

Participatory Science Data Management Case Studies

Virginia Department of Environmental Quality Water Monitoring



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Water Monitoring

Improving Data Management for Participatory Science

VA DEQ integrates participatory science data from multiple groups with state-collected data to support the assessments needed for reports under the Clean Water Act. The focus of VA DEQ is on acquiring, reformatting, performing Quality Assurance/Quality Control (QA/QC), and providing the data in systems that can be easily used by assessors.

Project Overview & Goals

The Virginia Department of Environmental Quality (VA DEQ) uses participatory science data to assess water quality for reporting under the Clean Water Act, in the agency's Water Quality Assessment Integrated Report to EPA. In support of this assessment, VA DEQ acquires, reformats, and performs quality assurance/quality control (QC/QA) on data from monitoring groups across the state. The participatory science data are then integrated with traditional data collected by the state, providing a single environment to support the assessment process.

Role of Project Participants

The project participants contributing to the VA DEQ data are members of groups, many of whom have received small grants from the agency. Groups range from 1-2 people to large non-government organizations. They can range from collection to analysis and represents the gamut of water quality monitoring. Training is being revamped, but typically VA DEQ offers in-the-field training exercises upon request from interested groups, a webinar about how to submit data, and several written materials on water monitoring on its website.

Data Management

There are two paths for monitoring groups to submit data to VA DEQ. Direct submissions are electronic via email as Excel or CSV files following a specified template. VA DEQ no longer accepts paper or scans of field data sheets. The second path uses the Chesapeake Monitoring Cooperative (CMC) Data Explorer's online data submission system. VA DEQ prefers the use of the Data Explorer since it is a public-facing relational database, has extensive metadata, and performs some QA/QC. VA DEQ downloads the data from the Data Explorer. This system is only available for submission of data from the Chesapeake Bay Watershed and therefore, excludes participatory science data from Virginia waters that do not drain to the Bay. This other data must be emailed directly to VA DEQ.

Regardless of the way data are submitted to VA DEQ, all such data must be accompanied by a Use Authorization Form, which summarizes the types of data being submitted and the intended use of these data by the participatory science group. The frequency of data collection depends on the

Issue:
Water Quality

Location:
Virginia

Tools:
Photography,
Sample
Collection & Data
Entry/Analysis

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objectives agreed upon in the Use Authorization Form and the parameters to be monitored. When the Use Authorization Form is finalized, it includes the level of the data which will be submitted. The levels (1-3) are based on QA/QC data characteristics required for specific types of DEQ use and become stricter as the levels increase.

Level 3 data can be used by the DEQ for water quality assessment and other Department business. Level 2 data can be used by the DEQ in a limited capacity, and Level 1 data are used as observational data only (e.g., they may be considered to prioritize follow-up monitoring by VA DEQ). Virginia Law currently prohibits the use of participatory science monitoring data in enforcement actions. A QAPP is required for every grant or project producing Level 2 or Level 3 data and these must be reviewed, re-submitted and approved annually. Field and lab audits of groups are required for projects producing Level 3 data. These are conducted by VA DEQ staff every 1-3 years, on a case-specific basis.

When the data are received, a series of R scripts are run to perform QA/QC and to assign an initial level. Whether the level expected from the Use Authorization Form is achieved depends upon the results of the QA/QC check and manual QA/QC review. The data level also depends upon whether the data are appropriate for their intended use. For example, Level 3 data, which are intended to be used for assessment against established water quality standards, cannot be produced for a parameter for which Virginia does not have a standard. Such data, even if of sufficient quality, would achieve a maximum of Level 2.

Data Use

The data are used by VA DEQ for assessment, Total Maximum Daily Load (TMDL) development, to track the progress of implemented TMDLs, to prioritize sites for follow-up monitoring, and for education and training. Groups may also use the data for their own purposes, especially for advocacy and education. There is no automated distribution system or API for data not submitted to the Data Explorer. Through VA DEQ, distribution is on a request basis. VA DEQ directly provides data produced by the Department, but typically does not provide data collected by participatory science groups to requestors. Instead, VA DEQ refers requestors to the group that collected the data or to the Data Explorer, depending on where the data of record reside. VA DEQ often coordinates such requests and assists the requestor in obtaining data from outside sources. Data are not uploaded to Water Quality Exchange (WQX) by VA DEQ but monitoring groups may do so individually.

Issues & Lesson's Learned

The biggest technical issue is the lack of a comprehensive data system that would bring together all the acquisition, reformatting, scripting, and automated QA/QC. Ultimately, this will save time and be more efficient. VA DEQ is working toward such a system, but it is going to take time because of limited resources and developer time.

The biggest quality issue is ensuring geospatial accuracy by matching up the latitude-longitude coordinates across the collection sites, thus ensuring that data are attributed to spatial locations correctly, all appropriate data are considered for a given assessment, and that monitoring efforts are

not redundant. VA DEQ has developed scripts and a series of interactive applications to assist the participatory science monitoring data review staff with this type of QA. Ultimately, they are hoping to develop a comprehensive water quality portal or build upon an existing system such as the Data Explorer to help resolve these geospatial problems.

Defining the objectives with a monitoring group, aligning processes to the objectives, and documenting them (e.g., in the Use Authorization Form) are important. Bureaucratic processes must be included in the objectives since they take time and add complexity if not appropriately addressed. The quality level targeted should match each group's intent regarding how it wants VA DEQ to use the data. Any tiering or leveling of the data needs to be related directly to the objectives and the processes.

Outcomes & Success Factors

Participatory science data is invaluable for the assessment process because it adds considerably to the geographic coverage. In addition, the monitoring by a group may result in a waterbody being designated as impaired, which often results in progress toward water quality improvement (e.g., implementation of new Best Management Practices (BMPs)). The data also provide education for people in the watershed on the functioning of aquatic ecosystems and how to improve water quality. After assessment, participatory science groups may contribute to water quality improvement projects or may monitor to track the progress of such projects through the CWA Section 319 program. VA DEQ allocates additional funding to participatory science groups through this program.

The VA DEQ's success factors include:

- Commitment and dedication from the participatory science monitoring groups.
- Commitment and skills of the VA DEQ staff.
- Staying connected and communicative between both the participatory science groups and VA DEQ.

Opportunities

- Automating and organizing the workflow including scripted routines.
- Training for project participants, particularly getting the data from their notebooks into the electronic systems.
- EPA and states could support similar programs through funding sources; training on data integrity and data management; and development of user-friendly databases.
- A common data platform across the states should be discussed, but it may be too difficult because of differing environments and water quality standards.
- The WQX platform is difficult for project participants to use, but it would be helpful to explore how this could be improved or simplified since WQX already exists and is integrated with other systems.
- Some overall approaches, best practices, basic skill sets, and tools for data management would be valuable at the national level.
- Tiering the data should also be discussed, but it is unclear if tiering could be done consistently across states at any level of detail.