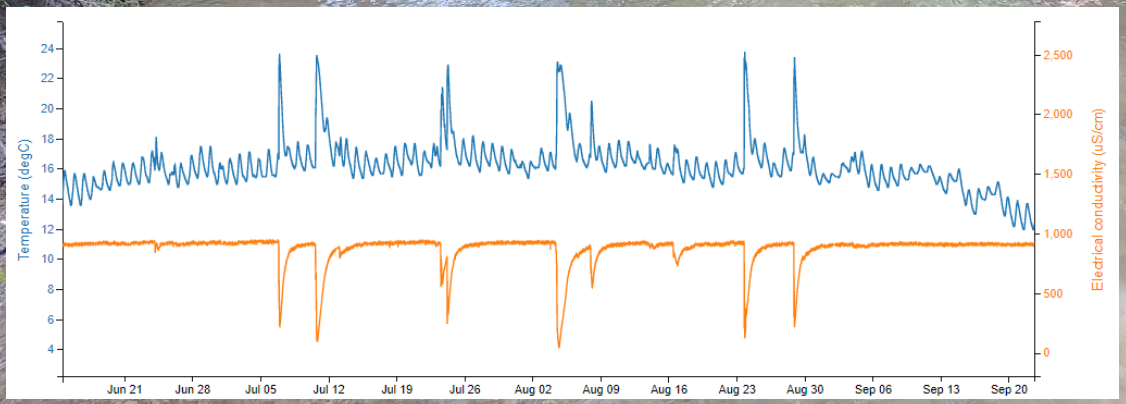
Spatio-Temporal Patterns of Stream Conductivity and Temperature in the Delaware Basin

Online, September 23, 2020, Watershed Congress

Diana Oviedo-Vargas, Marc Peipoch, and David Bressler
Stroud Water Research Center

Part 1, Introduction to the project and continuous data, David Bressler





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Parts 1-3

- **Part 1 – Introduction to the project and continuous data, David Bressler**

- Part 2 – Spatio-temporal patterns of specific **conductivity** in streams and rivers of the Delaware River Basin, Diana Oviedo-Vargas, PhD

- Part 3 – Spatio-temporal patterns of water **temperature** in streams and rivers of the Delaware River Basin, Marc Peipoch, PhD

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Part 1

- Project overview
- Overview of continuous data
  - What is continuous data?
  - Why is it useful?
  - What it takes to get good continuous data?

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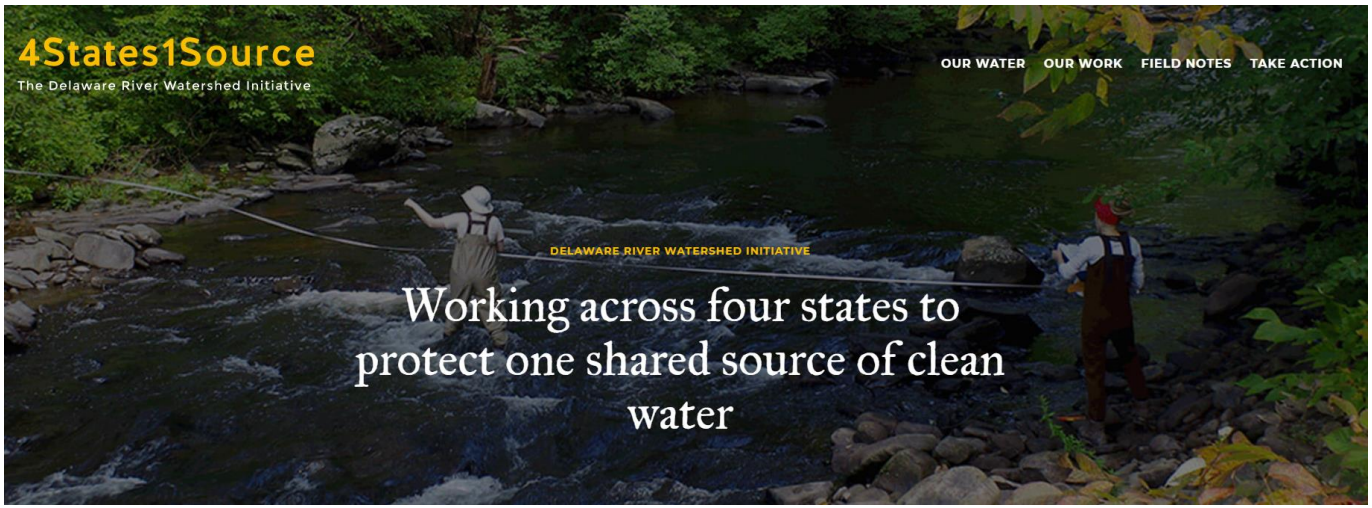
Project

Citizen science using EnviroDIY monitoring stations in the Delaware Basin

Delaware River Watershed Initiative



WILLIAM PENN FOUNDATION

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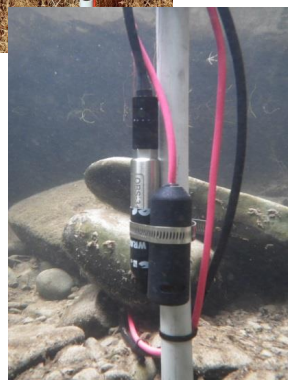
What is continuous data?

Measurements taken in regular intervals automatically with an instrument installed in the stream



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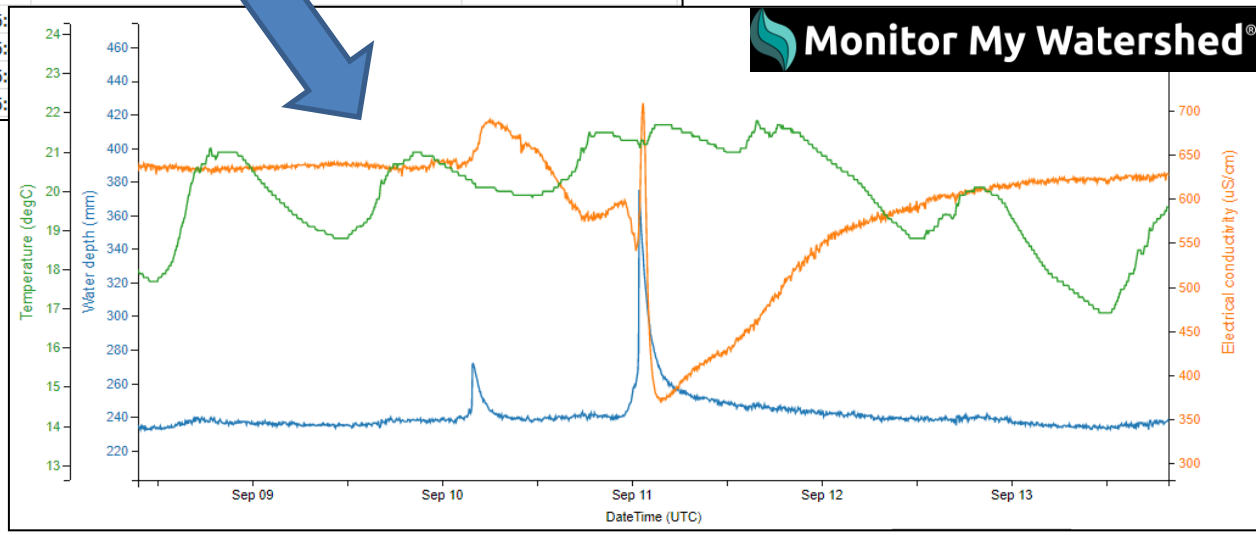
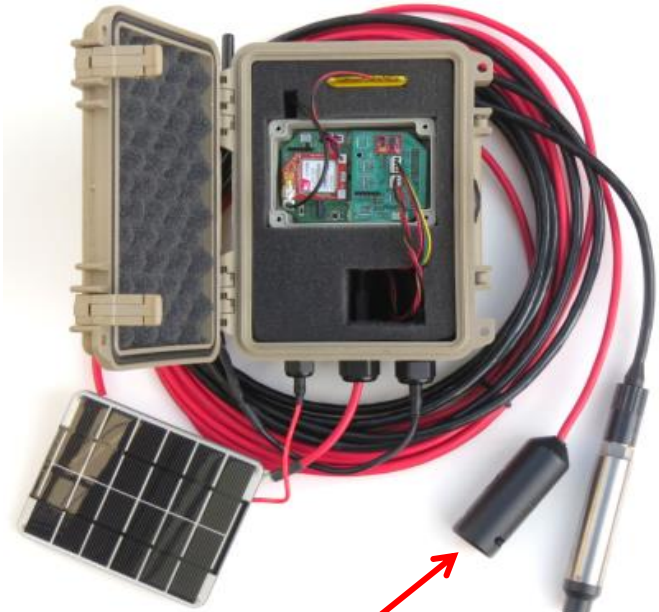


Basic EnviroDIY monitoring station

***Stations designed, programmed, and built by Stroud Center (Shannon Hicks, engineer)**



Conductivity, Temperature, Depth

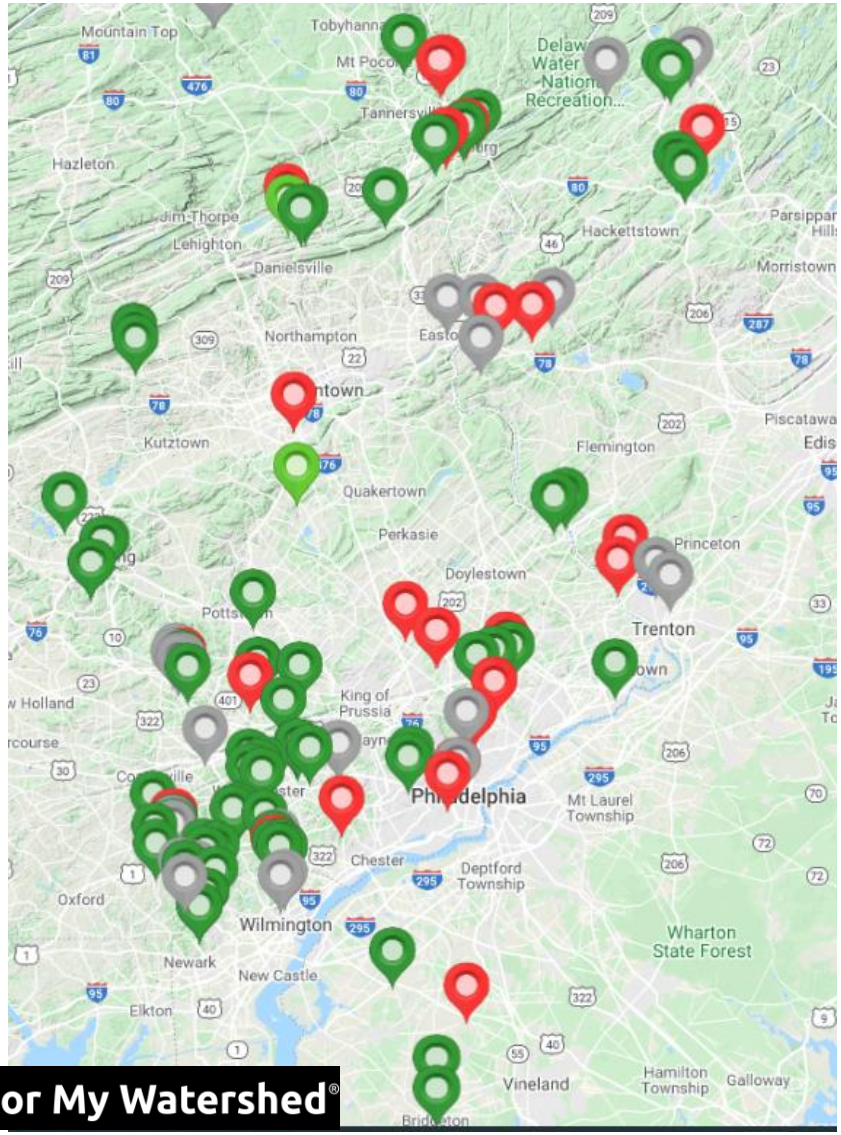
Turbidity

Stroud Water Research Center

Station deployed across the Delaware Basin

>70 Stations in DRB

Owned by >40 watershed groups



Monitor My Watershed®

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Utility of continuous data

- Fuller story
- Know where you're at presently
- Track where you came from
- Predict where you might go

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Continuous data

Measurements taken automatically – no person necessary(?) Less time and effort(?)

Standard, Single point measurements

Alternate to continuous, lots of time and effort!

Hand held meters

Grab samples for lab analysis

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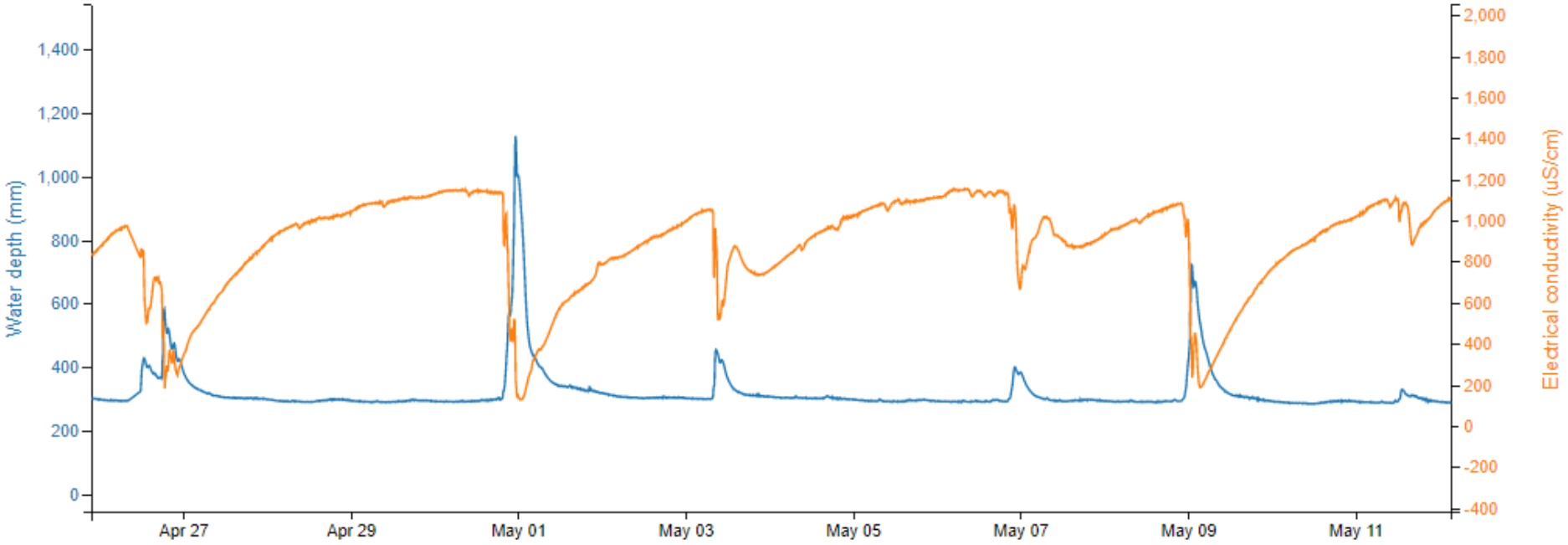
Common conductivity patterns we see

Stormwater enters stream, conductivity goes down – dilution of ions



Goose Creek at Greenfield Park

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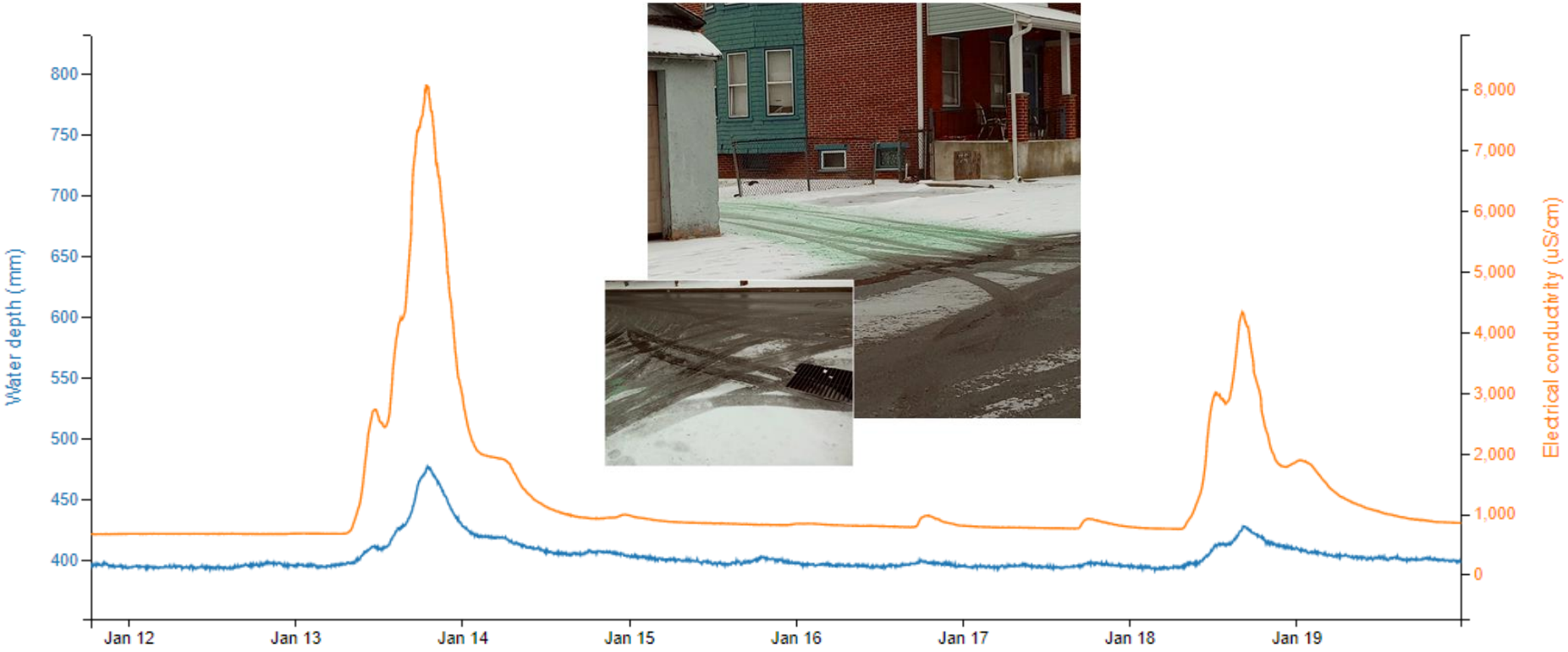
Common conductivity patterns we see

Road salt and de-icer pollution events



Naylors Run at Drexel Garden Park, 2019

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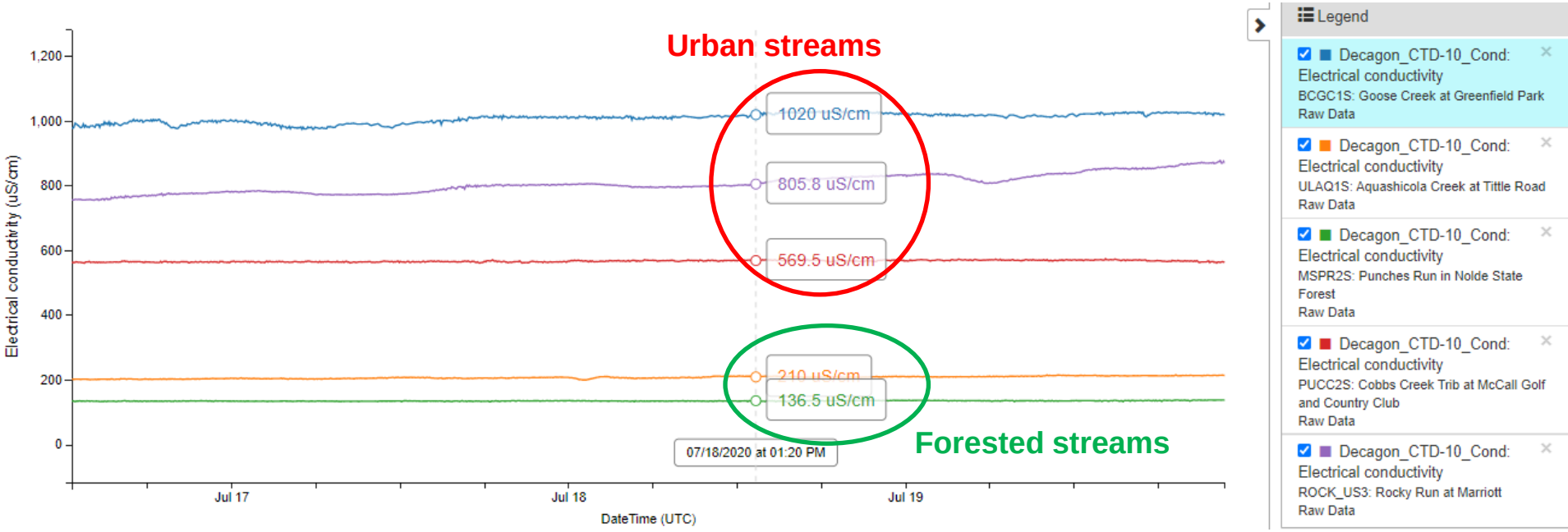
Common conductivity patterns we see

High conductivity in urban streams



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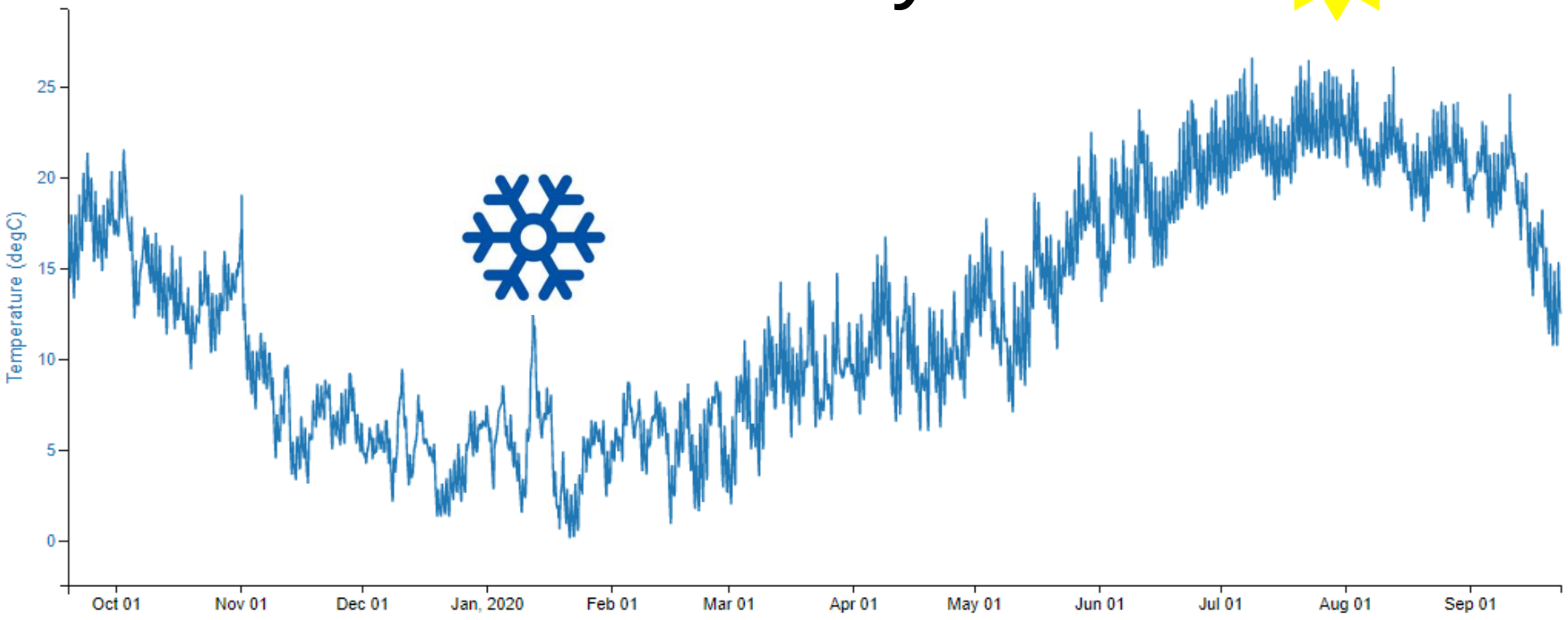
Common temperature patterns we see

Seasonality



Angelica Ck downstream of The Nature Place, 2019-2020

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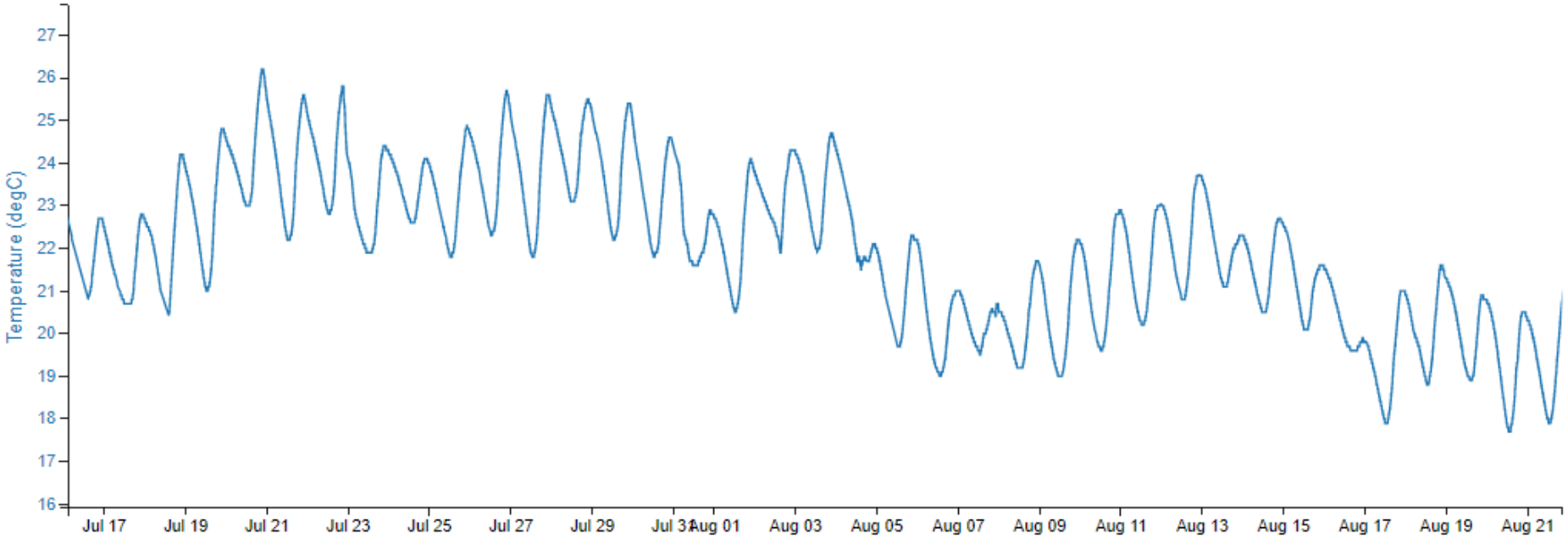
Common temperature patterns we see

Diel (day and night)



Hosensack Creek at Hwy 29, 2020

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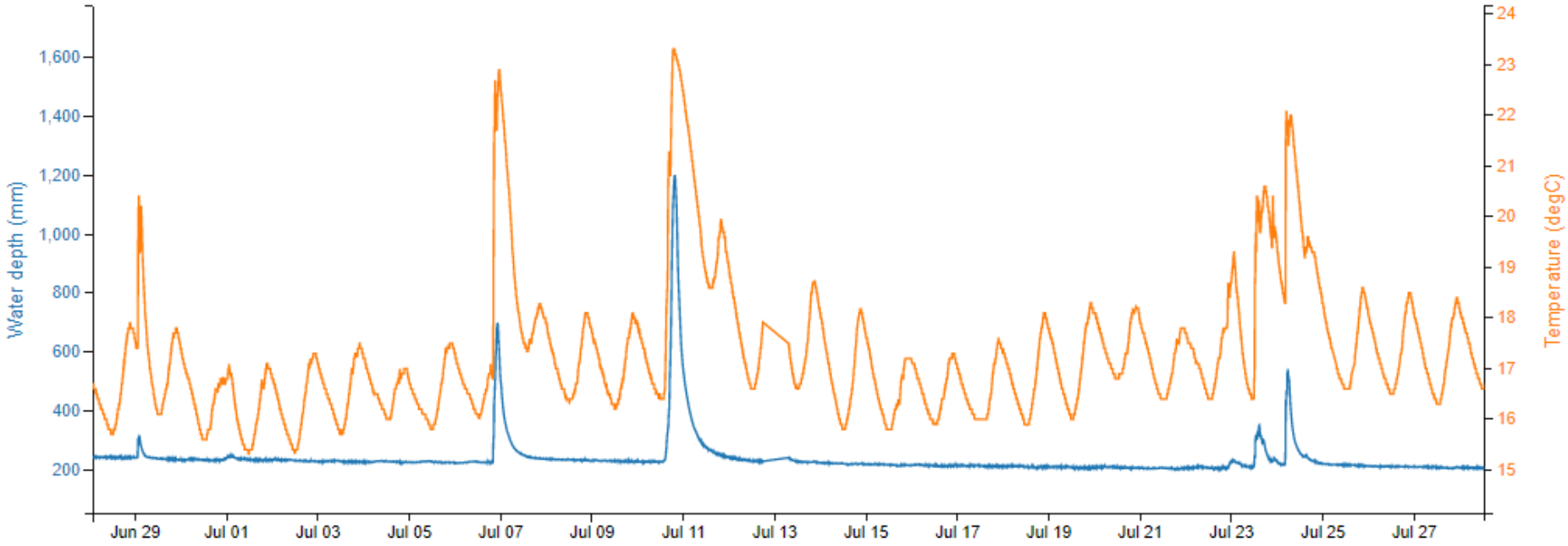
Utility of continuous data

Thermal pollution during summer storm events



Valley Creek at Valley Creek Park, 2020

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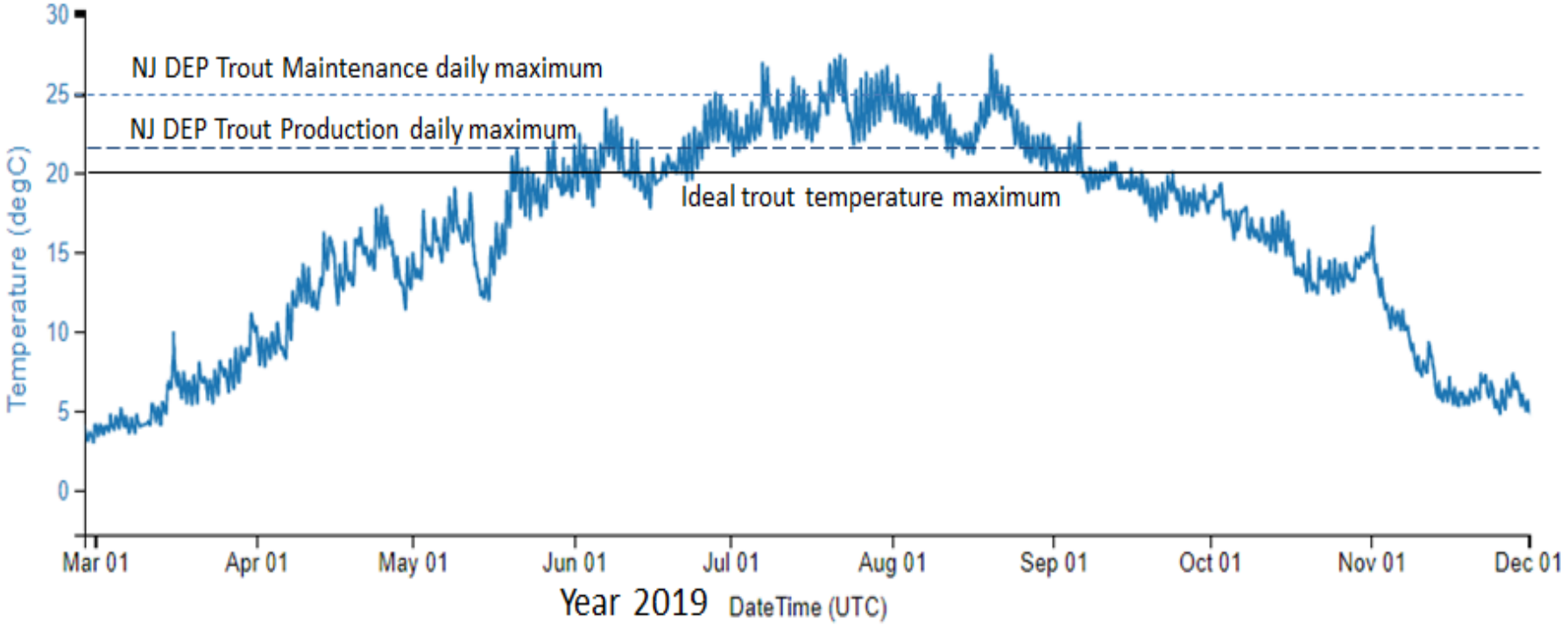
Utility of continuous data

Temperature considerations for trout management



Paulins Kill at Sussex County Community College

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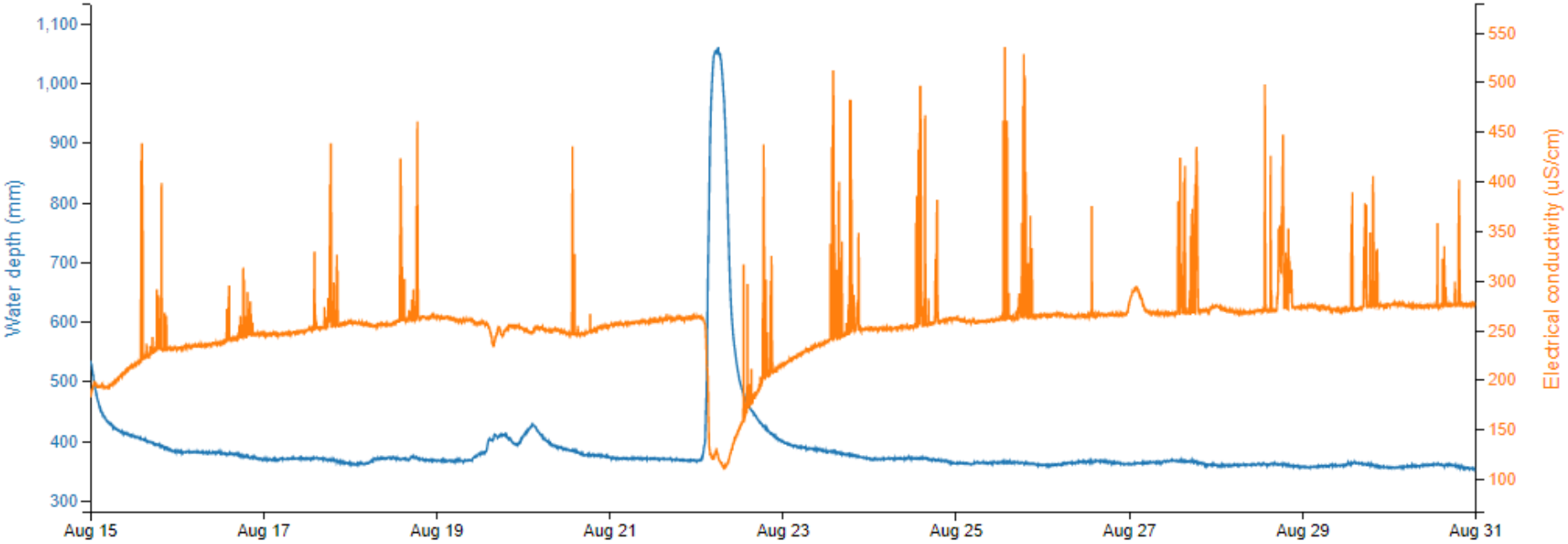
Utility of continuous data

Non-storm events

Conductivity spikes during baseflow conditions



Pickering Creek at Montgomery School, 2018

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What it takes to get Diana and Marc good data

Sounds easy! The station does it all!

DateTime	TimeOffse	DateTimeUTC	Decagon_CTD-10_Cond	Decagon_CTD-10_Depth	Decagon_CTD-10_Temp
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7/29/2020 10:25	-5:00	7/29/2020 15:25	464.8	252	29.5
7/29/2020 10:30	-5:00	7/29/2020 15:30	466.5	253.8	29.52
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7/29/2020 11:45	-5:00	7/29/2020 16:45	466	254	30.3
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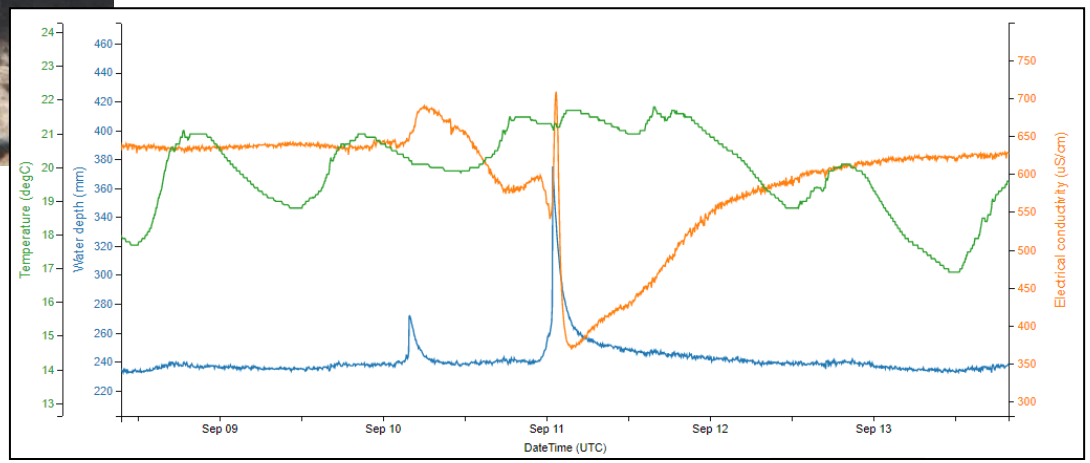
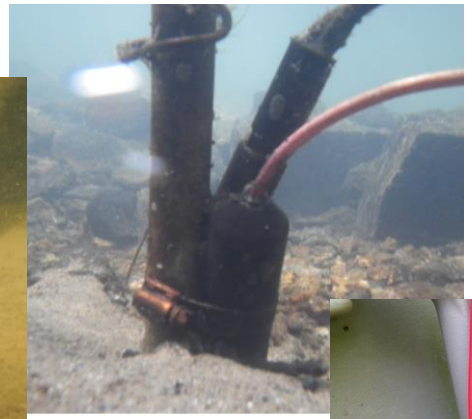
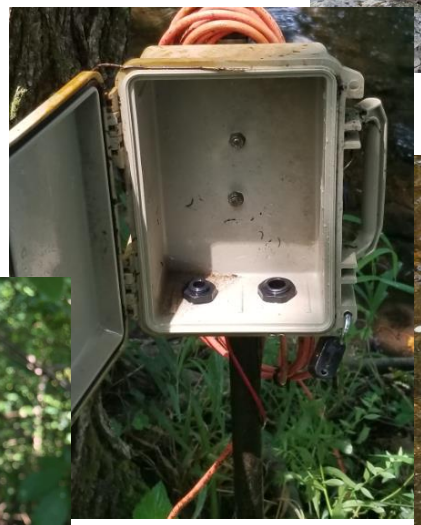


What it takes

Yes but…

- Water and weather are destructive
- Sensors foul easily and regularly
- People and creatures can damage





What it takes

- **People!** Time and training of **Citizen Scientists**
  - Clean sensors and station
  - Monitor live feed of data for station function and anomalies
  - Quality Control cross checks of station data

What it takes

Clean sensors

329 uS/cm before cleaning

356 uS/cm after cleaning

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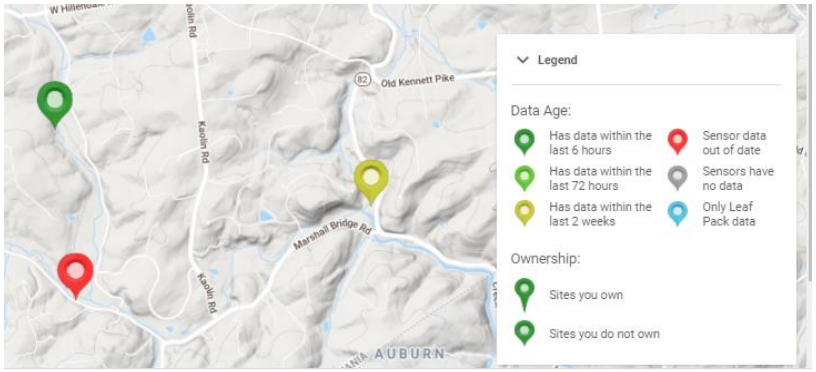
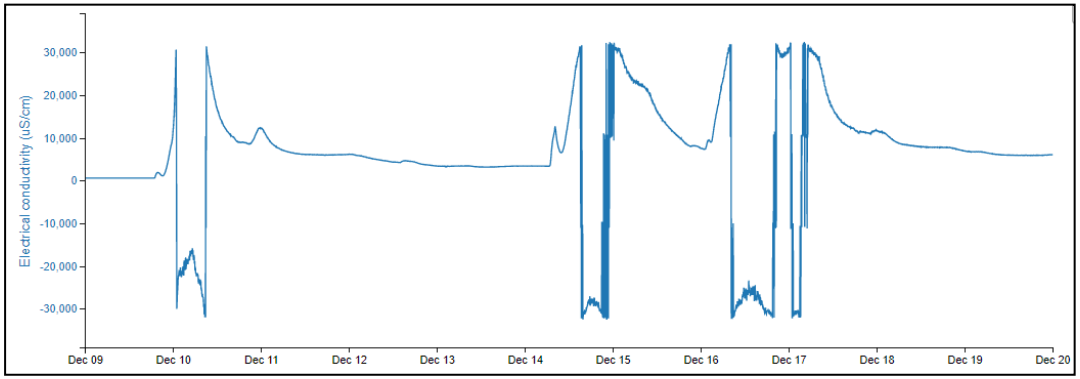
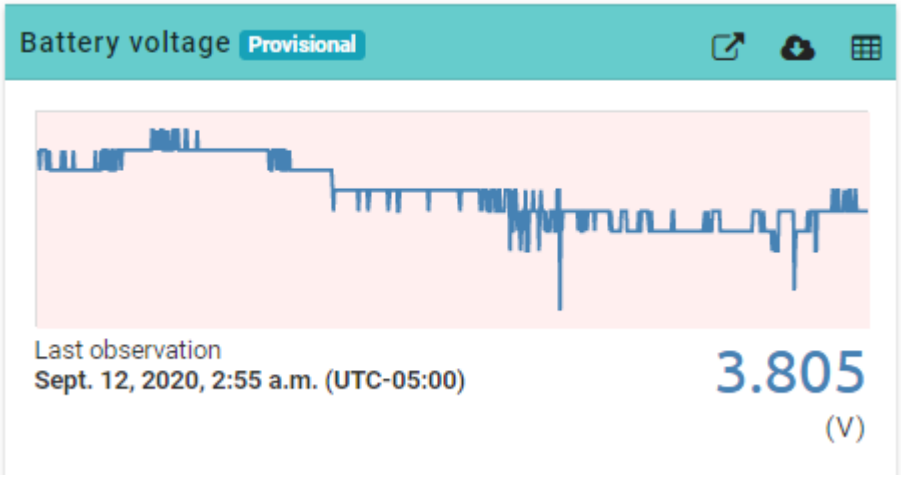
What it takes

Monitor live data feed for station function





Rccky Run at Marriott



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What it takes

Quality Control cross checks using calibrated hand-held meter and/or grab samples

314.8 uS/cm ⟷ 380 uS/cm

Red flag! Numbers not matching up! Suggests a problem with continuous data

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Take home

- Continuous data help to develop a fuller picture of a stream
- Long-term patterns, short-term and rare events can all be detected
- Although automated, stations need attention and quality control to ensure reliable data
    - **State agencies and other regulators beginning to accept and incorporate these type of data*

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Parts 1-3

- Part 1 – Overview of EnviroDIY monitoring stations and citizen science in the Delaware River Basin, Bressler
- **Part 2 – Spatio-temporal patterns of specific conductivity in streams and rivers of the Delaware River Basin, Diana Oviedo-Vargas, PhD**
- **Part 3 – Spatio-temporal patterns of water temperature in streams and rivers of the Delaware River Basin, Marc Peipoch, PhD**

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Thank You!

Special thanks to:

- Carol Armstrong and George Seeds, Chester/Delaware Co. Master Watershed Stewards
- Shannon Hicks, Rachel Johnson, Christa Reeves, John Jackson, Stroud Water Research Center
- **All the watershed groups, stewards, schools, and universities that own and manage the stations!**

David Bressler
Stroud Water Research Center
dbressler@stroudcenter.org
410-456-1071 mobile

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NOTES

- Bressler intro (5-7min) overview of data, site spatial distribution, why continuous sensors why cond, variability across sites, why temp - introduce the whys - this will connect to the take-homes from Marc and Diana; partnerships - your ability to understand the site is dependent on others maintaining sensors for comparison (e.g., punches provides perspective for other berks stations; first state sites); importance of QC and grab samples for additional info
- Show audience that single point measurements on temp for instance the diel shift in temp is big so comparing between sites can be tough; also show oxygen and temp related - naturally driving DO down as temp goes up therefore all animals have possibility of diff metabolic challenges
- Intro should talk about this is the advantages of what continuous data can do, why monitoring continuous data, what it takes, what it gives you, why temp important - what it means to talk about thermal pollution (annual, daily, seasonal basis - varies among sites that can be close together; salt - remind about underlying geology (<500 uS/cm but generally below 300 uS/cm), give basics of ions, softwater versus hardwater stream under natural conditions, seasonality of cond, groundwater contamination and summer salt loads, winter spikes, toxicity and temperature; the harder the water (e.g., limestone) the more you can absorb salt and less toxic (best guess is that calcium balances out osmotic challenges that road salts present - road salt is an osmotic challenge); sensor tells you what grab sample misses (everything between grab samples); Cl regulation in states (Iowa and Illinois but EPA moved off of this because these were not totally protective - tests on ceriodaphnia; additional work on mussels and mayflies showed they were more sensitive than ceriodaphnia) that have it is related to associated hardness (have to pay attention to hardness and temp in salt toxicity);

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NOTES

Dave,From my part nothing has changed since we talked. If you can introduce the overall project (1-2slides) and explain why sensors? what do sensors tell us that discrete samples do not? why do we need grab samples? etc.

So you don't work day and night:
some thoughts related to Marc's
show difference between grab sample and continuous record
Show different sensors - CTD plus the expensive sensors such as our research sondes
Highlight that both are important, depending on the question/issue of interest of significance
When diel variation is important - nightime DO sags, deicing spikes,
When weekly/seasonal variation is important, especially if they reflect unpredictable variability - thermal bottleneck
5 summers, DO impacts of leaf fall or a maintenance pattern (dropping yard waste into streams, spreading compos
thermoelectric management plans (flow or temperature)
When rare events are of interest (storms, droughts, heat waves, spills or regular, unknown discharges, industrial fa
regular pattern than Mike B had?
Where planning needs to know extremes - what is to be avoided
Where/when there is a need to compare extremes - perspectives from sites with and without a stressor (references
Emphasize that continuous data are a lot of work to collect, analyze, interprete, communicate - only propose to do
grab sample is sufficient, and it often is, then keep it simple. Many people take their "big data" and distill it down to
close to matching the mean of monthly or bimonthly grab samples.
Just some thoughts.

I assumeyou will also describe the network, show a map with the 70+ locations and how long (in general) they have been collecting data.
I am saving my presentation here \\STROUDSAS\Research\WilliamPenn_Delaware River\CitSci\Stroud data analysis\Abstracts and presentations\Oviedo_WatershedCongress2020_09202020.pptx
Not finished yet but you can have an idea.
Diana