

## A framework for interagency coordination on a National fixed-site water quality network for streams and rivers: Executive summary

Monitoring organizations face many common water-quality challenges across the United States, leading to unintentional commonalities in their monitoring approaches. These commonalities offer an opportunity to leverage our collective monitoring activities to create a coordinated national fixed-site network for rivers and streams in the United States. This report presents recommendations for establishing a coordinated network of core sites that are sampled over the long term by multiple monitoring organizations using a minimum set of common design elements. These common design elements can be built upon as needed by the originating monitoring organizations to meet additional local needs.

Based on lessons learned from past coordination efforts, the initial emphasis of the network is recommended to be on the identification of existing or recently discontinued sites that require no changes or only small changes that organizations can make to ensure overall consistency within the interagency network, without extensive modification to their current monitoring approach and without securing large new sources of funding.

A census of currently available nutrient data in the Water Quality Portal shows that 735 sites are already available that meet the recommended minimum sampling elements for a coordinated network for nutrients. Through small changes that build upon the commonalities already in place, an additional 1,917 sites could be available for inclusion in a coordinated network (figure 1; the additional 1,917 sites are the blue, orange, purple, and green sites combined).

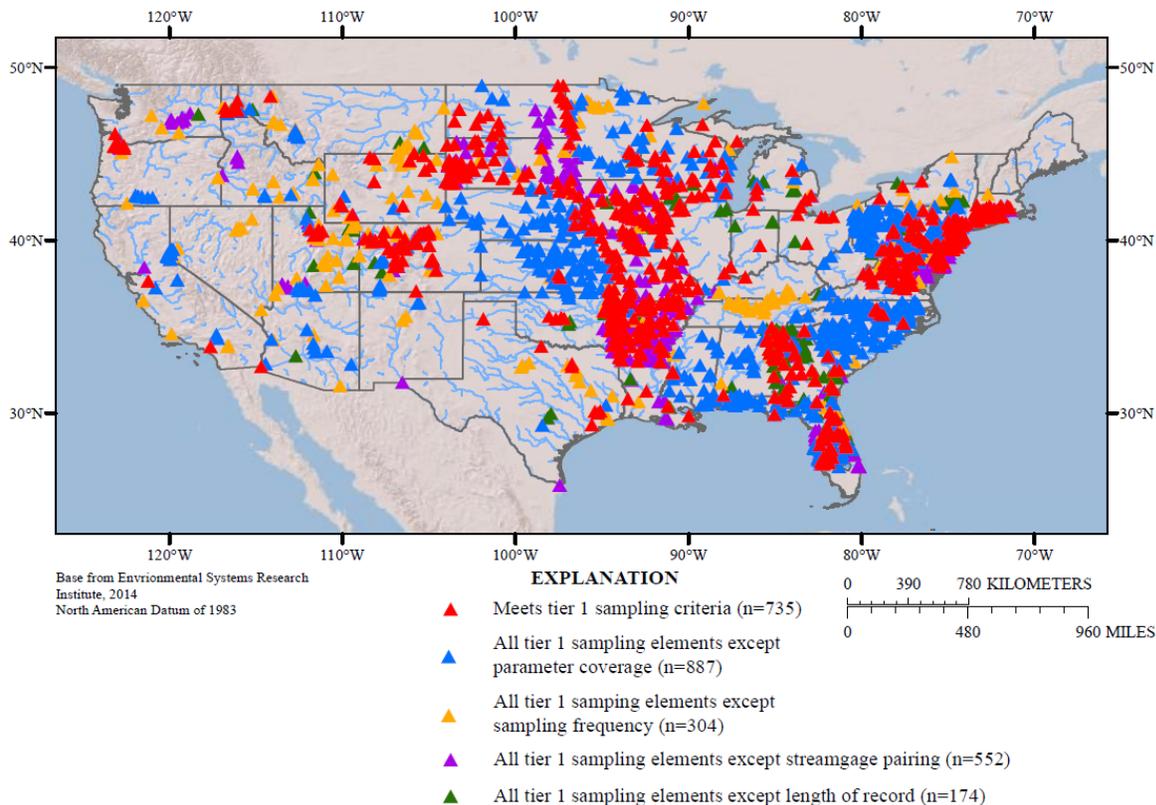


Figure 1. Sites that meet minimum (“tier 1”) sampling elements, plus additional sites that could meet minimum sampling elements with small changes

## Summary of recommendations

### **Establishment of a core set of interagency sites that are monitored consistently, routinely, and over the long term across the United States**

1. Recommended network objective
  - a. Evaluation of long-term water-quality trends in a fixed-site network distributed across in the United States.
2. Recommended minimum sampling elements:
  - a. Parameter coverage: sites monitored for 4 out of 5 nutrients and 3 out of 4 field parameters.
  - b. Sampling frequency: sites monitored at least quarterly each year
  - c. Streamflow data are potentially available from a co-located or nearby streamgage
3. Recommended site locations once the network has been fully developed
  - a. Sites in all possible hydrological units (HUC4 level), at the most downstream location in the hydrologic unit
  - b. Upstream sites in each HUC4 with relatively homogenous land uses. One site each for agriculture, urban, and undeveloped land use.
  - c. Sites at the outlet of any HUC2 entering a coastal area or interior lake

More comprehensive – but also more burdensome – recommendations for network objectives, sampling criteria, and site locations are also given in this report, as targets for a possible second phase of network implementation.

### **Next steps for network initiation, operation, and coordination**

1. Develop a web-based visualization tool showing candidate sites for an interagency network
  - a. Would help advertise the concept of a coordinated interagency network
  - b. Would help an individual organization identify candidate sites that already meet the minimum sampling elements, or could with just small changes
2. Establish a coordinating group for the network as soon as possible.
  - a. Would conduct outreach with major monitoring organizations.
  - b. Provide nominal governance and coordination of the network.
  - c. Identify funding programs to incentivize adoption of new sites and sampling schemes that fit this network while also meeting local monitoring needs.
3. All data collected at sites in the network should be reported through the Water Quality Exchange (WQX) and reside in the Water Quality Portal
  - a. Ensures that minimum metadata elements are included, and that data are available through a centralized and discoverable data repository.
  - b. Participating sites should be flagged in WQX as being a part of this federated interagency network.

# Consistency in Data Reporting Quality: Recommendations to the National Water Quality Monitoring Council (NWQMC)

## Executive Summary

This report focuses on how to improve metadata submission to WQX. Metadata in the Water Quality Portal can lack key elements which make the underlying data difficult to use. A key goal of this working group has been to try to identify the best practices for water quality metadata submission. The group consists of members from federal, state, tribes, NGOs and universities. Members believe that it is important to recognize that “One size does not fit all, but *more* metadata makes portal data more valuable and useful for a wider audience” (B. Horn, pers. comm.). Therefore, the group encourages data providers to enhance water quality data submission and potential reuse by including as much metadata as possible. This working group focused on identifying how using recommended or optional WQX web elements could improve data quality. We hope that use of these recommended or optional elements will become the best practice in the future. By providing guidance including specific metadata submission examples, the group believes this will enhance and improve metadata submission to the Water Quality Portal. The working group did not seek to redefine how to create metadata in general or the metadata elements in WQX.

## Recommendations for Increasing Submissions to the WQP and Creating Customized Entry Points Using WQP Web Services

To ensure water-quality data collected in the United States are available in a format consistent with the Water Quality eXchange (WQX) and from a single unified database, the Consistency in Data Discoverability subgroup devised a list of recommendations to increase data sharing and creating customized entry points for displaying water quality data. The recommendations are primarily targeted at staff and implementers at the state, regional, and national level (people with the ability to create, establish and implement these ideas and share them with others).

### Increasing Submissions to the WQP

The recommendations from the workgroup for increasing submissions to the WQP focus on initiating the data publishing process, the development of support materials, strategies for maintaining data partners, establishing an onboarding process for Exchange Network grant recipients, and marketing WQX and the WQP. Some highlights include: providing suggestions on submission mechanisms to meet organizations where they are, making existing support materials and opportunities more visible, creating a dashboard of data submissions, and reaching out to Exchange Network grant recipients upon award to help them understand the process of publishing data.

### Creating Customized Entry Points Using WQP Web Services

The WQP provides RESTful web services to simply retrieve data based on URL inputs. Many organizations are already using the WQP web services for their customized applications. One example explored was the USEPA's newly developed *How's My Waterway 2.0* website. The site is driven completely by web services from various water quality databases, the WQP being one. The WQP provides a stable infrastructure making data discoverable, available in a consistent format and published through web services. These concepts make data analysis, integration, and visualization easier. Similarly, it provides a secondary application where data reusers can go directly to get an organizations data. Therefore, the collecting organization does not have to stand up an application to share data or personally respond to data requests. The organizations can simply provide the water quality portal web service link to data inquiries.

Web services are extremely useful in applications, but the ability to incorporate them immediately into a water quality program requires staff expertise and time to devote to coding an application that can function similar to the HMW 2.0 applications. Realistically, these web services will slowly be integrated into state websites, where a developer has been hired or a technical staff person has been trained. In response to these

This table is displaying data from the Water Quality Portal CSV file for the Midlands Rivers Coalition which can be found [here](#).

Year Results						
Year	Samples	Average	N_samples_exceed_standard	Average_samples_exceed_standard	Chart	
2018	248	75.97	7	618.24		
2017	127	83.45	9	603.67		

Year Station Results						
Year	Stat	Samples	Average	N_samples_exceed_standard	Average_samples_exceed_standard	Chart
2018	MRC-B-337	22	38.1	0		
2018	MRC-BRRC	22	49.24	0		
2018	MRC-CSB-001L	23	108.07	1	727	
2018	MRC-CSB-001R	22	89.34	0		
2018	MRC-I-20	23	77.6	1	770.1	
2018	MRC-RBZ	23	104.3	1	816.4	
2018	MRC-RDL	22	118.07	0		
2018	MRC-S-298	24	105.44	2	532.35	
2018	MRC-SRE	24	93.1	2	474.75	
2018	MRC-SSCL	22	16.25	0		
2018	MRC-SSLL	21	46.19	0		
2017	MRC-CSB-001L	15	62.4	1	378	
2017	MRC-CSB-001R	14	39.85	0		
2017	MRC-I-20	15	130.6	2	637.5	
2017	MRC-RBZ	15	138.13	2	563.5	
2017	MRC-RDL	15	64.07	1	411	
2017	MRC-S-298	15	199.93	3	747.33	
2017	MRC-SSCL	10	20.7	0		
2017	MRC-SSLL	14	38.36	0		
2017	MRC-SSUL	14	26.36	0		

challenges, the workgroup recommends the use of open source platforms when integrating web services into applications. This option would provide an avenue for water quality program owners to borrow code to provide quicker and more cost-efficient spin-up time. This will require thorough documentation for reusing code and marketing of the available web services.

One option for creating an easy web page to display water quality portal data is demonstrated in gitpages, created by Bryan Rabon from S.C. Department of Health & Environmental Control, to display data from the Midland River Coalition (shown above). The example shows Escherichia coli data values for the past two years including the number of samples, average value, number of exceedances, average number of exceedances and a chart displaying the trend for each station. The code in github could be used and slightly modified by any other organization. Then the organization can create a gitpage and their data is available in the same format. The more participants in the development of open source code, the more these applications can evolve to display more data in more complex ways. Lastly, a link at the top of the page allows a user to download the data directly from the portal using the web services. For more information about gitpages, please see <https://pages.github.com/>. To see the Midland River Coalition organization demonstration from South Carolina, please see <https://bryanrabon.github.io/MidlandRivers/>. It is recommended the National Water Quality Monitoring council consider sponsoring an open source platform such as github to host collaborative community where water quality organizations can discover, share and build projects.

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