Water Quality in Southwestern Pennsylvania: Knowledge Gaps and Approaches

Pittsburgh Collaboratory for WATER
Research, Education, Outreach

A WHITE PAPER REPORT FROM THE AGENDA BUILDING MEETING ON JANUARY 28, 2019

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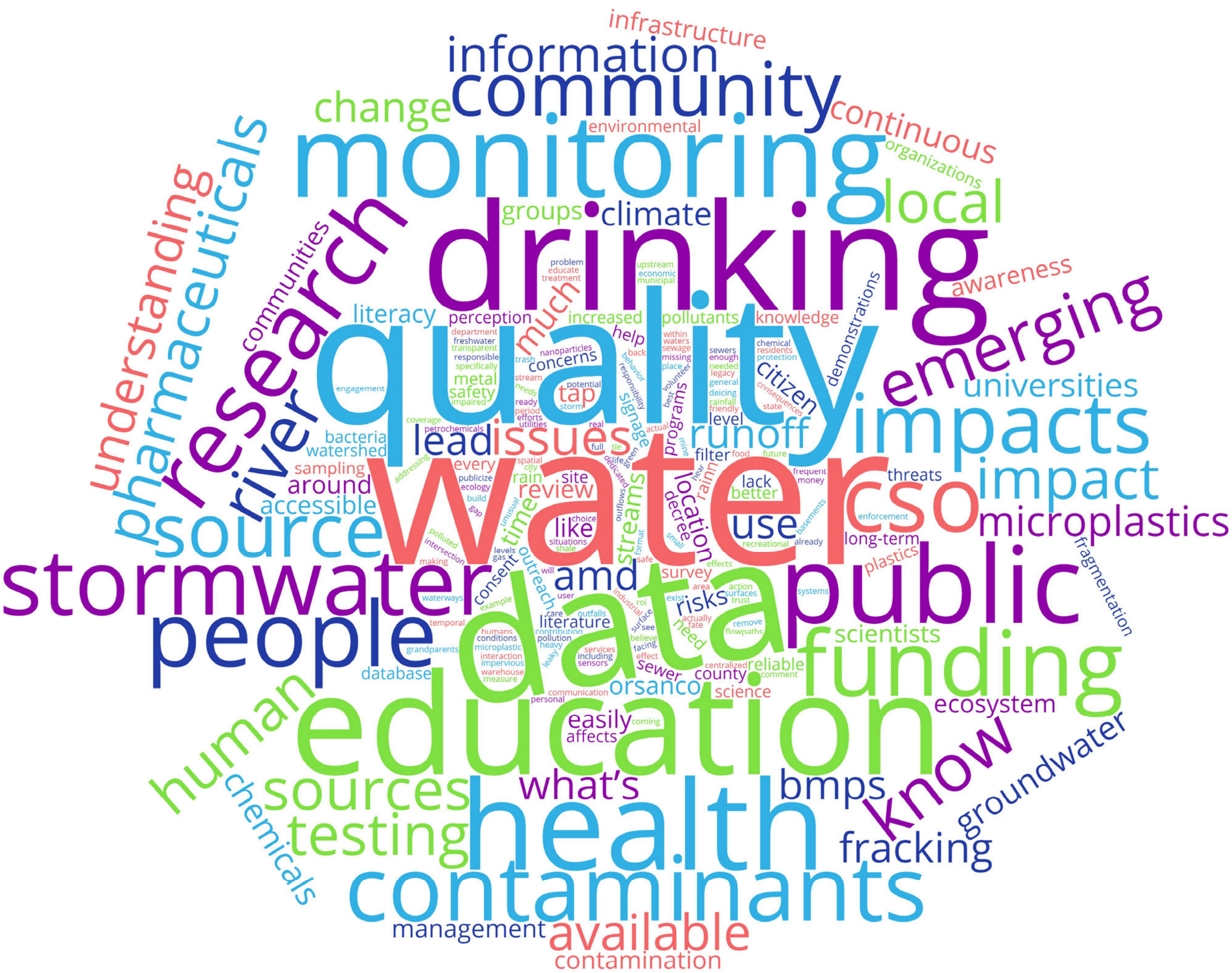
Common words from consensus building exercise: size of the word is proportional to number of times it was written in workshop materials.



Executive Summary

As southwestern Pennsylvania continues to evolve from its industrial past to become a national leader in innovation and sustainability, it has encountered a complex set of water challenges that threaten the economy, ecology, and public health of the region. In this context, over the last year, the Heinz Endowments has funded the Pittsburgh Collaboratory for Water Research, Education, and Outreach at the University of Pittsburgh to hold a series of consensus-building meetings among regional academic scholars, community groups, governmental and non-governmental organizations. These meetings (one each on green infrastructure, water quality, and flooding) aim to identify key regional knowledge gaps and chart a collaborative research agenda to fill these gaps and enhance the region's ability to strategically and creatively solve water problems. In June 2019, the first of the reports on Green Infrastructure and Stormwater Management was released.

Now, in October 2019, the second report describing the research agenda on regional water quality arising from a January 28, 2019 meeting will be formally released. This report outlines several fundamental knowledge gaps in the region and suggests methods to span these gaps with new collaborative research.

Gaps

As the region continues to grow and evolve, chemical waste also is changing. New materials that "emerge" from these changes in commerce can have unexpected and detrimental consequences (e.g., perfluorooctane sulfonate (PFOS)). Likewise, the long and rich history of steel production and other industry has left forgotten and sometimes dangerous pockets of "legacy" contamination across the region (e.g., fly ash impoundments). Limited monitoring data create uncertainty about the extent and magnitude of "emerging" and "legacy" contaminants and therefore diminish the ability to effectively sustain regional water quality.

In southwestern PA, comprehensive assessment of water quality remains a challenge as water quality data has not been centralized into a single location. In addition, the vast majority of existing water quality data is for the major rivers, limiting our ability to discern the water quality in our region's abundant streams.

Paths Forward

Monitoring of regional water quality is in increasing peril as the federal government diverts water quality resources to other priorities. To ensure water quality threats to human health and natural systems are detected, cooperation amongst regional agencies will be necessary as emerging contaminants make monitoring programs more challenging to maintain.

Local citizens have been critical to progress in the clean-up of "legacy contamination" and the resulting improvements in water quality. Cultivation of continued connections between these citizens and available technological expertise is an important part of regional progress.

As with green infrastructure, development of enhanced data management tools, particularly tools that make data accessible to the general public are a fundamental part of understanding and managing regional water quality.

Preface

This white paper documents a regional, multi-stakeholder research agenda meeting held on January 28, 2019 in Pittsburgh, Pennsylvania. This meeting was the second of three topical research agenda meetings hosted by the Pittsburgh Water Collaboratory for Water Research, Education, and Outreach. The goal of the meeting was to identify key knowledge gaps regarding water quality in southwest Pennsylvania and identify potential approaches that can help to fill those knowledge gaps. Participants were asked to answer the following questions:

1. What are the knowledge gaps about water quality (and emerging risks) across scales and uses in southwest Pennsylvania?

2. What are the best approaches to fill knowledge gaps in water quality (and emerging risks) across scales and uses in southwest Pennsylvania?

Participants brainstormed ideas and built consensus in groups of 2, 4, and 8, culminating as a summary list from the consolidation of consensus groups. The writing of this white paper was guided by the points that came up through this brainstorm activity, the prioritization of these points by different groups, and a vote on priorities by all the participants. Participant consensus is summarized in this document to outline existing knowledge gaps identified during the meeting. Final consensus is presented in Section 2 and 3. In Section 4, suggested paths forward are recommended based on participant inputs. While these recommendations grew out of the meeting results, they will require continued discussion and research within and beyond the Collaboratory to be successfully enacted.

The Pittsburgh Water Collaboratory editorial board, which helped to prepare the final version of this white paper, includes:

Emily Elliott
Director

Dan Bain
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Brian Thomas
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Group participants from the meeting are included in Appendix 1.

More information about the Pittsburgh Collaboratory for Water Research, Education, and Outreach can be found at: **www.water.pitt.edu**.

This report should be cited as:

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1.0 Background

The Pittsburgh Collaboratory for Water Research, Education, and Outreach hosted an open meeting for members of the Pittsburgh community to contribute their thoughts on water quality knowledge gaps and potential approaches to fill those gaps. The meeting aimed to extract opinions and thoughts from the community at-large and initiate a long-term dialogue toward identifying and resolving water quality challenges in southwestern Pennsylvania (PA).

For context, the Upper Ohio region has not benefited from multi-agency, high-commitment efforts present in other portions of Pennsylvania including the Chesapeake Bay and Delaware River watersheds. Rather, monitoring of water quality in Western PA and the Upper Ohio has included important regional studies like the characterization of the Allegheny and Monongahela Rivers completed as part of the U.S. Geological Survey's National Water Quality Assessment (NAWQA), (McAuley, 1995). However, these assessments were completed on an intermittent basis and without a singular coordinating authority (e.g., the Chesapeake Bay Program office or water utilities promoting source water protection for Philadelphia). Consequently, the region lacks a rich historical water quality dataset to serve as the foundation for a coherent monitoring strategy.

2.0 Meeting Results

The meeting was held on January 28, 2018 at the University of Pittsburgh's Community Engagement Center in Homewood and included 47 attendees (Appendix 1). Participants at the meeting spanned governmental and non-governmental organizations and community members. All participants were asked to answer the following questions:

1. What are the knowledge gaps about water quality (and emerging risks) across scales and uses in Southwest Pennsylvania?

2. What are the best approaches to fill knowledge gaps in water quality (and emerging risks) across scales and uses in Southwest Pennsylvania?

Participants brainstormed ideas and built consensus in groups of 2, 4, and 8, culminating as a summary list from five groups of at least 8 persons. Then the consensus lists were distributed among these five groups for comment and review. After these reviews, the finalized answers to both questions from each group were posted on a wall and each participant voted on their top answers choosing from all posted answers. Participants voted on final consensus built by groups of 8 using the following criteria:

Question	Dot color	Place dot next to the
What are the knowledge gaps about water quality (and emerging risks) across scales and uses in Southwest Pennsylvania?	**Green**	Most important gap
	Yellow	Hardest knowledge gap to fill
	Red	Gap most easily addressed with existing data
What are the best approaches to fill knowledge gaps in water quality (and emerging risks) across scales and uses in Southwest Pennsylvania?	**Green**	Best approach
	Yellow	Most intriguing approach, but risky
	Red	Worst approach

Final consensus from the groups of 8 varied in both the number of knowledge gaps and approaches and in the specificity of knowledge gaps and approaches. Resulting group consensus and participant voting results are summarized in Table 1.

Table 1. *Vote tallies on the knowledge gaps/approaches identified by the various consensus groups. Columns correspond to the gap that was viewed to best meet the criteria outlined above. The themes receiving the most votes in each of the categories are colored with the associated color (i.e., green, yellow, red).*

Knowledge Gaps (What are the knowledge gaps about water quality and emerging risks across scales and uses in Southwest Pennsylvania?)	**Green** (most important gap)	**Yellow** (hardest knowledge gap to fill)	**Red** (gap most easily addressed with existing data)
Presence, fate, and behavior (pathways) of contaminants on human and environmental health • Emerging contaminants • Legacy contaminants	**7**		
Education and public literacy about where drinking water and source water comes from, how it becomes impaired, and how we can protect it. Better understanding of effective science communication techniques around water-related issues.	**7**	1	2
Emerging contaminants (microplastics, pharmaceuticals, hydrocarbons, fertilizer, fracking waste, pesticides, algae toxins, personal care products, heavy metals)	6	2	
Have a clear two-way communication hearing from and communicating to citizens	4	1	1
Mechanism to gather, store, analyze, and manage data • ORSANCO as a model • Chesapeake Bay as a model	3		2
Human health impacts of poor water quality: fracking, plastics, petrochemicals, pharmaceuticals, PFOA/PFAF	1	**9**	2
Holistic water resource management	1	3	2
High resolution data on the spatial and temporal extent of sewer contaminants (CSO)	1	4	3
Urban stormwater/CSOs • Higher resolution data • Climate change leading to increased rainfall, flowpaths	1		4

Green Infrastructure planning based on ecosystem services and equity	1	5	1
Pathways and interactions of emerging and existing contaminants	1		
Stormwater and source water impacts of climate change			**10**
Climate change impacts on water quality		1	5
Emerging risks and contaminants		4	

Approaches (What are the best approaches to fill knowledge gaps in water quality and emerging risks across scales and uses in Southwest Pennsylvania?)	**Green** (best approach)	**Yellow** (most intriguing approach)	**Red** (worst approach)
Easily- accessible, scientifically-valid public data, public education, and awareness about how to understand and use it. • Demonstration projects	**12**		
Proactive basin management • e.g. IWMP, Ohio River Basin Commission	7	5	
Research partnerships with citizen science	3	6	1
Collaboratory and funded research	3		
Data collection at strategic hydrologic points	2		5
Use current affairs to educate and activate the public (i.e. consent decree comment period and heavy rainfall/flooding)	2	**10**	2
Full-time scientists focused on systematic water quality data gathering	1		**10**
Data-driven policy and public education initiatives	1	2	
Look to ORSANCO and Chesapeake Bay data sharing (expand who and how to collect)		1	
Funding and enforcement, both govt. and community/ advocacy		3	
Research into human health and ecosystem impacts		1	1
Public engagement		1	
ID sources to ID solutions			

3.0 Discussion of Major Themes in Meeting Results

Several important themes emerged from the meeting (see tables in Section 2.0). In general, these were grouped into emerging and legacy contaminants, education and public literacy, and accessible public data.

3.1 Emergent Contaminants

Emerging contaminants (Box 1) were frequently raised during the meeting. In particular, pharmaceuticals, microplastics, agricultural runoff, perfluorinated compounds, and fracking waste were mentioned as important emerging contaminants in southwestern Pennsylvania. The potential variety of emerging contaminants creates a challenge in the determination of monitoring and reporting needs.

While the U.S. Geological Survey and the PA Department of Environmental Protection (PA DEP) have long monitored a broad suite of water quality parameters (e.g., pH, turbidity, dissolved oxygen, nutrients, and major ions), emerging contaminants are generally measured infrequently and across a limited spatial coverage.

One of the most important ways to broaden emerging contaminants data is to increase coordination in water quality monitoring and management in the region. Monitored water chemistry parameters need to be expanded to adequately detect emerging contamination problems and this monitoring has to be spatially broad enough to create a representative baseline of chemical concentrations across the region. However, monitoring budgets are static at best, so improved coordination to collect more data with existing resources is vital. This monitoring does not necessarily have to be more intense. For example, it can use biological samples that may be more sensitive due to bioconcentration. The broadening of local water chemistry measurements and the faithful reporting of these measurements is fundamental to the detection of emergent contaminants.

Box 1

Emerging contaminants

Also known as "contaminants of emerging concern", emerging contaminants are chemicals not previously detected in or released to the environment that pose an uncertain risk to human health and the environment. A wide variety of emerging contaminants were discussed in this meeting (Table 1).

Legacy contaminants

Legacy contaminants persist in the environment and continue to impact environmental systems for substantial periods after they are introduced. Examples of legacy pollutants includes acidic mine drainage, polychlorinated biphenyls (PCBs), dioxins, and industrial metallurgical waste. Legacy pollutants can be toxic.

Perhaps the most fundamental challenge in emergent contamination is “if we detect a new contaminant, how do we know if we need to be concerned?” Chronic health effects take many years to detect and thus if one waits for evidence of public health impacts, populations can be exposed to harmful substance(s) for unacceptably long periods. This is a universal problem and there do not seem to be clear, good answers on how to balance this other than being precautious in limiting human exposures to substances with uncertain risk. Monitoring and evaluation of broad water quality parameters suites is a cornerstone of this precautionary approach. In some cases, given the long lag time typical of regulating new chemicals at the federal level, multiple states have developed their own statewide standards for emerging contaminants that are stricter than US EPA limits.

3.2 Legacy Pollutants

Southwestern Pennsylvania has significant legacy water quality problems, in particular, acidic mine drainage and combined sewer overflows. Both are monumental challenges to improvement of water quality. In addition, but less appreciated, are potential risks from metal and other legacy pollutants from the region’s industrial history. Legacy contaminants (Box 1) are persistent and difficult to clean up.

A key concern raised by participants is a lack of urgency about legacy contamination. Participants worried that cleanup of acid mine drainage has decreased in recent years. Similarly, concerns about oil and gas brine disposal practices (particularly conventional brines) that emerged during regional decision making on unconventional brine management linger without resolution. This is another challenge with few good answers other than facilitating and promoting local efforts to address legacy contamination on water quality.

The final concern about legacy pollutants is their potential interaction with existing or emerging contaminants. For example, road salt or brine can mobilize legacy metals attached to sediments. Additionally, pharmaceuticals directly input to waterways through combined sewers can interact with other pollutants to become more toxic. In a related example, an increasingly wet climate may raise once-stabilized mine pool elevations and contribute more acidic mine drainage to regional waters.

3.3 Education/Public Literacy

One of the most important justifications for increased public education and outreach was a concern that many residents of southwestern Pennsylvania are detached from "water" and thus issues of "water quality" in general. For example, participants were concerned that the region's residents do not know where their drinking water comes from. As a result, residents are not engaged in efforts to protect and improve water quality upstream of drinking water sources. This general lack of recognition leads to limited political impetus to implement politically hard, but potentially effective and efficient approaches, such as source water protection or more serious monitoring of emergent contaminants.

Regardless of the level of public understanding, the quality of risk communication can be improved. For example, the drinking water lead crisis in Pittsburgh was not communicated well to the public and this has degraded the public trust of water agencies. Similar failures in risk analysis and communication with the public are at the heart of discussions on emerging contaminants.

A suite of potential education and outreach mechanisms were proposed by the consensus groups. Demonstration projects, along with signage and other interpretation were proposed as an effective way to help connect the public to local water issues. In addition, participants suggested the introduction of more educational materials into K-12 schools to communicate regional/local water issues, a curriculum that focuses on the complexities in water quality decision-making, and the potential effectiveness of a citizen science framework in these efforts. This outreach to school-age children was mentioned as both an effective way to prepare the next generation to grapple with these challenges and as a way to reach parents at home. Further, public service announcements were mentioned as being very effective at educating the public on local water quality issues in the past and should be used again in the future.

Finally, given the technical need for more water quality data, this issue is primed for citizen science approaches to engagement. But that is a double-edged sword. Citizen science requires infrastructure to provide the training, data quality control, and data interpretation that make good programs special. There was a strong appetite for citizen science opportunities amongst the participants, so building that infrastructure seems a fruitful path forward.

3.4 Accessible Public Data

As with the green infrastructure research agenda formulation (**https://www.water.pitt.edu/resources/white-papers**) there was a general sentiment that the existing data is not effectively organized into a comprehensive whole. As a result, decision-making based on data is degraded and advocacy based on water quality is less effective. The utility of monitoring and data collection efforts could be enhanced if the data were organized in a widely available and accessible form.

Part of the challenge in the use of data is the wide variety of groups and agencies that collect data in the region. The National Water Quality Portal (**https://www.waterqualitydata.us/**) consolidates U.S. Geological Survey (USGS) and U.S. Environmental Protection Agency (US EPA) data (including Pennsylvania Department of Environmental Protection (PA DEP) data reported to US EPA, Figure 1). However, data from other important regional data collectors including the Ohio Rivers Sanitary Commission (ORSANCO), U. S. Army Corps of Engineers (USACE), and some PA DEP data are not available through the National Water Quality Portal. As a result, collection of regional data requires consultation of multiple data portals by users. Some of these data portals are easily accessible (e.g., web available), while others require Freedom of Information Act requests. Furthermore, local organizations that are taking a leadership role and collecting water quality data with their own staff or through citizen science efforts generally do not have the resources to build web portals and therefore find it a substantial challenge to share this data. In addition, organizations may use slightly different methods that require documentation and consideration when comparing and analyzing data from multiple sources.

In addition, there are gaps in actual data. For example, combined and sanitary sewer overflows are not continuously monitored. As a result, decisions are made on modeled results characterized by substantial uncertainty (Section 5-3 in: (Pittsburgh Water and Sewer Authority, 2016)). Moreover, this overflow monitoring, if it exists, is intermittent and relatively infrequent. Continuous monitoring of overflows would provide valuable information on flow dynamics required to effectively improve regional water quality through green infrastructure and other approaches. Of additional concern is the fact that existing water quality data is biased towards major rivers compared to small tributaries (Figure 1). Since the 3 Rivers 2nd Nature efforts (**https://3r2n.collinsandgoto.com/**), most small streams draining to mainstem rivers in SW PA have almost no direct monitoring data, let alone a continuous monitoring station. Given the complicated mix of regional water quality impacts, understanding the contributions of these small streams is particularly important to regional water quality assessment and improvement.

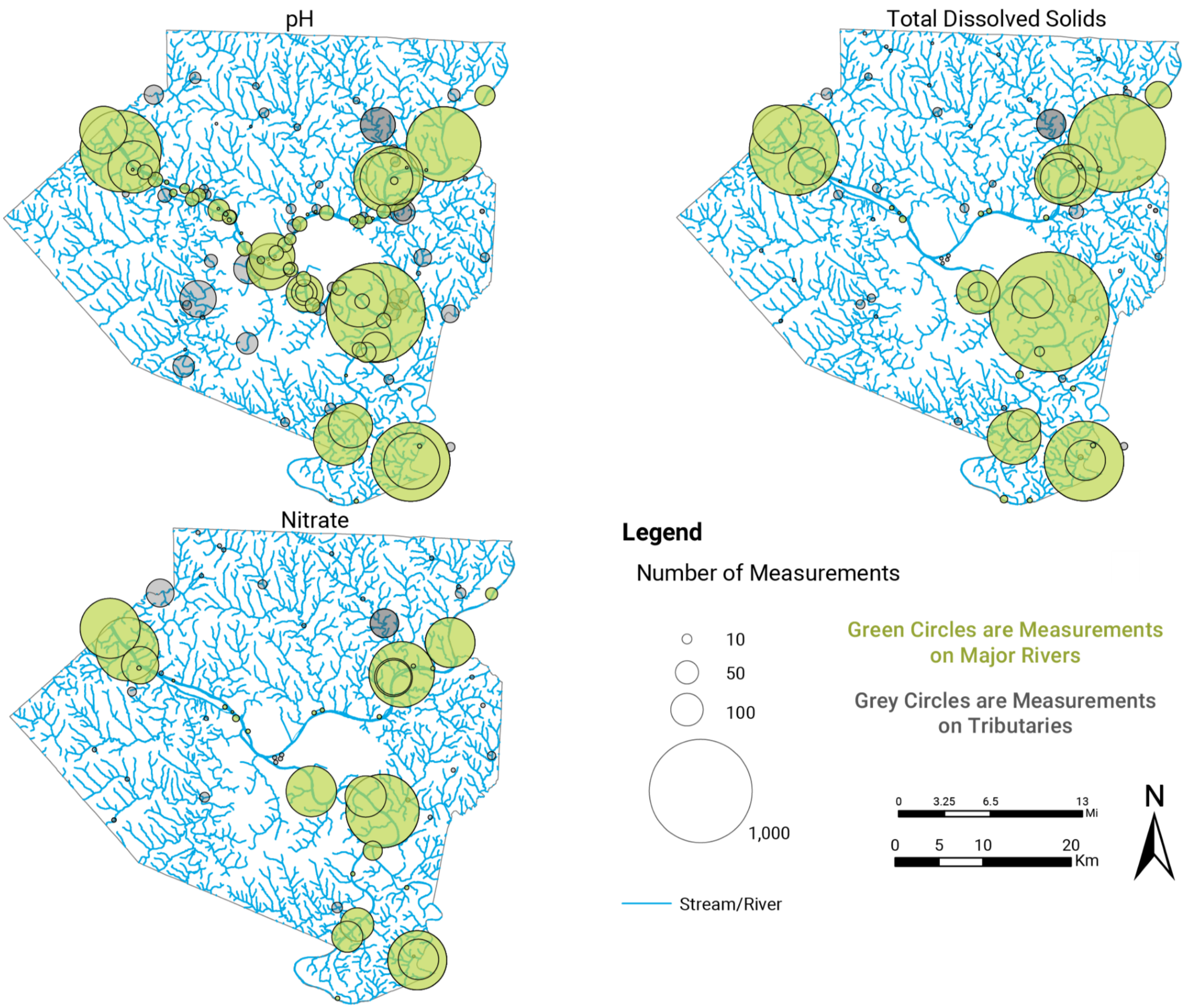

Figure 1. *Counts of water quality measurements in Allegheny County including pH, total dissolved solids, and nitrate concentration available on the National Water Quality Portal. The size of the circle is proportional to the number of samples reported and the center of the circle is the sampling location. Color of the circle indicates if the samples are from a major river (red) or tributary (grey). While major rivers are regularly sampled, there is limited historical sampling of smaller streams and tributaries.*

4.0 Recommendations and Future Directions

4.1 Coordinate to Monitor for a Broader Suite of Contaminants in Regional Waters

The potential importance of emerging contaminants and the limited funding available for monitoring creates the need for agencies responsible for regional water quality monitoring to carefully coordinate monitoring and identify emerging contaminants of interest. In many cases, the simple collection of an additional subsample during normal sampling events can sharply reduce the marginal cost of monitoring. Part of this process requires the organization and consolidation of water quality data described in Section 4.4. However, increased coordination among agencies and organizations responsible for water is the far more important and fundamental step.

The vital question to answer during this coordination is "what are the most important emergent contaminants to track?" There are countless organic compounds, most have not rigorously subjected to toxicological testing. Effective decision-making here requires attention to ongoing scientific, health, and policy conversations at the national and international level to ascertain which chemical constituents pose the highest risks. This outward attention needs to be coupled with rigorous evaluation of the potential use and production of emerging contaminants (i.e., industrial, residential, etc.) in regional activities. This question is the crux of emergent contamination management everywhere.

Characterization of emerging contaminants will require cooperation and coordination between governmental organizations, NGOs, and academics. Funding mechanisms for this effort should trigger and sustain this cooperation. The investment and attention to emerging contaminants will minimize the risk of legacy pollutants in the future.

4.2 Harness Citizen Power to Eliminate Legacy Contamination

While “citizen science” is an en-vogue term, southwestern Pennsylvania has a long history of citizen action directed toward cleanup of legacy contamination. For example, organizations like Trout Unlimited systematically installed passive treatment systems at acidic mine drainage outlets across the region. Likewise, Allegheny Cleanways evolved from tireless efforts to clean legacy dumping in the Three Rivers to a group that advocates for prevention of future dumping through policy and enforcement changes. In both cases, these would not necessarily be considered “citizen science” but rather citizen engagement. Thus, broadening the definition of engagement beyond just “citizen science” allows space for a broader range of activities and engagement, and therefore, more progress.

The two cases of citizen engagement mentioned above represent important case studies of how citizen engagement has bettered the region. Scrutiny of these and other cases (Nine Mile Run, Urban Ecostewards, etc.) and documentation of what works and what does not work are an important knowledge base for others in the region to evaluate and emulate. For example, what outreach methods and materials were particularly effective? How were data collected, organized, analyzed, and translated? What were the most effective means for citizen groups to interact with governmental and other non-governmental agencies?

Pittsburgh and the region have no shortage of success stories in the organization of citizen activity to address water quality challenges. The trick is identifying the thing that sparks the activity. Therefore, it is probably wise to maintain a broad definition of citizen engagement and encourage collaborations once activity is sparked.

4.3 Develop Water Quality Outreach for a Broad Spectrum of End Users

Given the concern raised by meeting participants regarding the general lack of urgency and concern with water quality issues, it is imperative to evaluate how to elevate water into local/regional/state discourse. For example, through diligent efforts, air quality concerns in the Allegheny County region have become elevated in social media, newspapers, and other outlets. It is not clear what mechanisms would be most effective to similarly elevate water in the regional dialog, but elevation of this conversation may be critical for improving regional water quality.

The outreach needs identified in the meeting ranged across a broad spectrum: from school children to the general public. This range is a challenge and outreach to different groups in this spectrum should be distinct. In addition, instead of building new outreach structures from the ground-up, collaboration with existing successful efforts to supplement with water quality content would maximize effort. For example, to provide uniform school-age outreach, efforts likely need to follow one of two paths: 1) Working with local school districts to incorporate local water quality information into curriculum; or 2) cooperating with existing programs run by local NGOs in partnership with the schools to provide or augment water quality content with local/regional cases and data.

Similarly, outreach to adult populations should coordinate with and build on existing efforts. For example, signage should be built into demonstration projects to let the public know what is going on. Public service announcements have been effective in the past (Figure 2), however, given the changing media landscape it is not clear when or where to push these types of media. In general, documentation of the effectiveness of the new media for instilling messages, and learning from the successes and failures of recent outreach efforts in the area seem like an important component to pursuing this strategy.

Figure 2. *Example of effective and informative public service announcement materials from Three Rivers Wet Weather.*

Government agencies need to communicate risk earlier and more clearly. There already seems to be some leadership on this task, however, environmental enforcement agencies are widely understaffed across jurisdictional scale. This lack of person-power is a crucial, large-scale problem. For example, if an agency lacks personnel for basic enforcement or operations, requesting additional outreach from that agency will fall on deaf ears. Adequate staffing of environmental enforcement agencies is a fundamental part of improving risk communication.

Finally, it would be useful to carefully examine the assumptions that underlie outreach efforts. It is not entirely clear that improved education leads to better decision-making. This does not mean we should not do outreach, because there are a wide variety of other benefits to individuals. It does mean, however, that if improved decision-making is the goal, there may be other more effective strategies to pursue.

4.4 Develop and Broaden Regional Water Quality Information Management Systems

As discussed in detail in the green infrastructure white paper (Bain et al. 2019, **https://www.water.pitt.edu/resources/white-papers**), the creation and curation of a database is a substantial task. Here we iterate major points from that discussion and encourage the reader to consult that white paper for more detail.

Essential components of a regional water quality database:

- Data organization will require buy-in from major data generators in addition to smaller organizations that gather water quality data.
- The database needs a home with resources to sustain and maintain the database.
- The database curation will likely require guidance from a group of individuals that represent the breadth of the regional water quality community.

It should be noted that there is national interest in this type of database. In particular, the water data collaborative https://waterdatacollaborative.org and CUASHI's HYDROCLIENT (**https://www.cuahsi.org/data-models/discovery-and-analysis/**) are two prime examples. This presents an opportunity for regional water stakeholders to work with organizations, such as the Water Data Collaborative and CUASHI, to develop a hybrid system of agency and NGO data in a single platform as discussed at the water quality meeting.

5.0 Acknowledgements

The Pittsburgh Collaboratory for Water Research, Education, and Outreach thanks all working group participants for their time and generous sharing of experiences and ideas. We thank the Heinz Endowments for their support of the Pittsburgh Water Collaboratory and the Homewood Community Engagement Center for hosting the event. We thank Laura Branby and Carl Nim for their helpful review of this document.

6.0 References

Bain, DJ; Elliott, EM; Thomas, BF; Shelef, E; River, M (2019) Green Infrastructure for Stormwater Management: Knowledge Gaps and Approaches. Pittsburgh Collaboratory for Water Research, Education, and Outreach, University of Pittsburgh: **http://d-scholarship.pitt.edu/36717/**

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Appendix 1: Meeting Participants

Please note, this participant list is not necessarily accurate. The attendance list was lost and this list was reconstructed using the RSVP list and feedback from those on that list. If you notice an inaccuracy in this list, please let Collaboratory staff know.

Participant	Organization
Danielle Andrews-Brown	University of Pittsburgh
Matthew Barron	The Heinz Endowments
Tom Batroney	PWSA
Chris Beichner	Allegheny Land Trust
Michael Blackhurst	University of Pittsburgh
Suzi Bloom	Rivers of Steel
Laura Branby	Allegheny College
Maryann Brendel	(none)
Neil Brown	(none)
Maria Bustamante	University of Pittsburgh
Angela Chung	University of Pittsburgh
Evan Clark	Allegheny Cleanways
Paige Colao	Green Building Alliance
Marja Copeland	University of Pittsburgh
Maureen Copeland	Nine Mile Run Watershed Association
Erin Copeland	Pittsburgh Parks Conservancy
Marion Divers	Ethos Collaborative
Beth Dutton	3 Rivers Wet Weather
Matt Erb	Tree Pittsburgh
Becky Forgrave	University of Pittsburgh
Gabrielle Goudy	Chatham University
Richard Harrison	Ohio River Valley Water Sanitation Commission
Ben Hedin	University of Pittsburgh
Memphis Hill	University of Pittsburgh
Tom Hoffman	Sierra Club
Elijah Hughes	evolveEA
Brian Jensen	Allegheny Conference on Community Development

Participant	Organization
Erika Johnson	Rivers of Steel
Phil Johnson	The Heinz Endowments
Stan Kabala	3 Rivers QUEST
Noble Maseru	University of Pittsburgh
Andrew McElwaine	The Heinz Endowments
Matt Mehalik	Breathe Project
Emily Mercurio	CivicMapper
Oliver Morrison	PublicSource
Myrna Newman	Allegheny Cleanways
Carl Nim	U.S. Army Corps of Engineers
Maureen Olinzock	Pittsburgh Parks Conservancy
Abigail Owen	Carnegie Mellon University
Donna Pearson	Girty's Run Watershed Association
Tim Prevost	ALCOSAN
Anne Quinn	Jacobs Creek Watershed Association
Lou Reynolds	US Environmental Protection Agency
Marcus Shoffner	Venture Outdoors
Katie Stanley	University of Pittsburgh
Angelica Starkey	The Forbes Funds
Annett Sullivan	USGS
Emily West	Allegheny County Conservation District
Rebecca Zeyzus	Allegheny Watershed Alliance
Kate Zidar	(none)

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