Benthic TMDL Study for the Accotink Creek Watershed

Response to Comments on the July 6, 2015 Public Meeting

Introduction:

The second public meeting for the Accotink Creek Watershed Benthic TMDL project was held on July 6, 2015 at the Kings Park Library in Burke, Virginia. DEQ presented the results of the draft stressor analysis, which identified the most probable stressors (pollutants and non-pollutants) to the benthic communities in the Accotink watershed. The draft stressor analysis identified the pollutant stressors of sediment and chloride, and recommended that these stressors be addressed by the development of a TMDL. The draft report also identified the non-pollutant stressors of hydromodification and habitat modification as contributing causes of the benthic impairments in the watershed. The public comment period started on July 6, 2015 and closed on August 5, 2015, allowing for a 30 day comment period for the materials presented at the meeting. A number of comments were received during the comment period. The list of commenters, their affiliation, and the date comments were received is provided in the table below. It is acknowledged that the comments received from the Chesapeake Bay Foundation were received after the close of the comment period. DEQ opted to include those comments to document all correspondence received on the draft stressor analysis.

Comments submitted following the July 6, 2015 Public Meeting			
Name	**Affiliation**	**Date Submitted**	**Link to Comments**
John Levtov	Christopher Consultants	July 7, 2015	Comment
Tony Vellucci	Citizen	July 7, 2015	Comment
Kimberly Larkin	Dewberry	July 7 & 8, 2015	Comment
Roger Hill	Citizen	July 8, 2015	Comment
Scott Surovell	Virginia House of Delegates	July 24, 2015	Comment
Donald Pless	Citizen	August 1, 2015	Comment
Philip Latasa	Friends of Accotink Creek	August 3, 2015	Comment
Sharon Bulova	Fairfax County Board of Supervisors	August 4, 2015	Comment
Chris Ruck	Citizen	August 5, 2015	Comment
Joseph Wood	Chesapeake Bay Foundation	August 7, 2015	Comment

Each received comment is presented in its entirety. For most comments, the DEQ response follows the comment and is designated by italic text and a "DEQ Response" header. The responses to comments from the Fairfax County Board of Supervisors and watershed resident Chris Ruck are given following the original comment letter, with the specific comment repeated before the response.

During the comment period, DEQ received written correspondence seeking clarification or additional information, to which DEQ responded in a timely manner to fulfill the information request. These responses that were sent during the public comment period are designated with a "Sent On" header preceding the DEQ response. Corrections or additions to these responses subsequent to the original date sent are marked with brackets.

Organization: Christopher Consultants
Contact: John Levtov
Received on: July 7, 2015

I'm curious about the timing of new stormwater restrictions that this will result in.

It seems that the "implementation" phase will start roughly in the winter of 2016.
How long before MS4 permit holders and new development/redevelopment will be following new rules?

I know that is hard to pin down but generally is it one year after starting implementation, two years?

I appreciate your work on this. I can see that it is a big task.

DEQ Response
Sent On: July 8, 2015

Good questions. At this point, any changes that may come about as a result of the current TMDL project for Accotink are likely at least a few years away.

The TMDL will address the pollutants we identified in the draft stressor analysis (sediment and chlorides) and will result in allocations for the point and non-point sources in the watershed. The TMDL itself will not establish any new rules or restrictions. Following the final approval of the TMDL, the identified allocations for point sources will be incorporated into the permits for the permittees in the watershed at the time the permit is reissued; the allocations for the point sources won't take effect immediately.

The permitted sources have the responsibility to implement practices to reduce the pollutant loadings, including the location and timing of implementing any changes.

Organization: Citizen
Contact: Tony Vellucci
Received on: July 7, 2015

Stormwater management has come a long way in the last 10 years.

Glad to see that we are putting more and more effort into it. I like Bryant and his outlook .... it will take years for Accotink to get back to where it should be, but now that we are devoting more and more resources to it, it will get there.

I was and still am critical of VDOT because I believe they do not do enough to protect the environment. I've seen VDOT contractors do work in our neighborhood and while the contractors comply with the letter of the environmental law, they cut corners every chance they can. The VDOT project managers never seem to stay on top of them to ensure they finish the job with the same environmental support measures that they started the job with

DEQ Response

Thank you for your support of the Accotink TMDL project. Your observations regarding the VDOT contractors are noted.

Organization: Dewberry
Contact: Kimberly Larkin
Received on: July 8, 2015

I just read the power point slide program from the last Accotink Creek TMDL meeting, and have a few questions / items of note. I'm curious if the temperature readings that the power point was based on included 24 hour monitoring for months at a time data. I ask this because from field experience the temperature shifts in Accotink Creek channel at the beginning of a summer thunderstorm downpour are enough to spike the temperature at least 4 degrees F or more. This alone has been documented to kill larval fishes in Four Mile Run. While the other data seems reasonable, I personally would not discount that factor on face value. Just thought I should ask.

DEQ Response
Sent On: July 9, 2015

Thank you for your question regarding the temperature data in Accotink Creek.

We were able to analyze continuous temperature data measured at 2 USGS gage stations, as well as from one short-term DEQ continuous monitoring event. One of the USGS gage stations was located on Accotink Creek near Ranger Road with data from the Fall of 2011 to the Fall of 2014. The second USGS gage station is located on Long Branch, near Annandale with data from the Spring of 2013 to the Fall of 2014. The DEQ monitoring event captured measurements for about a week in August 2006 in Accotink Creek near Alban Road. Virginia's water quality standards state that the maximum hourly temperature change shall not exceed 2 degrees Celsius. There were only 4 occurrences during the continuous monitoring at these sites where temperature increased more than 2 degrees Celsius in an hour. Sudden increases in temperature from storm runoff can impact the benthic communities, but we did not see such increases occurring on a frequent basis in the data we looked at.

Using the continuous monitoring data measured at the Ranger Road location, an analysis of the daily temperature changes was also performed. Daily fluctuations in temperature greater than 3 degrees Celsius occurred more often under baseflow conditions than during storm conditions.

Additional details on the temperature data analysis can be found in Section 3.5.1 [in the final] Stressor Identification Analysis report, which is on DEQ's website: TMDL Documents.

Contact: Kimberly Larkin
Received on: July 9, 2015

Thanks, just wondering why temperature is not a stessor [*sic*] with 3 degree changes, isn't that in itself a violation of Water Quality Standards? There must be some reasoning behind the temperature fluctuations. Sump pump discharges, car washes, utility flushing, just seems odd that that level of fluctuation is occurring.

DEQ Response
Sent On: July 10, 2015

[Streams experience natural fluctuations in temperature depending on changes in air temperature, time of day, etc. These natural changes probably account for most of the temperature changes seen in the mainstem of Accotink Creek.]

The WQS specify that any rise above natural temperature shall not exceed 3 degrees Celsius. The intent of this criterion [applies] more towards discharges from treatment plants or industrial discharges. The continuous monitoring data show only 4 events where the temperature increases 2 degrees Celsius or more within an hour. Those 4 events are less than <0.1% of all hourly observations. [In DEQ's assessment of] continuous monitoring data[[1]], if the number of exceedances of the maximum hourly temperature change [is] greater than 10.5% of all the hourly observations, then the water quality criterion is not [met]. Given that such spikes in temperature do not occur on a frequent basis and the temperature [criterion] was met, we classified temperature as a [least probable stressor].

The daily temperature fluctuations were analyzed by looking at the maximum and minimum temperature measured each day. The daily fluctuations observed under baseflow conditions are likely caused the natural heating and cooling of the water on a daily basis, as sudden spikes in temperatures, which would indicate a discharge, are not regularly observed in the data.

Organization: Citizen
Contact: Roger Hill
Received on: July 8, 2015

As I indicated during the Monday meeting at Spv. Cook's office, the presentation, while helpful, was not very informative. The unexplained use of acronyms and abbreviations, especially as they relate to potential measures of environmental degradiation [*sic*] was particularly unhelpful.

The repeated statement of Mr. Thomas during the meeting that the problem of water system degradiation [*sic*] could be dealt with by elementary school teachers teaching environmental science (water ecology, etc.) to their students was especially misleading because (a) that is ALREADY being done in Fairfax County Schools, (b) by implication it seeks to push out any action on water degradiation [*sic*] for 30-40 years.

By (indirectly) proposing delaying any action on the water shed degradiation [*sic*], the presentation distracts, attendees from simple facts such as chloride concentration, an identified potential degradiating [*sic*] factor, appears to stem from actions of another State Agency, VDOT.

Directing citizen attention away from easily doable short term, partial solutions to other potential but longer range ones is not properly serving the interests of residents of the county.

DEQ Response

Education and outreach is an important component in changing behaviors and raising awareness of local environmental issues. It is true that environmental education through the school system is currently taking place. Students learn about water quality issues and may participate in local water quality improvement projects. By the active engagement of the

[1] Virginia Department of Environmental Quality. 2014. Guidance Memo No. 14-2005, 2014 Water Quality Assessment Guidance Manual. Richmond, VA.
http://www.deq.virginia.gov/Portals/0/DEQ/Water/Guidance/142005.pdf

students, parents and other community members are also informed and made aware of local efforts to improve water quality. The investment in education has a short-term benefit in addition to long-term goals. Outreach and education efforts also include sharing information at community meetings, at environmental events such as watershed clean up and Earth Day activities, and engagement with local watershed groups.

Education and outreach are but one of the measures and actions that are part of an overall strategy to address water quality improvements. It was not intended to imply that this would be the sole approach. Another approach for implementing water quality improvements is through the DEQ issued permits for the permitted entities in the watershed. The wasteload allocations calculated in the TMDL for point sources will be incorporated into the permits at the time the permit is reissued.

There are several sources that contribute chloride to the watershed. As noted during the public meeting, the largest source of chloride are deicing agents that are applied to roads, sidewalks, parking lots and driveways during inclement weather conditions. The Virginia Department of Transportation is but one entity that uses deicing materials in the watershed. Schools, college campuses, local governments, property managers, private businesses and watershed residents all apply deicing materials to impervious surfaces in the watershed as well. The deicing agents are used to ensure public safety during inclement weather. The opportunity exists to educate watershed residents and business owners on the fate of deicing materials after the inclement weather event and the impacts that these materials have on their local waterways.

Organization: Virginia House of Delegates
Contact: Scott Surovell
Received on: July 24, 2015

I reviewed the presentation that my legislative aide received.

Can you let me know exactly what the plan is going forward? I didn't understand that from the presentation.

DEQ Response
Sent On: July 30, 2015

Thank you for your question.

By way of background, the TMDL process for biological impairments entails two general phases. The initial phase is to determine what is causing the impairments to the biological community, or the stressor identification analysis. The second phase is to develop a plan for addressing the pollutants causing or contributing to the impairments. The second phase is referred to as a Total Maximum Daily Load (TMDL). A TMDL determines the total amount of a pollutant that a waterbody can receive and still meet water quality standards. It is sometimes described as a pollution diet, or a pollution budget. The attached project plan provides additional information for your consideration. [The Accotink Creek TMDL project plan is included in Appendix A.]

We are currently in the public comment period for the first phase of the project, which is the draft stressor identification analysis. After the close of the comment period (August 5), we will address the comments received and make the needed edits (if any) to the stressor analysis *report. As it stands now, sediment has been identified as the dominant stressor to the biological community. Chloride has also been identified as a stressor, although it impacts the biological community only seasonally. We will be moving into developing TMDLs for the sediment and chloride pollutants.*

Part of the TMDL development process will entail determining the appropriate water quality endpoint for sediment, as there are not established water quality criteria for sediment in Virginia. There are water quality criteria for chlorides. We will also be developing watershed models for the loading and transport of the pollutants contributing to the impairments. With calibrated models, the reductions needed from the sources of sediment and chloride can be determined and pollutant allocations can be assigned to the point and non-point sources in the watershed. We will begin development of the TMDLs later this summer, with the final TMDL reports prepared by the end of 2016. After the State Water Control Board (SWCB) and EPA approval of the TMDL, the allocations given in the TMDL for the [regulated] point sources, which includes MS4 permittees, will be implemented through the DEQ issued permits when those permits are reissued. It should be noted that the TMDL process does not establish any new regulatory authority; rather, the requirements of the TMDL will be implemented through existing regulatory and incentive-based programs.

Organization: Citizen
Contact: Donald Pless
Received on: August 1, 2015

Condition of the Watershed

The DEQ briefing slides for the public meeting held on July 26, 2010 identified the condition of Accotink Creek as impaired based on data collected over a decade ago. So far nothing has been done that will change the current condition of the stream.

Although the stream's tributaries began losing biodiversity at an increasing rate since the late 1950's when development began pushing west outside the what is now RT. 495--referred to as the Washington Beltway or just the Beltway--built in the early 1960's--nothing has been done that will reverse that trend.

Before that time the tributaries still supported a fairly healthy aquatic ecosystem based on observations of dragon flies, crayfish, and frogs in the creeks.

By the early 1950's much of the tree canopy had grown back shading the streams, cooling the water, and providing habitat for a large number of animals--many of which are now rarely seen or no longer exist in the watershed. Beavers--an integral part of the native ecosystem--can no longer survive in habitat as degraded as Lake Accotink. Although I have seen beavers in Accotink as recently as several yeas [*sic*] ago, they were either extirpated or found the area too inhospitable to make it their home.

The extent of the tree cover before the onslaught of development as well as the amount of impervious ground cover can be confirmed by aerial photographs taken over time. While farming--as well as other human industry--resulted in the loss of much of the native ecosystem habitat--covering the land with asphalt and concrete meant certain death without hop of recovery.

The TMDL study issued by EPA in April 2011 identified the primary cause of the stream's poor condition as storm water runoff from impervious surfaces--the volume and velocity of which is eroding the stream banks and scouring the aquatic life from the stream bed.

To address this condition EPA proposed a TMDL for sediment based on the velocity of the storm water.

Then Attorney General Anthony Cuchinelli [*sic*]--at the behest of VDOT and the Fairfax County Board of Supervisors--decided that the cost of mitigation based on controlling the amount of run off was too great--joined in a law suit to prevent the EPA from taking regulatory action to control the amount of erosion even though most of the reaches of the stream above the impoundment are functionally dead--a condition that has been known to exist for decades.

<u>Cause</u>

The destruction of the native ecosystem is the direct result of construction allowed by the Fairfax Board of Supervisors through the permitting process--acquiescing to the "land developers" like Mr. Til Hazel who cared little about the environmental degradation cause by "development".

Fairfax County is not the first county to be "urbanized" nor unfortunately is it likely to be the last. The consequences of "development" --covering the land with asphalt, concrete, and buildings--has been known for decades.

Even though the cause of the problem is clear, VDOT recently allowed large volumes of sediment to be deposited in the creek during construction of the HOT lanes for the Beltway--not to mention the destruction of over 400 acres of trees.

Widening of RT. 66 and Braddock Road will contribute even more sediment to the stream--even more degradation.

The Fairfax County Board of Supervisors and VDOT succeeded in a legal action preventing EPA from taking regulatory with EPA suggesting that the DPWES Watershed Management Plan for Accotink Creek issued in January 2011 would address the problem.

Although the county plan identifies priority projects that may or may not be successful in restoring the benthic population to the stream there is no reasonable assurance that this goal will ever be achieved.

The Watershed Management Plan does not state it's goal as the restoration of benthic population--either for the stream or it's [*sic*] tributaries--nor does the Plan identify any criteria or milestones for achieving any measurable goal.

According to the Watershed Management Plan, the Accotink Stream Valley Watershed is roughly 90% developed. The open space that remains--that which is not water--is contiguous to the streams. Currently, roughly 30% of the land area is covered by asphalt, concrete, and buildings.

Based on the amount of impervious ground cover in the Long Branch Stream watershed (40%), the amount of impervious surface in the upper watershed above the impoundment is likely much higher than 30 percent.

The headwaters of the creek and tributaries have been buried underground, put in culverts, and paved over.

Paving over of land in Fairfax County continues as evidenced by the widening of Rt. 66 and Braddock Road and asphalting trails in county parks like Accotink.

The county has no plan to remove asphalt and concrete from areas in the watershed much l--such as the deteriorated trail along Danberry [*sic*] Forest Drive from Braddock Road--much less restore these areas to the condition prior to paving.

Conclusion

Because Accotink Creek and it's [*sic*] tributaries no longer support a healthy benthic population, Fairfax County is in violation of the Clean Water Act--a condition that has been known to county officials for several decades. When I contacted the FCPA Director in the mid 1990's to ask about efforts to restore Flag Run Creek--a tributary of Accotink--he referred to the creek as an "open sewer".
Ha [*sic*] "For Profit" enterprise by exploiting natural resources--the systematic destruction of the native ecosystem--in order to generate additional revenue to fund it's [*sic*] operations.

The Fairfax County Government has knowingly and willfully chose to violate the provisions of the Clean Water Act--enacted to protect the aquatic life in our streams, rivers, and estuaries.

Request for Information

Please provide any information that contradicts the preceding discussion.

Also, please provide answers to the following questions:

What percentage of the sediment load in Accotink Creek is subject to regulation?

When will DEQ start issuing permits for sediment?

Will VDOT require a permit for construction like the HOT lanes or widening RT. 66?

What is DEQ's plan for addressing the volume (velocity) of storm water entering the Creek during heavy storms?

In addition, I have reservations regarding evaluations of pollutants in the water column.

Observations

Because of the volume, velocity, and force of the water that runs through the stream channel during flood state events--which are frequent--I believe that the pollutants discharged into the stream are likely flushed out fairly quickly. However, I do not believe that this should be interpreted as having no effect on the aquatic organisms that manage to survive the flush or the waters to which these toxics are delivered.

The pollution problem most likely varies among tributaries where sampling is infrequent at best. The last county sampling of Flag Run was in 2005 for which DPWES has not been forthcoming in their either their sampling protocol or extent of analysis.

If your data is showing that there is not a pollution problem then I suggest that the sampling methodology, data analysis as well as the findings--especially including delimitations--be reviewed by an interdisciplinary panel of experts in statistics, toxicology, biology, ecology, and evaluative assessments.

I suspect that the data for Accotink Creek's tributaries is insufficient to conclude that toxic chemicals--such as herbicides, insecticides-- such as atrazine, glyphosate, etc, along with heavy metals--such as cadmium, mercury, etc. and petroleum based chemical--along with their by products [*sic*]--degreasers, detergents, etc. as well as other chemicals--do not represent a threat the restoration of aquatic organisms in these streams--not to mention the break down [*sic*] of styrene and other plastic consumer products.

<u>Recommendation</u>

Virginia DEQ, DNR, and VDOT as well as the Fairfax Board of Supervisors can and should do more to correct the problems created by the Fairfax County Government and VDOT as well as assist citizens who would like to see Fairfax County in compliance with the CWA by:

--funding an ecological assessment by GMU to get a better understanding of current condition of the native ecosystem.

--taking proactive measures to protect the remaining native ecosystem by designating areas as protected habitat enforced by sanctions with serious monetary consequences for violators.

--implementing projects identified in the Watershed Management Plan as priority projects intended to correct the current dysfunctional hydromorphic changes to the stream no later than 2020 as planned.

--and conducting statistically valid sampling and toxicological testing of the sediment in the Accotink impoundment.

Good governance derives from integrity, transparency, and accountability. Fairfax County needs to take action to show that it's [*sic*] commitment to these values.

Please include these comments--along with DEQs response--in the official record or advise if some other form of communication is required.

The content of these comments is based on my understanding of the facts. Please advise of any statements that you believe are inaccurate. Also, please provide sources for your views.

> ***DEQ Response***
>
> *Thank you for providing your understanding of the conditions and causes of the Accotink watershed deterioration. The purpose of this comment response document is to acknowledge feedback from the public on the materials pertaining to the Draft Stressor Identification Analysis presented at the July 6, 2015 Public Meeting, as well as provide explanations and/or clarifications for the information used in and conclusions of the draft stressor analysis. We are not in a position to refute or clarify information that was not used to develop the draft stressor analysis.*
>
> <u>*The following responses address the requests for information and observations of the monitoring data*</u>*:*

During the process of developing the sediment TMDL, the existing sediment loads in the Accotink Creek watershed will be determined. The TMDL will identify the reduction in the sediment loads needed from each source in the watershed. It will be during this process that the sediment loads allocated to the regulated discharges within the watershed will be determined.

There are several different permitting programs in place for the protection of water quality. The Virginia Pollutant Discharge Elimination System (VPDES) permits are issued to point source discharges in order to maintain and protect the Virginia Water Quality Standards (9VAC25-260). VPDES permits generally have a 5-year term; they are revisited and renewed every five years. In the Accotink Creek watershed, there are 4 industrial facilities that have an Individual Permit and each facility has limits on the concentration of total suspended solids (TSS) that can be discharged. It may be possible that the sediment TMDL for the Accotink Creek watershed will require lower limits of TSS from these industrial facilities. In that case, the permitted facility will receive a lower limit when the permit is reissued by DEQ. Also under the VPDES program are General Permits for the discharge of Stormwater Associated with Industrial Activity. There are twelve facilities in the Accotink Creek watershed that have an Industrial Stormwater general permit, which requires best management practices (BMPs)to meet water quality goals to the maximum extent possible. These permittees may have to enhance BMPs to meet goals or targets that may be established in a TMDL if the facility discharges the pollutant(s) of concern.

The Virginia Stormwater Management Program (VSMP) also issues permits that regulate the quality and quantity of stormwater runoff. Any construction activity which results in land disturbance equal to or greater than one acre is required to be covered by a DEQ issued construction general permit. In addition, a permit is also required for construction activities that result in land disturbances less than one acre that are part of a larger common plan of development that ultimately disturbs one or more acres. The construction general permit requires the operator to implement a site-specific stormwater pollution prevention plan (SWPPP). The SWPPP outlines the steps that an operator must take to comply with the permit, including water quality and quantity requirements, to reduce pollutants in the stormwater runoff from the construction site. The SWPPP also specifies all potential pollutant sources that could enter stormwater leaving the construction site and covers methods used to reduce pollutants in stormwater runoff during and after construction. It is worthwhile to note that the locality (Fairfax County) also has a Stormwater Management Ordinance in place for construction activities that result in land disturbances between 2500 ft^2 and one acre.

The volume/velocity of stormwater entering the Accotink Creek watershed during a heavy storm is a cause of concern. Flow is not a pollutant, therefore cannot be addressed by the development of a TMDL. However, through the VSMP permit program, new development and redevelopment construction activities are required to meet design requirements to control the quantity and quality of stormwater runoff.

DEQ aims to monitor metals and toxics under a variety of hydrological conditions. Two of 12 samples analyzed for metals and two of four samples analyzed for toxics were collected during storm events. This information has been added to the stressor identification report.

Collecting and analyzing additional data is almost always helpful; however additional data may not resolve the degree to which organic toxic chemicals are stressors in Accotink Creek. None of the water column or sediment concentration data collected in Accotink Creek suggests that toxic chemicals are present at levels that are known to be detrimental to the *biota. There were no exceedances of the acute or chronic criteria for the organic toxics in water column samples. Also, there were also no exceedances of the Probable Effect Concentration (PEC) for organic toxics in sediment samples. The PEC represents concentrations above which adverse impacts on biota are likely. However, there were organic toxics in sediment found above the Threshold Effect Concentration (TEC), which is the threshold below which adverse effects on biota are unlikely. Organic toxic concentrations in sediment were found above the TEC, but below the PEC, at levels where science cannot unambiguously determine their effect on biota. Given this evidence, as well as the results from the toxicity tests on water fleas and fathead minnows, toxics were identified as a possible stressor to the benthic communities.*

The focus of this TMDL project is on the biological impairments identified in Accotink Creek and Long Branch. We recognize the possibility that there may be tributaries in the Accotink Creek watershed with specific water quality issues. By developing a TMDL for the most probable pollutant stressors identified in the draft stressor analysis (sediment and chloride), the goal is for improvements in water quality within the entire Accotink watershed.

Organization: Friends of Accotink Creek
Contact: Philip Latasa
Received on: August 3, 2015

The Friends of Accotink Creek submit the following comments pursuant to the July 6, 2015, Accotink Creek TMDL public meeting:

- Avoid classifying parameters as “non-stressors” without more intensive sampling at peak flow which often represents the time of poorest water quality. A more appropriate set of classifications would be “least probable stressor, possible stressor, and most probable stressor”.
- Set goals to specifically address hydromodification and habitat modifications, rather than including them as subtasks of sediment control.
- VDOT stormwater ponds are an unsatisfactory solution, taking houses and habitat.
- Creative alternatives such as pervious pavement and Green Streets must be the default options for all projects.
- Develop specific plans to address pollutant loads coming from beyond public property, out into private parking lots, roofs, and driveways.
- Private property owners must come to desire Bayscaping as much as they now desire hardscaping.
- Ensure that the proposed widening of I-66 and Braddock Road and similar projects will contribute to TMDL goals, rather than increase impairment.
- Follow the example of northern jurisdictions in the U.S.A., Canada, and Europe where less harmful methods of road ice control are in use.
- Follow up the TMDL with regular monitoring of Accotink Creek and its tributaries, all of which would likely be labeled as “impaired”, were data available.

DEQ Response

For three out of the four parameters listed as least probable stressors (temperature, pH, and dissolved oxygen), data from individual samples as well as from continuous monitoring were evaluated. The continuous monitoring data captured variations in flow regimes. DEQ aimed to collect metals and toxics during both base flow and stormflow conditions. Two of 12 samples *analyzed for metals and two of four samples analyzed for toxics were collected during storm events. Based on available data, metals were categorized as a least probable stressor; however, toxics were identified as a possible stressor.*

The draft stressor analysis categorized the stressors into the following categories: "non-stressors", "possible stressors", and "most probable stressors". Based upon feedback received during the public comment period, the category of "non-stressor" has been changed to "least probable stressor" in the final Accotink Creek Watershed Stressor Analysis Report.

The non-pollutants stressors identified in the stressor analysis - hydromodification and habitat modification - are not parameters that can formally be addressed through the TMDL process. Impacts on the benthic communities from hydromodification and habitat modification are intertwined with impacts from sediment. Hydromodification includes changes in hydrology, channelization and loss of headwater stream networks. Increases in the magnitude and frequency of peak stream flow events cause excess stream bank erosion. The eroded sediment is transported through the streams, leading to scouring of benthic communities. Sediment deposition also occurs, which impacts the quality and variety of habitat. Given the relationship between sediment, hydromodification and habitat modification in stream systems, measures taken to address sediment will likely also lead to improvements in habitat and hydromodification.

The management measures mentioned in the comment are noted; however, the identification of restoration strategies is a topic outside the scope of the stressor analysis but is appropriate in the context of TMDL implementation.

Any proposed construction activities, such a road widening projects, are subject to requirements of the Virginia Stormwater Management Plan (VSMP) permitting program. If the construction project is located in a watershed with a completed TMDL, the construction general permit requires the operator to implement a site-specific stormwater pollution prevention plan (SWPPP), which outlines the steps that an operator must take to comply with the permit, including water quality and quantity requirements, to reduce pollutants in the stormwater runoff from the construction site. In addition, additional sediment stabilization measures and an increased inspection frequency are required.

Organization: Fairfax County Board of Supervisors
Contact: Sharon Bulova
Received on: August 4, 2015

The purpose of this letter is to provide Fairfax County's comments on the Draft Stressor Analysis Report for the Benthic Macroinvertebrate Impairments in the Accotink Creek Watershed, which was posted to the Virginia Department of Environmental Quality (DEQ) website on July 6, 2015.

The draft report generally makes good use of the available data, some of which was provided by the county, to evaluate a wide array of potential stressors including both pollutants and non-pollutants. The most probable stressors for the benthic community in Accotink Creek are identified as chloride, habitat modification, hydromodification, and sediment. Two of these stressors are pollutants (chloride and sediment) and can be used to establish total maximum daily loads (TMDLs). The remaining two (habitat modification and hydromodification) are non-pollutants and DEQ has expressed interest in seeing these stressors addressed through implementation of the pollutant-based TMDLs.

Fairfax County staff has developed detailed technical comments on the draft report, which are included here as an enclosure. In this letter we will emphasize the most significant comments on the technical aspects of the report, and discuss challenges with the TMDL program.

Technical Comments:

Chloride:

At a recent public meeting to present the draft stressor analysis, DEQ staff acknowledged that the identification of chloride as a stressor to the benthic community is a novelty in Virginia. As such, we believe the possibility of a chloride TMDL deserves careful examination and offer the following comments and suggestions:

- The foundation for the chloride water quality criteria needs to be described in greater detail. We have concerns about the methodology applied to develop the criteria, including the embodiment of a factor of safety of two being added to a criterion that was originally developed by EPA in 1988. We believe that a more complete review of current scientific literature regarding the specific responses to chlorides by organisms is needed to ensure that the TMDL is not overly conservative. This more detailed review is suggested in the anticipation that changes to road salting practices, which are a matter of significant public safety and commerce, will be difficult to implement and that there will have to be a compelling linkage to the biological impairments that are occurring before changes are considered.

- Many of the report's conclusions regarding chloride are based not on direct chloride observations, but rather on measurements of specific conductivity that were used to calculate chloride values using a regression equation. Of 178 observations collected at all sites within the Accotink Watershed between 2001 and 2014, only eleven exceeded the chronic water quality criterion and only 5 exceeded the acute criterion. In addition, Fairfax County water quality monitoring data indicates that background levels of specific conductance are likely tied to the underlying geology. For instance, the annual average specific conductance levels (from quarterly monitoring) are approximately twice as high in the Triassic Basin as in the rest of the Northern Piedmont. Relying on specific conductance observations to calculate chloride values will therefore result in artificially higher chloride levels in the Triassic Basin and artificially lower values in the Coastal Plain.

- We believe that there is not sufficient data to substantiate the conclusion that lower Accotink Creek is primarily stressed by chloride. The assumption that lower Accotink Creek is likely impaired simply because upper Accotink is impaired ignores the known phenomenon of dilution on specific conductivity and total dissolved solids and chloride concentrations farther down in the watershed. This phenomenon is supported by comparing the range of concentrations in Figures 3-48 for upper Accotink Creek and 3¬49 for lower Accotink Creek.

Hydromodification:
The draft report defines hydromodification to include not only flow alteration and channelization of streams, but also the replacement of headwater streams by storm sewer systems. However, no study or data is referenced for the finding that extensive headwater stream elimination and replacement with storm sewers has occurred in the watershed. The report fails to define what constitutes a head water stream versus a perennial stream, or basically where the stream begins. While there is an extensive stormwater drainage network in the watershed, it is possible that the majority of the network outfalls into headwater streams rather than replacing them. The presence or absence of headwater streams available for restoration is likely to be a finding that has significant

ramifications for the approach and potential to succeed in meeting VSCI scores because such systems export particulate carbon and faunal drift that is important to downstream waters. We ask that DEQ clarify the definition and then the presence or absence of headwater streams and cite the information relied upon for determining the extent of headwater stream replacement with storm sewers.

Habitat modification:

The draft report correctly finds that most of the adverse habitat modifications in the Accotink Creek watershed are the result of excessive sediment transport and deposition. Inadequate stream buffering, based on forested buffer widths less than 100 feet, is cited as a pervasive issue likely to adversely affect shade, large woody debris and sediment yields in the piedmont tributaries to the main stem of Accotink Creek. It seems that shade and large woody debris can occur at lesser widths, however, and the county's stream physical assessment accordingly used a cutoff of 20 meters (66 feet) as a threshold for a minimally impacted riparian corridor. We request that DEQ cite reference the data used as the basis for evaluating a 100 foot buffer for all streams and describe the methods used to inventory the extent of inadequately buffered areas.

Sediment:

The draft report correctly states that there is 'ample evidence' that sediment is being transported and deposited in sufficient quantities to adversely impact the benthic community in Accotink Creek. While the draft report does not provide any weighting of the most probable pollutant stressors, sediment is likely to be the primary cause of the benthic impairments. Sediment is closely related to the two non-pollutant stressors (hydromodification and habitat modification), and bank erosion is a significant and pervasive problem in the Accotink Creek Watershed stream network. A sediment TMDL may not be sufficient to restore the benthic community, but it is more likely to directly address the underlying causes of the impairments than a chloride TMDL.

Comments on the TMDL Program:

The draft stressor analysis appropriately identifies multiple complex factors that have contributed to the benthic impairment in Accotink Creek. Review of the study leads us to the conclusion that an approach that addresses one "pollutant" at a time may prove ineffective in situations where there is clearly not a single cause of impairment. The draft stressor analysis confirms that Accotink Creek is typical of many urban streams where the issues are much more complex and interrelated, and this complexity seems to warrant a different approach, beyond TMDLs, to addressing impairments in urban streams. Further we are not aware of any communities that have successfully implemented a TMDL action plan that has resulted in full restoration of the benthic community. All of which leads us to offer the following observations on the TMDL program:

- Implementation of a chloride TMDL could require a balancing act between public safety and the environment because chemicals used for road de-icing are a major source of the chloride. DEQ has acknowledged that management of chloride is new and could impact road de-icing operations.

- Implementation of sediment and chloride TMDLs will not guarantee restoration of the benthic community to the current standard, and we are not aware of any literature that identifies the time that is required to achieve restoration, or substantiates that full benthic restoration is even achievable in urban streams of this nature.

- Much of the hydromodification and piping of head water streams occurred decades ago and conformed to standards and practices in place at the time. Much of this development is virtually impossible to undo.

- The current standards require restoration of urban streams to rural, unimpaired, almost pristine conditions. The factors and conditions affecting urban streams are so different from rural, unimpaired conditions that those water quality goals may not be realistic or even attainable for urban streams and, again, we are unaware of any scientific literature that supports this as an achievable goal.

- While we all agree that our current stream conditions are severely degraded, regulations must acknowledge the complexities associated with urban streams, that the current standards may be unachievable, and that there will be an unknown lag time after implementation of water quality measures before we see in-stream improvements. We believe this supports a different approach to urban streams beyond identifying and working with one pollutant at a time. We believe that communities with MS4 permits may already have the more comprehensive practices in place to address urban stream issues.

- No matter how many resources we devote to our stormwater program, our ability to reach pristine conditions that mimic rural streams is limited by the complexities of addressing issues in an already developed, urban environment and where other priorities such as public safety come into play. We believe it is appropriate to develop more achievable goals, or even progressive goals that provide a reasonable measure of value for investment.

Fairfax County remains fully committed to controlling pollutant sources, maintaining and improving stormwater infrastructure, and protecting our receiving streams. Given the conclusions in the draft report and the acknowledged complexities involved in addressing urban stream impairments, perhaps there is a better model that would allow us to get away from the high cost and complexity of developing individual TMDLs for all urban streams. A model that is based on a broader watershed approach that provides the framework for us to define more reasonable, attainable goals and that acknowledges that a return to pristine stream conditions is simply not possible in our developed environment. We appreciate the opportunity to comment on the Draft Stressor Analysis Report for the Benthic Macroinvertebrate Impairments in the Accotink Creek Watershed and look forward to continuing to work with the Commonwealth to help improve urban stormwater management in Fairfax County and in Virginia.

Attachment: Fairfax County Comments on the Draft Stressor Analysis Report for the Benthic Macroinvertebrate Impairments in the Accotink Creek Watershed, Fairfax County, Virginia

As DEQ explained, the identification of chloride as a potential stressor is different from previous TMDLs. The science connecting benthic impairment to chloride concentrations or specific conductance (SC) — which are often used as surrogates for total dissolved solids (TDS) — is not well established. Identifying studies from other states where reduced loadings of road salts to receiving waters led to improvements in biological communities and additional studies would help make this linkage.

Further, there is not sufficient data to substantiate the conclusion that lower Accotink Creek is primarily stressed by chlorides. The stressor identification (SI) analysis concludes (Section 4.3.1, page 4-11) that although no continuous record of SC is available for lower Accotink Creek, that water quality standards for chloride are likely exceeded in lower Accotink Creek - based on similarity of ambient SC and TDS grab samples exceeding the ProbMon "suboptimal" and 90th percentile conditions. (Note: Figure 3-47 indicates no acute or chronic standards were exceeded in 2006-

2007). This assumption ignores the known phenomenon of dilution on SC/TDS/chloride concentrations farther down in the watershed. This phenomenon is supported by comparing the concentrations of SC in upper Accotink Creek (Figure 3-48) to the range of concentrations observed in the much larger, and more dilute, lower Accotink Creek (Figure 3-49).

Below please find comments related to specific sections within the Stressor Identification Analysis for Accotink Creek Watershed report.

Executive Summary

- Page ES-4: The text refers to "twelve potential stressors" but only 10 are listed in Table ES-3 on page ES-5. Were two more stressors considered? If so, what were they?
- Page ES-6: While there were four noted exceedances in the upper Accotink Creek watershed using the National Water Quality Assessment Program (NAWQA) dataset (please note comments below regarding this) this does not imply that such exceedances are "not infrequent occurrences."
- Page ES-6: The statement that there is "strong indirect evidence that exceedances of Virginia's chloride criteria are not infrequent occurrences" is misleading. There are only four observed exceedances of the acute criterion in Upper Accotink Creek. The conclusion drawn is based on a correlation between chloride and specific conductivity that does not take into account several potentially confounding factors, including the underlying geology. This could be rephrased as "suggest that exceedances of Virginia's chloride criteria may not be infrequent occurrences."

2.2.3 Municipal Separate Storm Sewer Systems (MS4s)

- Page 2-22: Table 2-13 does not include the Virginia Department of Transportation, which holds a Phase II MS4 Permit. This permit needs to be included.

3.1.2 EPA Biological Monitoring

- Page 3-11: The text states that "The EPA in conjunction with the USGS, began biological and water quality modeling in December 2005 ..." Should the word "modeling" be replaced with "monitoring?"
- Pages 3-11 and 3-12: The report heavily cites EPA's Selakumar [*sic*] et al. (2008) study in which the Environmental Protection Agency (EPA) and United States Geological Survey (USGS) monitored a section of stream in the upper Accotink watershed. This stream restoration was performed prior to development of more current practices and would likely be considered a stream stabilization today. The study's failure to acknowledge that design techniques have changed should be noted when drawing conclusions, particularly when discussing the success (or lack thereof) of stream restorations at reducing sedimentation.
- Page 3-12: We agree with the statement that "it might take longer than two years of post-restoration monitoring for stream restoration to have a greater positive impact on the biological community." Therefore, any conclusions drawn from this study as to the lasting effect of these restorations on the condition of the benthic macroinvertebrate community should be avoided.
- Page 3-13: Tables 3-6 and 3-7 include data from the Selvakumar et al. (2008) study prior to the restoration. The SI report indicates that "the post-restoration monitoring results and metric scores were not available for analysis." Lacking this data it is difficult to draw conclusions from post-restoration data regarding the benthic community and/or its response to stream restoration.

3.1.3 Fairfax County Biological Monitoring

- Page 3-21: The statement that the blacknose dace (*Rhinichthys atratulus*) is almost absent in the lower mainstem of Accotink Creek is not accurate. This species has been found in lower Accotink Creek by FCDPWES staff on many occasions since 1999. For more information, please see: http://www.fairfaxcounty.gov/dpwes/stormwater/fishiminnows.htm
- It is likely that the distribution and abundance of fishes in either the upper or the lower section of Accotink Creek is due to the Lake Accotink impoundment (which is a fish migration barrier) or to the relative catchment size at a particular sampling point, and not necessarily correlated to pollutants that may be found in the waterway.

3.1.4 Volunteer Monitoring

- Page 3-23: The heading of the sixth column in Table 3-15 should read "Calamo Branch," not "Calemo Run."

3.3.1 DEQ Geomorphic Assessment

- Pages 3-35 to 3-36: The text references bankfull return intervals as being 1.5 to 2 years. This continues to be a widely cited, yet we believe outdated, concept based on results from annual maximum series (AMS) calculations. AMS calculations cannot provide return intervals of a year or less and characteristically provide unreliable or skewed data for any actual intervals less than 10 years. We believe it would be more correct to state that actual occurrences of bankfull discharge can be more frequent, but that annual maximum series calculations often provide bankfull return intervals of 1.5 to 2 years. This is importance because channels designed on the basis of bankfull flow occurring at 1.5 to 2 year returns are likely to be over dimensioned to support a desirable benthic fauna.
- Page 3-37: The three sites included in Table 3-23 are located in the downstream section of the watershed. Specifically, sites lAAC0006.10 and 1 AAC0004.84 are located next to or just within the coastal plain physiographic province where the system is naturally flatter and aggrading. It appears the LRBS is applied across physiographic provinces without regard to differences in substrate, geology and watershed slope factors. If that is the case, it should be noted that estimating and comparing bed stability conditions at sites across widely differing ecoregions/provinces is not a valid approach to geomorphic assessment. More analysis should be conducted, particularly in the upper watershed (which is in the Piedmont physiographic province) in order to develop an effective sediment TMDL towards which restoration progress can be accurately measured.
- Interpretation of the 4 LRBS data points as indicating 'a stable channel bed' with bed materials akin to 'mountain streams' may be an overstatement. Bed stability should be reported based on the weight of all evidence, not a single metric sampled on a particular bed formation at a limited number of sites. For example, the bed is clearly unstable at locations where 12 headcuts were inventoried and reported by CH2MHILL (2005). CH2MHILL also reported a general presence of 'large unstable sediment bars.' Sediment moves through eroding systems as slugs and in waves through time. Therefore, portions of the bed are excessively mobile and others, as indicated by the reported LRBS scores, are highly armored at any given time. Further, LRBS scores are sensitive to assumptions made regarding channel bankfull dimension, which is notoriously difficult to properly assign in actively eroding urban channels. If the LRBS riffles that were studied are in fact stable, then the details of their particle size distribution and bankfull dimensions and field indicators used are of great interest to stream restorationists. We request DEQ provide the locations, data, and calculations used to arrive at the reported LRBS scores.
- Page 3-37: the report states "Since the LRBS scored for Accotink Creek assessments are above -0.5, they indicate that the mainstem Accotink Creek is not carrying excessive sediment loads. The large LRBS values found in Accotink Creek are more typical of steep mountain streams and indicate significant armoring of the bed." The statement that the creek

"is not carrying excessive sediment loads" seems to directly contradict the report's own finding that excess sediment is a major stressor to the aquatic life use in Accotink Creek.

- Page 3-38: Table 3-25 shows the total stream length inventoried by CH2MHILL (2005) as being in channel evolution model (CEM) Stage III (widening/bank erosion). No summary statistics are provided or described regarding this data, but the narrative subsequently provides statistics on the number of reaches and percentage of stream length inventoried in the same 2005 study as 'moderate to severe' erosion defined as sites with erosive faces 2-3 feet high. The implications or rationale behind this categorization is not described. Only 1% of the total assessed stream length was reported as having greater than 2 feet of erosion. Some readers may easily miss the fact that the data in Table 3-25 indicate that 334,754 of 370,500 linear feet of stream channel was reported to be eroding by widening. In fact, bank erosion is such a significant and pervasive problem in the Accotink drainage network, we suggest adding a bullet to the sediment conclusions on page 4-15 that 90% of the channel length assessed was categorized as having bank widening (CEM Type III).

3.3.3 EPA Particle Size Analysis

- Page 3-40: It is likely that the in-stream particle size analysis that resulted in a similar finding of particle size distributions (pre and post restorations) can be attributed to the 70-year storm event (and floods) that took place in June of 2006. The report states "These results may suggest that there is significant temporal variation in the amount of sand and fine-grained sediment at a given location." The results of this analysis may be considered inconclusive based on the confounding factors mentioned here and in the comments regarding section 3.1.2.

3.4 Flow

- Page 3-43: The report uses paired gage data to assert that flow percentiles from the gage on the mainstem of upper Accotink Creek near Annandale "can be used as an index of hydrological conditions for the lower mainstem." This assertion is supported by paired gage data from the upper and lower mainstem when there was briefly a gage on the lower mainstem between 1949 and 1956. Considering the intensive degree of urbanization that has occurred since 1956 (particularly in the upper watershed), this conclusion does not seem valid. Additionally, these gaging stations are/were situated in different physiographic provinces with different hydrologic characteristics. The assumption that the upper and lower mainstem of Accotink Creek are similar in hydrologic condition is in the foundation of the report's analysis of water quality monitoring data and is not supported with long-term data.
- Page 3-44: The title on Figure 3-8 seems to be incorrect and should be replaced with the title on Figure 3-9. An appropriate title referencing flow percentiles should be used for Figure 3-9.

3.5 Analysis of Conventional Water Quality Monitoring Data

- Page 3-50: Although the narrative in this section states that "only samples collected under ambient or baseflow conditions were compared to the ProbMon suboptimal thresholds or the 90th percentile ProbMon concentrations," it goes on to state that "in the sections that follow, time series plots will represent observations taken under all hydrological conditions." This is confusing, as time series plots of the (ambient) grab samples appear to include only spring and fall non-storm event samples rather than samples under all hydrological conditions.
- Flow data for both the USGS gages (upper mainstem near Annandale & Long Branch) are accompanied by this statement: "NOTE: During storm events, backwater effects on stage and discharge determinations at this station are likely. Streamflow data displayed on this page may be significantly different from actual values during these events. Adjustment of data for backwater effects can only be done after detailed analysis. Users are encouraged to contact this office for more information." Has the stressor analysis accounted for these necessary corrections?

- For the USGS gage on Long Branch, in addition to the continuous record of water quality parameters, the jointly operated monitoring study also collects monthly grab samples. Four of these monthly samples per year are targeted for wet weather samples. Does the stressor analysis account for these non-ambient samples and screen them out of the dataset before comparison to the ProbMon 90th percentile values (eg. Figure 3-64)? We believe this is necessary for data comparability.

3.5.4, 5 & 6 Specific Conductance, Total Dissolved Solids and Chloride

- More clarity is needed in the text and regarding the use of the NAWQA data (Sections 3.5.4 and 3.5.6). We believe the cluster of samples taken in early 2014 is of concern. It's not clear if they are independent observations and most of the exceedances were observed during a short period of time; were multiple samples taken during the same storm event, or are these separate storms? If taken during separate events, was there enough time between storms for the four data points to be considered independent and thus representative of a pattern of problems vs. a problematic year?
- It is unclear based upon the stressor report if DEQ regularly takes direct measurements of chloride when taking water quality samples. In Virginia's 2012 Integrated Report — Probabilistic Monitoring Chapter, DEQ indicates they test for TDS (ionic strength) but did not publish any data regarding direct measures of chloride in streams, nor do they state that the ProbMon program makes direct measures of chloride. The USGS water quality samples processed by the Fairfax County Water Quality Lab do not measure chloride, and FCDPWES does not measure chloride. The USGS data from the NAWQA sampling program do measure chloride. However, only 6.2% (11 of 178) samples were above the chronic threshold from 2001-2014. There were only 5 samples above the acute threshold over the same period (2.8% of samples, or 5 of 178). Therefore, most of the evidence of chloride levels exceeding the standards are actually projections tied to conversions based upon a SC-chloride relationship and not from direct measurements. Monitoring from DEQ and USGS programs indicate that instances of SC >2,850 are not common.
- 90th percentile ProbMon measurements were exceeded on a more frequent basis, but those data are collected in spring and fall (see page 3-49) and do not follow storm events. These samples were compared to samples in winter following storm events, when there are spikes in SC. This discrepancy confounds the comparison between the two data sets, and does not take seasonal and storm differences into account; i.e. winter storm samples could very well be outside of normal summer base flow conditions without chloride.
- Page 3-77: In the regression equations on Figures 3-48 and 3-49, there are only four data points in the entire dataset (all in upper Accotink) that show the observed SC vs. chloride relationship above 2,500. These outliers appear to be driving the slope of the regressions and their low variance. This should be investigated further prior to using these regressions to establish TMDL allocations.
- SC Exceedances will likely not appear in routine monitoring data - exceedances only appeared four times in DEQ routine monitoring through the period of analysis (Figure 3-48), and appear to be associated with spikes in SC following snow melt events (Figures 3-38 and 3-40).
- Fairfax County water quality monitoring data also indicates that background levels of SC are likely tied to the underlying geology, using physiographic province as a determinant. For instance, the annual average SC levels (from quarterly monitoring) are approximately twice as high in the Triassic Basin compared to the rest of the Northern Piedmont. Likewise, the Coastal Plain SC levels are typically lower than those found in the non-Triassic portions of the Northern Piedmont. However, many of the taxa sampled through benthic surveys are found among all three physiographic provinces. Below is a summary table of the over 2,200 direct measures of SC from 2005 through 2014. Using the measured SC values to determine chloride concentration (using the regression equation provided by the SI report), on only two

occasions did the modeled chloride levels exceed the acute concentration threshold (2009, 2014). Both occurrences were in Horsepen Creek, within the Triassic Basin portion of the Northern Piedmont.

Annual Mean Specific Conductance (n, samples collected 2005-2014)			
Physigraphic Province	Bacteria (Quarterly)	Benthics (Mar15-Apr15)	Fish (August)
Coastal Plain	239.3 (81)	254.4 (83)	200.1 (83)
Piedmont	301.3 (559)	361.5 (564)	234.8 (564)
Triassic	620.5 (93)	1002.2 (93)	434.3 (93)

While these data suggest that concentration of dissolved solids is greatly tied to the physiographic province, the stressor analysis does not include any discussion of the sensitivity of specific benthic taxa to changes in chloride, SC, or TDS among the different provinces. Benthic taxa may be more sensitive or resilient to changes in areas with higher background levels of chloride. At a minimum, the distinction between upper and lower Accotink Creek should follow the physiographic boundaries.

- If DEQ plans to pursue the establishment of chloride TMDLs, it may be more appropriate to establish a state-specific chloride standard using more recent data. Section 4-9 of the stressor analysis says "[Chloride] criteria are ... derived from toxicological studies on a wide variety of aquatic organisms." This statement is not accurate; the 1988 EPA standard was made using the limited data available at that time:
    - The 1988 acute EPA standard was based off 12 genera (13 species, which includes *Daphnia magna* and *pulex*), of which only the four most sensitive genera were used to calculate the standard (which includes the *Daphnia* genus) (rf. EPA 1988, Table 3, pp. 17-18; and EPA 1985* p.16). The four used were: *Daphnia sp*., *Physa gyrina* (snail), *Lireus fontinalis* (isopod), and *Cricotopus trifascia* (midge). At this point, one would think that there would be hundreds of genera for which LD50 chloride values are available, many of which would be specific to the Piedmont and Coastal Plain.
    - The 1988 chronic standard was only based off 3 species, which are not the same used to create the acute criteria (rf. EPA 1988, Table 3, pp. 17-18). The data here was extremely limited. The three used were: *Daphnia pulex*, *Pimephales promelas* (Fathead Minnow), and *Salmo gairdneri* (Rainbow Trout).
    - Generally, because there are so few genera and species in the 1988 analysis, the criteria is sensitive to the particular species used. For example, if you exclude *Daphnia*, which is not a macroinvertebrate or fish, the acute criterian [*sic*] increases from 860 to 1140, about a 1/3rd higher. Also, dropping Daphnia from the chronic criteria leaves only two fish species, and decreases the criteria from 230 to 170, about 1/4th lower.

<u>4.3.1. Chloride</u>

On page 3-78, Cl:SC conversion factors of 0.33 (Difficult Run), 0.31 (Upper Accotink Creek) and 0.29 (Lower Accotink Creek) are introduced. The same factors are restated on page 4-10, however a new factor of 0.3 is introduced and it is not clear where it came from or why it is applied to the SC timeseries data for Upper Accotink Creek and Long Branch. It would be helpful if the predicted Cl timeseries in Figures 4-1 and 4-2 included a footnote describing which conversion factor was applied.

DEQ responses to the above comment letter are provided below. Each specific comment from the letter is repeated, with the DEQ response following.

Technical Comments:

Chloride:

At a recent public meeting to present the draft stressor analysis, DEQ staff acknowledged that the identification of chloride as a stressor to the benthic community is a novelty in Virginia. As such, we believe the possibility of a chloride TMDL deserves careful examination and offer the following comments and suggestions:

- The foundation for the chloride water quality criteria needs to be described in greater detail. We have concerns about the methodology applied to develop the criteria, including the embodiment of a factor of safety of two being added to a criterion that was originally developed by EPA in 1988. We believe that a more complete review of current scientific literature regarding the specific responses to chlorides by organisms is needed to ensure that the TMDL is not overly conservative. This more detailed review is suggested in the anticipation that changes to road salting practices, which are a matter of significant public safety and commerce, will be difficult to implement and that there will have to be a compelling linkage to the biological impairments that are occurring before changes are considered.

  DEQ Response

  The methodology used to develop chloride criteria is in accordance with current EPA guidance. That guidance specifies using a factor of two as a margin of safety in the development of acute criterion. Detailed remarks on the foundation for the chloride water quality criteria are provided in the response to the technical comments on this issue (please see comment response on page 40). It is not within the scope of the stressor analysis report to provide background information on the development of water quality criteria. The current chloride criteria are part of Virginia's water quality standards and, in accordance with the Clean Water Act, a TMDL must be developed to determine chloride loads consistent with meeting those standards. DEQ is committed to implementing the TMDL in a manner which will not compromise public safety.

- Many of the report's conclusions regarding chloride are based not on direct chloride observations, but rather on measurements of specific conductivity that were used to calculate chloride values using a regression equation. Of 178 observations collected at all sites within the Accotink Watershed between 2001 and 2014, only eleven exceeded the chronic water quality criterion and only 5 exceeded the acute criterion. In addition, Fairfax County water quality monitoring data indicates that background levels of specific conductance are likely tied to the underlying geology. For instance, the annual average specific conductance levels (from quarterly monitoring) are approximately twice as high in the Triassic Basin as in the rest of the Northern Piedmont. Relying on specific conductance observations to calculate chloride values will therefore result in artificially higher chloride levels in the Triassic Basin and artificially lower values in the Coastal Plain.

  DEQ Response

The acute chloride criterion states that there can be no more than one exceedance in a three year period. Three samples taken in 2014 two weeks apart exceed the criterion. This is sufficient by itself to assert that Accotink Creek is not supporting water quality standards to protect aquatic life because of high chloride concentrations. The point of using the specific conductance continuous monitoring data and the conductance-chloride relation to estimate chloride concentrations is to show that conditions in 2014 are not a one-time occurrence.

It should be noted that the number of samples citied in the comment, as well as the number of exceedences, seems to refer to the data collected by the USGS NAWQA program, 2001-2014, at the USGS gage on Accotink Creek near Annandale (01654000), not at all sites in the watershed. Please see the response provided on page 36. The stressor identification report analyzed conventional water quality data collected in the period 2004 through 2014. During that time, 195 observations of chloride were made by DEQ and USGS at several sites in the Accotink Creek watershed. Four observations exceeded the acute chloride criterion (860 mg/l) and seven additional observations had instantaneous concentrations greater 230 mg/l, the four-day chronic chloride criterion.

This analysis of the relation between dissolved solids and physiographic province is interesting and useful, but it has limited relevance to the stressor identification analysis. Upper Accotink Creek and Long Branch are wholly within the Piedmont physiographic province, and the lower mainstem of Accotink Creek is predominately in the Piedmont. Please see additional discussion regarding physiographic provinces in the response provided on page 39. Background chloride concentrations, however, are not the issue in the stressor identification analysis of chloride. At issue is the very large increase in chloride concentrations in the winter months. Even if benthic taxa adapt to background levels of chloride in different physiographic provinces, they are unlikely to be resilient to increases in chloride concentrations of one or more orders of magnitude in the winter.

- We believe that there is not sufficient data to substantiate the conclusion that lower Accotink Creek is primarily stressed by chloride. The assumption that lower Accotink Creek is likely impaired simply because upper Accotink is impaired ignores the known phenomenon of dilution on specific conductivity and total dissolved solids and chloride concentrations farther down in the watershed. This phenomenon is supported by comparing the range of concentrations in Figures 3-48 for upper Accotink Creek and 3-49 for lower Accotink Creek.

DEQ Response

Chloride is among the most probable stressors of lower Accotink Creek, but it is not the primary stressor. The impacts of chloride predominately occur in the winter, whereas the impact of sediment, hydromodification, and habitat modification occur year round. The difference in the range of chloride concentrations in Figure 3-48 and 3-49 is primarily due to the greater number of observations made in upper Accotink Creek (171) compared to lower Accotink Creek (23) and the fact that far few samples are collected in lower Accotink Creek than upper Accotink Creek during the winter months. Please see additional technical details provided in the response on page 27. There is little reason to suspect that dilution should occur. Since chloride is a conservative substance, all of the chloride in upper mainstem Accotink Creek will reach the lower mainstem. The land use in lower Accotink Creek is similar to upper Accotink Creek. The percent of the lower watershed in impervious cover (28%) is a *little less than the upper watershed (31%), but the percent of the land use which is developed or in the transportation sector is about the same. There is little reason to suspect that less de-icing salt is applied in lower Accotink Creek watershed or that less of it reaches Accotink Creek. Therefore, it appears likely that chloride concentrations in the lower mainstem will be comparable to the upper mainstem.*

While it is DEQ's judgment that elevated chloride concentrations are a source of stress to the biological communities in lower Accotink Creek and in Long Branch, DEQ has decided to not move forward with developing chloride TMDLs for these two impaired watersheds unless the chloride impairment is corroborated by (1) continuous monitoring of specific conductance in Lower Accotink Creek and (2) collection of additional chloride samples to verify the predictive relationship between chloride and conductance in lower Accotink Creek and in Long Branch. DEQ will make an effort to collect the additional data this winter.

Hydromodification:

The draft report defines hydromodification to include not only flow alteration and channelization of streams, but also the replacement of headwater streams by storm sewer systems. However, no study or data is referenced for the finding that extensive headwater stream elimination and replacement with storm sewers has occurred in the watershed. The report fails to define what constitutes a head water stream versus a perennial stream, or basically where the stream begins. While there is an extensive stormwater drainage network in the watershed, it is possible that the majority of the network outfalls into headwater streams rather than replacing them. The presence or absence of headwater streams available for restoration is likely to be a finding that has significant ramifications for the approach and potential to succeed in meeting VSCI scores because such systems export particulate carbon and faunal drift that is important to downstream waters. We ask that DEQ clarify the definition and then the presence or absence of headwater streams and cite the information relied upon for determining the extent of headwater stream replacement with storm sewers.

DEQ Response

Headwater streams are roughly synonymous with first-order streams, either perennial or intermittent (Freeman, Pringle, and Jackson, 2007[2]). Meyer and Wallace (2001[3]) discuss the difficulty in cataloguing headwater streams. Although no study specific to Accotink Creek is known, it is the generally accepted view of researchers that development eliminates headwater streams and reduces drainage density. See Dunne and Leopold (1978[4]) for a narrative textbook treatment. For an illustration of this effect, please see the Center for Watershed Protection (2003a[5]), where Rock Creek in MD (also shown in Dunne and Leopold, 1978) and Four Mile Run in VA are used as examples. Meyer et al. (2005[6])

[2] Freeman, M.C., C.M. Pringle, and C.R. Jackson. 2007. Hydrologic Connectivity and the Contribution of Stream Headwaters to Ecological Integrity at Regional Scales. Journal of the American Water Resources Association 43(1): 5-14.

[3] Meyer, J.D., and J.B. Wallace. 2001. Lost Linkages and Lotic Ecology: Rediscovering Small Streams. In M.C. Press, N.J. Huntly, and S. Leven (eds.) Ecology: Achievement and Challenge. Blackwell Science. New York, NY.

[4] Dunne, T. and L. Leopold. 1978. Water in Environmental Planning. W. Freeman. New York, NY.

[5] Center for Watershed Protection. 2003a Impact of Impervious Cover on Aquatic Systems. Ellicott City, MD. http://cwp.org/online-watershed-library/doc_download/595-impacts-of-impervious-cover-on-aquatic-systems-watershed-protection-research-monograph

[6] Meyer, J.L., M.J. Paul, and W.K. Taulbee. 2005. Stream Ecosystem Function in Urbanizing Landscapes. Journal of the North American Benthological Society. 24(3): 602-612.

consider "fewer small streams in the network" an element in the "urban stream syndrome." The alteration of the relationship between the stream and the landscape in urban environments is a critical factor in the impairment of the biological community and will need to be addressed before urban streams can be restored to health. This point of view is consistent with the comments submitted regarding the TMDL program (please see comments on *page 14**).*

Habitat modification:

The draft report correctly finds that most of the adverse habitat modifications in the Accotink Creek watershed are the result of excessive sediment transport and deposition. Inadequate stream buffering, based on forested buffer widths less than 100 feet, is cited as a pervasive issue likely to adversely affect shade, large woody debris and sediment yields in the piedmont tributaries to the main stem of Accotink Creek. It seems that shade and large woody debris can occur at lesser widths, however, and the county's stream physical assessment accordingly used a cutoff of 20 meters (66 feet) as a threshold for a minimally impacted riparian corridor. We request that DEQ cite reference the data used as the basis for evaluating a 100 foot buffer for all streams and describe the methods used to inventory the extent of inadequately buffered areas.

DEQ Response

The 100 foot forested buffer references the assessment of stream buffers in the Infrastructure Inventory of Fairfax County's Stream Physical Assessment (SPA[7]). The report has been revised to make it clearer that the buffer assessment was part of the inventory. The term "inadequate" has been replaced by "deficient," the term used in the SPA report. According to Fairfax County Stream Physical Assessment Protocols (Appendix A of the SPA, p. 40), buffers are evaluated as deficient if there is less than 100 feet of forest buffer. See also the Buffer Field Forms (Attachment A2). Deficient buffers, as defined here, are primarily a problem in the tributaries to upper Accotink Creek.

Sediment:

The draft report correctly states that there is 'ample evidence' that sediment is being transported and deposited in sufficient quantities to adversely impact the benthic community in Accotink Creek. While the draft report does not provide any weighting of the most probable pollutant stressors, sediment is likely to be the primary cause of the benthic impairments. Sediment is closely related to the two non-pollutant stressors (hydromodification and habitat modification), and bank erosion is a significant and pervasive problem in the Accotink Creek Watershed stream network. A sediment TMDL may not be sufficient to restore the benthic community, but it is more likely to directly address the underlying causes of the impairments than a chloride TMDL.

DEQ Response

The stressor identification report in Sections 4.3.5 and 4.4 recognizes that the effects of sediment, hydromodification, and habitat modification are interconnected. It is likely that measures used to reduce sediment in the Accotink Creek watershed will also address the effects of hydromodification and habitat modification. In addition, as noted above, the impacts of chloride predominately occur in the winter, whereas the impact of sediment, hydromodification, and habitat modification occur year round. Nevertheless, addressing the

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[7] CH2MHILL. 2005. Fairfax County Stream Physical Assessment. CH2MHILL. Herndon, VA.

impacts of high chloride concentrations may also be a necessary, though not sufficient condition for restoring the benthic community in Accotink Creek.

Comments on the TMDL Program:

The draft stressor analysis appropriately identifies multiple complex factors that have contributed to the benthic impairment in Accotink Creek. Review of the study leads us to the conclusion that an approach that addresses one "pollutant" at a time may prove ineffective in situations where there is clearly not a single cause of impairment. The draft stressor analysis confirms that Accotink Creek is typical of many urban streams where the issues are much more complex and interrelated, and this complexity seems to warrant a different approach, beyond TMDLs, to addressing impairments in urban streams. Further we are not aware of any communities that have successfully implemented a TMDL action plan that has resulted in full restoration of the benthic community. All of which leads us to offer the following observations on the TMDL program:

- Implementation of a chloride TMDL could require a balancing act between public safety and the environment because chemicals used for road de-icing are a major source of the chloride. DEQ has acknowledged that management of chloride is new and could impact road de-icing operations.

- Implementation of sediment and chloride TMDLs will not guarantee restoration of the benthic community to the current standard, and we are not aware of any literature that identifies the time that is required to achieve restoration, or substantiates that full benthic restoration is even achievable in urban streams of this nature.

- Much of the hydromodification and piping of head water streams occurred decades ago and conformed to standards and practices in place at the time. Much of this development is virtually impossible to undo.

- The current standards require restoration of urban streams to rural, unimpaired, almost pristine conditions. The factors and conditions affecting urban streams are so different from rural, unimpaired conditions that those water quality goals may not be realistic or even attainable for urban streams and, again, we are unaware of any scientific literature that supports this as an achievable goal.

- While we all agree that our current stream conditions are severely degraded, regulations must acknowledge the complexities associated with urban streams, that the current standards may be unachievable, and that there will be an unknown lag time after implementation of water quality measures before we see in-stream improvements. We believe this supports a different approach to urban streams beyond identifying and working with one pollutant at a time. We believe that communities with MS4 permits may already have the more comprehensive practices in place to address urban stream issues.

- No matter how many resources we devote to our stormwater program, our ability to reach pristine conditions that mimic rural streams is limited by the complexities of addressing issues in an already developed, urban environment and where other priorities such as public safety come into play. We believe it is appropriate to develop more achievable goals, or even progressive goals that provide a reasonable measure of value for investment.

Fairfax County remains fully committed to controlling pollutant sources, maintaining and improving stormwater infrastructure, and protecting our receiving streams. Given the conclusions in the draft report and the acknowledged complexities involved in addressing urban stream impairments, perhaps there is a better model that would allow us to get away from the high cost and complexity of developing individual TMDLs for all urban streams. A model that is based on a broader watershed approach that provides the framework for us to define more reasonable, attainable goals and that acknowledges that a return to pristine stream conditions is simply not possible in our developed environment. We appreciate the opportunity to comment on the Draft Stressor Analysis Report for the Benthic Macroinvertebrate Impairments in the Accotink Creek Watershed and look forward to continuing to work with the Commonwealth to help improve urban stormwater management in Fairfax County and in Virginia.

DEQ Response

While we acknowledge and understand some of the possible limitations of the TMDL program, we do see the benefit of the TMDL study to both highlight the scientific and technical issues as well as setting up water quality goals that otherwise may not exist outside of the regulatory structure of the TMDL program. Additionally, it should be noted that the TMDL endpoint is not a pristine, un-impacted target. Rather, the VSCI target score of 60 represents the tenth percentile of the best available reference streams in Virginia. Reference sites used in the development of the VSCI[8] and in the VSCI validation study[9] were selected by objective criteria independent of biology and professional judgment of DEQ biologists.

Attachment: Fairfax County Comments on the Draft Stressor Analysis Report for the Benthic Macroinvertebrate Impairments in the Accotink Creek Watershed, Fairfax County, Virginia

As DEQ explained, the identification of chloride as a potential stressor is different from previous TMDLs. The science connecting benthic impairment to chloride concentrations or specific conductance (SC) — which are often used as surrogates for total dissolved solids (TDS) — is not well established. Identifying studies from other states where reduced loadings of road salts to receiving waters led to improvements in biological communities and additional studies would help make this linkage.

DEQ Response

The link between chloride concentrations and benthic impairment is based on the toxicology analysis supporting Virginia's water quality criteria to protect aquatic life. Please see the response to the comments on chloride criteria below (on *page 40**). Illinois (2004a[10], b[11]), New Hampshire (2008[12]), and Minnesota (2006b[13], 2010[14]) have established chloride*

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[8] Burton, J. and Gerritsen, J. 2003. A Stream Condition Index for Virginia Non-Coastal Streams. Tetra Tech, Inc. Owings Mills, MD.
http://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityMonitoring/BiologicalMonitoring/vsci.pdf

[9] Virginia Department of Environmental Quality. 2006. Using Probabilistic Monitoring Data to Validate the Non-Coastal Virginia Stream Condition Index.
http://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityMonitoring/ProbabilisticMonitoring/scival.pdf

[10] CH2MHill and Aqua Terra. 2004a. Total Maximum Daily Loads for West Branch DuPage River, Illinois. CH2MHill. Milwaukee, WI. http://www.epa.state.il.us/water/tmdl/report/dupage/west-branch-dupage.pdf

[11] CH2MHill and Aqua Terra. 2004b. Total Maximum Daily Loads for Salt Creek, Illinois. CH2MHill. Milwaukee, WI. http://www.epa.state.il.us/water/tmdl/report/salt-creek/salt-creek.pdf

[12] New Hampshire Department of Environmental Services. 2008. Total Maximum Daily Load (TMDL) Study for Waterbodies in the Vicinity of the I-93 Corridor from Massachusetts to Manchester, NH: Beaver Brook in Derry and Londonderry, NH.
http://des.nh.gov/organization/divisions/water/wmb/tmdl/documents/chloride_dinsmore_brook.pdf

TMDLs to address the contribution of deicing salts to benthic impairments. Implementation plans exist for Shingle Creek in Minnesota (2007[15]) and for impacted water bodies along the I-93 corridor in New Hampshire (2009[16]). It does not appear that results from these implementation plans are available at this time.

Further, there is not sufficient data to substantiate the conclusion that lower Accotink Creek is primarily stressed by chlorides. The stressor identification (SI) analysis concludes (Section 4.3.1, page 4-11) that although no continuous record of SC is available for lower Accotink Creek, that water quality standards for chloride are likely exceeded in lower Accotink Creek - based on similarity of ambient SC and TDS grab samples exceeding the ProbMon "suboptimal" and 90th percentile conditions. (Note: Figure 3-47 indicates no acute or chronic standards were exceeded in 2006-2007). This assumption ignores the known phenomenon of dilution on SC/TDS/chloride concentrations farther down in the watershed. This phenomenon is supported by comparing the concentrations of SC in upper Accotink Creek (Figure 3-48) to the range of concentrations observed in the much larger, and more dilute, lower Accotink Creek (Figure 3-49).

DEQ Response

There is no evidence from the monitoring data that chloride concentrations are diluted downstream. The difference in the range of chloride concentrations in Figure 3-48 and 3-49 is primarily due to the greater number of observations made in upper Accotink Creek (171) compared to lower Accotink Creek (23) and the fact that far few samples are collected in lower Accotink Creek than upper Accotink Creek during the winter months. As Figure 3-50 shows, no observations of chloride were made in lower Accotink Creek in February, the month where chloride concentrations in upper Accotink Creek are highest. The figure below compares the distribution of chloride concentrations under ambient conditions in upper and lower Accotink Creek. If there were downstream dilution, the lower Accotink Creek distribution would be expected to be shifted uniformly downward from the upper Accotink Creek distribution, but that is not the case.

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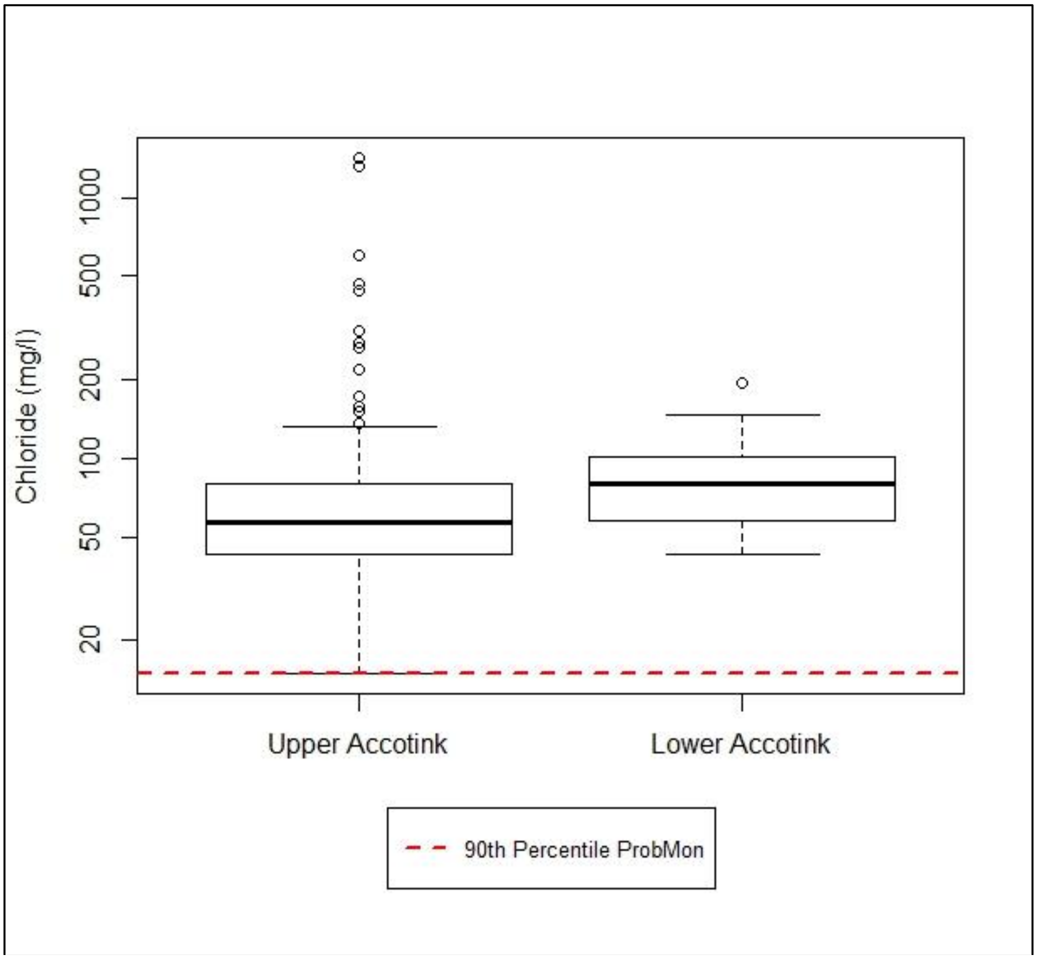
[13] Wenck Associates. 2006b. Shingle Creek Chloride TMDL Report. Maple Plain, MN. http://www.pca.state.mn.us/index.php/view-document.html?gid=8169

[14] Barr. 2010. Nine Mile Creek Watershed Chloride Total Maximum Daily Load Report. Minneapolis, MN. http://www.epa.gov/waters/tmdldocs/40253_final%20TMDL.pdf

[15] Wenck Associates. 2007. Shingle Creek Chloride TMDL Implementation Plan. Maple Plain, MN. http://www.pca.state.mn.us/index.php/view-document.html?gid=8173

[16] New Hampshire Department of Transportation. 2009. Implementation Plan to Increase the Efficiency and Effectiveness of Road Salt Use To Meet Total Maximum Daily Load For Chloride In Water Bodies Along the I-93 Corridor From Salem to Manchester, NH. http://www.rebuildingi93.com/documents/DOT%20TMDL%20Chloride%20Implementation%20Plan-Sept%202009.pdf



Distribution of Chloride Concentrations (mg/l), upper and lower Accotink Creek

There is little reason to suspect that dilution should occur. Since chloride is a conservative substance, all of the chloride upper mainstem Accotink Creek will reach the lower mainstem. The land use in lower Accotink Creek is similar to upper Accotink Creek. The percent of the lower watershed in impervious cover (28%) is a little less than the upper watershed (31%), but the percent of the land use which is developed or in the transportation sector is about the same. There is little reason to suspect that less de-icing salt is applied in lower Accotink Creek watershed or that less of it reaches Accotink Creek. Therefore, it appears likely that chloride concentrations in the lower mainstem will be comparable to the upper mainstem.

While it is DEQ's judgment that elevated chloride concentrations are a source of stress to the biological communities in lower Accotink Creek and in Long Branch, DEQ has decided to not move forward with developing chloride TMDLs for these two impaired watersheds unless the chloride impairment is corroborated by (1) continuous monitoring of specific conductance in Lower Accotink Creek and (2) collection of additional chloride samples to verify the predictive relationship between chloride and conductance in lower Accotink Creek and in Long Branch. DEQ will make an effort to collect the additional data this winter.

Below please find comments related to specific sections within the Stressor Identification Analysis for Accotink Creek Watershed report.

<u>Executive Summary</u>

- Page ES-4: The text refers to "twelve potential stressors" but only 10 are listed in Table ES-3 on page ES-5. Were two more stressors considered? If so, what were they?

  DEQ Response

  The document has been changed to say "ten potential stressors."

- Page ES-6: While there were four noted exceedances in the upper Accotink Creek watershed using the National Water Quality Assessment Program (NAWQA) dataset (please note comments below regarding this) this does not imply that such exceedances are "not infrequent occurrences."

  DEQ Response

  See response to the following comment.

- Page ES-6: The statement that there is "strong indirect evidence that exceedances of Virginia's chloride criteria are not infrequent occurrences" is misleading. There are only four observed exceedances of the acute criterion in Upper Accotink Creek. The conclusion drawn is based on a correlation between chloride and specific conductivity that does not take into account several potentially confounding factors, including the underlying geology. This could be rephrased as "suggest that exceedances of Virginia's chloride criteria may not be infrequent occurrences."

  DEQ Response

  The term "strong indirect evidence" has been changed to "indirect evidence." This indirect evidence describes the support for the claim that exceedances of Virginia chloride criteria occur frequently. The direct observed chloride concentrations show exceedances of the acute chloride criterion, but do not indicate the frequency of exceedances. Rather, the frequency of exceedance is based on indirect evidence given the strong correlation between specific conductance and chloride concentrations. There are sufficient observations of specific conductance at concentrations that imply, given the strength of the correlation between chloride and conductance, that Virginia's chloride criteria are exceeded in the winter months. As is discussed in more detail below (please see response on page 39), the relation between chloride and specific conductance is not confounded by geology in the Accotink Creek watershed.

2.2.3 Municipal Separate Storm Sewer Systems (MS4s)

- Page 2-22: Table 2-13 does not include the Virginia Department of Transportation, which holds a Phase II MS4 Permit. This permit needs to be included.

  DEQ Response

  Table 2-13 in the final stressor identification analysis report has been corrected to include the Virginia Department of Transportation permit. Thank you for identifying this omission.

3.1.2 EPA Biological Monitoring

- Page 3-11: The text states that "The EPA in conjunction with the USGS, began biological and water quality modeling in December 2005 ..." Should the word "modeling" be replaced with "monitoring?"

  DEQ Response

  Yes. The word "modeling" has been replaced in the text with "monitoring."

- Pages 3-11 and 3-12: The report heavily cites EPA's Selakumar [*sic*] et al. (2008) study in which the Environmental Protection Agency (EPA) and United States Geological Survey (USGS) monitored a section of stream in the upper Accotink watershed. This stream restoration was performed prior to development of more current practices and would likely be considered a stream stabilization today. The study's failure to acknowledge that design techniques have changed should be noted when drawing conclusions, particularly when discussing the success (or lack thereof) of stream restorations at reducing sedimentation.

  DEQ Response

  The stressor identification analysis is required to present all evidence from monitoring data. The EPA study includes biological monitoring data that DEQ used to assess upper Accotink Creek, and additional monitoring data that also should be considered in the stressor identification analysis. A summary of the findings of the EPA study are presented to provide the context for the monitoring data. The views of Selvakumar et al. are identified as their opinions and they play no role in any of the conclusions of the stressor identification analysis. Identification of the best restoration strategies is a topic outside the scope of the analysis but is appropriate in the context of TMDL implementation.

- Page 3-12: We agree with the statement that "it might take longer than two years of post-restoration monitoring for stream restoration to have a greater positive impact on the biological community." Therefore, any conclusions drawn from this study as to the lasting effect of these restorations on the condition of the benthic macroinvertebrate community should be avoided.

  DEQ Response

  Please see previous comment.

- Page 3-13: Tables 3-6 and 3-7 include data from the Selvakumar et al. (2008) study prior to the restoration. The SI report indicates that "the post-restoration monitoring results and metric scores were not available for analysis." Lacking this data it is difficult to draw conclusions from post-restoration data regarding the benthic community and/or its response to stream restoration.

  DEQ Response

  Please see previous comment.

3.1.3 Fairfax County Biological Monitoring

- Page 3-21: The statement that the blacknose dace (*Rhinichthys atratulus*) is almost absent in the lower mainstem of Accotink Creek is not accurate. This species has been found in lower Accotink Creek by FCDPWES staff on many occasions since 1999. For more information, please see: http://www.fairfaxcounty.gov/dpwes/stormwater/fishiminnows.htm

DEQ Response

The statement is based on Table 3-14 in the final stressor identification analysis report, which is a summary of the fish monitoring data provided by Fairfax County. The phrase "almost absent" may be a poor choice of words, and has been replaced by "observed far less frequently" in the report.

- It is likely that the distribution and abundance of fishes in either the upper or the lower section of Accotink Creek is due to the Lake Accotink impoundment (which is a fish migration barrier) or to the relative catchment size at a particular sampling point, and not necessarily correlated to pollutants that may be found in the waterway.

DEQ Response

The following sentence has been added in the report: "Lake Accotink acts a fish migration barrier and may contribute to patterns of distribution or abundance in the Accotink Creek watershed."

3.1.4 Volunteer Monitoring

- Page 3-23: The heading of the sixth column in Table 3-15 should read "Calamo Branch," not "Calemo Run."

DEQ Response

The heading has been changed in the report as recommended.

3.3.1 DEQ Geomorphic Assessment

- Pages 3-35 to 3-36: The text references bankfull return intervals as being 1.5 to 2 years. This continues to be a widely cited, yet we believe outdated, concept based on results from annual maximum series (AMS) calculations. AMS calculations cannot provide return intervals of a year or less and characteristically provide unreliable or skewed data for any actual intervals less than 10 years. We believe it would be more correct to state that actual occurrences of bankfull discharge can be more frequent, but that annual maximum series calculations often provide bankfull return intervals of 1.5 to 2 years. This is importance because channels designed on the basis of bankfull flow occurring at 1.5 to 2 year returns are likely to be over dimensioned to support a desirable benthic fauna.

DEQ Response

It is correct the 1.5 to 2 year estimate of bankfull return intervals is based on the annual maximum time series. Since the bankfull return period is not used in any calculation and full discussion of the calculation of the bankfull return period would be a digression from the discussion, references to the return period have been deleted from the report.

- Page 3-37: The three sites included in Table 3-23 are located in the downstream section of the watershed. Specifically, sites 1AAC0006.10 and 1AAC0004.84 are located next to or just within the coastal plain physiographic province where the system is naturally flatter and aggrading. It appears the LRBS is applied across physiographic provinces without regard to differences in substrate, geology and watershed slope factors. If that is the case, it should be noted that estimating and comparing bed stability conditions at sites across widely differing ecoregions/provinces is not a valid approach to geomorphic assessment. More analysis should be conducted, particularly in the upper watershed (which is in the Piedmont physiographic province) in order to develop an effective sediment TMDL towards which restoration progress can be accurately measured.

DEQ Response

The LRBS is based on the physics of sediment motion, which equates the shear stress of bankfull flow with the stress necessary to move particles of a certain size. Given its general nature, this relation should hold across physiographic provinces. Slope is taken into account in the calculation of the shear stress of bankfull flow, where the channel slope should reflect the bed slope. The roughness coefficient can also take into account local features.

- Interpretation of the 4 LRBS data points as indicating 'a stable channel bed' with bed materials akin to 'mountain streams' may be an overstatement. Bed stability should be reported based on the weight of all evidence, not a single metric sampled on a particular bed formation at a limited number of sites. For example, the bed is clearly unstable at locations where 12 headcuts were inventoried and reported by CH2MHILL (2005). CH2MHILL also reported a general presence of 'large unstable sediment bars.' Sediment moves through eroding systems as slugs and in waves through time. Therefore, portions of the bed are excessively mobile and others, as indicated by the reported LRBS scores, are highly armored at any given time. Further, LRBS scores are sensitive to assumptions made regarding channel bankfull dimension, which is notoriously difficult to properly assign in actively eroding urban channels. If the LRBS riffles that were studied are in fact stable, then the details of their particle size distribution and bankfull dimensions and field indicators used are of great interest to stream restorationists. We request DEQ provide the locations, data, and calculations used to arrive at the reported LRBS scores.

DEQ Response

The goal of the stressor identification analysis is to (1) present all of the evidence from monitoring and other studies of the watershed, and (2) weight the evidence to determine which stressors are most likely contributing to the biological impairment. This section is presenting LRBS analysis of relative bed stability. In Section 4, where the stressor identification analysis takes place, the conclusions of the LRBS analysis are weighed against other evidence, such as Fairfax County's Stream Physical Assessment (SPA). More weight is given to the SPA study in determining that sediment is in fact among the most probable stressors of the biological community in Accotink Creek. A map showing the locations where the data for the LRBS analysis was collected has been added to the stressor identification report. Information pertaining to the station locations, data, and calculations are provided in Appendix B.

- Page 3-37: the report states "Since the LRBS scored for Accotink Creek assessments are above -0.5, they indicate that the mainstem Accotink Creek is not carrying excessive sediment loads. The large LRBS values found in Accotink Creek are more typical of steep mountain streams and indicate significant armoring of the bed." The statement that the creek "is not carrying excessive sediment loads" seems to directly contradict the report's own finding that excess sediment is a major stressor to the aquatic life use in Accotink Creek.

DEQ Response

See previous response. The comparison of the stability of Accotink Creek with mountain streams is unnecessary and has been deleted from the report. The report has been edited to make it clear that the conclusions in the DEQ Geomorphic Assessment section are the results of the LRBS analysis, not of the stressor analysis as a whole. Furthermore, text has been added to clarify the interpretation of LRBS results in urban watersheds. In such watersheds, positive LRBS scores may indicate streambeds that have been armored as a result of flashy storm flows that erode banks and remove fine-grain sediment from the stream reach.

- Page 3-38: Table 3-25 shows the total stream length inventoried by CH2MHILL (2005) as being in channel evolution model (CEM) Stage III (widening/bank erosion). No summary statistics are provided or described regarding this data, but the narrative subsequently provides statistics on the number of reaches and percentage of stream length inventoried in the same 2005 study as 'moderate to severe' erosion defined as sites with erosive faces 2-3 feet high. The implications or rationale behind this categorization is not described. Only 1% of the total assessed stream length was reported as having greater than 2 feet of erosion. Some readers may easily miss the fact that the data in Table 3-25 indicate that 334,754 of 370,500 linear feet of stream channel was reported to be eroding by widening. In fact, bank erosion is such a significant and pervasive problem in the Accotink drainage network, we suggest adding a bullet to the sediment conclusions on page 4-15 that 90% of the channel length assessed was categorized as having bank widening (CEM Type III).

DEQ Response

The report has been modified to say over 90% of the channel length assessed was Type III. The CEM is the first (and most prominent) evidence presented for excess erosion and sediment transport in Section 4.3.4. The bulleted items are described as corroborating evidence. The characterization of 'moderate to severe' erosion is taken from the SPA (Appendix A p.40). Since the SPA habitat assessment reports bank instability is widespread, much of the bank erosion is probably less than 2-3 feet in height.

3.3.3 EPA Particle Size Analysis

- Page 3-40: It is likely that the in-stream particle size analysis that resulted in a similar finding of particle size distributions (pre and post restorations) can be attributed to the 70-year storm event (and floods) that took place in June of 2006. The report states "These results may suggest that there is significant temporal variation in the amount of sand and fine-grained sediment at a given location." The results of this analysis may be considered inconclusive based on the confounding factors mentioned here and in the comments regarding section 3.1.2.

DEQ Response

The hypothesis that there is significant temporal variation in the amount of sand and fine-grained sediment at a given location seems consistent with the comments on Section 3.3.1, especially the claim that "[s]ediment moves through eroding systems as slugs and in waves through time." The SI report is only suggesting that, in contrast to the conclusions of Selvakumar et al., the increase in sand and fine sediment is not necessarily due to the restoration work because it also occurred at a site upstream of *the restoration. It is not clear how the occurrence of the 70-year storm resulted in similar particle size distributions pre- and post-restoration.*

3.4 Flow

- Page 3-43: The report uses paired gage data to assert that flow percentiles from the gage on the mainstem of upper Accotink Creek near Annandale "can be used as an index of hydrological conditions for the lower mainstem." This assertion is supported by paired gage data from the upper and lower mainstem when there was briefly a gage on the lower mainstem between 1949 and 1956. Considering the intensive degree of urbanization that has occurred since 1956 (particularly in the upper watershed), this conclusion does not seem valid. Additionally, these gaging stations are/were situated in different physiographic provinces with different hydrologic characteristics. The assumption that the upper and lower mainstem of Accotink Creek are similar in hydrologic condition is in the foundation of the report's analysis of water quality monitoring data and is not supported with long-term data.

DEQ Response

The purpose of this analysis is to determine if storm events in lower Accotink Creek occur if and only if storm events occur in upper Accotink Creek. At issue is the effect of Lake Accotink on the peak storm flow. Figure 3-9 shows that as percentile flow increases, the flow percentiles tend to converge, and there is relatively good agreement that if the upper Accotink Creek is experiencing flow above the 90th percentile, so is the lower Accotink Creek, and vice versa. Since, as Figure 3-9 shows, the convergence improves as the flows approach the maximum flows, a shift in the 90th percentile flow upwards, which has occurred with increased development since 1956, likely has increased the convergence in upper percentile flows. The comment overstates the importance of using the 90th percentile flow at USGS gage 01654000 to identify storm flow conditions. First, the report states this is only an approximate way to identify storm flows, even in upper Accotink Creek. Second, the main use of this classification is to eliminate samples suspected of occurring during storm events when Accotink Creek observations are compared to ProbMon thresholds. The only candidate stressor where comparison with ProbMon thresholds plays a key role is nutrients; for other stressors and water quality constituents, the comparison plays primarily a descriptive role. Moreover, since there was not extensive storm sampling conducted in lower Accotink Creek, the use of the upper Accotink Creek gage to identify samples collected in lower Accotink Creek under storm conditions is less critical.

- Page 3-44: The title on Figure 3-8 seems to be incorrect and should be replaced with the title on Figure 3-9. An appropriate title referencing flow percentiles should be used for Figure 3-9.

DEQ Response

Thank you for pointing out that these figures (that are now Figure 3-10 and Figure 3-11, respectively) have the wrong captions. They have been corrected in the report as suggested.

3.5 Analysis of Conventional Water Quality Monitoring Data

- Page 3-50: Although the narrative in this section states that "only samples collected under ambient or baseflow conditions were compared to the ProbMon suboptimal thresholds or the 90th percentile ProbMon concentrations," it goes on to state that "in the sections that follow, time series plots will represent observations taken under all hydrological conditions." This is confusing, as time series plots of the (ambient) grab samples appear to include only spring and fall non-storm event samples rather than samples under all hydrological conditions.

DEQ Response

The time series plots contain all of the observations taken from grab samples, regardless of hydrological conditions. The box-and-whisker plots excludes samples taken when the flows at USGS gage on Accotink Creek near Annandale (01654000) is greater than 90th percentile flow. When the number of observations above or below the ProbMon suboptimal threshold or 90th percentile concentration is reported, it includes only observations taken from samples collected under baseflow conditions.

- Flow data for both the USGS gages (upper mainstem near Annandale & Long Branch) are accompanied by this statement: "NOTE: During storm events, backwater effects on stage and discharge determinations at this station are likely. Streamflow data displayed on this page may be significantly different from actual values during these events. Adjustment of data for backwater effects can only be done after detailed analysis. Users are encouraged to contact this office for more information." Has the stressor analysis accounted for these necessary corrections?

DEQ Response

This warning applies to current conditions data on the webpage, not historical data. Generally, flow data remains provisional until reviewed by the USGS after the water year is concluded. Even after review, some observations can still be flagged as "estimated." The stressor identification analysis used final data for water years prior to 2014 and provisional data from water year 2014. The water year 2014 data were not yet finalized by the USGS at the time the analysis for the stressor identification was completed. No corrections were applied to the provisional data, since that requires the expertise of the USGS. It is noted that the most recent flow data will be obtained and used in the development of the TMDLs.

- For the USGS gage on Long Branch, in addition to the continuous record of water quality parameters, the jointly operated monitoring study also collects monthly grab samples. Four of these monthly samples per year are targeted for wet weather samples. Does the stressor analysis account for these non-ambient samples and screen them out of the dataset before comparison to the ProbMon 90th percentile values (eg. Figure 3-64)? We believe this is necessary for data comparability.

DEQ Response

Yes, Long Branch samples were screened before comparison with ProbMon 90th percentile concentrations.

<u>3.5.4,5 & 6 Specific Conductance, Total Dissolved Solids and Chloride</u>

- More clarity is needed in the text and regarding the use of the NAWQA data (Sections 3.5.4 and 3.5.6). We believe the cluster of samples taken in early 2014 is of concern. It's not clear if they are independent observations and most of the exceedances were observed during a short period of time; were multiple samples taken during the same storm event, or are these separate storms? If taken during separate events, was there enough time between storms for the four data points to be considered independent and thus representative of a pattern of problems vs. a problematic year?

DEQ Response

The following table shows the dates of chloride concentrations exceeding the acute criteria in 2010 and 2014:

Date	Chloride Concentration (mg/l)
2/2/2010	1320
2/19/2014	925
3/5/2014	1410
3/19/2014	977

The acute criterion states that there can be no more than one exceedance in a three year period. Three samples taken in 2014 two weeks apart exceed the criterion. This is sufficient by itself to assert that Accotink Creek is not supporting water quality standards to protect aquatic life because of high chloride concentrations. The point of using the specific conductance continuous monitoring data and the conductance-chloride relation to estimate chloride concentrations is to show that conditions in 2014 are not an anomaly.

- It is unclear based upon the stressor report if DEQ regularly takes direct measurements of chloride when taking water quality samples. In Virginia's 2012 Integrated Report — Probabilistic Monitoring Chapter, DEQ indicates they test for TDS (ionic strength) but did not publish any data regarding direct measures of chloride in streams, nor do they state that the ProbMon program makes direct measures of chloride. The USGS water quality samples processed by the Fairfax County Water Quality Lab do not measure chloride, and FCDPWES does not measure chloride. The USGS data from the NAWQA sampling program do measure chloride. However, only 6.2% (11 of 178) samples were above the chronic threshold from 2001-2014. There were only 5 samples above the acute threshold over the same period (2.8% of samples, or 5 of 178). Therefore, most of the evidence of chloride levels exceeding the standards are actually projections tied to conversions based upon a SC-chloride relationship and not from direct measurements. Monitoring from DEQ and USGS programs indicate that instances of SC >2,850 are not common.

DEQ Response

Table 3-29 in the final stressor identification analysis report, shows the number of observations of each constituent by agency. About 20% of the samples collected by DEQ are analyzed for chloride. About 60% of the water quality samples collected in the ProbMon program were analyzed for chloride[17]*. The evidence for chloride exceeding water quality criteria are based on the observed chloride concentrations. The determination of impairment for chloride is not based on a 10.5% exceedance rate as is done for select conventional parameters, such as temperature. Rather, the water quality standards stipulate there can be no more than one exceedance of the one-hour average in a three year period for the acute criterion, and no more than one exceedance of the four-day average for the chronic criterion. The SC-chloride relation is used to show that the exceedances of the criterion are not unusual. Please*

[17] Jason Hill, DEQ, Personal communication. August 2015.

see the response to the previous comment. SC measurements in excess of 2,850 µS/cm occur in every year in which there was continuous monitoring of SC, both in Accotink Creek and Long Branch. See Figures 3-38 and 3-40 in the report. The commenter is correct to say that most of the chloride data used in the stressor identification analysis was collected by the USGS NAWQA program. Based on the data provided by the USGS for the stressor analysis, the NAWQA program reported 180 observations of chloride from 2001 through July 15, 2014, with five exceedances of the acute criterion and 11 observations above the 230 mg/l chronic criterion. The data record provided by the USGS includes data that are outside of the 2004 through 2014 data window analyzed in the stressor identification report.

- 90th percentile ProbMon measurements were exceeded on a more frequent basis, but those data are collected in spring and fall (see page 3-49) and do not follow storm events. These samples were compared to samples in winter following storm events, when there are spikes in SC. This discrepancy confounds the comparison between the two data sets, and does not take seasonal and storm differences into account; i.e. winter storm samples could very well be outside of normal summer base flow conditions without chloride.

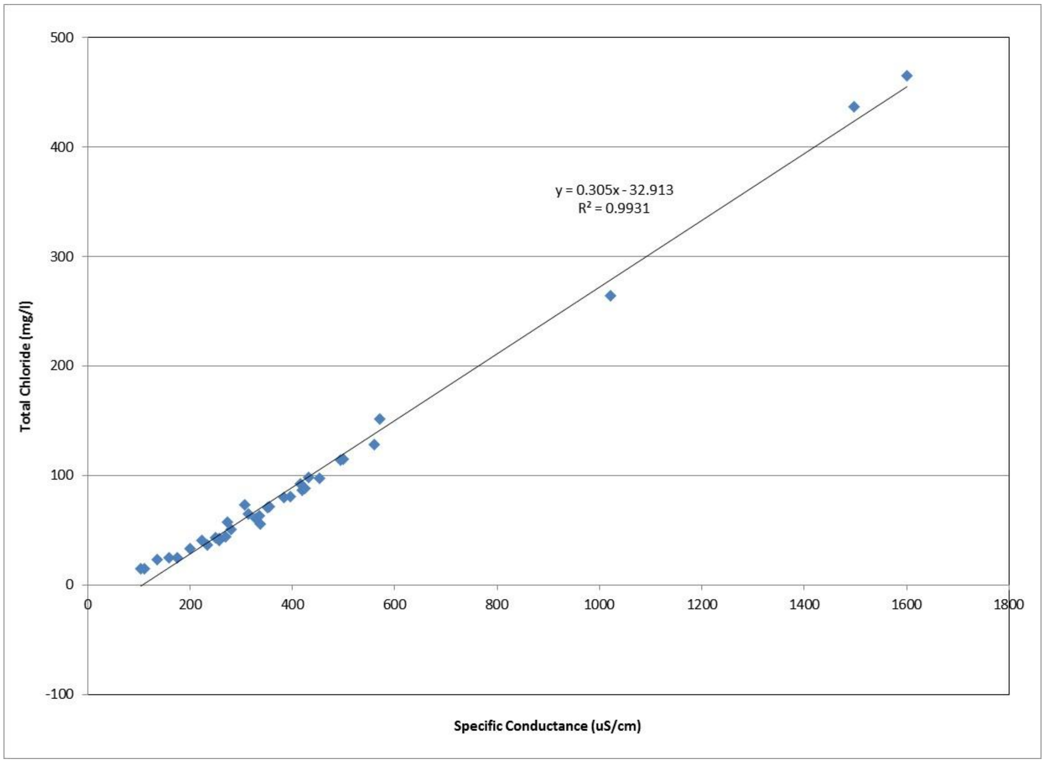
DEQ Response

The 90th percentile concentration of the ProbMon data is used as a benchmark for identifying concentrations of constituents that may be high relative to concentrations found elsewhere in the Commonwealth. In the case of chloride, the only conclusion drawn from the comparison with the 90th percentile chloride concentration and monitoring data is that chloride concentrations observed in Accotink Creek under base flow or ambient conditions are uniformly high, regardless of season. All such observations in lower Accotink Creek and all but two such observations in upper Accotink Creek are larger than the 90th percentile concentration of the ProbMon data. This analysis excludes chloride samples taken during high flows.

- Page 3-77: In the regression equations on Figures 3-48 and 3-49, there are only four data points in the entire dataset (all in upper Accotink) that show the observed SC vs. chloride relationship above 2,500. These outliers appear to be driving the slope of the regressions and their low variance. This should be investigated further prior to using these regressions to establish TMDL allocations.

DEQ Response

An analysis using only DEQ data collected in Upper Accotink Creek has almost the same slope (0.305) and the same tight relation (R^2 = 0.99) between chloride and specific conductance. The maximum SC value is less than 2,500 µS/cm. Therefore, the validity of the regression holds true throughout the range of observed chloride and specific conductance data. See figure below.



Correlation between Total Chloride and Specific Conductance, Upper Accotink Creek (DEQ Monitoring data only)

- SC Exceedances will likely not appear in routine monitoring data - exceedances only appeared four times in DEQ routine monitoring through the period of analysis (Figure 3-48), and appear to be associated with spikes in SC following snow melt events (Figures 3-38 and 3-40).

  DEQ Response

  It is quite likely that winter spikes in SC occur primarily after melt events; however, Accotink Creek and Long Branch are still required to meet water quality standards under those conditions. It should be noted that the four exceedances of the acute chloride criterion shown in Figure 3-48 are from monitoring data collected by the USGS NAWQA program, not DEQ.

- Fairfax County water quality monitoring data also indicates that background levels of SC are likely tied to the underlying geology, using physiographic province as a determinant. For instance, the annual average SC levels (from quarterly monitoring) are approximately twice as high in the Triassic Basin compared to the rest of the Northern Piedmont. Likewise, the Coastal Plain SC levels are typically lower than those found in the non-Triassic portions of the Northern Piedmont. However, many of the taxa sampled through benthic surveys are found among all three physiographic provinces. Below is a summary table of the over 2,200 direct measures of SC from 2005 through 2014. Using the measured SC values to determine chloride concentration (using the regression equation provided by the SI report), on only two occasions did the modeled chloride levels exceed the acute concentration threshold (2009, 2014). Both occurrences were in Horsepen Creek, within the Triassic Basin portion of the Northern Piedmont.

Annual Mean Specific Conductance (n, samples collected 2005-2014)			
Physigraphic Province	**Bacteria (Quarterly)**	**Benthics (Mar15-Apr15)**	**Fish (August)**
Coastal Plain	239.3 (81)	254.4 (83)	200.1 (83)
Piedmont	301.3 (559)	361.5 (564)	234.8 (564)
Triassic	620.5 (93)	1002.2 (93)	434.3 (93)

While these data suggest that concentration of dissolved solids is greatly tied to the physiographic province, the stressor analysis does not include any discussion of the sensitivity of specific benthic taxa to changes in chloride, SC, or TDS among the different provinces. Benthic taxa may be more sensitive or resilient to changes in areas with higher background levels of chloride. At a minimum, the distinction between upper and lower Accotink Creek should follow the physiographic boundaries.

DEQ Response

This analysis of the relation between dissolved solids and physiographic province is interesting and useful, but it has limited relevance to the stressor identification analysis. Upper Accotink Creek and Long Branch are wholly within the Piedmont physiographic province. Part of the lower Accotink flows through the Coastal Plain and part of its watershed, particularly Long Branch South, lies in the Coastal Plain. At the downstream extent of the impairment, 78% of the lower Accotink Creek watershed is in the Piedmont. The percent of the watershed in the Piedmont increases moving upstream, so that the watersheds upstream of DEQ biological monitoring locations are more and more dominated by Piedmont sources: both the flow and chloride observed at DEQ monitoring locations in lower Accotink Creek are predominately derived from the Piedmont. Physiographic province probably should be taken into account when the sources of chloride are identified and quantified for the TMDL, particularly in Long Branch South. The relation between SC and chloride determined for upper Accotink Creek (shown in Figure 3-48) or by Sanford et al. (2012) were confined to data from the Piedmont. The regression equation for the lower Accotink Creek watershed shown in Figure 4-49 used seven samples taken from Long Branch South. If the samples from Long Branch South are removed from the analysis, so the data used in the regression comes from a single physiographic province, the regression model has a slope of 0.2985, which is still consistent with the assumptions of the stressor identification report. Background chloride concentrations, however, are not the issue in the stressor identification analysis of chloride. At issue is the very large increase in chloride concentrations in the winter months. Even if benthic taxa adapt to background levels of chloride in different physiographic provinces, they are unlikely to be resilient to increases in chloride concentrations of one or more orders of magnitude in the winter.

- If DEQ plans to pursue the establishment of chloride TMDLs, it may be more appropriate to establish a state-specific chloride standard using more recent data. Section 4-9 of the stressor analysis says "[Chloride] criteria are ... derived from toxicological studies on a wide variety of aquatic organisms." This statement is not accurate; the 1988 EPA standard was made using the limited data available at that time:

- The 1988 acute EPA standard was based off 12 genera (13 species, which includes *Daphnia magna* and *pulex*), of which only the four most sensitive genera were used to calculate the standard (which includes the *Daphnia* genus) (rf. EPA 1988, Table 3, pp. 17-18; and EPA 1985* p.16). The four used were: *Daphnia sp*., *Physa gyrina* (snail), *Lireus fontinalis* (isopod), and *Cricotopus trifascia* (midge). At this point, one would think that there would be hundreds of genera for which LD50 chloride values are available, many of which would be specific to the Piedmont and Coastal Plain.
- The 1988 chronic standard was only based off 3 species, which are not the same used to create the acute criteria (rf. EPA 1988, Table 3, pp. 17-18). The data here was extremely limited. The three used were: *Daphnia pulex*, *Pimephales promelas* (Fathead Minnow), and *Salmo gairdneri* (Rainbow Trout).
- Generally, because there are so few genera and species in the 1988 analysis, the criteria is sensitive to the particular species used. For example, if you exclude *Daphnia*, which is not a macroinvertebrate or fish, the acute criterian [*sic*] increases from 860 to 1140, about a 1/3rd higher. Also, dropping Daphnia from the chronic criteria leaves only two fish species, and decreases the criteria from 230 to 170, about 1/4th lower.

DEQ Response

Virginia's regulatory water quality criteria for chloride in freshwater are 860 mg/L acute (short term exposure, 1 hour average) and 230 mg/L chronic (long term exposure, 4 day average). These are based on EPA's recommended criteria for chloride published in 1988 and these remain EPA's current recommended criteria for chloride in freshwater. These criteria were developed following the EPA guidelines for deriving numerical national water quality criteria for the protection of aquatic organisms which were developed by EPA in 1985 and with some modifications these guidelines are still the recommended method for developing water quality criteria to protect aquatic life.

Briefly, the criteria guidelines require a literature search of toxicity literature to identify all available toxicity information that are of a quality that can be used to calculate water quality criteria. The guidelines require that valid toxicity data must be available for a wide variety of aquatic life, specifying that toxicity data for certain specific types of species are required, including several fish, invertebrates, insects and crustaceans. This is to try to include representative species for different types of aquatic life that fill different ecological niches so that the criteria should be protective of most of the aquatic community. A minimum of eight different genera are required to calculate criteria.

A dataset is collected of all the genera and ranked in sensitivity based on the genus's mean LC50 value (a concentration that was lethal to 50% of the individuals in an acute toxicity test). This acute toxicity dataset is used to establish the range in sensitivity of different aquatic genera. The criterion is intended to provide protection to 95% of the overall dataset, in order to protect most, but not all genera, with the 5% most sensitive genera remaining under protected. This dataset of genera and their acute values are used to calculate the fifth percentile value, and then the criteria.

Unless there are acceptable toxicity data available for more than sixty different aquatic genera (which is almost never the case), the estimate of the fifth percentile acute value is calculated based on the acute values of the four most sensitive genera in the dataset, and the total number of genera in the dataset. These data are used to calculate the *cumulative probability of 0.05 in the acute toxicity values for the genera in the toxicity dataset for the toxic substance. This method calculates a Final Acute Value (the estimate of a concentration of the toxic substance that will be lethal to 50% of exposed individuals of a genus that is ranked as being the fifth percentile in the distribution of sensitivities). This Final Acute Value is an estimated LC50 value (a concentration that would be lethal to 50 percent of exposed individuals), so it is divided by two to convert it into a concentration that should cause little or no lethal effects, and thus it should provide the desired protection when used as the recommended acute criterion concentration. To calculate a chronic criterion concentration, the Final Acute Value is usually divided by an "acute to chronic ratio" which is a ratio of lethal effects noted in acute, short term exposure tests (a LC50 value) divided by a concentration of the toxic substance that caused adverse effects (usually death, reduced growth or reduced reproduction) as observed in longer (chronic) toxicity tests. This method is intended to use the acute toxicity dataset as a basis for understanding the distribution of toxicity sensitivities, then using the observed relationship between acute and chronic toxicity to calculate the chronic criterion. This is the most common method of calculating water quality criteria and most of EPA's recommended water quality criteria are calculated using this method. Good quality chronic toxicity tests are difficult and expensive to perform and there are generally few chronic toxicity tests available for any toxic chemical.*

Only a relatively limited number of species are amenable to reliable rearing and maintenance in a laboratory setting, and/or can be reliably used in toxicity testing procedures. There will always be relatively fewer toxicity data on fewer species and genera in comparison to the very large number of aquatic species. Any species for which we have valid toxicity data is considered to be a reasonable surrogate for other, related but untested species.

The comment is correct in noting that the dataset for chloride in the 1988 criteria document is relatively small, with toxicity data for 13 species and 12 genera. However, this is not unusual and it meets the criteria guidelines of a minimum of eight genera and there is wide diversity among the different genera and the diversity is sufficiently comprehensive to meet the requirements of the guidelines for deriving criteria. Five fish genera, as diverse as trout and American eel are included in the dataset. Also included are four insects, a snail, an isopod and a planktonic crustacean. All of these tested species are surrogates for the thousands of untested species. A larger dataset with newer toxicity data for additional genera is not necessarily expected to result in revising the criteria to allow higher criterion concentrations of chloride.

A review of the available toxicity in the EPA chloride criteria's dataset indicates that there is relatively little variation in the sensitivity between many of the species, despite the widely different types of species tested. The most tolerant species (American eel) has an LC50 value only six times higher than the LC50 value of the most sensitive genera (Daphnia). The most sensitive 50% of the dataset are all invertebrates and are all are acutely sensitive within a factor of 2.5 of each other. This suggests that invertebrates are more sensitive than fish and that the sensitivities of many diverse invertebrates are similar.

EPA has been working on developing revised water quality criteria for chloride since at least 2007. Currently, additional toxicity tests are being conducted to gather new information, but EPA has not finalized any recommendations for revising the criteria for chloride at this time. The most recent dataset compiled of acute toxicity data for chloride included acute LC50 values for 29 different genera, compared to 12 in the 1988 criteria *dataset. Toxicity data for several new genera have been added that are more sensitive than the four most sensitive genera (which are used to calculate the criterion) in the 1988 dataset. A fingernail clam (Sphaerium tenue) and the crustacean Ceriodaphnia dubia are both more sensitive than the ranked #1 most sensitive genus (Daphnia) in the 1988 dataset and a mussel (Lampsilis fasciola) would have raked #2 in the 1988 dataset. In all, 11 of the 29 genera (38% of the genera) in the new dataset are more sensitive than the #4 ranked most sensitive genus in the 1988 dataset. These sensitive genera include; two genera of snails, a second mussel genera, an isopod, a copepod, a leach and a frog.*

These new, lower LC50 values in the revised chloride toxicity dataset would have the effect of lowering a revised final acute value and the acute criterion. Considering the most recent dataset compiled by EPA, the newer data indicate that a revised acute criterion would be about 40% lower than the 1988 criterion. A quantifiable relationship was observed between hardness and chloride toxicity for some of the species, and if this hardness-effect is used to adjust the LC50 values to the hardness of Accotink Creek (85 mg/L), a Final Acute Value would be 1052 mg/L (compared to 1720 mg/L in the 1988 criteria) and the acute criterion would be 530 mg/L compared to 860mg/L in the current Virginia water quality standards.

However, all of this is just hypothetical at this time, because EPA is currently conducting additional toxicity tests and has not released any official recommendations regarding revised criteria for chloride. The available information does suggest that any future revision of the chloride criterion may not be extremely different in magnitude from the current criteria concentrations. Adopting new or revised criteria for chloride, or any toxic chemical is a complicated process requiring at least two years and requires final approval by EPA before any revised criteria can be used in a regulatory manner. This leaves us with the current chloride criteria that are part of Virginia's water quality standards and, in accordance with the Clean Water Act, a TMDL must be developed to determine chloride loads consistent with meeting those standards.

4.3.1. Chloride

On page 3-78, Cl:SC conversion factors of 0.33 (Difficult Run), 0.31 (Upper Accotink Creek) and 0.29 (Lower Accotink Creek) are introduced. The same factors are restated on page 4-10, however a new factor of 0.3 is introduced and it is not clear where it came from or why it is applied to the SC timeseries data for Upper Accotink Creek and Long Branch. It would be helpful if the predicted Cl timeseries in Figures 4-1 and 4-2 included a footnote describing which conversion factor was applied.

DEQ Response

The three slopes all round to 0.3 to the nearest tenth. For that reason, 0.3 was used to estimate chloride concentrations from specific conductance. The sentence "[t]he three CL:SC ratios all round off to 0.3 to the nearest tenth," has been added to the report.

Organization: Citizen
Contact: Chris Ruck
Received on: August 5, 2015

As a resident of the City of Fairfax, living within the Accotink Creek watershed, I wanted to submit my comments in response to the Public Notice of the draft stressor identification analysis. Please find these below:

<u>Metals and Toxic Chemicals</u>:

The stressor identification report (The Report) bases some of the analysis of metals and toxics monitoring data (section 3.6) on fish tissue samples. The statement "Ambiguous results from the toxicity tests and the fact that toxics concentrations in the sediment were below the PEC benchmarks indicate that toxics are not a major stressor of the biota in the AC watershed," is technically correct. While the evidence, as presented, does not provide a compelling case that toxics should be classified as a "possible stressor" in Accotink Creek, is does not preclude that from being a stressor either and more appropriate data should be gathered.

The Report is flawed in its use of fish tissue samples taken from migratory and stocked species, American eel and rainbow trout, respectively. Metals and toxics (or lack thereof) in these organisms are likely <u>not representative</u> of Accotink Creek. These two species make up almost half of the tissue samples assessed.

- 26.9 % (18 out of 67) of the fish tissue samples were obtained from stocked rainbow trout. There are no naturally reproducing populations of rainbow trout in the Accotink basin and no determination of the length of time these trout were residing in Accotink Creek (eg. correlation of otolith microchemistry with bioaccumulation of toxics). Therefore, one cannot assume that any bioaccumulation (or lack thereof) of metals and/or other lipid-bound toxic chemicals represents the water quality of Accotink Creek and not the originating hatchery. Including the rainbow trout tissue samples in the current analysis confounds any collective results of fish community due to the question of actual sample representativeness.
- 19.4% (13 out of 67) of the fish tissue samples were obtained from American eel. These fish are highly migratory and travel thousands of miles across salt, estuarine and fresh waters as part of their life cycle and may encounter a suite of concentrations of lipid-binding toxic chemicals. For instance, any eel present in Accotick [*sic*] Creek has migrated through the tidal Potomac River for which there is/are TMDL(s) for toxic chemicals and/or metals. Without a better understanding on the length of exposure one cannot make an assumption regarding the contribution of toxics to fish tissue in Accotink Creek.
- For future TMDL stressor analyses, these two species (stocked trout or migratory eel) should not be used when making water body-specific stressor determinations based on tissue toxicity tests.

Additionally, The Report incorporates the Bailey (2005) study in section 3.6.3, "Toxicity Tests," which used fathead minnows (*Pimphales promelas*) to determine the toxic effects of water from Accotink Creek on fishes. According to Fairfax County's biological monitoring program (1999-2013), fathead minnows have never been found within the Accotink drainage and are a rare occurrence for the county. This species is native to the Tennessee River drainage in the Southwestern part of the state, but has been introduced in some locations throughout Fairfax County. Using this species as the basis for biologic toxicity tests for Accotink Creek may not be appropriate, because species native to Accotink Creek may be more or less sensitive. The toxicity study (and future toxicity studies) should have been conducted using either ubiquitous or known sensitive fish taxa found within Fairfax City/County.

<u>Chloride</u>

There is much to address in this section of The Report, but I believe a number of other agencies will be addressing Chloride. However, in general, The Report uses an approach that correlation is causation regarding Chloride levels as being a primary stressor for benthic impairments. This is not sound science. The connections between specific conductance and chloride, and the upper and lower Accotink are not well founded (Ex. there were no events in the lower Accotink that exceeded the acute standard). In the future DEQ should help fund a Chloride probe at the USGS gauging station. Once this is implemented real-time tracking of Chloride levels (and loads) could be calculated.

<u>EPA biological Monitoring Section</u>:
The Report heavily cites EPA's Selakumar [*sic*] et al. (2008) in which the EPA and USGS monitored a section of stream in the upper Accorink [*sic*] watershed in the City of Fairfax. There are many problems with this EPA report and any conclusions drawn from them should be used with care. The modifications to the stream itself were largely focused on stream bank stabilization and not a reconnection of the stream to the floodplain or an improvement of benthic habitat. Further, there are many factors confounding the EPA document that were not addressed in the research or conclusions.

First, the City of Fairfax continued developing open space in the headwaters of Accotink Creek, upstream from this restoration location throughout the study period. Additionally, the stream reach immediately upstream of all monitoring locations (upstream of Lee Hwy in Ranger Road Park) underwent a restoration project (2002-03) prior to the restoration in the EPA study (2006). The Ranger Road Park restoration project was poorly designed and/or constructed, with many in-stream structures and stream banks failing and/or eroding almost immediately. This led to a net increase in sediment export from this upstream section of Accotink Creek directly into (or through) the Selakumar [*sic*] et al. (2008) study reach. A portion of the stream bank within Ranger Road Park was monitored with bank pins and lost approximately 0.5 meters of stream bank over a 1-yr period in 2006-07. The lack of acknowledgement to these major contributors of upstream sediment, known to affect the benthic community, undermines much of the EPA report's conclusions, particularly when discussing the success (or lack thereof) at reducing sedimentation.

The Report (stressor analysis) indicates "it might take longer than two years of post-restoration monitoring for stream restoration to have a greater positive impact on the biological community". However, The Report does not cite any studies indicating a benthic rebound due to restoration or any lag time associated with that. The Report also states that "the post-restoration monitoring results and metric scores were not available for analysis". Having post-restoration data from the Selvakumar et al. (2008) study is essential to evaluate any conclusions on the benthic community or its response to this stream restoration. Therefore, there is no evidence to support the notion that a stream restoration project will help a macroinvertebrate community rebound. Further, there is no evidence presented that restoration projects in urban streams can achieve lift in the benthic community. If a TMDL load allocation for sediment is to be developed, a stronger link between the restoration of degraded systems with benthic community improvements must be shown.

Long Branch: There is very little information provided regarding Long Branch.

DEQ responses to the above comment letter are provided below. Each specific comment from the letter is repeated, with the DEQ response following.

<u>Metals and Toxic Chemicals</u>:

The stressor identification report (The Report) bases some of the analysis of metals and toxics monitoring data (section 3.6) on fish tissue samples. The statement "Ambiguous results from the toxicity tests and the fact that toxics concentrations in the sediment were below the PEC benchmarks indicate that toxics are not a major stressor of the biota in the AC watershed," is technically correct. While the evidence, as presented, does not provide a compelling case that toxics should be classified as a “possible stressor” in Accotink Creek, is does not preclude that from being a stressor either and more appropriate data should be gathered.

DEQ Response

Collecting and analyzing additional data is almost always helpful; however additional data may not resolve the degree to which organic toxic chemicals are stressors in Accotink Creek. None of the water column or sediment concentration data collected in Accotink Creek suggests that toxic chemicals are present at levels that are known to be detrimental to the biota. There were no exceedances of the acute or chronic criteria for the organic toxics in water column samples. Also, there were also no exceedances of the Probable Effect Concentration (PEC) for organic toxics in sediment samples. The PEC represents concentrations above which adverse impacts on biota are likely. However, there were organic toxics, chlordane for example, in sediment found above the Threshold Effect Concentration (TEC), which is the threshold below which adverse effects on biota are unlikely. Organic toxic concentrations in sediment were found above the TEC, but below the PEC, at levels where science cannot unambiguously determine their effect on biota. Given this evidence, as well as the results from the toxicity tests on water fleas and fathead minnows, toxics were identified as a possible stressor to the benthic communities.

The Report is flawed in its use of fish tissue samples taken from migratory and stocked species, American eel and rainbow trout, respectively. Metals and toxics (or lack thereof) in these organisms are likely <u>not representative</u> of Accotink Creek. These two species make up almost half of the tissue samples assessed.

- 26.9 % (18 out of 67) of the fish tissue samples were obtained from stocked rainbow trout. There are no naturally reproducing populations of rainbow trout in the Accotink basin and no determination of the length of time these trout were residing in Accotink Creek (eg. correlation of otolith microchemistry with bioaccumulation of toxics). Therefore, one cannot assume that any bioaccumulation (or lack thereof) of metals and/or other lipid-bound toxic chemicals represents the water quality of Accotink Creek and not the originating hatchery. Including the rainbow trout tissue samples in the current analysis confounds any collective results of fish community due to the question of actual sample representativeness.
- 19.4% (13 out of 67) of the fish tissue samples were obtained from American eel. These fish are highly migratory and travel thousands of miles across salt, estuarine and fresh waters as part of their life cycle and may encounter a suite of concentrations of lipid-binding toxic chemicals. For instance, any eel present in Accotick [*sic*] Creek has migrated through the tidal Potomac River for which there is/are TMDL(s) for toxic chemicals and/or metals. Without a better understanding on the length of exposure one cannot make an assumption regarding the contribution of toxics to fish tissue in Accotink Creek.
- For future TMDL stressor analyses, these two species (stocked trout or migratory eel) should not be used when making water body-specific stressor determinations based on tissue toxicity tests.

DEQ Response

Fish tissue samples are collected and analyzed to determine if Virginia’s Fish Consumption Use is supported, that is, whether it is healthy to eat fish caught in Accotink Creek. From that point of view, it does not matter if the fish migrated to Accotink Creek, or if it was stocked. It is correct, however, that the results of the fish tissue analysis are being used for a different purpose in the stressor identification report, namely, to help determine if toxics were bioaccumulating in fish and the environment in general. The report expresses the view, similar to the commenter’s, that the observations of toxics in fish tissue must be used with *caution, because fish migrate (p. 3-113). Nevertheless, the stressor identification analysis must review all available data. In the case of Accotink Creek, toxics are detected infrequently at concentrations above the tissue values or tissue screening value, which does provide evidence against toxics being a major stressor of the biota. As for stocked trout, probably the key variable to determining where toxics accumulated (hatchery or stream) is the weight of the fish, which is a measure of its accumulation of biomass. Table 3-42 in the final stressor identification analysis report, gives the weights of the fish sampled. Most of the trout are fairly large in size.*

Additionally, The Report incorporates the Bailey (2005) study in section 3.6.3, "Toxicity Tests," which used fathead minnows (*Pimphales promelas*) to determine the toxic effects of water from Accotink Creek on fishes. According to Fairfax County's biological monitoring program (1999-2013), fathead minnows have never been found within the Accotink drainage and are a rare occurrence for the county. This species is native to the Tennessee River drainage in the Southwestern part of the state, but has been introduced in some locations throughout Fairfax County. Using this species as the basis for biologic toxicity tests for Accotink Creek may not be appropriate, because species native to Accotink Creek may be more or less sensitive. The toxicity study (and future toxicity studies) should have been conducted using either ubiquitous or known sensitive fish taxa found within Fairfax City/County.

DEQ Response

Toxicity tests are experiments which test the toxicity of the source water in question against a control. Fathead minnows and water fleas are used as test subjects because they are known to be sensitive to toxic effects, and presumably are more sensitive than the majority of biota found in the waters being tested. Using uniform subjects, like fathead minnows or water fleas, provides a standardized way of testing different waters for their toxic effects.

<u>Chloride</u>

There is much to address in this section of The Report, but I believe a number of other agencies will be addressing Chloride. However, in general, The Report uses an approach that correlation is causation regarding Chloride levels as being a primary stressor for benthic impairments. This is not sound science. The connections between specific conductance and chloride, and the upper and lower Accotink are not well founded (Ex. there were no events in the lower Accotink that exceeded the acute standard). In the future DEQ should help fund a Chloride probe at the USGS gauging station. Once this is implemented real-time tracking of Chloride levels (and loads) could be calculated.

DEQ Response

The acute chloride criterion states that there can be no more than one exceedance in a three year period. Three samples from upper Accotink Creek taken in 2014 two weeks apart exceed the criterion. This is sufficient by itself to assert that upper Accotink Creek is not supporting water quality standards to protect aquatic life because of high chloride concentrations. The point of using the specific conductance continuous monitoring data and the conductance-chloride correlation to estimate chloride concentrations is to show that conditions in 2014 are not an anomaly. As for lower Accotink Creek, the land use is similar to upper Accotink Creek. The percent of the lower watershed in impervious cover (28%) is a little less than the upper watershed (31%), but the percent of the land use which is developed or in the transportation sector is about the same. There is little reason to suspect that less deicing salt is applied in lower Accotink Creek watershed or that less of it reaches

Accotink Creek. Since chloride is a conservative substance, all of the chloride from the upper mainstem Accotink Creek will reach the lower mainstem. Therefore, it appears likely that chloride concentrations in the lower mainstem will be comparable to the upper mainstem. This is borne out by the similarity of the distribution of total dissolved solids (TDS) in upper and lower portions of Accotink Creek. Chlorides are a major component of TDS.

While it is DEQ's judgment that elevated chloride concentrations are a source of stress to the biological communities in lower Accotink Creek and in Long Branch, DEQ has decided to not move forward with developing chloride TMDLs for these two impaired watersheds unless the chloride impairment is corroborated by (1) continuous monitoring of specific conductance in Lower Accotink Creek and (2) collection of additional chloride samples to verify the predictive relationship between chloride and conductance in lower Accotink Creek and in Long Branch. DEQ will make an effort to collect the additional data this winter.

EPA biological Monitoring Section:
The Report heavily cites EPA's Selakumar [*sic*] et al. (2008) in which the EPA and USGS monitored a section of stream in the upper Accorink [*sic*] watershed in the City of Fairfax. There are many problems with this EPA report and any conclusions drawn from them should be used with care. The modifications to the stream itself were largely focused on stream bank stabilization and not a reconnection of the stream to the floodplain or an improvement of benthic habitat. Further, there are many factors confounding the EPA document that were not addressed in the research or conclusions.

First, the City of Fairfax continued developing open space in the headwaters of Accotink Creek, upstream from this restoration location throughout the study period. Additionally, the stream reach immediately upstream of all monitoring locations (upstream of Lee Hwy in Ranger Road Park) underwent a restoration project (2002-03) prior to the restoration in the EPA study (2006). The Ranger Road Park restoration project was poorly designed and/or constructed, with many in-stream structures and stream banks failing and/or eroding almost immediately. This led to a net increase in sediment export from this upstream section of Accotink Creek directly into (or through) the Selakumar [*sic*] et al. (2008) study reach. A portion of the stream bank within Ranger Road Park was monitored with bank pins and lost approximately 0.5 meters of stream bank over a 1-yr period in 2006-07. The lack of acknowledgement to these major contributors of upstream sediment, known to affect the benthic community, undermines much of the EPA report's conclusions, particularly when discussing the success (or lack thereof) at reducing sedimentation.

The Report (stressor analysis) indicates "it might take longer than two years of post-restoration monitoring for stream restoration to have a greater positive impact on the biological community". However, The Report does not cite any studies indicating a benthic rebound due to restoration or any lag time associated with that. The Report also states that "the post-restoration monitoring results and metric scores were not available for analysis". Having post-restoration data from the Selvakumar et al. (2008) study is essential to evaluate any conclusions on the benthic community or its response to this stream restoration. Therefore, there is no evidence to support the notion that a stream restoration project will help a macroinvertebrate community rebound. Further, there is no evidence presented that restoration projects in urban streams can achieve lift in the benthic community. If a TMDL load allocation for sediment is to be developed, a stronger link between the restoration of degraded systems with benthic community improvements must be shown.

DEQ Response

Most of the views expressed in this section are Selvakumar et al.'s, including their suggestion that it will take longer than two years for restoration to have a positive impact on the biological community. Selvakumar et al.'s views are not endorsed by the stressor identification report and do not figure in the analysis conducted in Section 4 of the report. A discussion of the best techniques for stream restoration is outside the scope of the stressor identification report.

Long Branch: There is very little information provided regarding Long Branch.

DEQ Response

There has been fewer water quality samples collected in Long Branch compared to the number of samples collected in the mainstem of Accotink Creek. However, data to evaluate all stressors, except toxics and metals, is available in Long Branch as it is in rest of the watershed and is discussed in the report.

Organization: Chesapeake Bay Foundation
Contact: Joseph Wood
Received on: August 7, 2015

On behalf of the Chesapeake Bay Foundation, I submit the following comments regarding the Accotink Creek TMDL Process.

First, thank you for your work on the project and for the effort made to clarify stressors, pollutants and the role they play in this process. The stressor analysis appears to have identified important concerns for Accotink Creek and has made progress for restoring this site. That being said, this has been a long drawn out process and we encourage DEQ to expedite the process of addressing sediment concerns which have been apparent now for several years. We'd also encourage DEQ to outline a timetable for removing pollution issues and restoring Accotink Creek.

The stressor analysis report should give equal weight to classifying positive or negative results for impairment; specifically this comes up with the terms currently identified: non-stressor, least probable stressor and most probable stressor. A more appropriate set of classifications would be "***least probable*** stressor, possible stressor, and most probable stressor". While there has been significant data collection at this site, much of this collection occurs at a regular monitoring interval rather than peak flow (particularly for toxics) which in urban streams often represents the time of poorest water quality. As a result, DEQ should avoid classifying parameters as "non-stressors" without more intensive sampling.

Chloride and conductivity data which have been monitored more closely in this system than other systems suggest this problem could be widespread throughout the region. As a result, DEQ should develop a plan to monitor and address these issues in other waterbodies which have not received the same level of attention. DEQ should list practices which can help prevent chloride loads from reaching Accotink Creek with a specific emphasis on practices that can also help address nutrient and sediment issues.

Finally, DEQ needs to give substantial effort to ensure Accotink Creek is protected from hydromodification and habitat modifications. Current plans as presented in the presentation suggest that there will be an attempt to address these issues through implementation practices of the sediment and chloride TMDLs. We suggest DEQ should outline a process which can be used to ensure these non-pollutant based pollution issues will be addressed through the TMDL process.

Thank you for the opportunity to provide comments on the TMDL revision process for Accotink Creek; and I look forward to working with DEQ as process continues.

DEQ Response

DEQ will begin development of the sediment and chloride TMDLs within the next few weeks, with the final TMDL reports prepared by the end of 2016. After the State Water Control Board (SWCB) and EPA approval of the TMDL, the allocations given in the TMDL for the regulated point sources, which includes MS4 permittees, will be implemented through the DEQ issued permits when those permits are reissued. The permitted sources have the responsibility to implement practices to reduce the pollutant loadings, including the location and timing of implementing any changes.

The draft stressor analysis categorized the stressors into the following categories: "non-stressors", "possible stressors", and "most probable stressors". Based upon feedback received during the public comment period, the category of "non-stressor" has been changed to "least probable stressor" in the final Accotink Creek Watershed Stressor Analysis Report. It should be noted that data from individual samples and from continuous monitoring were used to categorize three of the four parameters listed as least probable stressors (temperature, pH, and dissolved oxygen). The continuous monitoring data captured variations in flow regimes. DEQ aimed to collect metals and organic toxics during storm flow conditions as well as during base flows. Two of 12 samples analyzed for metals and two of four samples analyzed for toxics were collected during storm events. Based on available data, metals were categorized as a least probable stressor; however, toxics were identified as a possible stressor.

It is acknowledged that conductivity and chloride concentrations are a concern in urban watersheds. The specific conductivity and chloride relationship in the Difficult Run watershed was evaluated as part of a USGS study[18] on quantifying components of the hydrologic cycle. DEQ has performed trend analyses on the specific conductivity data collected statewide. The results of these trend analyses show increasing trends in specific conductivity concentrations in several Northern Virginia watersheds. The details regarding these analyses are presented in Appendix C. DEQ will consider options for further characterization of specific conductivity and chloride in urban watersheds.

The technical advisory committee and stakeholders involved with the development of the TMDLs for the Accotink Creek watershed can discuss strategies for chloride reductions in the watershed. This information will be included in the implementation chapter of the TMDL report. Education and outreach is one strategy that can be considered in an effort to reduce chloride concentrations in surface waters. Chloride is the main component of the deicing materials used to ensure public safety during inclement weather. Education of watershed residents and business owners on the fate of deicing materials after an inclement weather event and the impacts that these materials have on their local waterways may be the first step in improving water quality.

The non-pollutants stressors identified in the stressor analysis - hydromodification and habitat modification - are not parameters that can formally be addressed through the TMDL

[18] Sanford, W.E., D.L. Nelms, J.P. Pope, and D.L. Selnick. 2012. Quantifying components of the hydrologic cycle in Virginia using chemical hydrograph separation and multiple regression analysis: U.S. Geological Survey Scientific Investigations Report 2011–5198, 152 p. http://pubs.usgs.gov/sir/2011/5198/

process. Impacts on the benthic communities from hydromodification and habitat modification are intertwined with impacts from sediment. Hydromodification includes changes in hydrology, channelization and loss of headwater stream networks. Increases in the magnitude and frequency of peak stream flow events cause excess stream bank erosion. The eroded sediment is transported through the streams, leading to scouring of benthic communities. Sediment deposition also occurs, which impacts the quality and variety of habitat. Given the relationship between sediment, hydromodification and habitat modification in stream systems, measures taken to address sediment will likely also lead to improvements in habitat and hydromodification.

APPENDIX A

Accotink Creek TMDL Project Plan
July 2015

Accotink Creek TMDL
Project Plan

Introduction

The replacement TMDL for Accotink Creek will be developed in two phases. The first phase of the project will involve data gathering and research to develop a stressor analysis report, which will identify the key stressor(s) contributing to the aquatic life impairment and provide recommendation(s) to address the impairment. The second phase will entail development of a TMDL replacement focusing on the pollutant reductions needed to achieve water quality goals. The Interstate Commission on the Potomac River Basin (ICPRB) will be working with the Virginia Department of Environmental Quality (DEQ) on the project by providing technical support for the stressor analysis, model development, and preparing reports to document the findings of the study. The two phases of the project will rely heavily on stakeholder participation. A Technical Advisory Committee (TAC) will be established to facilitate participation and feedback from the stakeholders.

The members of the Technical Advisory Committee are anticipated to include:

- Audubon Naturalist Society
- Audubon Society of Northern Virginia
- City of Fairfax
- Fairfax County
- Fairfax County Division of Environmental Health
- Fairfax County Park Authority
- Fairfax County Public Schools
- Friends of Accotink Creek
- Ft. Belvoir
- George Mason University
- Home Builders Association of Virginia (HBAV)
- Metropolitan Council of Governments
- Northern Virginia Community College
- Northern Virginia Regional Commission (NVRC)
- Northern Virginia Soil and Water Conservation District
- Potomac River Greenway Coalition
- Potomac Riverkeeper
- Sierra Club
- Town of Vienna
- United States Geological Survey (USGS)
- Virginia Department of Forestry
- Virginia Department of Game and Inland Fisheries
- Virginia Department of Transportation (VDOT)
- Wetland Studies and Solutions, Inc.

Citizens and general public will be invited to attend two public meetings that will be held during phase one and submit their comments and questions. The roles of each of the stakeholder groups are outlined in the 'Engagement and Outreach' section below. The stressor analysis document will consider all of the potential stressors to the benthic community in Accotink Creek, identify the most probable stressor(s), and provide a recommendation in moving forward to best address the aquatic life impairment.

The second phase of the Accotink Creek project will focus on the development of a replacement TMDL document that has support of the stakeholders. This project plan outlines the process of developing a TMDL for Accotink Creek, however, an alternate solution or document will be considered if there is support from the stakeholders and it adequately addresses regulatory provisions. The stakeholders will be involved in the TMDL development by way of the TAC noted above. The general public and citizens will be encouraged to be involved and will be welcomed to share their feedback and comments. At least one public meeting will be held during the TMDL development phase. The final TMDL document will have source allocations and reductions, and will include interim implementation milestones. The inclusion of interim implementation milestones will recognize the severe benthic impairment in Accotink Creek and establish a framework for incremental improvements of water quality.

Management

DEQ will take the lead on developing a replacement TMDL to address the benthic impairments in Accotink Creek, with assistance from ICPRB.

Key Milestones

Stressor Analysis Report – September 2015
Final TMDL Report, with interim implementation milestones – October 2016

These milestone dates are identified for planning purposes. The dates are subject to change based on circumstances that arise during project development.

Engagement and Outreach Process

In addition to the formation of and input from the TAC noted above, correspondence will be sent to Virginia Pollutant Discharge Elimination System (VPDES) and Virginia Stormwater Management Program (VSMP) permit holders in the Accotink Creek watershed to announce the project and encourage their participation throughout the project. Permittees holding the following types of permits have been identified in the Accotink watershed and will be informed of and invited to attend the TAC meetings and public meetings:

- Individual Industrial VPDES Permit
- Small Domestic Sewage General Permit
- Industrial Stormwater General Permit
- Concrete Products General Permit
- Non-Contact Cooling Water General Permit
- Vehicle Wash and Laundry General Permit
- Construction Stormwater General Permit

The outreach and advertisement of TAC meetings and public meetings associated with the Accotink TMDL project will follow the procedures outlined in DEQ's Public Participation Procedures for Water Quality Management Planning guidance. In addition to the planned TAC and public meetings, DEQ recognizes there may be a need to meet with specific stakeholders during the project to ensure on-going coordination and communication. These meetings may be initiated by DEQ or may be requested by stakeholders, as the need arises.

Overview and Roles of Stakeholder Groups:

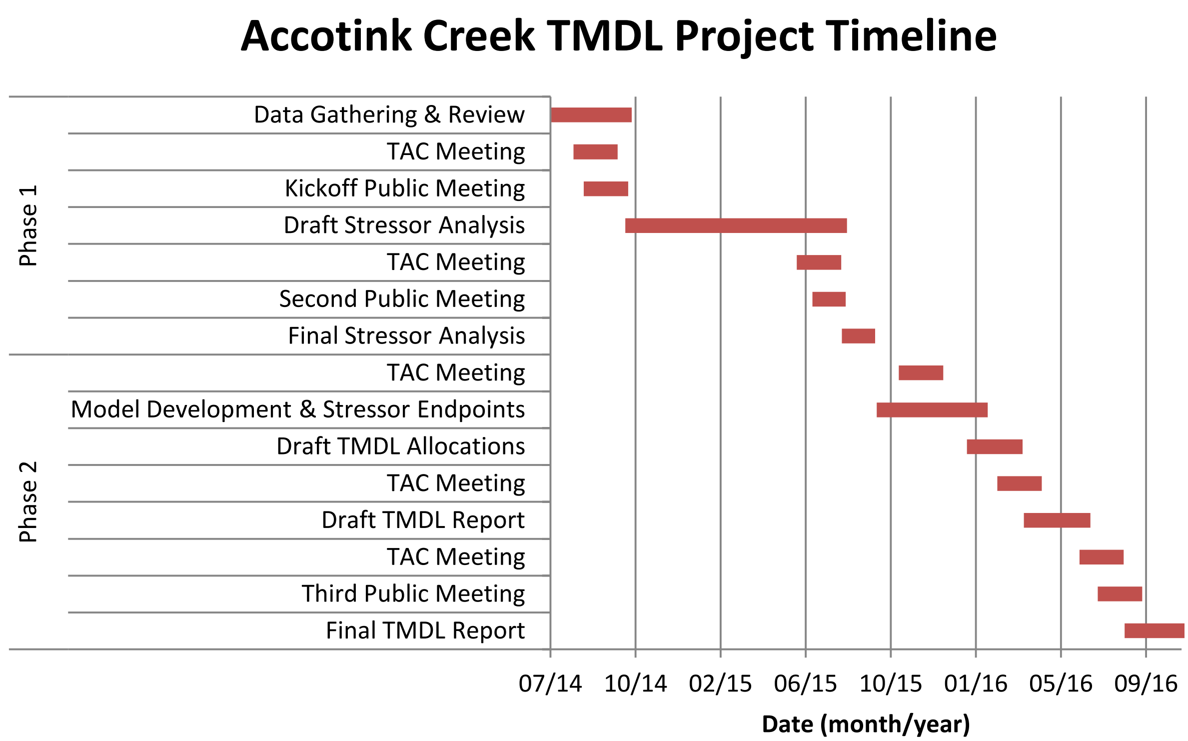
A. Technical Advisory Committee
    a. All stakeholders are invited, including permittees and citizen groups

b. Daytime meetings (posted on Virginia Regulatory Town Hall)
c. Opportunity for information exchange and feedback
d. Meet prior to public meetings to share information and coordinate on public process

B. General Public and Watershed Citizens
   a. Everyone is invited to attend the public information meetings
   b. Evening meetings (posted on Virginia Regulatory Town Hall and published for public notice in the Virginia Register)
   c. Share project information and receive comments

Following each TAC meeting, a meeting summary will be prepared to document meeting discussions and, if applicable, action items. There will also be a 30-day comment period associated with each of the public meetings which will allow written comments to be provided to DEQ on the materials presented at each of the meetings.

Project Timeline



This is the anticipated timeline; however it is subject to change throughout the project. Additional meetings may be added as necessary.

APPENDIX B

Physical Habitat (Relative Bed Stability) Data

Physical Habitat (Relative Bed Stability) Information

DEQ performed Relative Bed Stability (LRBS) surveys at locations within the Accotink Creek watershed shown in the table below:

Station ID	Stream Name	Location	Latitude (DMS)	Longitude (DMS)	Date
1AACO004.84	Accotink Creek	Rt. 611 (Telegraph Rd)	38.7205	-77.19072	6/25/2008
1AACO006.10	Accotink Creek	Rt. 790 (Alban Rd)	38.728614	-77.20334	11/21/2006
					6/26/2008
1AACO009.14	Accotink Creek	Upstream of Rt. 636 (Hooes Rd) and Fairfax County Parkway	38.761945	-77.20723	6/26/2008

Information pertaining to the data collected during the LRBS surveys and the calculations used to evaluate the data can be found on DEQ's Probabilistic Monitoring – Data Sources website:

http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/ProbabilisticMonitoring/ProbMonDataSources.aspx

There are two databases available with the physical habitat information:

1. The ProbMon Phab Database contains the data collected during the physical habitat field surveys.
2. The ProbMon Phab Tool file contains:
    a. A word document that explains the physical habitat metrics
    b. An excel workbook that provides the final summary of the calculated physical habitat metrics
    c. SAS code to run the physical habitat calculations
    d. R code to run the physical habitat calculations
    e. An excel workbook based calculator to perform the physical habitat calculations

Additional information on the technical background information on the physical habitat calculations can be found in the following literature:

Kaufmann, P.R., P. Levine, E.G. Robison, C. Seeliger, and D.V. Peck. 1999. *Quantifying Physical Habitat in Wadeable Streams*. EPA/620/R-99/003. U. S. Environmental Protection Agency, Washington, D.C.

Kaufmann, P.R., J.M. Faustini, D.P. Larsen, and M.A. Shirazi. 2008. A Roughness-Corrected Index of Relative Bed Stability for Regional Stream Surveys. Geomorphology 99:150-170.

APPENDIX C

DEQ Specific Conductivity Data Analysis

DEQ Specific Conductivity Data Trend Analyses

Conductivity (or specific conductance) can serve as a surrogate for chloride measurements, and is a parameter that is routinely measured at DEQ monitoring stations. DEQ has identified increasing trends in specific conductivity concentrations at specific monitoring station locations and at the 5th order watershed scale.

Analysis of data collected at long term monitoring stations is conducted every 6 years, and was last conducted as part of the 2012 Water Quality Assessment Integrated Report. A modified seasonal Kendall nonparametric procedure was used to analyze the trend data for a number of parameters. Al though the analysis is conducted for a range of parameters, the results for select parameters (bacteria, nitrogen, phosphorus, and suspended solids) are published in the Integrated Reports. The trend analysis results for the specific conductivity parameter have not been published in the past, and were not published in the Surface Water Trend Analysis Results chapter of the 2012 Integrated Report[19]. The analysis of the specific conductivity trend data statewide indicated that of the 380 trend monitoring stations statewide, 104 stations showed statistically significant increasing trends in specific conductivity. Only 14 stations showed statistically significant decreasing trends in specific conductivity. The specific conductivity trends for monitoring stations located in free-flowing streams in Northern Virginia are shown in the table below.

Results of the Kendall Specific Conductivity Trend Analysis. The period of record for the analysis was 1991 to 2010. The number of observations for specific conductivity and the minimum, median, and maximum values of specific conductivity (µS/cm) are given for each station. The tau is the value of seasonal Kendall's tau. Red cells indicate an increase in specific conductivity, whereas blue cells indicate a decrease in specific conductivity. Green cells in the P-value indicate a statistically significant trend at 90% confidence.

Station	Stream	Observations	Minimum	Median	Maximum	tau	P-value
1AACO014.57	Accotink Creek	116	101	257.8	7614	0.314	0.004331
1ABEC004.76	Beaverdam Creek	84	63.1	167	388	0.161	0.291598
1ABRB002.15	Broad Run	143	133	318	1066	0.511	0.000061
1ABUL025.94	Bull Run	76	16.3	160.8	371.4	0.281	0.048731
1ACAM002.92	Cameron Run	45	123.7	349.7	2254	0.297	0.51272
1ACAX004.57	Catoctin Creek	198	75.4	169	434	0.288	0.005713
1ACER006.00	Cedar Run	137	76	160	4676	0.172	0.080587
1ADIF000.86	Difficult Run	148	92.8	166	1171	0.586	0.000164
1AFOU001.92	Four Mile	44	147.6	471.2	4014	-0.018	0.981958
1AGOO002.38	Goose Creek	158	116	173.65	516	0.157	0.133542
1AGOO011.23	Goose Creek	62	112.7	166.95	285.1	0.024	0.954369
1ALIM001.16	Limestone Branch	73	116	256	349.9	0.29	0.03547
1ANOG005.69	North Fork Goose Creek	84	109.5	199	464	0.336	0.036551

[19] Virginia Department of Environmental Quality. 2012. Chapter 4.5 Trend Analysis in the Final 2012 305(b)/303(d) Integrated Report. Richmond, VA. http://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityAssessments/IntegratedReport/2012/ir12_Ch4.5_Trend_Analysis.pdf

1APIA001.80	Piney Run	90	74	105.45	194.9	0.258	0.098055
1APIM000.15	Pimmit Run	122	101	276	3814	0.273	0.008532
1APOE002.00	Popes Head Creek	89	53	172	1413	0.458	0.000537
1APOH005.36	Pohick Creek	42	84	189.6	1209	-0.235	0.674304
1AQUA004.46	Quantico Creek	141	40.4	78	155	0.258	0.013384
1ASUG004.42	Sugarland Run	86	98.9	329	1208	0.433	0.000253
1AWOL001.26	Wolf Run	39	69	140.8	565	0.246	0.665427

In addition to the trend analysis conducted and published in the prior Water Quality Integrated Reports, the 2012 Water Quality Assessment Integrated Report included a new type of trend analysis. The Integrated Water Quality (IWQ) analysis is a seasonally-derived nonparametric scoring procedure with results based on the 5th order watershed scale. Details regarding the analysis can be found in the Integrated Water Quality Index Results chapter of the report[20]. It is noted that the analysis for specific conductivity was performed but the results were not published because specific conductivity was not a parameter published in the previous trend analysis reports. The IWQ analysis assessed 282 5th order watersheds statewide for specific conductivity. Eighty-eight watersheds showed significant declines water quality for specific conductivity (increases in specific conductivity concentrations), and 57 5th order watersheds showed significant improvements in water quality (decreases in specific conductivity concentrations). The results of the IWQ for specific conductivity in 5th order watersheds located in Northern Virginia are shown in the table below.

Results of the Integrated Water Quality Index Analysis. The period of record for the analysis was 1991 to 2010. The P Value indicates a statistically significant trend at 90% confidence.

WATERSHED (5th Order)	HUC_10	SLOPE	PVALUE	IWQ
Piney Run	0207000802	-0.005	0.07	SIGNIFICANT DECLINES
Catoctin Creek	0207000803		0.29	NO CHANGE
Tuscarora Creek	0207000804	-0.0092	0.00	SIGNIFICANT DECLINES
North Fork Goose Creek	0207000806		0.44	NO CHANGE
Lower Goose Creek	0207000807	0.00261	0.08	SIGNIFICANT IMPROVEMENTS
Broad Run	0207000809	-0.0039	0.01	SIGNIFICANT DECLINES
Difficult Run	0207000810	-0.0052	0.00	SIGNIFICANT DECLINES
Pimmit Run	0207001001	-0.0033	0.05	SIGNIFICANT DECLINES
Cameron Run	0207001003	-0.0041	0.00	SIGNIFICANT DECLINES
Pohick Creek	0207001004	-0.0055	0.00	SIGNIFICANT DECLINES
Broad Run	0207001005	-0.0046	0.03	SIGNIFICANT DECLINES
Bull Run	0207001007	-0.004	0.02	SIGNIFICANT DECLINES
Occoquan River	0207001008	0.00553	0.00	SIGNIFICANT IMPROVEMENTS
Quantico Creek	0207001101		0.62	NO CHANGE

[20] Virginia Department of Environmental Quality. 2012. Chapter 4.6 Integrated Water Quality Index Results in the Final 2012 305(b)/303(d) Integrated Report. Richmond, VA.
http://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityAssessments/IntegratedReport/2012/ir12_Ch4.6_IWQ_Assessment.pdf