Best Practices for Submitting Nutrient Data to the Water Quality eXchange (WQX)

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Presentation Objectives

1. Learn about WQX & WQP
2. Nutrient Metadata Case study
3. Lessons learned & takeaway message
4. Next Steps

Water Quality eXchange (WQX)

- Stores water quality data sampled by States, tribes, territories, and EPA collected in Rivers, Lakes, Oceans, Wetlands, etc.
- Est in 2007
- Developed with EPA, USGS, States, & Tribes
- Environmental Sampling and Analytical Results (ESAR) standard

In summary: we didn't make this up

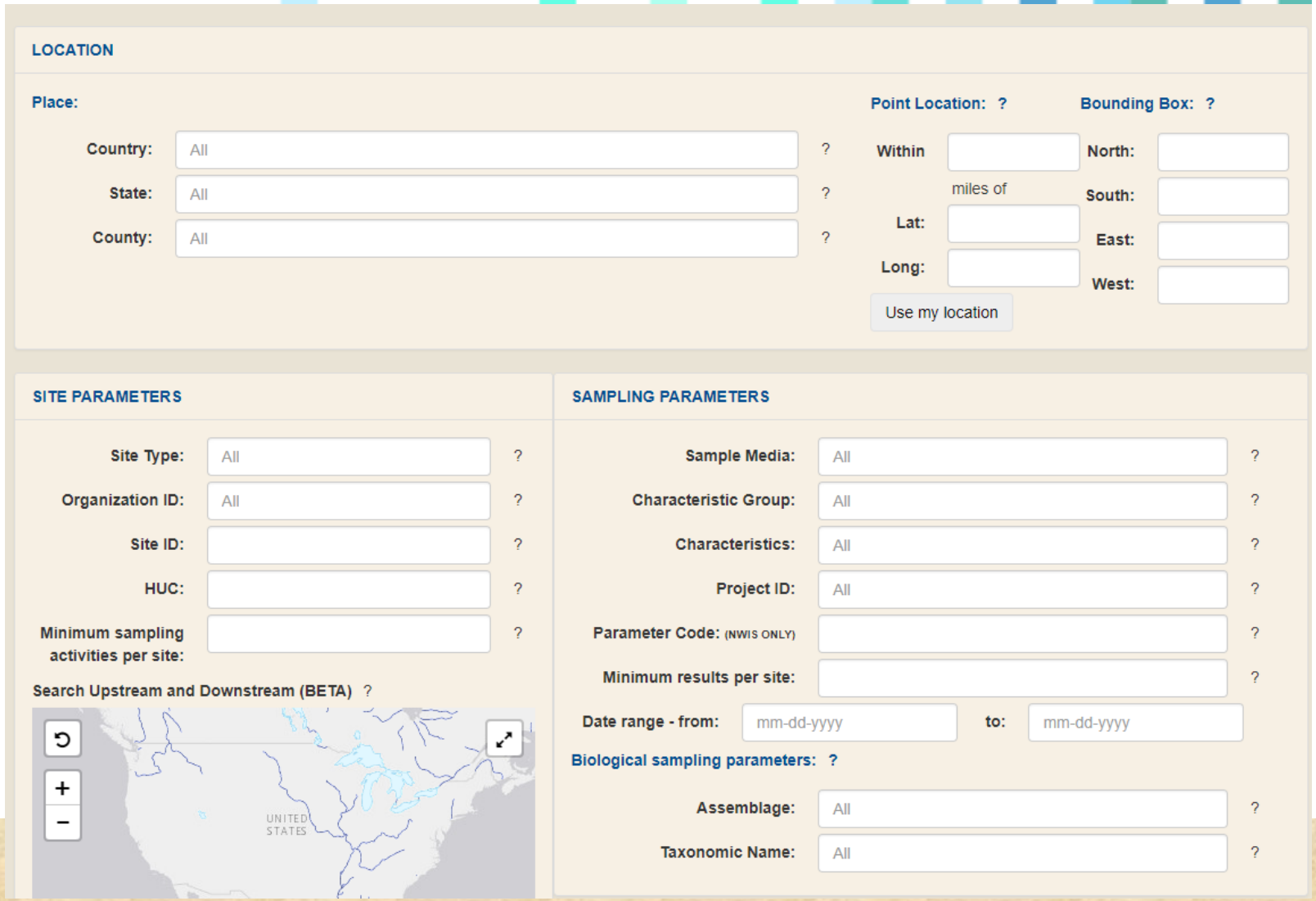
Water Quality Portal

- Cooperative service by EPA's WQX and USGS' National Water Information System (NWIS) all supported by the National Water Quality Monitoring Council.
- Data is served in WQX format
- ~215 million results from over 475K stations come from EPA's WQX/STORET
- Portal contains ~316 million results from over 875K stations

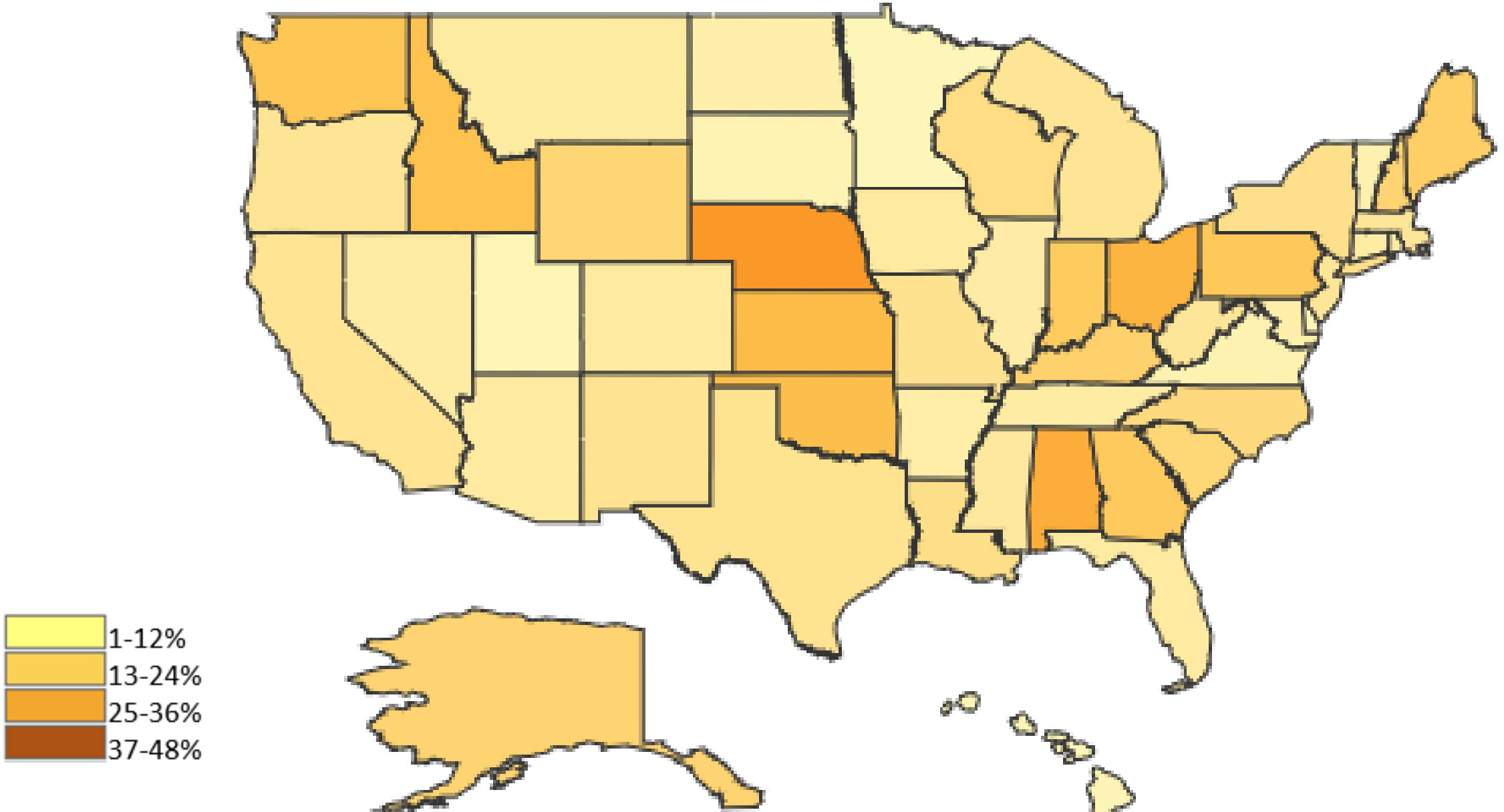
National Water Quality Monitoring Council

Working together for clean water

- User-friendly download
- Data is in ***ONE*** format
- Reusable by many organizations for many projects



Project Example: Ambiguous Nutrient Data



Nutrient Workgroup

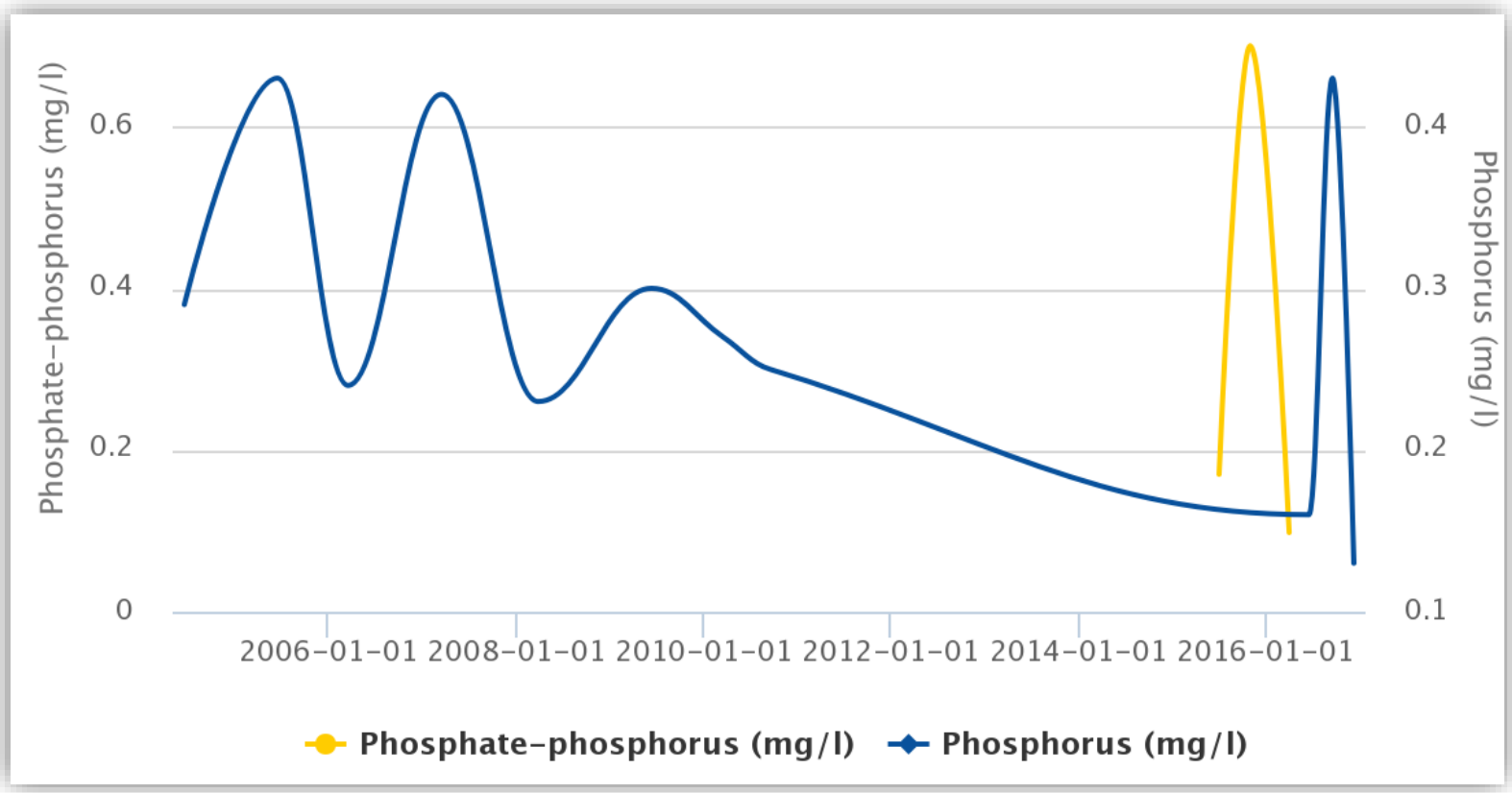
- Composed of state, tribal, USGS, and EPA to determine how to capture a complete nutrient data record.
- Met once a month for a year
- Determined the issues, why the issues were happening, and developed a WQX nutrient best practices guide.
- Created rules for WQX 3.0 coming in 2019

Nutrient Data Ambiguity

- Identified by data reusers from EPA and USGS
- Data is missing essential metadata
- The Issues:
  - Duplicate Monitoring Locations
  - Synonymous Parameters
  - Sample fraction “Total”
  - Method Speciation
  - Analytical Methods
  - Incorrectly documenting censored data

The Issues – Synonymous Parameters

- Total Phosphorus, mixed forms
- Phosphorus
- Phosphate-phosphorus
- Phosphorus (Total: PO4 & Organic)

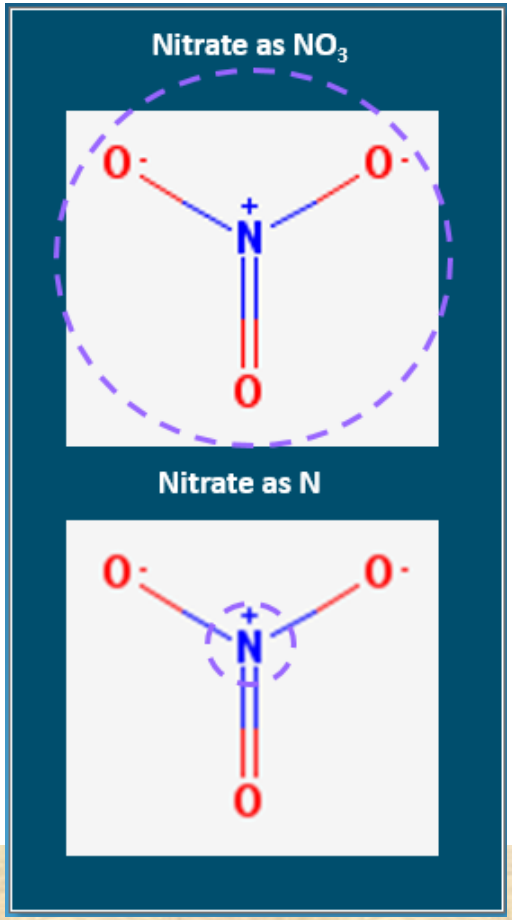


The Issues –Sample Fraction “Total”

- What does Total mean?
- Unfiltered? Sum of forms?
- For WQX, Total = sum of all forms
  - Ex: Total Nitrogen = N03 + NO2 + NH3 + Organic N
- Sample Fraction = filtration state

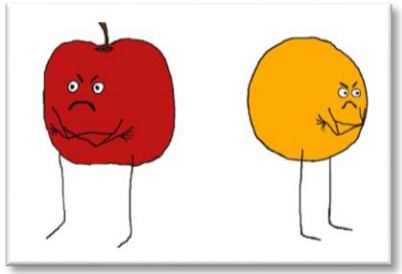
Media	Parameter	Speciation	Result Value	Result Units	Sample Fraction	Analytical Method
Water	Total Nitrogen, mixed forms	as N	2.0	mg/L	Filtered, field	USEPA 351.1
Water	Total Phosphorus, mixed forms	as PO4	1.8	mg/L	Unfiltered	USEPA 365.1

The Issues – Speciation



- Speciation = chemical form of analyte
- Why is it important?
  - Affects the result value
  - Example: MCL for Nitrate:

45 mg/L as NO_3



10 mg/L as N

- Without speciation info, data can't be used reliably.
- Independent of analytical method!

Table 4 Nutrient Result Guidance at a Glance

Preferred WQX Characteristic Name	Former WQX Characteristic Name(s) (Synonyms)	Method Speciation	Result Sample Fraction	Top-Reported Methods for Preferred Characteristic
Ammonia	○ Ammonia Nitrogen ○ Nitrogen, ammonia (NH3)	as N or as NH3	○ Filtered, Lab ○ Filtered, Field ○ Unfiltered ○ Non-Filterable (Particle)	**USEPA**: 350.1 **APHA:** 4500-NH3(C), 4500-NH3(E) **HACH**: 8155, 10023 **ASTM**: D6919-03, D6919-09 **LACHAT:** 10-107-06-3-D
Ammonium	NA	as N or as NH4	○ Filtered, Lab ○ Filtered, Field ○ Unfiltered ○ Non-Filterable (Particle)	**APHA:** 4500-NH3(F), NH3(H) **ASTM:** D6919-03
Inorganic nitrogen (NO2, NO3, & NH3)	○ Inorganic nitrogen (ammonia, nitrate and nitrite)	as N	○ Filtered, Lab ○ Filtered, Field ○ Unfiltered ○ Non-Filterable (Particle)	**USEPA**: 300.0, 353.1, 353.2, 353.4, 354.1 **APHA**: 4500-NO3(E), 4500-NO3(F), 4500-NO3(H) **ASTM**: D3867-04, **USDOIS/USGS**: I-4545 **LACHAT**: 10-107-04-1-J
Nitrate + Nitrite	○ Inorganic nitrogen (nitrate and nitrite)	as N	○ Filtered, Lab ○ Filtered, Field ○ Unfiltered ○ Non-Filterable (Particle)	**USEPA**: 353.2, 353.1, 353.4, 300.0, 300.1, 300.6, 354.1 **APHA**: 4500-NO3(F), 4500-NO3(I), 4110-C,4110B, 4500-NO3(B), 4500-NO3(E) **ASTM**: D3867-04 **LACHAT**: 10-107-04-1-C
Total Kjeldahl nitrogen (Organic N & NH3)	○ Kjeldahl nitrogen	as N	○ Filtered, Lab ○ Filtered, Field ○ Unfiltered ○ Non-Filterable (Particle)	**USEPA:** 351.2, 351.3(A), 351.3(B), 351.3(C), 351.1, 351.4, 350.1, 350.2, 350.3 **APHA:** 4500-NORG(B), 4500-NORG C, 4500 NORG D, 4500-NH3(C), 4500-NH3(D), 4500-NH3(G) **HACH:** 10242 **ASTM:** D3590(A) **LACHAT:** 10-107-06-2-M
Nitrate	NA	as N or as NO3	○ Filtered, Lab ○ Filtered, Field ○ Unfiltered ○ Non-Filterable (Particle)	**USEPA**: 353.2, 353.1, 352.1, 300.1, 300.0 **APHA**: 4500-NO3(D), 4500-NO3(E), 4500-NO3(F), 4500-NO3(H), 4110-B **HACH**: 10020 **ASTM:** D3867-04, D3867-16 **USDOI/USGS**: I4545
Nitrite	NA	as N or as NO2	○ Filtered, Lab ○ Filtered, Field ○ Unfiltered ○ Non-Filterable (Particle)	**USEPA**: 353.2, 300, 300.1, 354.1 **APHA**: 4500-NO3(E),4500-NO3(F), 4500-NO2(B) **ASTM**: D3867-04, D3867-16 **USDOI/USGS:** I-4545

Check out the best practices guide

https://www.epa.gov/waterdata/wqx-nutrients-best-practices-guide

Lessons Learned & Takeaways

National Database Management

1. Make sure all essential metadata for reuse is required
2. Periodically reassess data quality in the system
3. If a user can get around a rule, they will
4. ***The data is being used!***

Individual Data Steward

1. When your data is combined nationally, the data reuser cannot make the same assumptions you do
2. Ensure your data is represented accurately in a national system – and check with your lab
3. Follow best practices and guidance for data sharing.
4. ***The data is being used!***

Next Steps

- Continue Improvement on WQX 3.0
- Better communicate requirements and guidance to user community
- Explore other potential QA issues
  - Metals
  - General QA