Sand Branch Benthic Total Maximum Daily Load (TMDL) Study

Fifth Technical Advisory Committee Meeting

April 20, 2022

Meeting Summary

Location: Northern Virginia Regional Commission, Main Conference Room
3040 Williams Dr., #200
Fairfax, VA 22031

Start: 10:00 A.M.
End: 12:00 P.M.

Meeting Attendance:

See attached sign-in sheet for list of meeting attendees (provided as an attachment to the PDF).

Meeting Materials:

The meeting agenda is provided as an attachment to the PDF.

The meeting was conducted with the assistance of a MS PowerPoint presentation. Detailed information in the presentation (provided as an attachment to the PDF) is not repeated in these summary notes; instead, highlights from each general topic section of the meeting are summarized along with the questions and discussion held during the meeting.

Meeting Summary:

Sarah Sivers, DEQ opened the meeting by welcoming the participants and going over the meeting materials and noted that those will also be posted to DEQ's webpage for TMDL project currently under development. She then discussed the objectives of the meeting:

1. Provide a brief refresher of TMDL development.
2. Share the approach and the resulting TMDL endpoint for total dissolved solids (TDS) and discuss the approach that is being taken to develop TMDL endpoints for sediment and total phosphorus (TP).
3. Provide an update on the watershed modeling being conducted, including an overview of the selected model, how the model is calibrated and the current progress on the source assessment for each of the three pollutants.

Ms. Sivers then shared a refresher on TMDL development. She reminded the TAC that this project is for the development of TMDLs for three pollutants, identified below.

Stream	TMDL Target
Sand Branch	▪ TDS ▪ Total Phosphorus ▪ Sediment

Ms. Sivers noted that the watershed was highly developed and the team was aware of the proposed Amazon data center, the construction of which is now permitted under a Construction Stormwater General Permit (CGP). She also updated the TAC on the current status of the development of each TMDL, which is calibrating the model, completing the source assessment and working to establish TMDL endpoints for sediment and TP.

Ms. Sivers then turned the presentation over to Dr. Robert Brent, who kicked off the topic discussion of setting the TMDL endpoints for each of the three pollutants. The need to identify an endpoint is necessary as all three pollutants have only narrative and not numeric water quality criteria. Dr. Brent first presented on the approach and subsequent endpoint developed for TDS. He shared details on developing the TMDL endpoint for TDS, followed by providing an overview of the approach to be taken to develop TMDL endpoints for TP and sediment.

Following Dr. Brent, Mr. Thomas Schubert spoke about the watershed modeling being done in support of developing these TMDLs. He provided an overview of the model selected, Hydrologic Simulation Program - FORTRAN (HSPF), and how that model is being calibrated. He then provided an overview of the pollutant source assessment, which provided a summary of the land cover for the watershed and the permitted sources. Mr. Schubert presented the conceptual approach to identifying existing loads, for point sources that are stormwater driven versus those that are process water. Summarized data from Discharge Monitoring Reports (DMRs) and/or data collected by DEQ compliance staff was shared with the TAC.

Summarized below is the content of the discussion and comments shared during the meeting.

<u>Setting TMDL Endpoints</u>

- Question was asked about when benthic macroinvertebrate sampling occurred, if done in both Spring and Fall. They noted that they have seen in their own sampling efforts higher Virginia Stream Condition Index (VSCI) scores in the Fall.
    - DEQ responded that sampling did occur in both Spring and Fall and also saw the same trend, that it is fairly common for Fall scores to be higher.
- In the toxicity testing conducted using water samples collected from Sand branch, why were field collected organisms not used in that round of testing?
    - Dr. Brent explained that it was largely due to the challenges with coordinating water sample collection (which was focused on sampling not near a rain event) with culturing of those field species, due to those being collected in the field.
- Question posed if there is a numeric criteria for conductivity?
    - DEQ responded that no, there is not.
- A TAC member noted that the upper part of the Sand Branch watershed is diabase and if there is any well data for that geology? The concern being that the data provided thus far may not fully characterize the water quality of the groundwater from that area.
    - Dr. Brent responded that the data reviewed for both groundwater and surface water was located within the same ecoregion, the Triassic Basin, as the Sand Branch watershed. Further ability to refine the dataset is not something the project team has available. The project team noted that further refinement at a smaller scale may not be worth the additional effort that would be needed to collect the additional information. The scale, at the ecoregion, at which the study is being conducted does provide a level of confidence that the information is characteristic of the watershed.

  - Ms. Sivers noted that the margin of safety (MOS) that is part of the TMDL equation accounts for the assumptions and inherent uncertainty that is associated with TMDL development. Whether this MOS is explicit or implicit is input the project team asked the TAC members to weigh in on. For TDS, an implicit approach, meaning it was incorporated into development of the threshold, may be sufficient.
- Representatives from Chantilly Crushed Stone, Inc. questioned why the well data they provided to DEQ was not used in deriving the TMDL endpoint for TDS. Also, asked about DEQ looking into other groundwater wells in the area, specifically within Sand Branch. They commented it could be the data shown for other areas in the ecoregion are not reflective of Sand Branch. Also voiced concern there could be other water quality impacts that are coming from other sources, such as Dulles Airport. Questioned about activities on that property, such as the Live Fire Training Facility.
  - The project team noted the groundwater data indicated that the deeper groundwater wells showed higher values than more shallow, and less opportunity for that deeper groundwater to influence surface water. The data provided by Chantilly Crushed Stone, Inc. was reviewed, but there was uncertainty about how much those wells are influenced by the quarry's activities and uncertainty the wells' construction and characteristics. DEQ also followed up with Loudoun County regarding information they provided to inquire about wells drilled within the watershed. Through the course of that coordination, and reconfirmed by the representative of Loudoun County present at the meeting, there is likely no usable shallow well data available. The team is happy to review any additional data that the TAC is able to provide.
  - The TMDL endpoint for TDS is very specific to this watershed as it's based upon water quality data collected in Sand Branch.
  - DEQ voiced their understanding and appreciation that this TMDL has implications on the regulated community. DEQ will continue to work with permittees on implementation of these TMDLs, moving this project forward with the goal of consensus.
  - DEQ conducted an inspection of Dulles Airport's Live Fire Training Facility and viewed the training activities. They observed that there was no runoff and no chemicals used and confirmed chemicals have not been used at that site. The airport has coverage under the Virginia Pollution Discharge Elimination System (VPDES) program.
- A TAC member asked if this was Virginia's first TDS TMDL.
  - No, there are TDS TMDLs in southwest Virginia. However, the pollutant source was associated with coal. This is the first non-coal based TDS TMDL.
- Regarding the toxicity testing of field collected species, a TAC member asked if emergence was what decided survival.
  - Dr. Brent responded that the test were conducted on organisms in the larval stage. Those organisms that underwent emergence (meaning hatched and crawled out) were removed from the statistics of the study. For both studies, it was 2.5% or less of the test group.
- A TAC member asked if as part of the toxicity study, if any constituent specific studies were conducted to figure out which ions have biggest effect.
  - Dr. Brent replied that the water sample used was based on the ion composition in Sand Branch. He noted that each ion has its own toxicity, and while individually may not be as

toxic, it usually the combination that results in the toxicity. He noted that it is difficult to tease out the toxicity of each ion in a mixture.

Phosphorus and Sediment Endpoints

- A question was posed if the MOS will be added to the AllForX calculation or is it already incorporated into that value.
  - The project team responded that whether the MOS for either phosphorus or sediment will be implicit or explicit has not yet been decided. Until that work has been done, the team does not yet have a recommendation. The team welcomes input from the TAC on this topic.

Watershed Modeling

- A TAC member asked if in the model, the stream erosion concentration correlated to rainfall runoff to TSS.
  - Mr. Schubert replied that, yes, the model accounts for more water in the stream leading to more erosion.
- Mr. Schubert posed a question to VDOT on whether there is winter salt application data available for watershed.
  - VDOT's representative responded that they will look into it, but the data is probably only available on a county level.
  - It was noted some information on this will be helpful to inform the model as it pertains to TDS.
- Another TAC member asked how pollutant existing loads will be developed for point sources.
  - Mr. Schurbert responded it was flow times concentration.
- It was asked if the Amazon data center will be considered in the model, and also, any idea how their water needs will be handled.
  - The model will consider the data center, there is an active construction stormwater GP. In terms of their water needs, typically data centers use potable water and discharge to sanitary.
- Ms. Sivers asked the TAC to consider and provide any input on what assumptions to use for acreage on-going each year for construction stormwater GPs. Also, what value of the wasteload allocation should be attributed to future growth. Another aspect the project team would benefit in hearing feedback from the TAC is preference in aggregating or disaggregating allocated loads. Also, should the TMDLs for each of the three pollutants be handled the same or differently? TAC did not have any feedback to provide during the meeting, but any thoughts that occur were encouraged to be coordinated with the project team.
- A TAC member asked if it was known yet in the model what the groundwater base flow to the stream is and also, how is the concentration determined. Also, if the percent of the total stream flow from VPDES discharges was known.
  - Mr. Schubert replied that currently do not know answers to the question posed about groundwater base flow and flow from VPDES dischargers as the model is still being calibrated. However, the concentration values are coming from available well data.

    - The TAC member followed up with a recommendation that the stream's low flow periods be used to see what base TDS loads are.
- A question was asked about the variability between benthic spring and fall VSCI scores, and if related to conductivity.
    - Dr. Brent responded that conductivity is high in the stream baseline flows, with decreases occurring with storm events. However, if it's a winter storm event (snow/ice), the conductivity increases, likely due to application of winter salts during winter maintenance activities. The effects of these winter salts remain after the winter storm event ends.
    - The follow-up question pertained to if and what data is available on those lasting effects.
        - The project team replied that there was not specific data for Sand Branch, but are some national studies being conducted. Also, that during development of the Salt Management Strategy, it was identified that there is not much information on application rates and/or studies, but more work is being done. For instance, the Occoquan Watershed Monitoring Lab is conducting a study that is looking at freshwater salinization, specifically in the Occoquan watershed. It was also noted by a TAC member that there's a collaborative effort with U.S. Geological Survey and that the Metropolitan Washington Council of Governments has refocused their monitoring efforts from nutrients to ions.

Ms. Sivers began the meeting wrap-up with an overview of next steps. She noted that the next TAC meeting is anticipated to be held sometime in Summer 2022 to share information on the TMDL endpoints for phosphorus and sediment and discuss scenarios for TMDL allocations.

She closed the meeting by thanking those present for attending.

Sand Branch Benthic TMDL Study
Fifth Technical Advisory Meeting
Agenda

April 20, 2022, 10:00 AM – 12:00 PM
Main Conference Room, Northern Virginia Regional Commission
3040 Williams Dr., #200
Fairfax, VA 22031

I. Welcome and Introductions (10:00 AM – 10:15 AM)
   a. Opening Remarks / Introductions
   b. Meeting Objectives

II. Refresher: TMDL Development (10:15 AM – 10:25 AM)

III. Setting the TMDL Endpoint (10:25 AM – 11:10 AM)
   a. Total Dissolved Solids (TDS)
   b. Phosphorus and Sediment

IV. Watershed Modeling (11:10 AM – 11:50 AM)
   a. HSPF (Hydrologic Simulation Program – FORTRAN)
   b. Calibration
   c. Source Assessment

V. Wrap-up and Next Steps (11:50 AM – 12:00 PM)
   a. Project Timeline
   b. Next Steps

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Sand Branch Benthic TMDL Study

Fifth Technical Advisory Committee Meeting

April 20, 2022

Agenda

- Welcome and Introductions
- Refresher: TMDL Development
- Setting the TMDL Endpoint
  - Total Dissolved Solids
  - Total Phosphorus and Sediment
- Watershed Modeling
  - HSPF
  - Calibration
  - Source Assessment
- Project Timeline and Next Steps

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VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

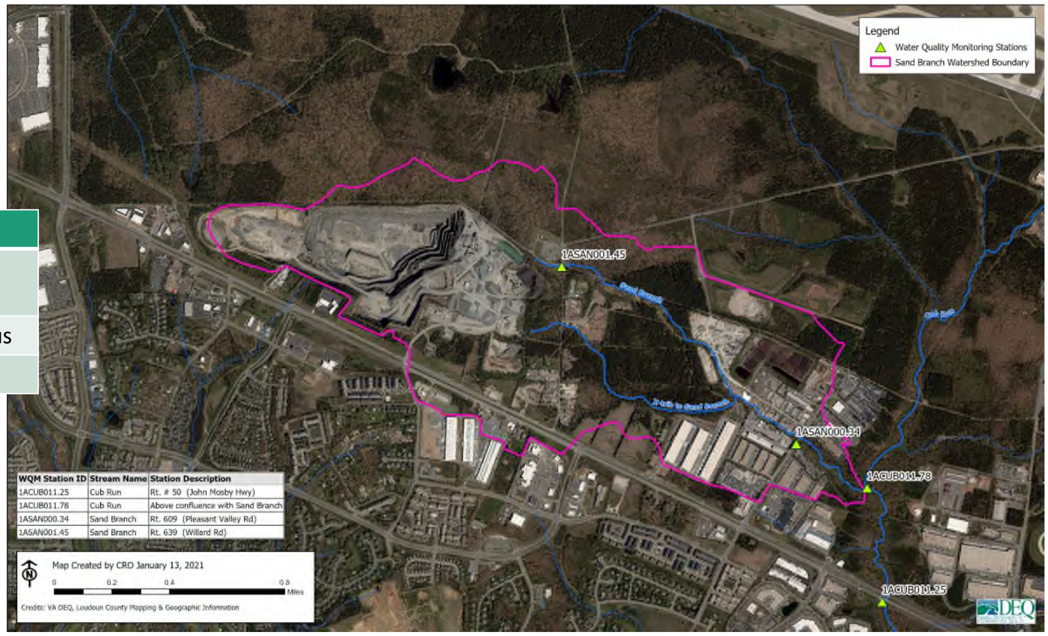
Refresher: TMDL Development

TMDL Targets and Overview of the Process

Sarah K. Sivers
Water Permitting, Planning and Monitoring Supervisor
Virginia Department of Environmental Quality

Sand Branch

TMDL Target
Total Dissolved Solids (TDS)
Total Phosphorus
Sediment



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Total Maximum Daily Load (TMDL)

*A **TMDL** is the total amount of a pollutant a waterbody can receive and still meet the water quality criteria for that pollutant*

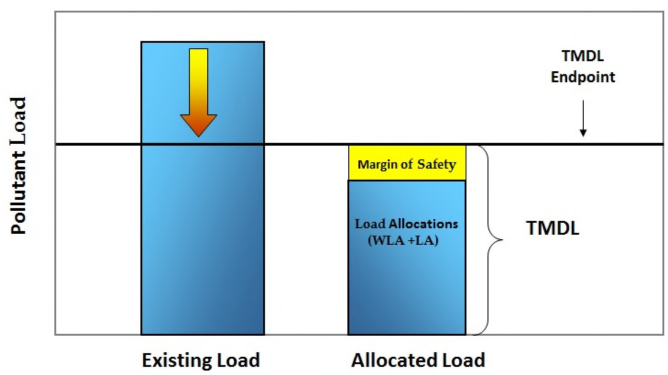
TMDL = WLA + LA + MOS

Where:

WLA = Wasteload Allocation
(Permitted/Point Source)

LA = Load Allocation
(Unpermitted/Nonpoint Source)

MOS = Margin of Safety



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TMDL Development Process

Characterize the Watershed
- Evaluate data on land use, soils, hydrology, ecoregion, etc.

Conduct a Pollutant Source Assessment
- Identify point (permitted) and nonpoint (unpermitted) sources
- Identify existing pollutant loads

Establish the TMDL endpoint
- Identify a numeric value/threshold that meets applicable water quality criteria

Identify the TMDL Condition and Needed Pollutant Reductions
- Model baseline and projected conditions to identify a scenario (loads) that attains the TMDL endpoint
- Calculate the pollutant reduction needed (the difference between the baseline and TMDL condition)

Allocate the TMDL to Pollutant Sources
- Assign pollutant load allocations to point and nonpoint sources to achieve reductions needed to meet the TMDL
- Include an allocation for future growth (FG) in WLA and a margin of safety (MOS)

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DEQ
Virginia Department of Environmental Quality

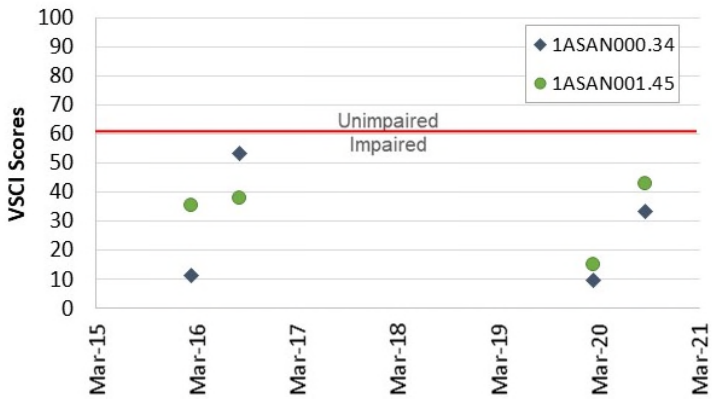
Setting the TMDL Endpoint

Total Dissolved Solids

Dr. Robert Brent
Professor of Aquatic Ecotoxicology
James Madison University

What is the Goal?

- Restore the health of aquatic life in Sand Branch
  - As measured by the Virginia Stream Condition Index (VSCI)



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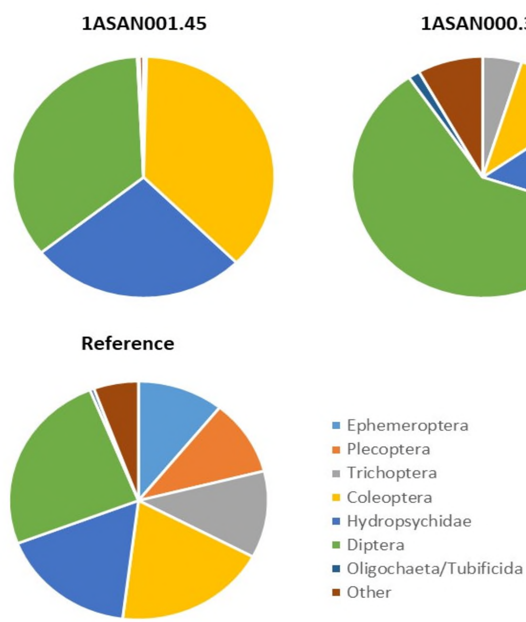
What is the Goal?

- This means a rich and diverse community of benthic macro-invertebrates



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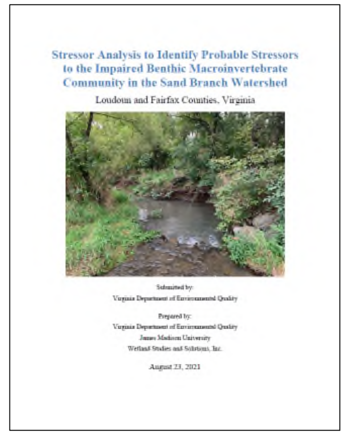
Benthic Stressor Analysis

- Identified 3 pollutants as probable stressors in Sand Branch for which TMDLs are being developed

Stream	TMDL Target
Sand Branch	Total Dissolved Solids (TDS)
	Total Phosphorus
	Sediment


Stressor Analysis to Identify Probable Stressors to the Impaired Benthic Macroinvertebrate Community in the Sand Branch Watershed

Loudoun and Fairfax Counties, Virginia

Submitted by:
Virginia Department of Environmental Quality

Prepared by:
Virginia Department of Environmental Quality
James Madison University
Wetland Studies and Solutions, Inc.

August 23, 2021

Stream	Contributing Factors
Sand Branch	Underlying Geology
	Land Disturbance
	Percent Imperviousness
	Degraded Riparian Buffer

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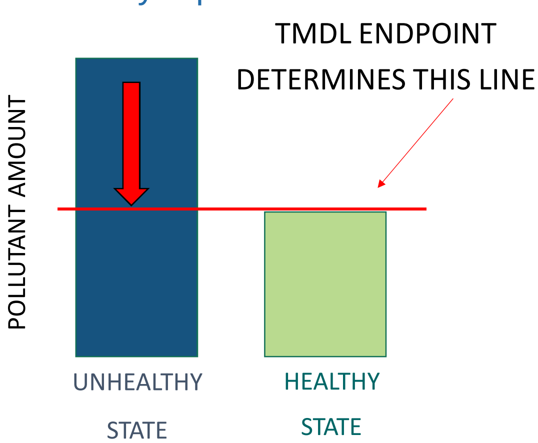
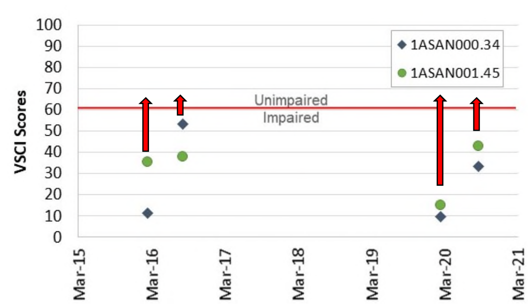
TMDL Endpoint Development

- Determine the level of each TMDL pollutant that will support healthy aquatic life





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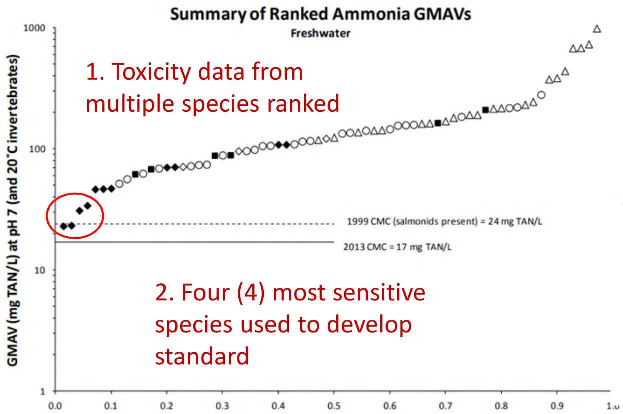
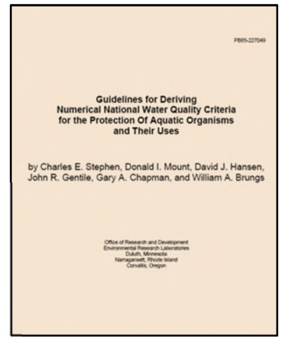
Total Dissolved Solids (TDS) Endpoint Development

- No numeric water quality criteria for TDS
- We used a site-specific toxicity approach
  - Similar to the approach used nationally to set numeric Water Quality Criteria, but specific to the conditions in Sand Branch



3. Statistical calculation made to develop standard that is protective of all species



Guidelines for Deriving Numerical National Water Quality Criteria for the Protection Of Aquatic Organisms and Their Uses

by Charles E. Stephen, Donald I. Mount, David J. Hansen, John R. Gentile, Gary A. Chapman, and William A. Brungs

Office of Research and Development
Environmental Research Laboratories
Duluth, Minnesota
Narragansett, Rhode Island
Corvallis, Oregon

$$S^2 = \frac{\sum((\ln GMAV)^2) - ((\sum \ln GMAV))^2/4}{\sum(F) - ((\sum(\sqrt{P}))^2/4}$$

$$L = (\sum(\ln GMAV) - S(\sum(\sqrt{P})))/4$$

$$A = S(\sqrt{0.05}) + L$$

$$FAV = e^A$$

Final value

DEQ

How was the Approach Site-Specific to Sand Branch?

1. Testing used a combination of:
   - Standard toxicity test species
   - More ecologically relevant field-collected species common to the area

Standard toxicity test species
(acute and chronic testing conducted at Coastal Bioanalysts)

Water flea (Ceriodaphnia dubia)

Fathead minnow (Pimephales promelas)

Scud (Hyalella azteca)

Field-collected species
(acute testing conducted at JMU)

Mayfly (Isonychia bicolor)

Freshwater Snail (Leptoxis carinata)

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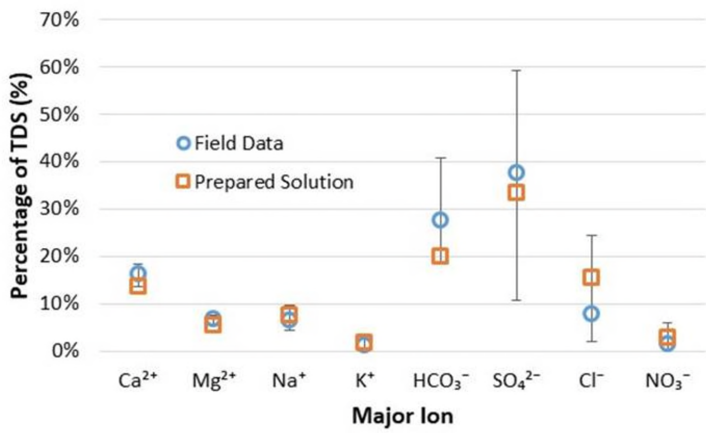
How was the Approach Site-Specific to Sand Branch?

2. TDS samples for toxicity testing were prepared to match ion composition of Sand Branch



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Type of Tests Conducted

- Acute Tests
  - Standard and field-collected species
  - Range of simulated Sand Branch sample concentrations
  - 96-hr exposure
  - Survival and death were monitored daily
  - LC50 endpoint calculated

- Chronic Tests
  - Standard test species (for field-collected species, chronic results were determined from acute to chronic ratios (ACR))
  - Range of simulated Sand Branch sample concentrations
  - 7-day exposures
  - Sublethal responses of growth and reproduction were monitored
  - IC25 endpoint calculated

ACR = Acute Result / Chronic Result

ACRs derived from literature or testing

LC50 = Concentration that kills 50% of the test organisms

IC25 = Concentration that produces a 25% reduction in growth or reproduction

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Results of Site-Specific Toxicity Testing

- Standard toxicity test species
  - All tests successfully met test acceptability criteria

Test	Test Period	Endpoint	Acute 96-hr LC50 (mg/L TDS)	Chronic IC25 (mg/L TDS)	Control Performance	QA Flags
C. dubia chronic test	6/23/21-6/30/21	Survival	3195		100% survival	None
		Reproduction		1440	30.8 neonates	None
P. promelas chronic test	6/23/21-6/30/21	Survival	1511		100% survival	None
		Biomass		1233	0.6853 mg	None
H. azteca chronic test	6/23/21-7/3/21	Survival	>4148		97.5% survival	None
		Growth		3669	0.0838 mg	None

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Results of Site-Specific Toxicity Testing

- Field-collected toxicity test species
  - Each test was duplicated twice (geometric mean used to represent species)
  - All tests successfully met test acceptability criteria
  - Small percentage (<2.5%) of mayflies hatched out during test

Test	Test Period	Endpoint	96-hr LC50 (mg/L TDS)	Control Performance	QA Flags
L. carinata acute test	7/5/21-7/9/21	Survival	3327	100% survival	None
L. carinata acute test	8/30/21-9/3/21	Survival	3349	95% survival	None
		Geometric Mean	**3338**		
I. bicolor acute test	9/6/21-9/10/21	Survival	2527	90% survival	3 organisms emerged (2.5%)
I. bicolor acute test	9/20/21-9/24/21	Survival	1339	90% survival	2 organisms emerged (1.7%)
		Geometric Mean	**1839**		

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Combined Results – Species Sensitivity

- Order of species sensitivity was
  I. bicolor > P. promelas > C. dubia > L. carinata > H. azteca

Test Species	Acute Result 96-hr LC50 (mg/L TDS)	Acute to Chronic Ratio (ACR)	ACR Source	Chronic Result IC25 (mg/L TDS)	Rank Order (most to least sensitive)
I. bicolor	1839	2.82	Literature (Echols 2010; Echols 2013)	652	1
P. promelas	1511	1.23	This study	1233	2
C. dubia	3195	2.22	This study	1440	3
L. carinata	3338	2.09	Average from this study	1597	4
H. azteca	>4148	>1.13	This study	3669	5

Top 4 used in statistical calculation

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TDS Endpoint Calculation – Acute Effects

Species	$GMAV$ (96-hr LC50)	R	$ln(GMAV)$	$ln(GMAV)^2$	P	$\sqrt{P}$
P. promelas	1511	1	7.320527	53.590115	0.166667	0.408248
I. bicolor	1839	2	7.516977	56.504947	0.333333	0.57735
C. dubia	3195	3	8.069342	65.114286	0.5	0.707107
L. carinata	3338	4	8.113127	65.822831	0.666667	0.816497
Sum			28.24581	199.94074	1.666667	2.509202

S^2	5.100087
S	2.258337
L	6.338337
A	6.843317

	TDS (mg/L)
FAV	938

Acute TDS Threshold

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TDS Endpoint Calculation – Chronic Effects

Species	GMCV (IC25)	R	$ln(GMCV)$	$ln(GMCV)^2$	P	$\sqrt{P}$
I. bicolor	652	1	6.48024	41.993515	0.166667	0.408248
P. promelas	1233	2	7.117206	50.654614	0.333333	0.57735
C. dubia	1440	3	7.272398	52.887778	0.5	0.707107
L. carinata	1597	4	7.375963	54.404831	0.666667	0.816497
Sum			28.24581	199.94074	1.666667	2.509202

S^2	5.227924
S	2.286465
L	5.627151
A	6.13842

	TDS (mg/L)
FCV	463

Chronic TDS Threshold

DEQ

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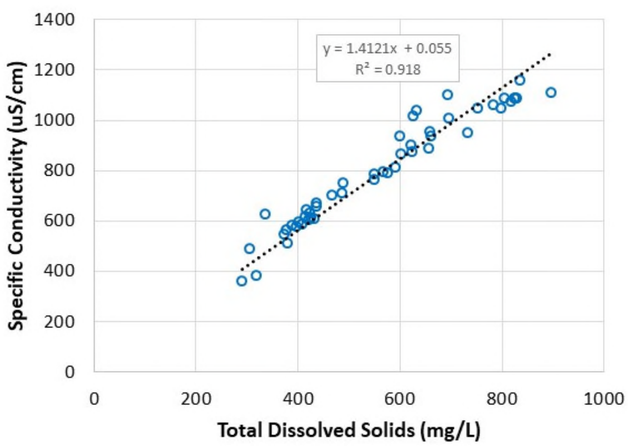
How Do TDS Endpoints Relate to Conductivity?

- Using the TDS to Conductivity relationship established in Sand Branch, we can relate TDS endpoints to equivalent conductivity values



	TDS (mg/L)	Conductivity (uS/cm)
Acute Endpoint	938	1324
Chronic Endpoint	463	654

DEQ

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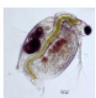
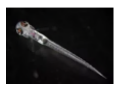
Comparison to In-stream Toxicity Testing

Toxicity Test Species	Field Collected Sand Branch Sample	
	March 2020	July 2021 (UV treated*)
C. dubia	No toxicity	No toxicity
P. promelas	NOEC: 50% IC10: 63.9%	No toxicity

*Ultraviolet (UV) treatment used to kill naturally present pathogens that could interfere with test results



Water flea (Ceriodaphnia dubia)



Fathead minnow (Pimephales promelas)

- Limitations of In-stream testing
  - Snapshot – only represents conditions at the time of sample collection
  - Can't isolate a single stressor
  - Other interferences – likely observed pathogen interference in the first phase
  - Testing limited to standardized test species – which were not the most sensitive or benthic organisms
- Results were consistent with endpoints
  - At sample collection, TDS was 967 – 974 mg/L
  - *P. promelas* IC25 was 1233 mg/L TDS, so toxicity would not necessarily be expected
  - *C. dubia* IC25 was 1440 mg/L TDS, so toxicity would not necessarily be expected

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How Reasonable is the TDS Chronic Endpoint?

- Comparison with other Virginia TMDLs
- All developed using a reference watershed monitoring approach
- TDS endpoints between 334-373 mg/L TDS

Sand Branch
463 mg/L TDS

Year	Stream	County	TDS Endpoint
2006	Russell Prater Creek	Buchanan, Dickenson	334 mg/L
2006	Straight Creek and Stone Creek	Lee	334 mg/L
2006	Callahan Creek	Wise	334 mg/L
2007	Garden Creek	Buchanan	373 mg/L
2007	Knox Creek	Buchanan	369 mg/L
2007	Paw Paw Creek	Buchanan	334 mg/L
2011	Bull Creek	Buchanan	369 mg/L
2011	North and South Fork Pound River	Wise	369 mg/L

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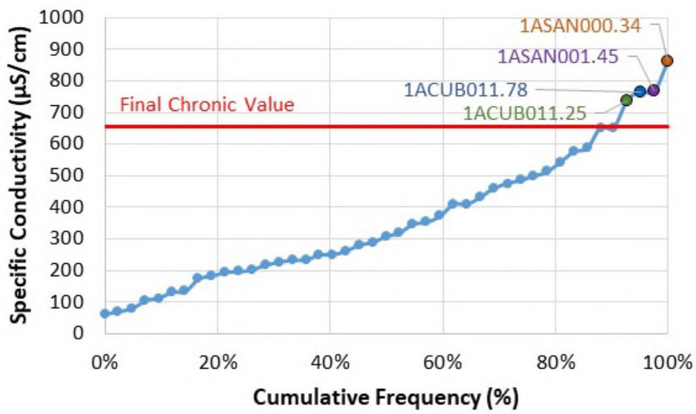
How Reasonable is the TDS Chronic Endpoint?

- Comparison with 43 DEQ monitoring stations in the Trap Rock Conglomerate Uplands and Triassic Lowlands ecoregions
- 654 uS/cm conductivity threshold is at 90th percentile of stations in the ecoregion

Only Sand Branch and Cub Run near confluence exceed this threshold



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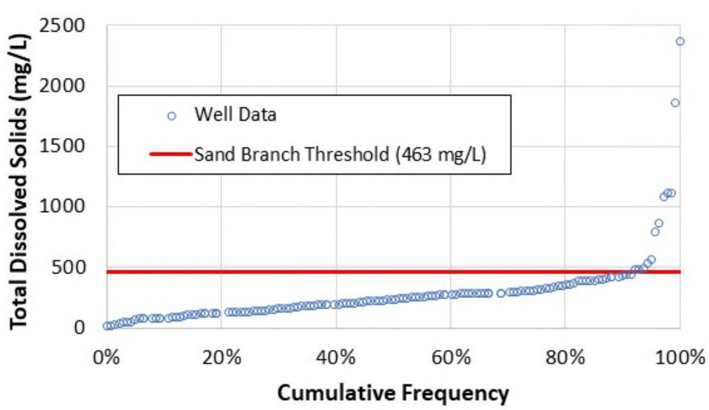
DEQ

How Reasonable is the TDS Chronic Endpoint?

- Comparison with 142 groundwater wells in the Trap Rock Conglomerate Uplands and Triassic Lowlands ecoregions
- 463 mg/L TDS threshold is at the 92nd percentile of wells in the ecoregion

Those wells that exceeded 463 mg/L were generally very deep (averaging 482 ft) and not likely representative of surface water interaction



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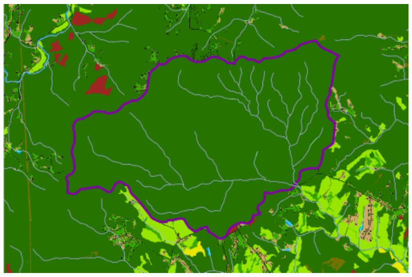
Setting the TMDL Endpoint

Total Phosphorus and Sediment

Dr. Robert Brent
Professor of Aquatic Ecotoxicology
James Madison University

Sediment and Phosphorus TMDL Endpoint Approach

- All-Forested Load Multiplier (AllForX) Approach selected
  - Used widely in Virginia since 2014
  - Doesn't rely on a single reference condition or watershed
  - Robust approach that compares the site to a range of similar watersheds
  - Directly links the TMDL endpoint to the health of aquatic life (VSCI scores)



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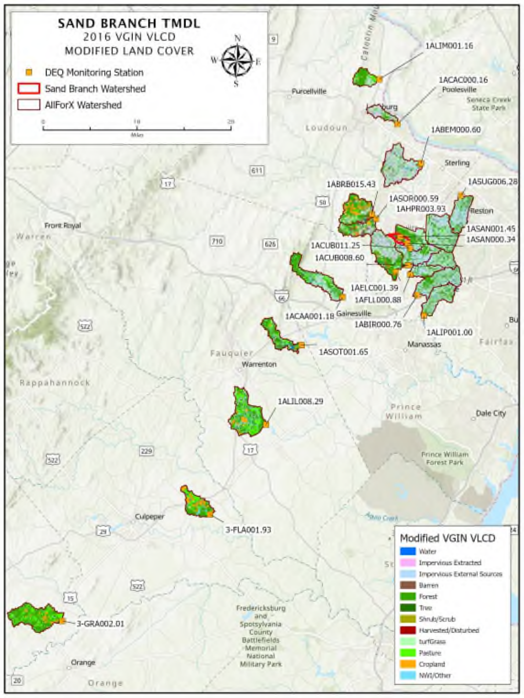
AllForX Approach

- Step 1: select 15-25 comparison watersheds
  - Within the same ecoregion
  - Of comparable size
  - Within close proximity
  - With available benthic data (impaired or unimpaired)



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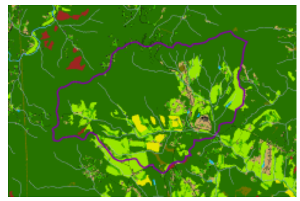
AllForX Approach

- Step 2: model pollutant load in each comparison watershed under two conditions
  - Existing condition
  - All-forested condition
- Step 3: calculate the AllForX multiplier for each comparison watershed

AllForX Multiplier = Existing Condition Pollutant Load / All Forested Pollutant Load



What Does It Mean?

Watershed produces 10 times the pollutant load that it would otherwise produce if it were all forested

50 T/yr / 5 T/yr = 10

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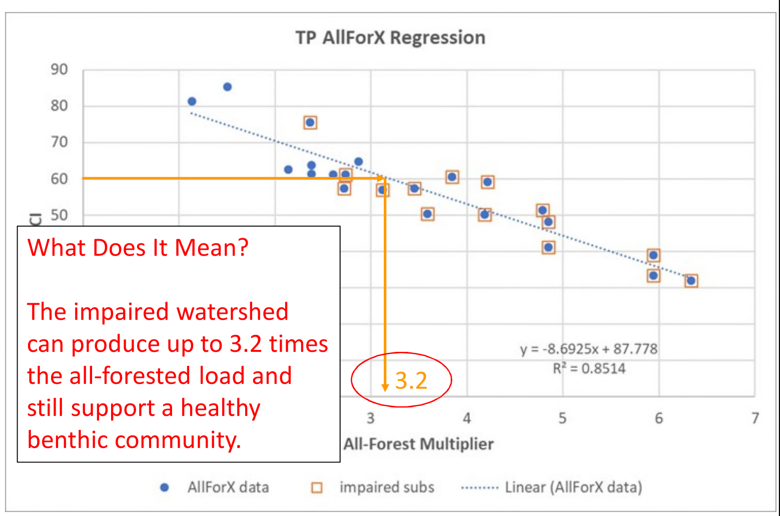
AllForX Approach

- Step 4: make a regression of AllForX multipliers versus VSCI scores for each of the comparison watersheds
- Step 5: TMDL target is the AllForX multiplier that corresponds to a VSCI of 60



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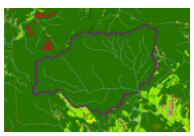
AllForX Approach

- Step 6: TMDL reductions are set to meet the all-forested load x AllForX multiplier

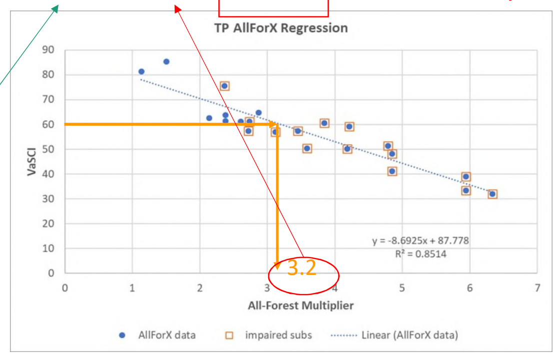
5 T/yr x 3.2 = 16 T/yr

TMDL Endpoint



50 T/yr

5 T/yr



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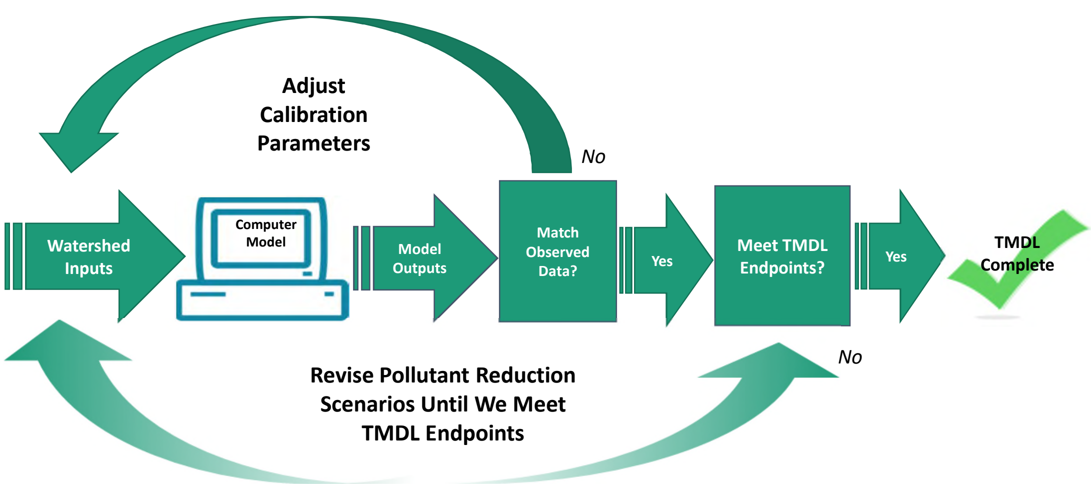
Watershed Modeling

HSPF, Calibration and Source Assessment

Thomas Schubert
Design Engineer
Wetland Studies and Solutions, Inc.

Model Watershed and Assign Reductions



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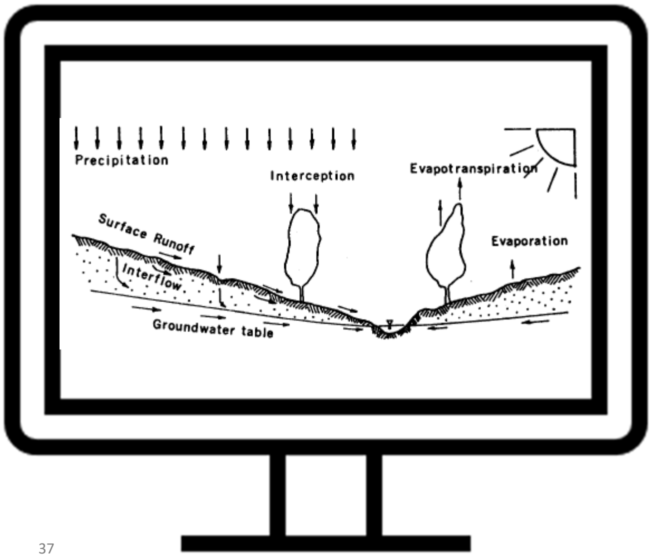
Watershed Computer Model Selection



HSPF (Hydrologic Simulation Program – FORTRAN)

- Continuous simulation
- Nonpoint and point sources
- Simulates stream network
- Able to model TDS

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HSPF Background – Model Inputs and Calibration

- Model Inputs:
  - Delineated watersheds draining to monitoring stations
  - Channel Cross Sections and Topography - DEM
  - Weather Data – IAD
  - Mapped Soil Units - SSURGO
  - Land Cover – VGIN 2016 with edits
- Model hydrology must be calibrated to match observed flow
  - Model is iteratively run, adjusting parameters each time until a good fit.
  - Adjusted parameters typically related to geology and soils
  - Ensures model is accurately portraying real world conditions

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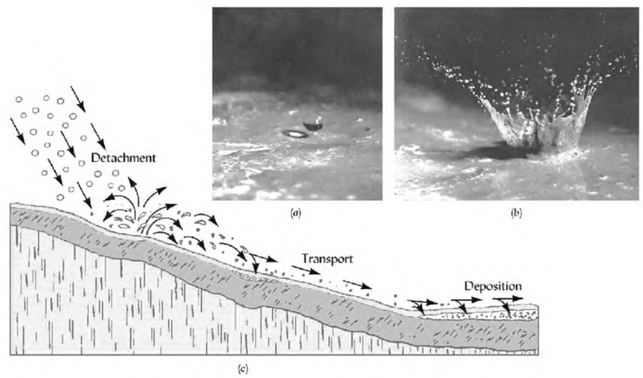
HSPF Background – Pollutant Loading

- Sediment (TSS)
  - Very sensitive to hydrology
  - Land erosion, stream erosion, in channel sediment transport
- Phosphorous (TP)
  - Sediment attached, dissolved in surface runoff, dissolved in groundwater and interflow
- Total Dissolved Solids (TDS)
  - Modeled in groundwater, interflow, and from overland runoff.
  - TDS in overland runoff must be calibrated
  - Can incorporate winter salt



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Pollutant Contribution from Nonpoint Sources

Land Cover Types	Total Existing Area (Ac)
Impervious	191.58
Barren	226.15
Forest	219.21
Tree	105.45
Harvest/Disturbed	10.07
Turf Grass	104.79
Pasture	15.48
NWI/Other	7.17

- Loadings from land cover types due to surface run-off and erosion (streambank and channel) will be calculated using HSPF
- Land cover acreages will be adjusted to account for 1) anticipated land changes and 2) regulated area

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Pollutant Contribution from Point Sources

- Permits without data for flow and the pollutant: calculate pollutant loadings using available information.
  - Concentration: Identify for applicable land use types using available data/literature.
  - Volume: Based upon modeled runoff for the watershed.

Permit Number	Facility	Permit Type
VAR040067	Loudoun County	MS4 Permit
VA0092975	VA Dept. of Transportation	
VAR050863	Virginia Paving Company - Chantilly Plant	Industrial Stormwater GP*

*DMR data for TSS and Phosphorus

Permit Number	Facility	Permit Type**
VAR10Q558	H&M Properties (Amazon)	Construction Stormwater GP
VAR10Q602	VEPCO Substation Expansion	Construction Stormwater GP
VAR101490	East Gate Marketplace	Construction Stormwater GP
VAR10K924	Quarry Commerce Center	Construction Stormwater GP

**Construction Stormwater GP: WLA addresses the land disturbance associated with construction of the project

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Pollutant Contribution from Point Sources

- Permits with data for flow and the pollutant: use that data to calculate existing loads
  - Avg. reported concentration x Avg. reported flow

Permit Number	Facility	Permit Type*
VA0091430	Loudoun Composting	VPDES Individual Permit (IP)
VAG110089	Virginia Concrete Company Inc. - Chantilly Plant	Concrete Products GP
VAG110094	Superior Concrete - Dulles	
VAG110318**	Aggregate Industries MAR – Chantilly	
VAG840106	Chantilly Crushed Stone Incorporated	Nonmetallic Mineral Mining GP
VAG406265	Chantilly Liberty	Domestic Sewage GP***

*Data available from DMRs and/or monitoring conducted by DEQ Compliance Staff

**VAG110318: No discharge (ND) reported.

***No data for Phosphorus or TDS

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Point Sources with TDS Data

Permit Number	Facility	Avg Reported Flow (MGD)	No. of Samples	Min. Conc. (mg/L)	Max. Conc. (mg/L)	Avg Conc. (mg/L)	Permit Type
VA0091430	Loudoun Composting	0.02	31	1.31	1590	792	VPDES IP
VAG110089	Virginia Concrete Company Inc. - Chantilly Plant	0.01	0				Concrete Products GP
VAG110094	Superior Concrete - Dulles	001: 0.0057 002: 0.0023	001: 3 002: 0	274	543	444	
VAG110318	Aggregate Industries MAR – Chantilly	ND	0				
VAG840106	Chantilly Crushed Stone Incorporated	001: 0.71	001: 17 002: 15	001: 441 002: 491	001: 825 002: 844	001: 641 002: 683	Nonmetallic Mineral Mining GP

*ND = No discharge

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Point Sources with Sediment (TSS) Data

Permit Number	Facility	Avg Reported Flow (MGD)	No. of Samples	Min. Conc. (mg/L)	Max. Conc. (mg/L)	Avg Conc. (mg/L)	Permit Type
VA0091430	Loudoun Composting	0.02	31	0.05	134.9	47.5	VPDES IP
VAG110089	Virginia Concrete Company Inc. - Chantilly Plant	0.01	18	0	20	5	Concrete Products GP
VAG110094	Superior Concrete - Dulles	001: 0.0057 002: 0.0023	001: 29 002: 9	001: 0 002: 20	001: 326 002: 160	001: 23.7 002: 59.7	
VAG110318	Aggregate Industries MAR – Chantilly	ND					
VAG840106	Chantilly Crushed Stone Incorporated	0.71	001: 44 002: 15	001: 0 002: 0	001: 54 002: 114	001: 11 002: 27.9	Nonmetallic Mineral Mining GP
VAG406265	Chantilly Liberty	0.001	1	9.4	9.4	9.4	Domestic Sewage GP
VAR050863	Virginia Paving Company - Chantilly Plant	No data	12	18.5	270	81	Industrial Stormwater GP

*ND = No discharge

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Point Sources with Phosphorus Data

Permit Number	Facility	Avg Reported Flow (MGD)	No. of Samples	Min. Conc. (mg/L)	Max. Conc. (mg/L)	Avg Conc. (mg/L)	Permit Type
VA0091430	Loudoun Composting	0.02	21	0	7.2	3.1	VPDES IP
VAG110089	Virginia Concrete Company Inc. - Chantilly Plant	0.01	1	0	0	0	Concrete Products GP
VAG110094	Superior Concrete - Dulles	001: 0.0057 002: 0.0023	001: 1 002: 0	0.03	0.03	0.03	
VAG110318	Aggregate Industries MAR – Chantilly	ND	0				
VAG840106	Chantilly Crushed Stone Incorporated	001: 0.71	001: 10 002: 10	0	0	0	Nonmetallic Mineral Mining GP
VAR050863	Virginia Paving Company - Chantilly Plant	No data	4	0	0.33	0.16	Industrial Stormwater GP

*ND = No discharge

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Questions?

Meeting Wrap-up

Project Timeline and Next Steps

Sarah K. Sivers
Water Permitting, Planning and Monitoring Supervisor
Virginia Department of Environmental Quality

Next Steps

- Complete HSPF model calibration and source assessment
- Develop TMDL endpoints for sediment and phosphorus
- Identify load reductions for each pollutant
- Develop TMDL allocation scenarios for each pollutant

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Questions?

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