EPA's Interoperable Watersheds Network

- A New Approach for Publishing Continuous Monitoring Data

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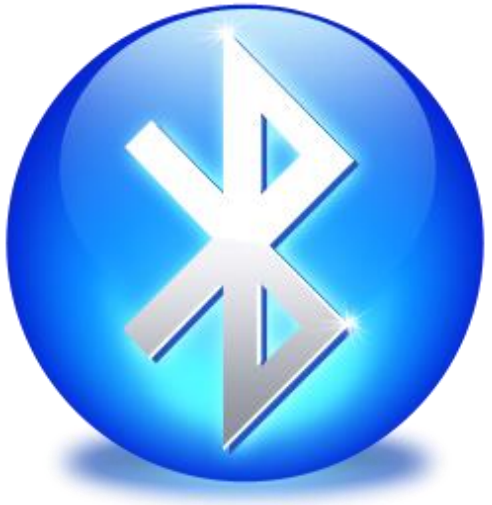
Outline

- An Introduction to 'Standards': The World is Built on Standards!
- What's the problem we're trying to solve?
- How IWN is a step towards solving these problems
  - The Data Standards Problem
  - The Metadata Problem
  - The Architecture Problem
- Currents: The Demonstration Application
- Real.m: A mobile implementation
- Next Steps

The World is Built on Standards!

- When people agree to do things in a common way it opens up many opportunities for everybody to do things better.
  - Technology standards: like Bluetooth and Wifi
  - Data Standards: like financial exchanges
  - Government Standards: like the Exchange Network



Environmental Information eXchange Network

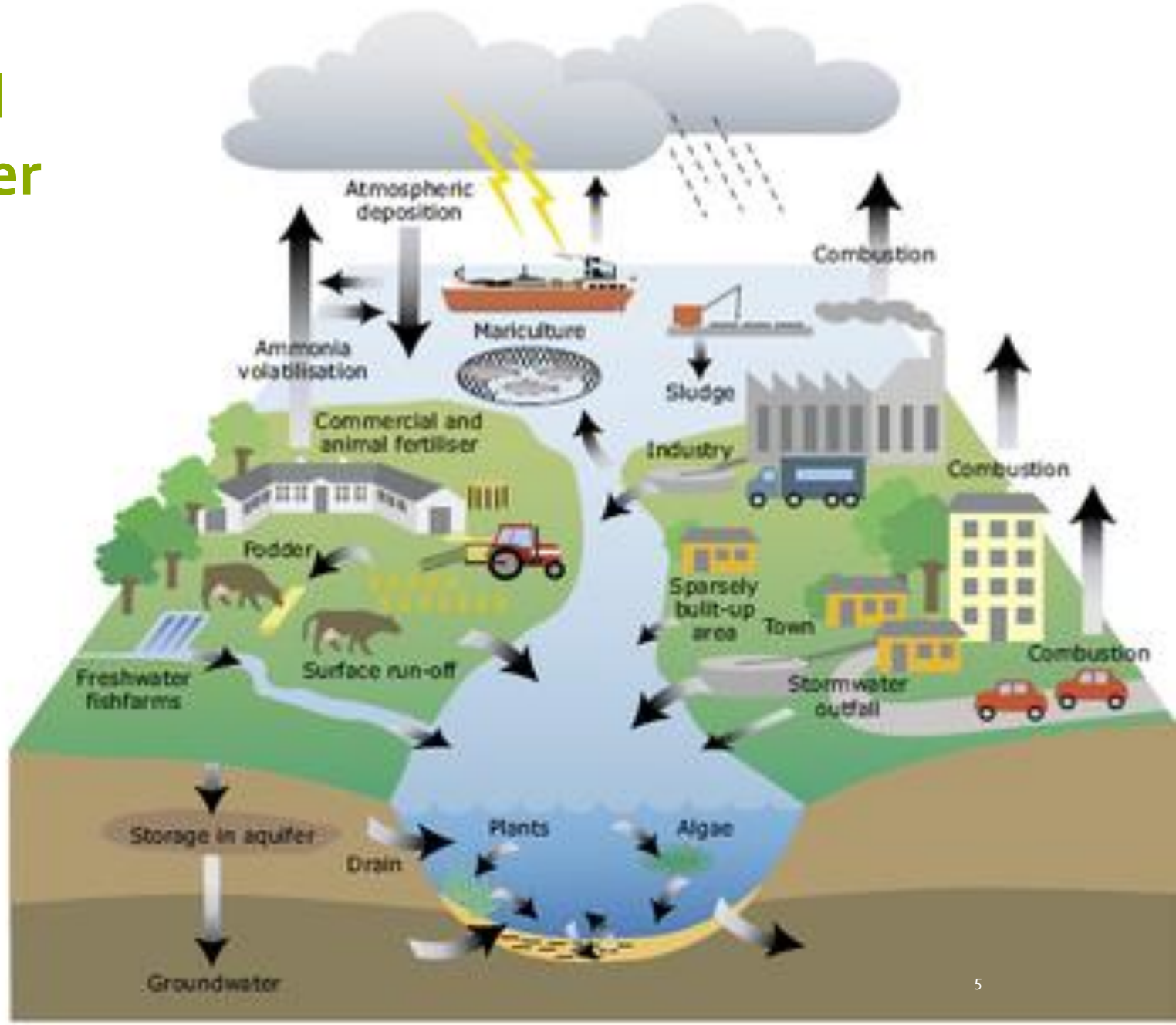
Other Examples of Standards

The IRS has open standards for electronically filing your taxes, enabling a better user experience

Banking: OFX Standards enable you to access your banking information from many 3rd-party applications

What Would Standardized Sensor Data Enable: **Better Modeling**

- Models need data, a lot of data
- Sensors are a great input for models, and can provide necessary ground truth
- Imagine being able to run a model without having to first discover and then reformat the data needed to run the model; rather the model can grab the data as it needs it in real time



What Would Standardized Sensor Data Enable: **Third-Party Applications**

- Adopting and promoting standards sends a clear signal to the market that there is value in supporting those standards
- Enables the market to develop solutions for data storage, data sharing, and data visualization
- Allows those outside government to develop applications and tools that are valuable to them and meet their specific needs

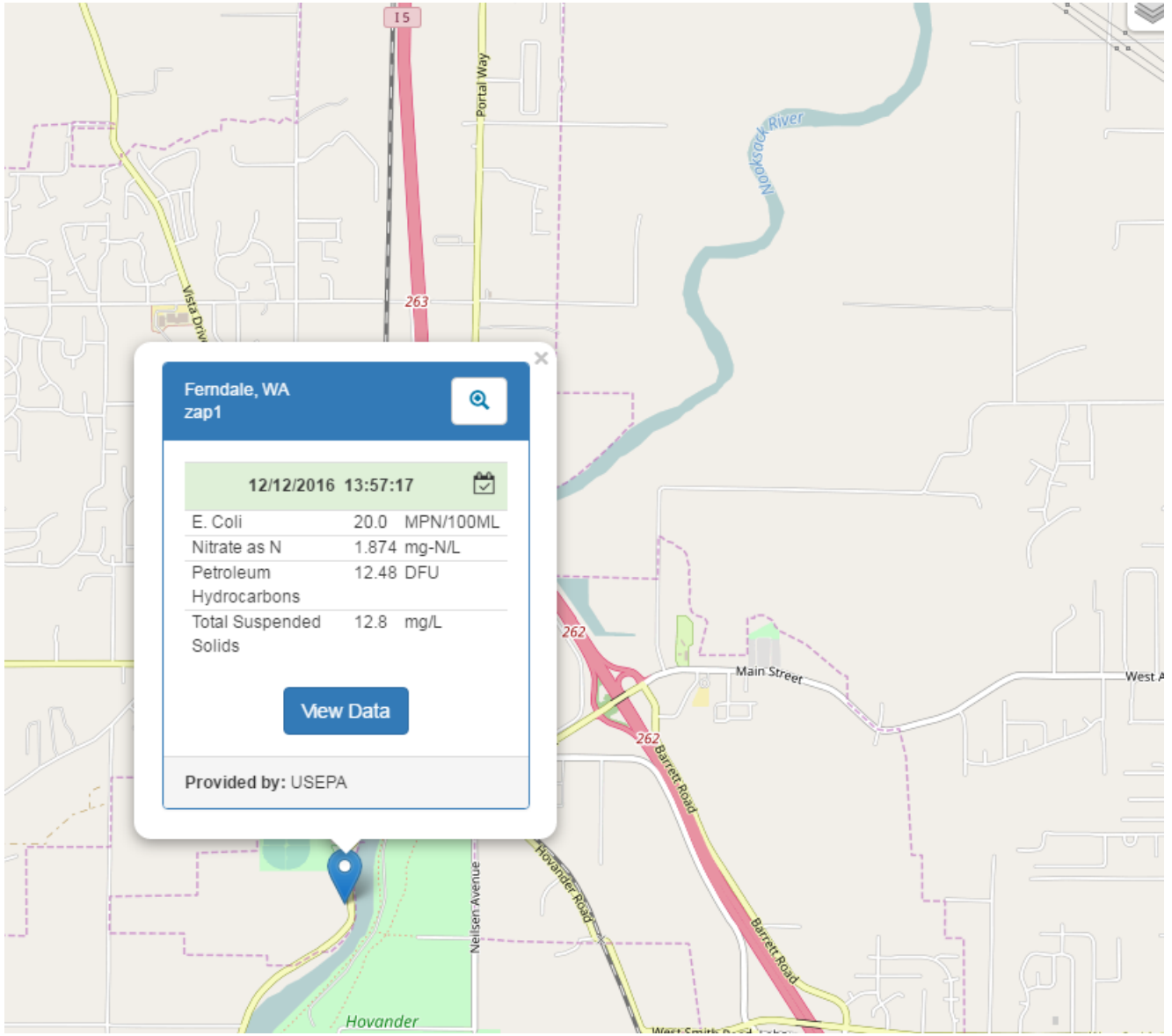
What Would Standardized Sensor Data Enable: **Quicker and Better Decisions**

- Having standardized data decreases the amount of time needed to spend in discovering and standardizing data
- Reduces errors from hand-entering data values
- Allows for MORE data to be used (often can't use data that's hard to find or difficult to reformat)

SAVED TIME = SAVED MONEY

How IWN is a Step Towards Solving These Problems

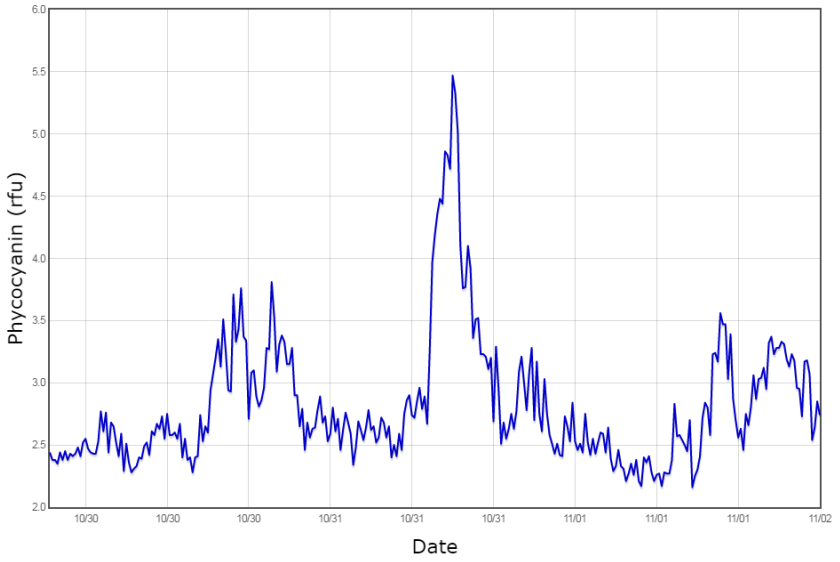
- The Interoperable Watersheds Network was a demonstration project that focused on evaluating approaches to improve sensor data sharing
- It was based on knowledge gained from an recommendations report that EPA developed in 2014
- The project focused on addressing three major areas:
  - Data Standards
  - Metadata
  - System Architecture



The Data Standards Problem

- We needed a common way to represent and communicate the data
- Standards for sensor data already exist, there was no need to create new standards
  - OGC Sensor Observation Service
  - OGC Water ML 2 and Sensor ML
- The Open Geospatial Consortium is an open-source, international standards setting body

OGC®
Making location count.



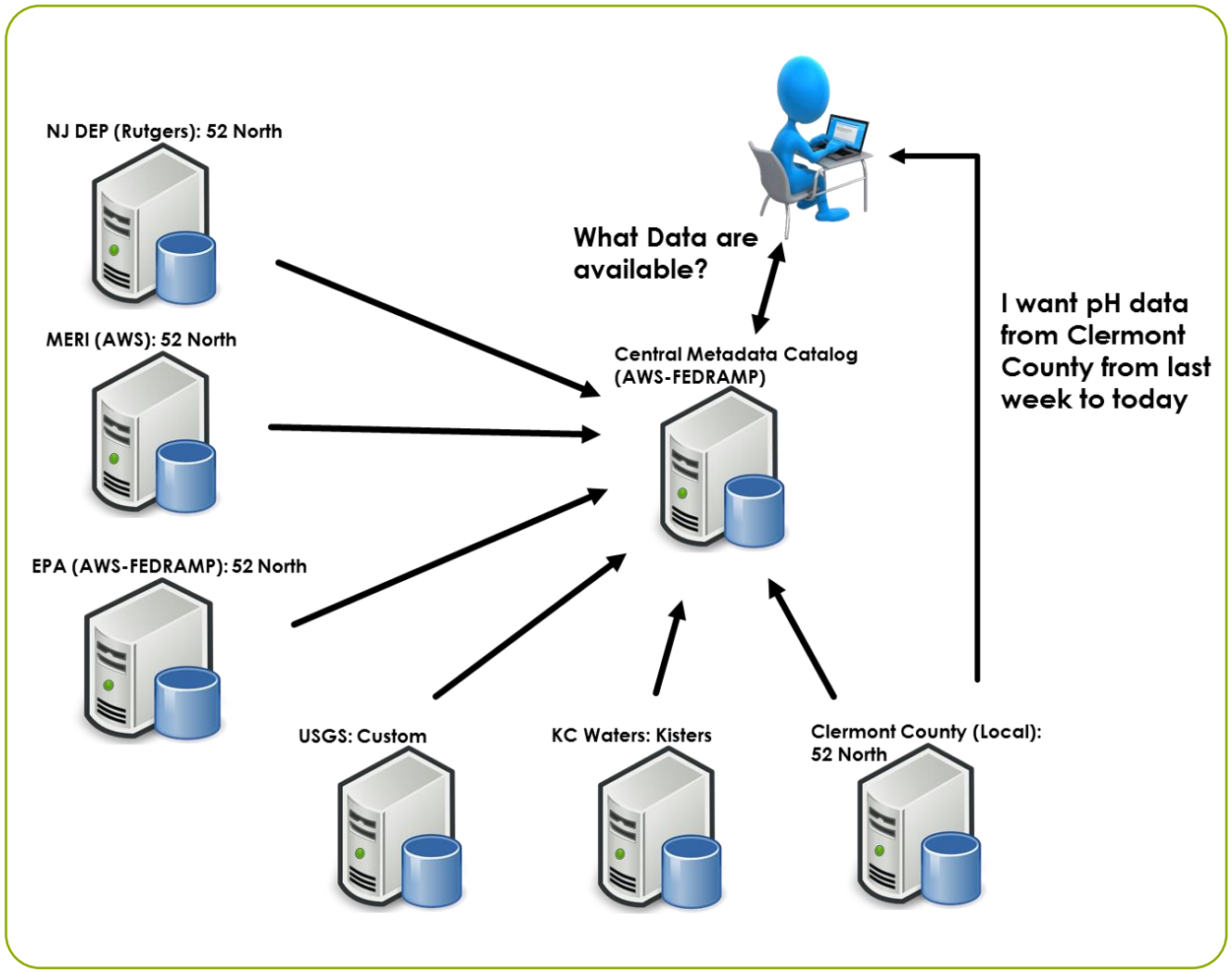
The Metadata Problem

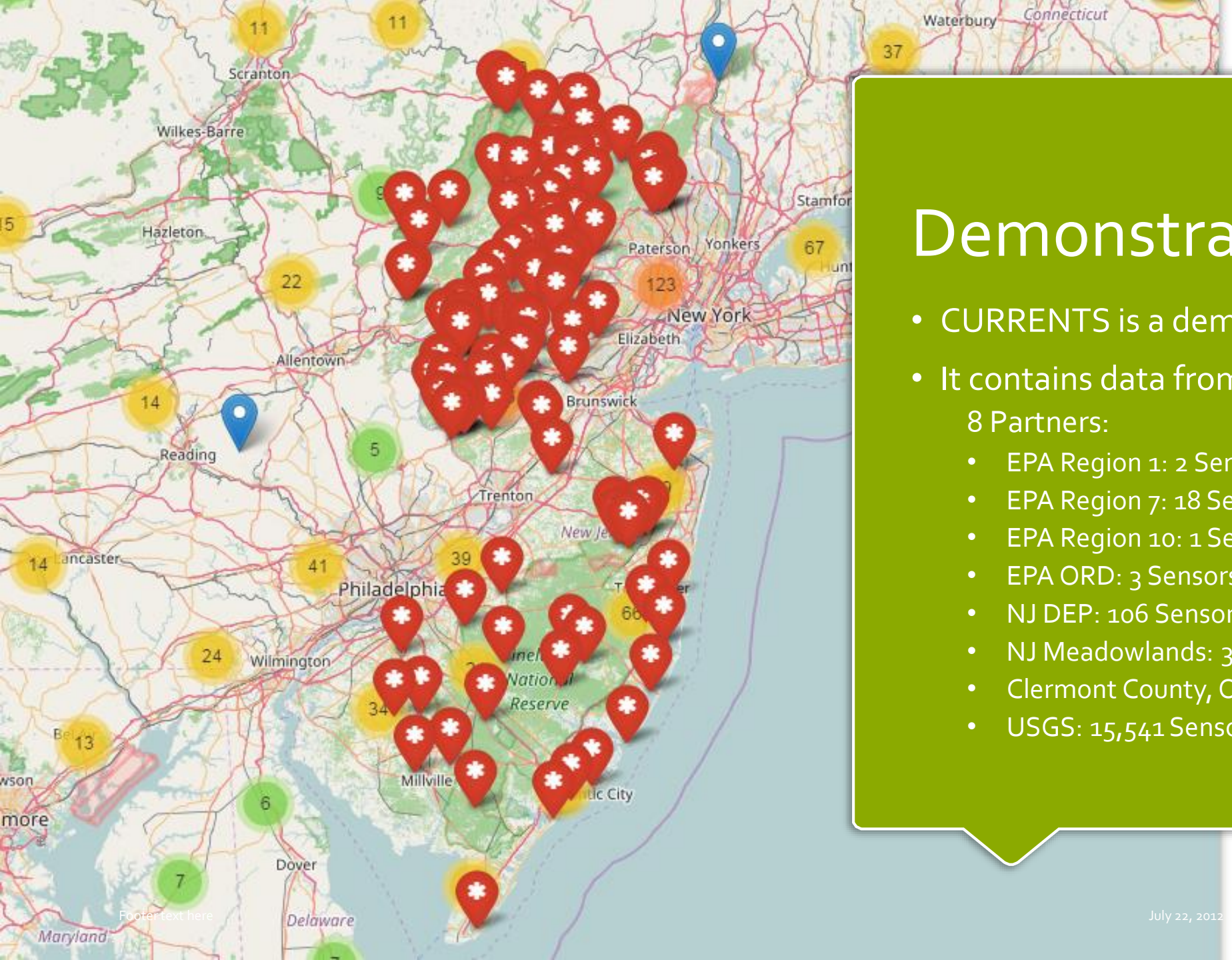
- Needed a standard way to answer the following questions:
  - What data are available and for what parameters?
  - What data can I use?
  - What's the quality of the data?
- IWN had to develop standard ways to do this (no existing standard existed)
- Further work needs to be done in this area as part of the Advanced Monitoring Team

The Architecture Problem

How do you solve the problem of multiple data providers with large amounts of data that have the potential to change every 3-15 minutes?

- Used a central catalog/index that references every data owner's assets with the corresponding metadata for each sensor
- Allowed for quick searching and discovery of available data
- This approach is similar to how Google allows you to search the internet
- Actual data comes from the partners systems in real-time





Demonstration

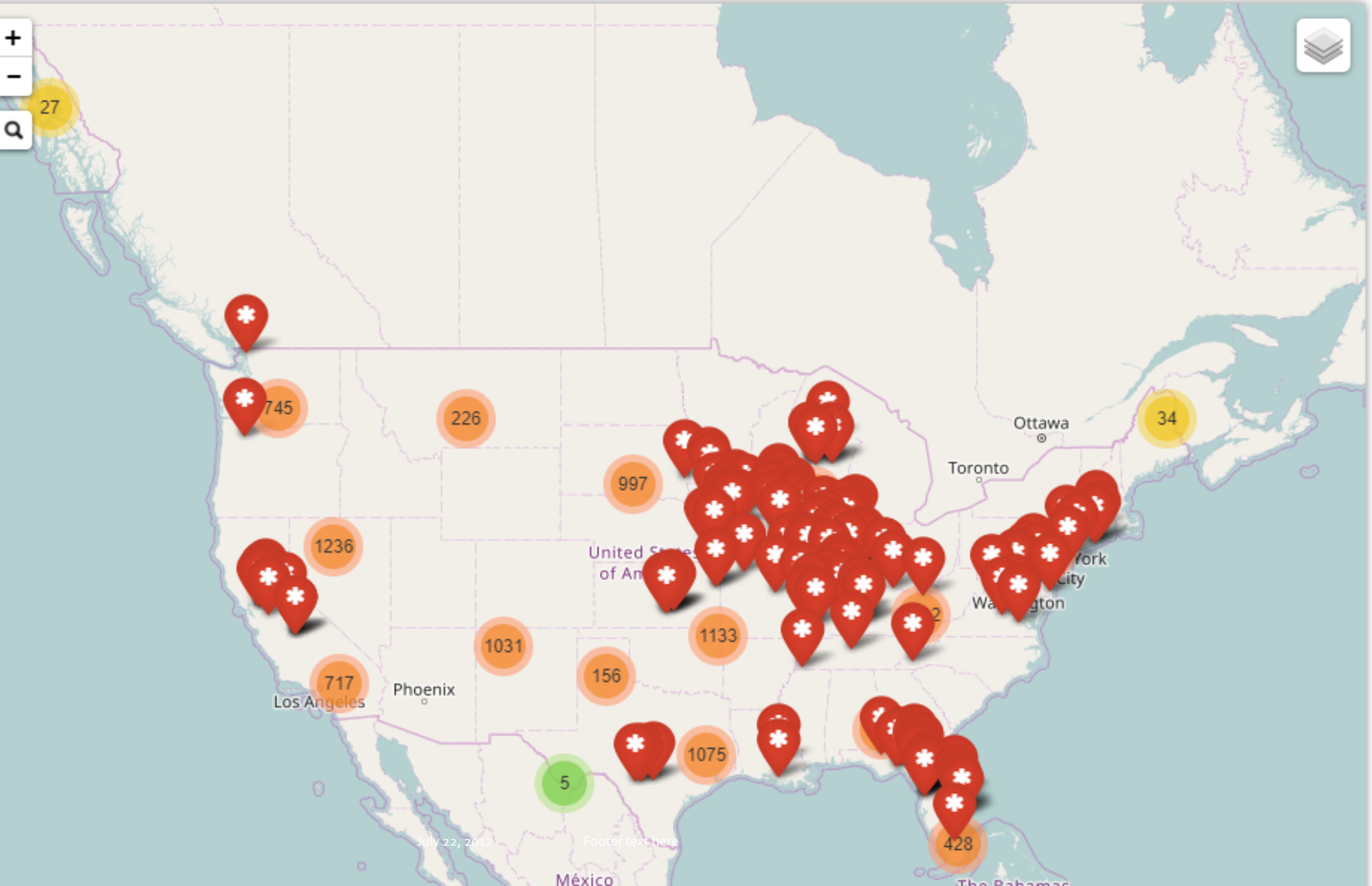
- CURRENTS is a demonstration tool
- It contains data from:

  8 Partners:
  - EPA Region 1: 2 Sensors
  - EPA Region 7: 18 Sensors
  - EPA Region 10: 1 Sensor
  - EPA ORD: 3 Sensors
  - NJ DEP: 106 Sensors
  - NJ Meadowlands: 3 Sensors
  - Clermont County, OH: 4 Sensors
  - USGS: 15,541 Sensors (nationwide coverage)

Organizations

an0605

an0742



Query

Organizations

Parameters Measured

- Flow, Total
- Height, gage
- Inorganic Nitrogen (Nitrat
- Lake or reservoir water s
- Light, photosynthetic acti
- [x] Nitrate as N
- Oxidation Reduction Pote
- Petroleum Hydrocarbons

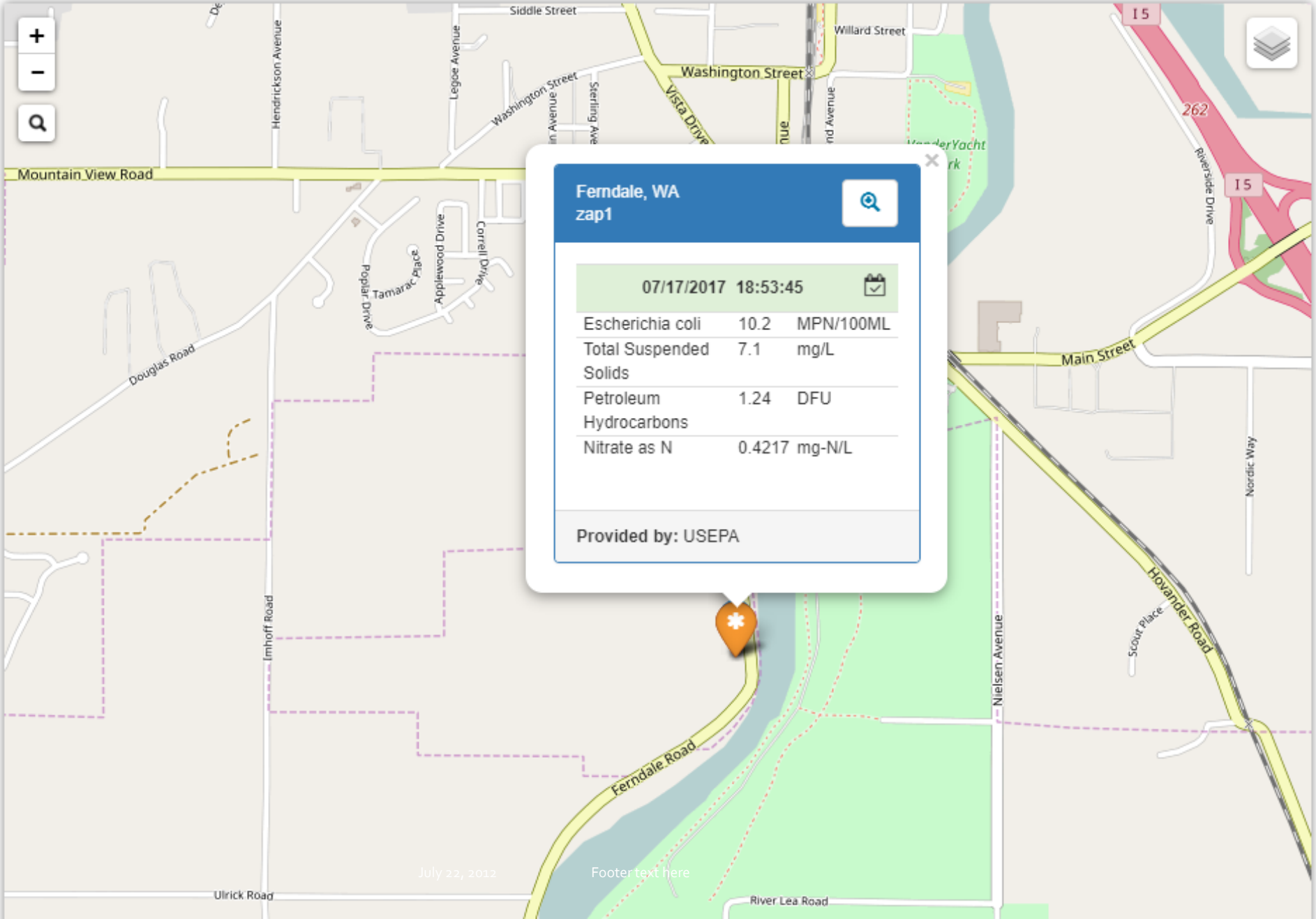
155 sites selected

04067958

04080798

443320089212304

04081000



Query

Clear Results

Organizations

Parameters Measured

Anywhere | Map Window | Draw Polygon

Run Query

Results

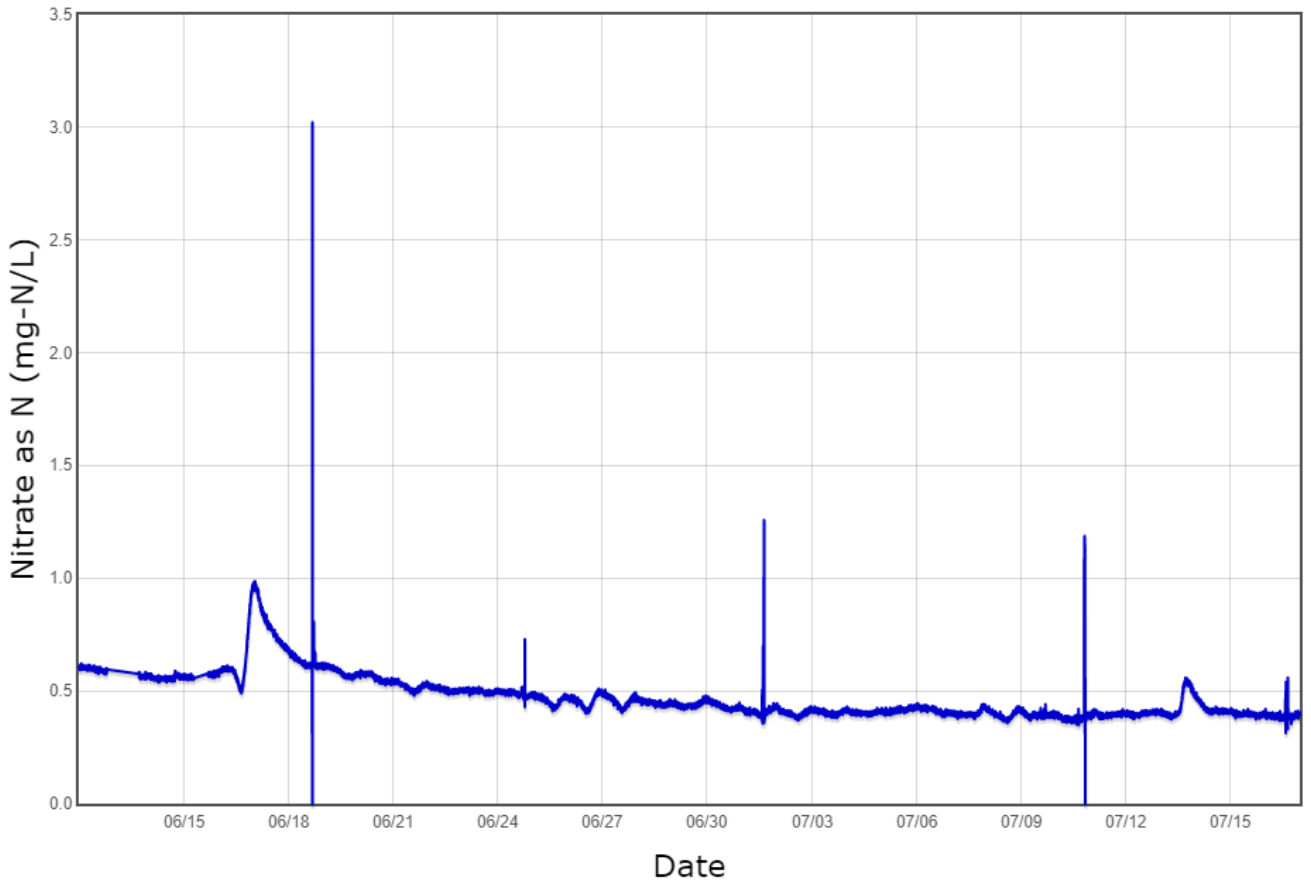
Zoom to Results

1 sites selected

zap1

- Petroleum Hydrocarbons (11/10/2016 - 07/17/2017)
- Total Suspended Solids (11/10/2016 - 07/17/2017)
- Escherichia coli (11/10/2016 - 07/17/2017)
- Nitrate as N (11/10/2016 - 07/17/2017)

Currents



zap1

Parameter: Nitrate as N **Start Date:** 06/12/2017 **End Date:** 07/16/2017

Ferndale, WA (zap1)

Provided by: U.S. EPA

Feature of Interest: urn:x-epaiwpp:feature:epa:epar10:zap1

Also known by: ferndale1, Ferndale Monitor 1

Contact: Dwane Young, IT Specialist, young.dwane@epa.gov

Petroleum Hydrocarbons (oil)	Start Date	End Date
○ oil (raw)	11/10/2016	07/17/2017
Total Suspended Solids (total_suspended_solids)	**Start Date**	**End Date**
○ total_suspended_solids (raw)	11/10/2016	07/17/2017
Escherichia coli (e_coli)	**Start Date**	**End Date**
○ e_coli (raw)	11/10/2016	07/17/2017
Nitrate as N (nitrate)	**Start Date**	**End Date**
◉ nitrate (raw)	11/10/2016	07/17/2017

*Parameter is not registered in the catalog.

Request Url

http://52.6.7.23/52n-sos-webapp/service?
service=SOS&version=2.0.0&request=GetObservation&FeatureOfInterest=urn:x-

Download

Clear Results

Select a parameter/procedure row on the left to download data.

Parameter: Nitrate as N

Procedure: nitrate (raw)

Start Date: 07/01/2017

End Date: 07/17/2017

Download

Results

Zoom to Results

1 sites selected

▶ zap1 ✖

- Petroleum Hydrocarbons (11/10/2016 - 07/17/2017)
- Total Suspended Solids (11/10/2016 - 07/17/2017)
- Escherichia coli (11/10/2016 - 07/17/2017)
- Nitrate as N (11/10/2016 - 07/17/2017)

View Details

A	B	C	D	E	F	G	H	
sults Period: 07/01/2017 - 07/17/2017								
ature of Interest: Ferndale WA (urn:x-epaiwpp:feature:epa:epar10:zap1)								
rameter: Nitrate as N (urn:x-epaiwpp:observable:nitrate)								
ocedure: raw:nitrate (urn:x-epaiwpp:sensor:epa:epar10:zap1:raw:nitrate)								
e	Procedure	Provided	Date	Time	Parameter	Value	Units	Nil Flag
p1	raw:nitrate	2017-07-01T00:32:04.000Z	7/1/2017	0:32:04	Nitrate as N	0.4237	mg-N/L	
p1	raw:nitrate	2017-07-01T00:34:23.000Z	7/1/2017	0:34:23	Nitrate as N	0.4181	mg-N/L	
p1	raw:nitrate	2017-07-01T00:36:42.000Z	7/1/2017	0:36:42	Nitrate as N	0.4221	mg-N/L	
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p1	raw:nitrate	2017-07-01T00:41:19.000Z	7/1/2017	0:41:19	Nitrate as N	0.4228	mg-N/L	
p1	raw:nitrate	2017-07-01T00:43:38.000Z	7/1/2017	0:43:38	Nitrate as N	0.4237	mg-N/L	
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p1	raw:nitrate	2017-07-01T00:48:16.000Z	7/1/2017	0:48:16	Nitrate as N	0.4229	mg-N/L	
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p1	raw:nitrate	2017-07-01T00:52:53.000Z	7/1/2017	0:52:53	Nitrate as N	0.4215	mg-N/L	
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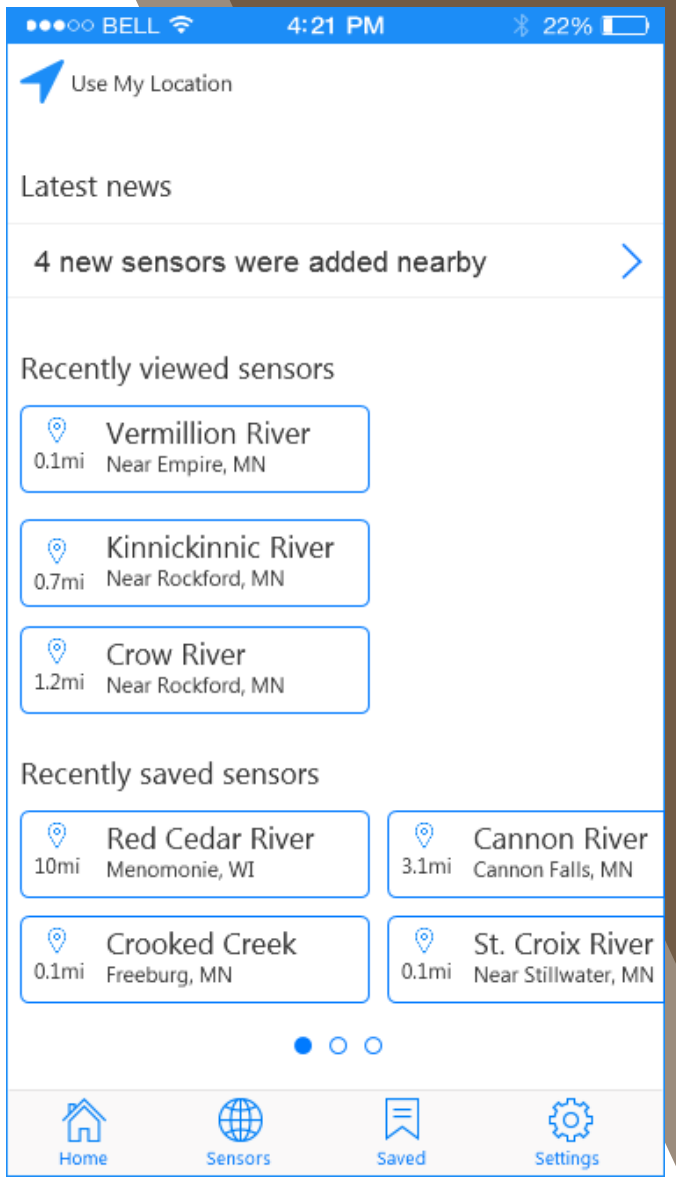
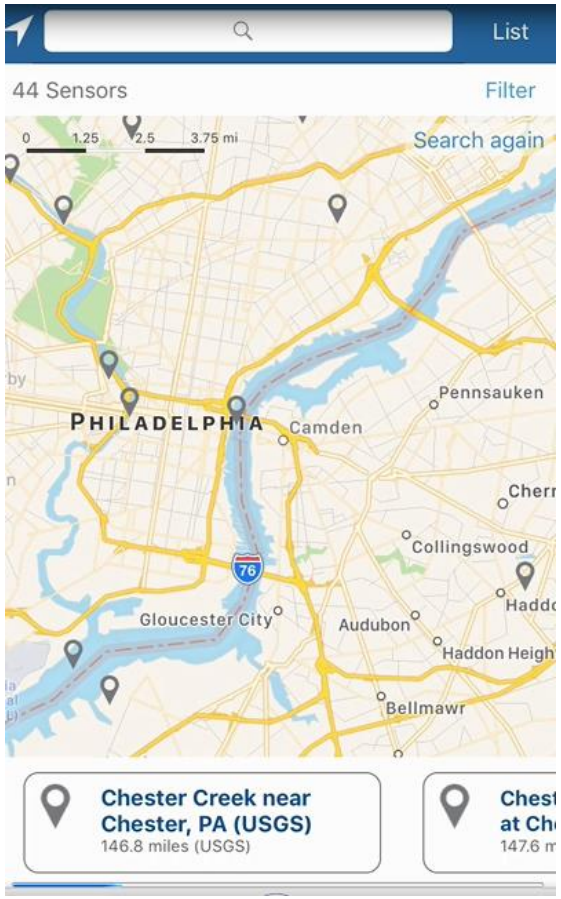


IWN's Open Architecture Allows Other Possibilities

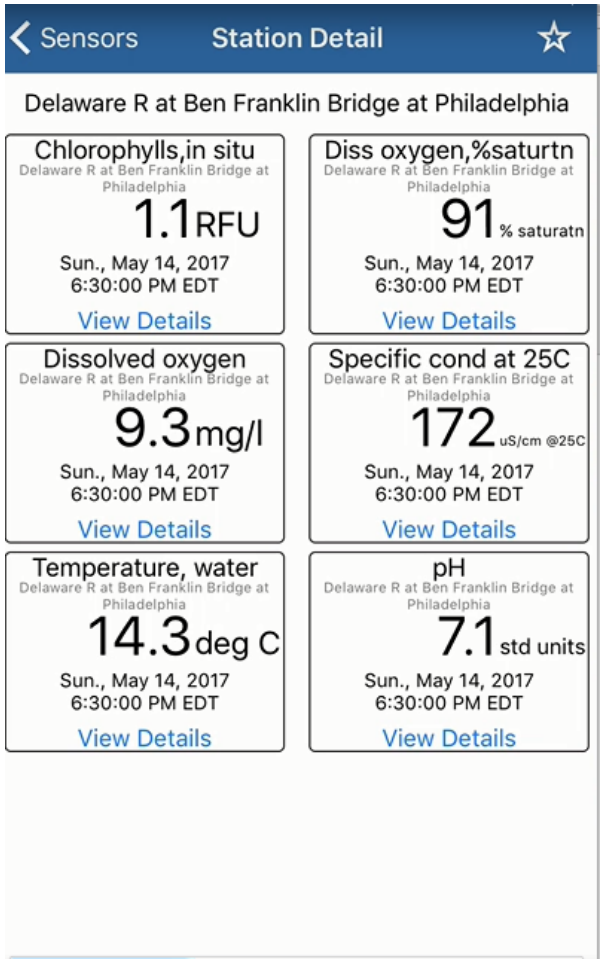
- IWN is built using an open architecture, meaning that all the functionality you see in the demonstration tool is also available as a corresponding **Web Service** or **Application Program Interface (API)**
- Enables for other apps to be developed (like mobile apps)
- Also allows for other third-party applications (like Excel) to be able to directly interact with the data without having to go to a website and 'download' the data

Real.m in Action

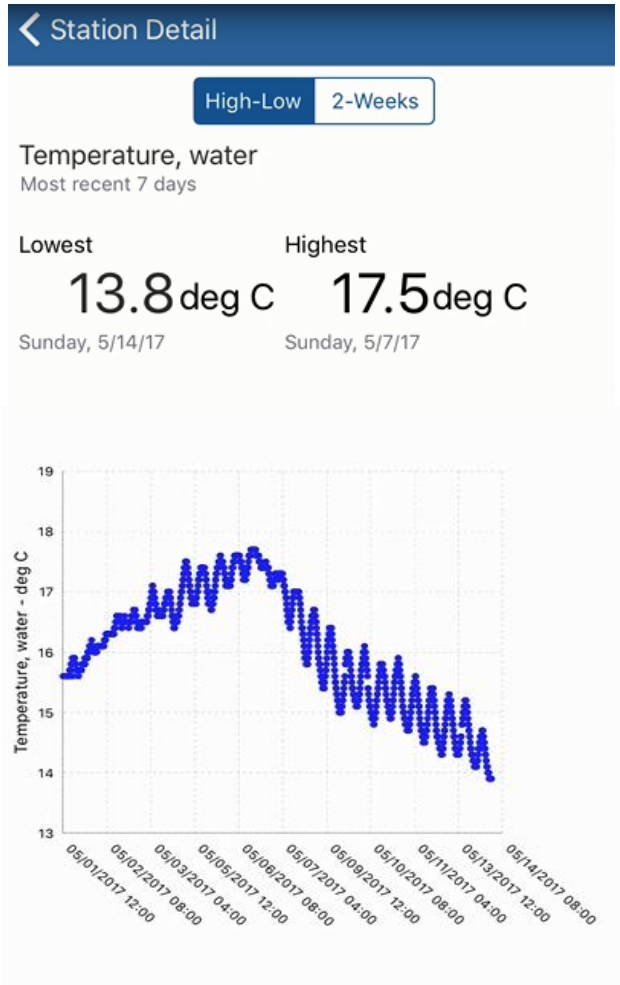
Discover Sensors



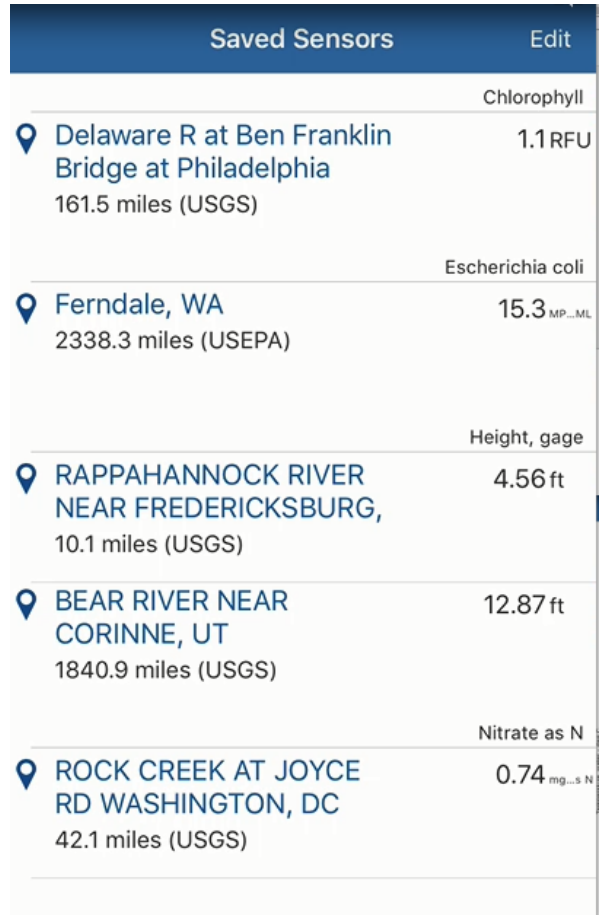
See Current Readings



Understand Trends



View Favorite Sites



Next Steps

- Demonstration project ended in December
  - A Lessons Learned Report has been completed
  - Demonstration tool will continue to be available
  - A mobile app is being developed that leverages the services/API developed as part of this project
- Demonstration proved to be very successful
  - Services worked better than expected
  - Ease of setting up a data appliance was simpler than anticipated
  - Ready to move to a production-level system
  - Advanced Monitoring Team is exploring if the services and standards would work for Air data as well

QUESTIONS?

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