

Salt Management Strategy (SaMS)

3rd Water Quality Monitoring and Research Workgroup Meeting

June 19, 2019

The third meeting of the Water Quality Monitoring and Research (WQMR) Workgroup for the Salt Management Strategy (SaMS) was held from 9:30 am – 12:00 pm on June 19, 2019 at Northern Virginia Regional Commission at 3040 Williams Drive, Fairfax, Virginia.

Attendance

Thirteen (13) individuals, including two Virginia Department of Environmental Quality (DEQ) staff members and one staff member from the Interstate Commission on the Potomac River Basin (ICPRB; DEQ's contractual support), participated in the meeting. Two of the participants joined the meeting via teleconference.

Joni Calmbacher, City of Alexandria
Scott Crafton, Virginia Department of
Transportation (VDOT)
Dave Evans, DEQ*
Will Isenberg, DEQ*
Joel Moore, Towson University
John Muse, Virginia Department of
Transportation (VDOT)[†]

Andrea Nagel, ICPRB[†]
Ivy Ozmon, City of Manassas
Niffy Saji, Fairfax Water
Erfaneh Sharifi, ICPRB*
Russ Short, Northern Virginia Trout Unlimited
(NVTU)
Jonathan Witt, Fairfax County
Carol Wong, Center for Watershed Protection.

*Facilitator

[†]Participated via teleconference

Meeting Highlights

At this meeting, the workgroup members reviewed the [Notes from Other Workgroups and the SAC](#), followed-up on action items from the [second Water Quality Monitoring and Research Workgroup \(WQMR\) Workgroup meeting](#), and discussed the [Ideas for Finalizing the Workgroup Products](#).

The main take-aways from this meeting are:

- The action items from the last meeting will constitute the resources/products and recommendations that the WQMR workgroup is developing. To finalize these items, workgroup members discussed and proposed modifications in addition to considerations for how to address these resources/products and recommendations in the final SaMS document.
- Workgroup members discussed processes for how, in the future, to update the resources/products that the workgroup has been developing.
- To assess changes in water quality as a response to BMP implementation, the workgroup recommends comparing summarized water quality data to trends (e.g., summertime median concentrations) in addition to other information such as the characterization of individual winters, changes in imperviousness, and the level of BMP implementation through a weight of evidence approach.
- The workgroup agreed that 2 regional specific conductance-chloride models should be developed: 1 for watersheds draining mostly Triassic Basin soils, and 1 for watersheds draining soils that are mostly comprised of the other four physiographic provinces in the SaMS project area.

- The workgroup agreed that recommendations for chloride monitoring should be year round, including monthly grab samples on predetermined dates and continuous monitoring of specific conductance, to the (fullest) extent possible.
- The workgroup agreed that the pilot project proposal should monitor 2 different small watersheds, 1 watershed which has dedicated BMP implementation occurring and 1 in which no change in winter maintenance practices (i.e., the control) occurs.

Notes for Other Workgroups / Potential Areas of Overlap:

- The workgroup recommends that the Salt Tracking & Reporting workgroup consider recommending four tiers of salt use data tailored to areas where water quality monitoring is conducted to measure the impact of BMP implementation on water quality. Starting with the most basic, the four tiers of salt use data are outlined below.
 1. Most basic: The number of days that operations were deployed and whether or not the deployment used brine and/or solid salt.
 2. Seasonal totals of salt used plus the total area serviced by the operation.
 3. Storm event totals plus the total area serviced by the operation.
 4. Storm event totals per location (e.g., snow plow route, property, etc.) plus the total area serviced by the operation.
- The workgroup also recommends that the Salt Tracking & Reporting workgroup consider reporting information about BMP use in areas where water quality monitoring is conducted to measure the impact of BMP implementation on water quality. Specifically, this would include whether BMPs are being implemented, and if so, the specific BMPs.

Follow-up Action Items

1. Modify the “Grab-and-go” resource and share it with workgroup members for comments on final revisions.
 - a. Volunteer: DEQ
 - b. Volunteer: All workgroup members are invited to provide feedback.
2. Revise the conceptual model based on the workgroup members’ comments and share it with the workgroup for comments on final revisions.
 - a. Volunteer: DEQ and Russ Short
 - b. Volunteer: All workgroup members are invited to provide feedback.
3. Revise the specific conductance trends report based on the workgroup members’ comments and share it with the workgroup for comments on final revisions.
 - a. Volunteer: DEQ will discuss revisions to Trends Analysis with ICPRB; for any significant changes resource needs will have to be considered.
 - b. Volunteer: If updated, all workgroup members are invited to provide feedback.
4. Revise the general criteria for a monitoring program based on workgroup members’ comments and share it with the workgroup for comments on final revisions.
 - a. Volunteer: DEQ
 - b. Volunteer: All workgroup members are invited to provide feedback.
5. Modify the Fairfax Water pilot project proposal based on workgroup members’ comments and share it with the workgroup for comments on final revisions.
 - a. Volunteer: Joel Moore will revise the proposal and DEQ will share it.
 - b. Volunteer: All workgroup members are invited to provide feedback.
6. A conference call will be scheduled following the review period for the items discussed above and prior to the next workgroup meeting. This conference call is intended to discuss the final revisions identified above and provide a final opportunity for workgroup member feedback.
 - a. Volunteer: DEQ

7. After proposing a draft definition of what constitutes a watershed that “mostly” drains Triassic Basin soils, a list of monitoring stations will be compiled for the Triassic Basin soils with each station characterized by the percentage of the watershed in the various physiographic provinces.
 - a. Volunteer: DEQ & Joel Moore
8. Identify potential funding resources and partner organizations/researchers
 - a. Volunteer: All workgroup members are invited to provide feedback.

Meeting Summary

Introductions

The meeting opened with brief introductory remarks from DEQ. Participants then briefly introduced themselves, providing their name and the organization they represent.

The objectives for this meeting were to follow up on action items from the last meeting, identify what is needed to finalize the recommendations and products from this workgroup, and identify how the workgroup intends to frame/address the recommendations and products in the final SaMS document.

DEQ announced two administrative items:

- The 4th WQMR Workgroup meeting will be scheduled for some time between November 2019 and February 2020, specific date forthcoming.
- In October 2019, ICPRB and DEQ will begin drafting the SaMS document.

The summary for the previous WQMR Workgroup meeting is available [online](#). Highlights of the second meeting included:

- Workgroup members agreed that the conceptual model should no longer be a priority for development since its main purpose is to be a tool for asking questions.
- Workgroup members identified other organizations to encourage to participate in the water quality monitoring data survey, and to use the survey results as a “grab-and-go” resource with organization names and contact information.
- Workgroup members identified a number of ways to evaluate water quality and associated changes from the implementation of Best Management Practices (BMPs). These included changes in long-term trends, the magnitude of storm-specific spikes in specific conductance, background summer concentrations, and shallow groundwater concentrations.
- The workgroup decided that the best way to learn how to measure the impact of BMP implementation on water quality should be through a pilot project approach that is reviewed and adjusted over time to better monitor the impact.

Action Item Discussions

Action Item: “Grab-and-go” resource for organizations looking to implement the water quality monitoring recommendations of the SaMS (DEQ)

DEQ assembled information from a survey as a “Grab-and-go” resource. The [“Grab-and-go” resource](#) summarizing existing and historical ion monitoring data in the SaMS project area was discussed.

Workgroup members provided their feedback in terms of possible modifications, a process to update this resource in the future, and how to include the product in the SaMS final recommendations.

Some feedback for the “Grab-and-go” resource:

- Modifications:
 - Make a new version of the Excel file that is simple and easy to use by breaking it into different worksheets.
 - Create a separate worksheet for agencies as “contacts”.
 - The first worksheet should include the dates during which the data was collected.
 - Add a column to show the date when information was last updated
 - For groups looking to do monitoring, identify which organizations in the resource are able to partner and support these groups.
- Process for updating the resource in the future:
 - Coordinate a review and update of the product by partners/other parties.
 - Workgroup members proposed an annual review, but agreed that if the adaptive implementation strategy recommends a longer period between meeting (e.g., every other year), then the review should occur at that frequency.
 - The survey that was used to collect this data will be updated by DEQ and filed for use in the future.
- Workgroup members agreed that the final resource would be posted at a SaMS website that will be developed at a later date to host all of the SaMS resources.
- Addressing the “Grab-and-go” resource in the SaMS:
 - To address the product in SaMS final recommendations, describe what was compiled, the purpose of this resource and the decisions behind its development, and the update procedure for the Excel file.
 - The workgroup agreed that the purpose of this resource is to provide an inventory of existing and historical monitoring work that has collected data on ions or ion related parameters. With this inventory of work and the contact information for the groups doing the monitoring, organizations that are interested in working with any existing data or partnering with existing ion monitoring groups have a resource to identify a contact to reach out to.

DEQ will make the revisions discussed and share the revised document for workgroup review and comment before the next meeting.

Action item: Update the draft Conceptual Model of Salt Origin, Transport, and Fate with workgroup member feedback (Joel Moore, Russ Short, and DEQ)

Workgroup members discussed and provided feedback on the [updated conceptual model](#) of salt origin, transport, and fate. The updates were based on feedback received after the draft model was presented at the second WQMR workgroup meeting.

- Depending on future use, the model may benefit from expert review and input. In particular, the workgroup agreed that this review and input should come from experts who are implementing the recommendations of the SaMS WQMR workgroup.
- Modifications:
 - Some possible refinements (e.g. color coding the arrows, changing the arrow widths, dotted vs solid lines, and shading the boxes) should be considered for the final conceptual model product.
 - Ultimately, the workgroup concluded that the model should be modified to shade the boxes where the SaMS is focusing recommendations for BMPs and water quality monitoring.

- Other modifications include adjusting some language for clarity, modifying the “general public input” box to focus on sources that the SaMS is focusing on, and to emphasize “likely major contributors.”
- Process for updating the resource in the future:
 - The conceptual model should be updated as more is learned from the SaMS implementation including the WQMR recommendations.
 - The workgroup agreed that just like the “Grab-and-go” resource, the conceptual model should be revisited regularly and in accordance with whatever frequency is ultimately recommended as part of the adaptive implementation strategy.
- Addressing the conceptual model in the SaMS:
 - The model contributes to the SaMS by identifying variables that should be understood and stimulating/guiding new monitoring and research efforts.
 - The model indicates what the workgroup believes are the most significant pathways.

DEQ will revise the conceptual model based on the comments and will send it to the workgroup members for review and comment before the next meeting.

Action item: Review long-term trends in specific conductance throughout the region (ICPRB)

ICPRB prepared and summarized analysis of [long-term trends in specific conductance](#) using USGS gauges throughout the SaMS project area. The workgroup discussed the Trends Report. Jonathan Witt from Fairfax County also briefly presented the Fairfax County’s trend analysis.

Workgroup members discussed the ICPRB’s long-term trend analysis and provided some feedback.

- The intent of this analysis is to provide a baseline analysis for use in assessing the impact of BMP implementation on water quality. It may be important to supplement data analyses in the future with BMP implementation information to form more compelling conclusions.
- Statistically sound and clear conclusions will support the SaMS recommendations. When using a metric such as median summertime conductance to show trends, clearly and simply describe its purpose so it will be understandable for general public.
- Selecting 2007 as the benchmark year seems appropriate in light of data availability.
- There is a USGS study analyzing trends in specific conductance throughout the continuous monitoring network in the project area that will be available this winter
- Modifications:
 - For annual summertime median concentrations, use flow weighted values to smooth out variations due to flow differences.
 - Information should be compiled to characterize each winter in order to compare and contrast them.
- Using the agreed upon modifications, a weight of evidence approach can be used to assess changes in water quality as a response to BMP implementation. Clear trends in some metrics, like summer median concentrations, may be slower to respond to operational changes than winter concentrations.
- The use of these trends are helpful, but should be considered in light of other variables like changes in impervious cover.
- Future studies like the Fairfax County and USGS analyses (when available) can be additional tools for assessing changes in water quality.
- The ICPRB trends report and can be used as a model for future metrics development.

Workgroup members discussed the Fairfax County's trend analysis and provided some feedback.

- Increased rate of conductance correlates with the percentage of impervious surface.
- Similar work in the mid-Atlantic shows that a higher rate of increase is evident in areas with higher average chloride concentrations.
- Workgroup members agreed that there are many variables influencing these trends, and wondered how changes in impervious cover and the results of the VCU impervious cover study for the project area are related to specific watershed trends.

Action item: Coordinate information needs with the Salt Tracking & Reporting workgroup (DEQ)

The WQMR Workgroup discussed the information needed by this workgroup and provided feedback.

- The purpose of this information is to allow researchers to estimate the salt inputs to a watershed. Therefore, while this information is seen as the best from a research perspective, it is not necessarily the recommendation for all winter maintenance operations. In other words, if a watershed is being studied, this is the preferred salt use information.
- The group agreed to four tiers of data that would be useful, starting with the most basic.
 1. Most basic: The number of days that operations were deployed and whether or not the deployment used brine and/or solid salt.
 2. Seasonal totals of salt used plus the total area serviced by the operation.
 3. Storm event totals plus the total area serviced by the operation.
 4. Storm event totals per location (e.g., snow plow route, property, etc.) plus the total area serviced by the operation.
- Where possible, specify whether or not BMPs were used, and what they were.
- While the workgroup agreed that the higher levels of useful data are currently unattainable, they communicate an important long-term goal.
- To address information needs in the SaMS document, explain the purpose and usefulness of different tiers of information, and what analyses they would allow (e.g., to assess trends).

Action item: Identify geographic gaps in chloride-conductance relationships for the different physiographic provinces in the SaMS project area (DEQ)

DEQ presented the [evaluation of gaps in chloride-conductance relationships](#). The workgroup members discussed the geographic gaps in chloride-conductance relationships for the different physiographic provinces and provided some feedback.

- The major physiographic provinces in the study area include Northern Piedmont (37.1%), Triassic Basin (25.0%), Piedmont (23.9%), Coastal Plain (10.0%), and Blue Ridge (3.9%) provinces.
- There are no monitoring stations with paired chloride and conductance data in the Coastal Plain, and most of the monitoring stations with paired data are in Fairfax County.
- Much of the paired data is comprised of lower concentrations where regression relationships are more variable/less confident.
- A workgroup member shared that there will be an opportunity for sampling in Cub Run in 2020.

- The workgroup agreed that the relationships did not need to be watershed-specific, but instead there should be 2 regional models; 1 model for stations mostly in the Triassic Basin and 1 model for stations mostly draining the other physiographic provinces. The group was comfortable with these two categories because existing monitoring data suggests that the only physiographic province where there is a difference in conductance and chloride relationships is the Triassic Basin.
- The group also agreed that these regional models could be developed using data from outside of the SaMS project area to fill any gaps. As a result, the workgroup agreed that a recommendation should be made to bolster the chloride and conductance data for Triassic Basin stations.
- DEQ agreed to list the monitoring stations draining mostly Triassic Basin soils and to characterize each monitoring station by the percentage of the watershed in the various physiographic provinces.
- DEQ will identify a draft definition for a watershed that “mostly” drains Triassic Basin soils, and share that criteria with Joel Moore to see what other sites exist in the mid-Atlantic region.
- These proposed regional models are not being developed for regulatory purposes and instead are intended to function as a tool for watershed studies prior to the development of watershed specific chloride and conductance relationships.

Action item: General criteria for a monitoring program that could be implemented by any organization to better understand the impact of BMPs on salt concentrations (Shannon Curtis and Niffy Saji)

DEQ shared the [draft general criteria for a monitoring program](#). The draft includes general criteria for a monitoring program that could be implemented by any organization to better understand the impact of BMPs on salt concentrations.

Workgroup members discussed general criteria of the monitoring program and provided feedback.

- Modifications:
 - Add recommended labs to the analytical methods section, and attempt to identify who can do what analytical methods.
 - Specify the Lower Reporting Limit for analytical methods outside of the existing list of analytical methods.
 - Test strips should only be used for screening and not for development of chloride-conductance relationships
 - Where flow is considered a valuable parameter to measure, it should be recommended that measurements occur at existing USGS gauges to avoid variation in estimation methods.
 - Where specific conductance is not measured continuously, point measurements should be taken before a storm and 5 days after a storm.
 - The recommended monitoring period should be year-round.
 - Continuous specific conductance probes should be calibrated every 1-2 months.
 - The winter season will be defined as December 1 through March 31 since that represents the period during which chloride criterion exceedances have been observed.
 - Chloride or other ion grab sample monitoring frequency should first be based on whether or not the monitoring effort is to assess ambient conditions, or to assess the impact of BMP implementation on water quality.
 - The ambient monitoring frequency should be monthly (at predetermined dates) for ion grab samples.
 - Monitoring in support of assessing the impact of BMP implementation on water quality should occur as follows: specific conductance should be collected continuously, and as

resources permit, storm event ion grab samples should be taken at times when the concentrations are expected to be highest.

- By doing so, the range of specific conductance and ion concentrations will better support regression models, allowing the continuous specific conductance to be a more accurate, watershed specific predictor of ion concentrations.
- If a specific conductance cannot be monitored continuously, results will be limited, but should include before and after storm ion grab samples.

Action item: Monitoring pilot project proposals (All members)

The workgroup members discussed and provided feedback on the pilot project proposals submitted by workgroup members and the [comments received on those pilot project proposals](#).

- The goal of the monitoring program is to see any changes in water quality as a result of BMP implementation, and not to conduct ambient water quality monitoring. When groups are just starting a monitoring program, the SaMS can recommend beginning with an ambient monitoring program (as recommended in the general criteria for a monitoring program recommendations) since it is less resource intensive.
- The group agreed that the minimum timeframe necessary to reach statistically significant results, should be a goal, but will depend on a number of questions to consider, including the amount of resources available.
- The workgroup agreed to recommend a single pilot project proposal that can be implemented as an iterative approach to build an understanding of how to measure the impact of BMP implementation on water quality.
- The workgroup agreed to use 2 watersheds to compare to each other rather than upstream/downstream sampling. As much as is possible, the 2 watersheds should include one where dedicated BMP implementation is occurring and another (i.e., the control) where no change in winter maintenance practices occurs.
- The table included in Joel Moore's pilot proposal that ranked watersheds based on a number of variables such as watershed size and extent of data record should be included in the final pilot project outline. Since the pilot project is contingent upon willing partners who do winter maintenance, the table should be used as a list of recommended watersheds to select from when partners are established.
- The Fairfax Water proposal should be modified to mirror much of the general criteria for a monitoring program. Specifically it should recommend the same winter season (December 1 through March 31), monthly monitoring, storm event sampling, and the table of priority watersheds.
- DEQ agreed to frame the necessary modifications and share this information with Joel Moore so that he can make the modifications to the Fairfax Water proposal. Once Joel has made these modifications, the revised pilot project will be shared with the workgroup for comment prior to the next workgroup meeting.

Additional Consideration

Because time ran out to discuss this portion of the agenda, the workgroup agreed that an action item for all workgroup members is to work to identify funding opportunities and researchers or partner organizations who can voluntarily implement the recommendations.

Meeting Wrap-up and Next Steps

DEQ will send revised materials to the workgroup members for review and comment. A conference call will be scheduled at the end of the comment period to allow for additional discussion and finalization of any revisions. The revised materials, listed below, will be discussed:

1. DEQ will apply the proposed modifications to the “Grab-and-go” resource and will it share with the workgroup members for comments on final revisions.
2. DEQ will revise the conceptual model based on the workgroup members’ comments and will share it with the workgroup for comments on final revisions.
3. DEQ will discuss revisions to Trends Analysis with ICPRB; for any significant changes resource needs will have to be considered. If possible, ICPRB will revise the specific conductance trends report based on the workgroup members’ comments and DEQ will share it with the workgroup for comments on final revisions.
4. DEQ will revise the general criteria for a monitoring program based on workgroup members’ comments and will share it with the workgroup for comments on final revisions.
5. Joel Moore will modify the Fairfax Water pilot project proposal based on workgroup members’ comments and DEQ will share it with the workgroup for comments on final revisions.

DEQ will send out a follow-up survey after this workgroup meeting to add ideas to the meeting directions.

Handouts from the meeting are available on the SaMS Meeting Materials [website](#).

All information, questions, additional resources, etc. should be emailed to Will Isenberg (william.isenberg@deq.virginia.gov) and Dave Evans (david.evans@deq.virginia.gov) (to reduce email traffic among WQMR members).

Meeting notes were prepared and submitted by the Interstate Commission on the Potomac River Basin.

Additional Feedback Contributed to the Follow-Up Survey or in Comments During the meeting summary review period:

A survey was shared with workgroup members following the meeting to capture any additional thoughts members may have had following the meeting. Also, during the week-long review period on the meeting summary, several comments were contributed. Feedback is arranged below based on the sections of the agenda. Only sections where additional thoughts were provided are included:

Finalizing Workgroup Products – Last Meeting Action Item #6: Conceptual Model of Salt Origin, Transport, and Fate

Regarding expert review of the conceptual model – *“Need to ensure against skewing decisions due to participant bias. Might be useful to also have some qualified outside 3rd parties to weigh in who have experience with WQ monitoring generally but also with chlorides and conductivity, but no dog in this particular exercise.”*

Finalizing Workgroup Products - Last Meeting Action Item #7: Long-term trends in Specific Conductance

“May want to consider flow-normalized concentrations (FNCs) to reduce some of uncertainty related to discharge. Hirsch and others at the USGS have done good work, and produced nice R libraries, to calculate FNCs.”

Regarding selecting 2007 as the benchmark year for trends analysis – *“If older data exist for any stations, it might be worth getting a longer view on chloride and/or specific conductance.”*

“I would recommend looking at annual, not just summer, median concentrations.”

Regarding annual summertime median concentrations – *“I believe that the group agreed that that winter was best defined as Dec – Mar? Might be worth it for these data to line up with this period, which is listed under monitoring action item below.”*

Finalizing Workgroup Products - Last Meeting Action Item #5: Coordinate information needs with the Salt Tracking & Reporting workgroup

“Should we also consider adding to these two options a characterization of the storm event (e.g., snowfall alone, sleet/freezing rain alone, snowfall-thaw-refreeze, etc.)?”

Finalizing Workgroup Recommendations - Last Meeting Action Item #2: Geographic gaps in chloride-specific conductance relationships for physiographic provinces

“I recommend looking at USGS (or other) sites located in the same physiographic province but outside the SaMS region to fill in gaps for chloride-specific conductance relationships.”

Finalizing Workgroup Recommendations - Last Meeting Action Item #1: Monitoring pilot project proposals

“I made a suggestion for the upstream/downstream approach and after more reflection on the survey components, there is also support to incorporate an upstream/downstream element in the approach. While the geographic province approach is important to evaluate the long term trends in the area, that approach does not seem to be as effective in providing more immediate feedback on BMP implementation and evaluation. If for instance, a government agency wanted to modify roadway treatment (e.g. reduce the salt applied to a roadway), a test case could be implemented at a stream crossing site over a defined section of roadway. The roadway conditions could be monitored as a result of the changes in treatment and at the same time, stream water quality response could be assessed on a real-time basis. This would provide the decision makers a more-straight forward data set to support any modification in salt application. Russ”

Additional Considerations

“The Chesapeake Bay Trust, Restoration Research call for proposals (next one likely to be in Feb/Mar 2020) seems like a good option.”

Wrap up and Next Steps

“I think it's great that we'll (likely?) have a conference call in September to keep the process moving forward”