Benthic TMDL Study on Deep Run, Dover Creek, and Upham Brook Watersheds in Henrico County, Goochland County, and the City of Richmond

Community Engagement Meeting #3

02/21/2025, 1:00 pm

Virginia DEQ-PRO Training Room

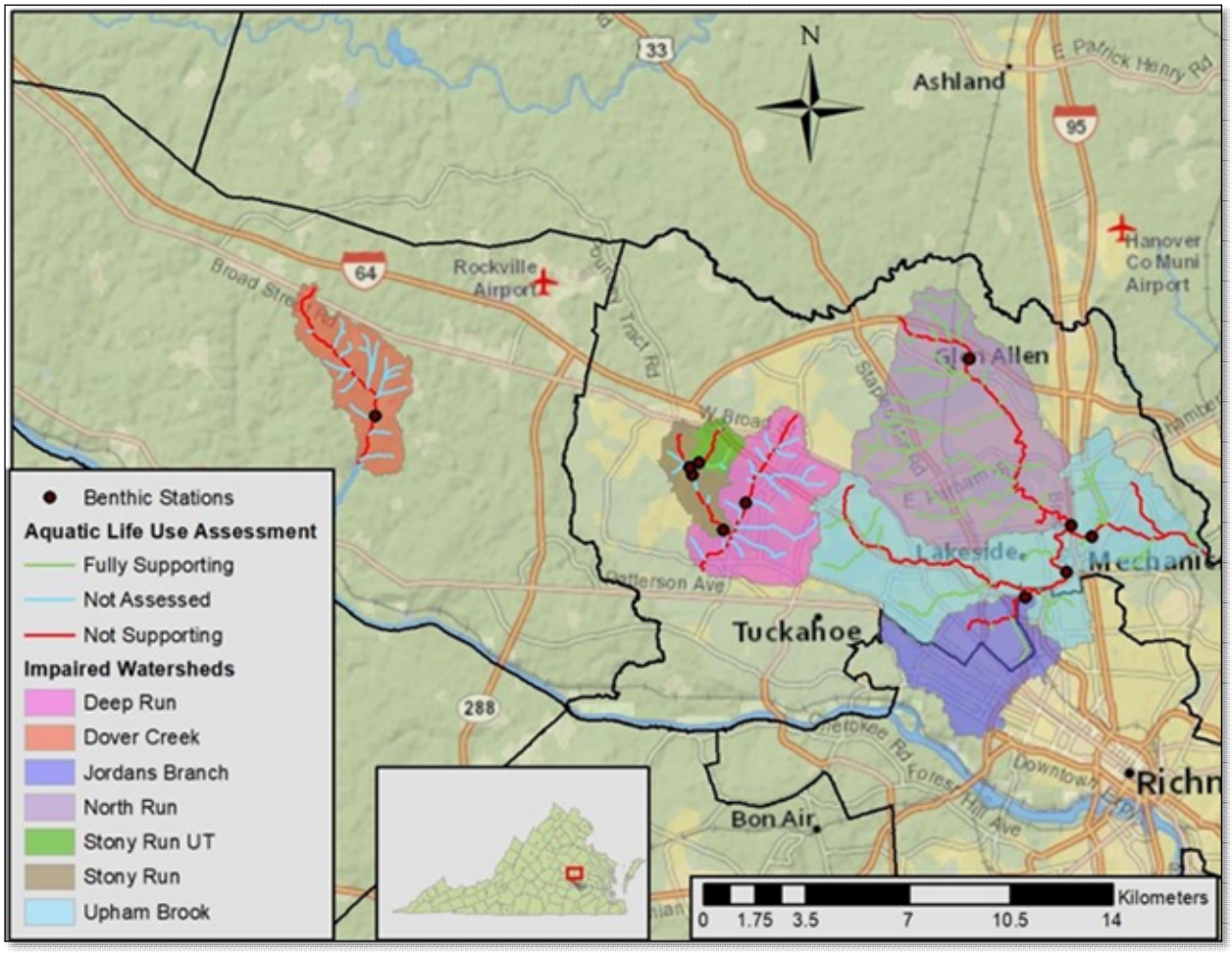


Figure 1. Impaired watersheds included in the Benthic TMDL Study.

Updates Since Last Meeting

Land Cover

There have been some minor updates to the land use categorization shown in the handout from the previous community engagement meeting. Several areas in the North Run, Deep Run, and Stony Run watersheds were incorrectly classified in the Chesapeake Bay Program (CBP) 2017/2018 land use/landcover (LULC) dataset. Several athletic fields and golf courses in these watersheds were mistaken for pasture or cropland and are more accurately represented in the model as turfgrass. In North Run, 19.2 acres of cropland were reclassified as 19.2 acres of turf. In Deep Run, 2.3 acres of pasture were reclassified as 2.3 acres of turfgrass, and, in Stony Run, 1.3 acres of pasture were reclassified as 1.3 acres of turfgrass.

Septic Systems

Based on the feedback from the previous community engagement meeting, the number of septic systems were reassessed in all of the TMDL watersheds **(Table 1)**. The new septic system counts in Upham Brook, North Run, Jordans Branch, Deep Run, Stony Run, and Stony Run UT were established based on information provided by Henrico County. The new septic system count in Dover Creek was determined by overlaying parcel boundaries and aerial imagery in GIS and tallying parcels in the watershed with visible residences.

Table 1. Estimate of known septic systems in each TMDL watershed. Note that each TMDL watershed does not account for areas included in an upstream TMDL watershed (e.g. the count for Stony Run does not include the count represented in Stony Run UT).

Stream Name	Number of Known Septic Systems
Upham Brook	120
North Run	117
Jordans Branch	9
Deep Run	36
Stony Run	6
Stony Run UT	11
Dover Creek	221

All Forest Load Multiplier (AllForX) Endpoint Approach

Previously, a single regression was presented for total suspended solids (TSS) and a second regression developed for total phosphorus (TP). In order to better represent the varied watersheds in this study, it was determined that the most appropriate path to developing pollutant load endpoints was to develop multiple regressions tailored to the various subsets of watershed characteristics represented in the study. The single TSS regression was split into three separate

regressions based on three 'types' of watersheds. These watershed type groupings were based on distinct and logical trends associated with watershed size and land use prevalence. The same split was applied to the TP regressions, though only two of the three were needed as not all study watersheds have TP as a pollutant of concern.

The "Small Watershed" regressions include the smaller TMDL watersheds: Deep Run, Stony Run, Stony Run UT, and Dover Creek. This regression type includes comparison watersheds that are more than half the size of the Stony Run UT watershed and less than twice the size of the Dover Creek watershed, which are the smallest and largest TMDL watersheds in this subset, respectively.

The "Large Watershed" regressions include the larger TMDL watersheds: Upham Brook and North Run. This regression type includes comparison watersheds that are more than half the size of the North Run watershed and less than twice the size of the Upham Brook watershed.

Finally, a third regression was developed specifically for Jordans Branch. Over 50% of the land use in Jordans Branch is classified as "Developed Impervious," and it is the closest TMDL watershed to the center of the City of Richmond. Due to this land cover distribution, Jordans Branch has an AllForX ratio much larger than the other TMDL watersheds. The Jordans Branch Watershed AllForX regression includes comparison watersheds that are more than half the size of and less than twice the size of the Jordans Branch study area and no data from the other TMDL study watersheds. Note that the Jordans Branch AllForX Regression type does not have a regression for TP since the Jordans Branch watershed does not have TP as an associated stressor.

The Small Watersheds AllForX regression for TSS (**Figure 2**) resulted in an R^2 value of 0.79 and the Small Watersheds AllForX regression for TP (**Figure 3**) resulted in an R^2 value of 0.75, both indicating a good correlation between the variables. In this regression category, an average VSCI score of 60 corresponds to a target TSS AllForX ratio of 7.5 and a target TP AllForX ratio of 4.3. This means that Deep Run, Dover Creek, Stony Run, and Stony Run UT are expected to achieve consistently healthy benthic conditions if sediment loads are less than 7.5 times the all-forested simulated load and phosphorus loads in the Stony Run and Dover Creek watersheds are less than 4.3 times the all-forested simulated load.

The Large Watersheds AllForX regression for TSS (**Figure 4**) resulted in an R^2 value of 0.82 and the Large Watersheds AllForX regression for TP (**Figure 5)** resulted in an R^2 value of 0.80, both indicating a good correlation between the variables. In this regression category, an average VSCI score of 60 corresponds to a target TSS AllForX ratio of 5.7 and a target TP AllForX ratio of 6.3. This means that Upham Brook and North Run are expected to achieve consistently healthy benthic conditions if sediment loads are less than 5.7 times the all-forested simulated load and phosphorus loads in the Upham Brook watersheds are less than 6.3 times the all-forested simulated load.

The Jordans Branch Watershed AllForX regression for TSS (**Figure 6**) resulted in an R^2 value of 0.83, indicating a good correlation between the variables. In the Jordans Branch AllForX regression, an average VSCI score of 60 corresponded to a target TSS AllForX ratio of 8.1. This means that Jordans Branch is expected to achieve consistently healthy benthic conditions if sediment loads are less than 8.1 times the all-forested simulated load.

These target ratios were used to determine the allowable sediment and phosphorus pollutant TMDL loads in the TMDL watersheds. See **Table 2** and **Table 3** for more information.

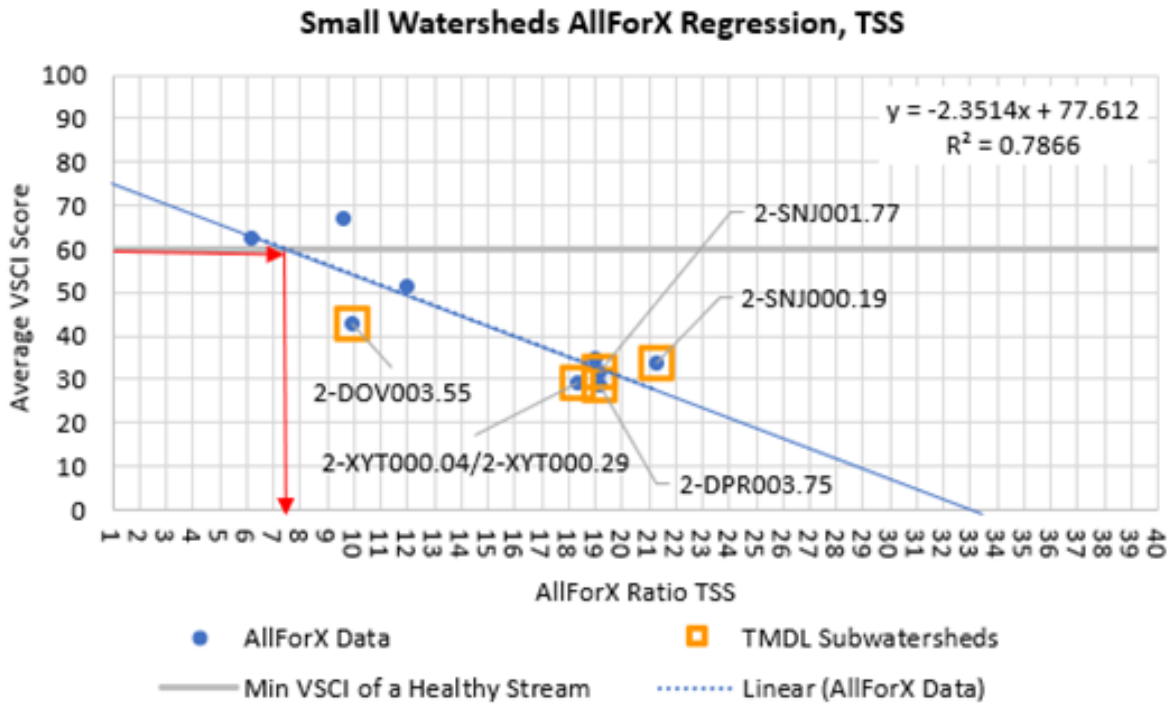


Figure 2. Small Watersheds Regression between the average VSCI scores and the all-forest multiplier for sediment, resulting in a TSS AllForX target ratio of 7.5.

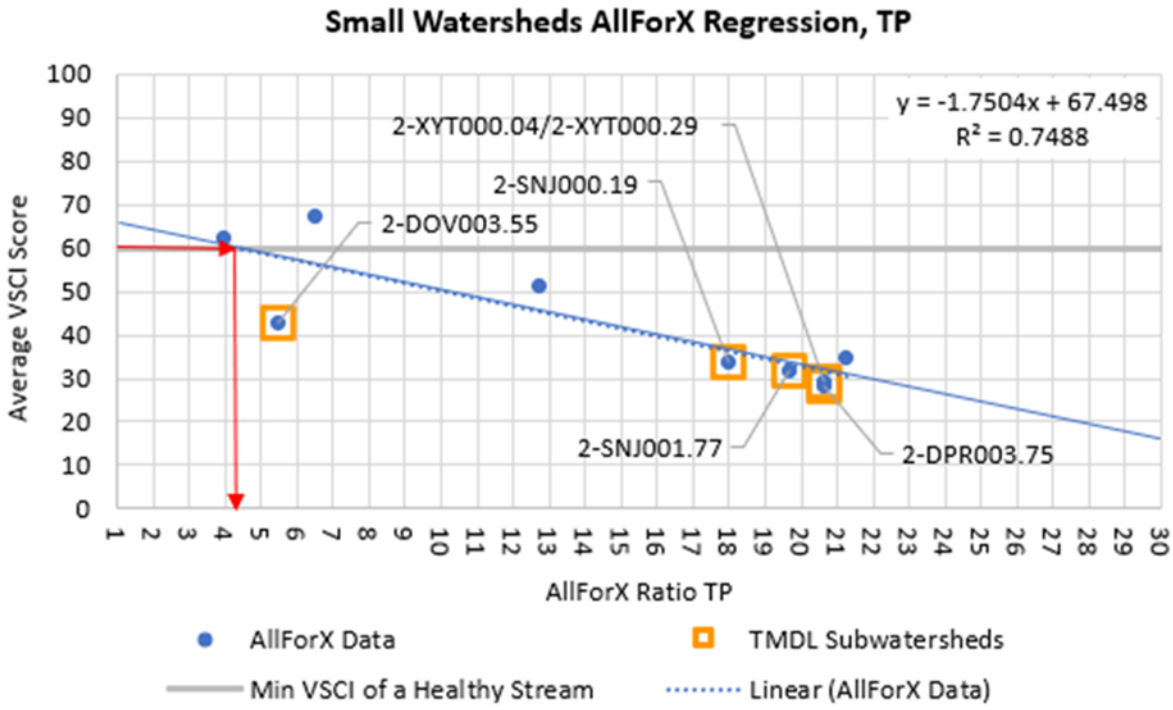


Figure 3. Small Watersheds Regression between the average VSCI scores and the all-forest multiplier for phosphorus, resulting in a TP AllForX target ratio of 4.3.

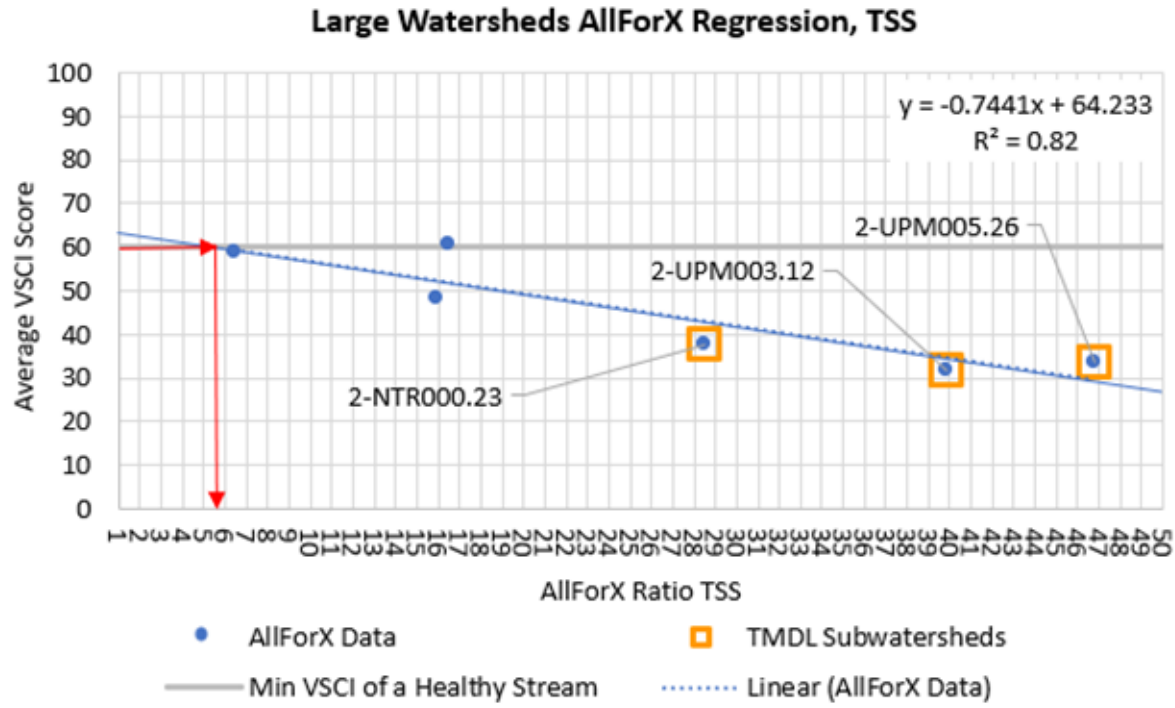


Figure 4. Large Watersheds Regression between the average VSCI scores and the all-forest multiplier for sediment, resulting in a TSS AllForX target ratio of 5.7.

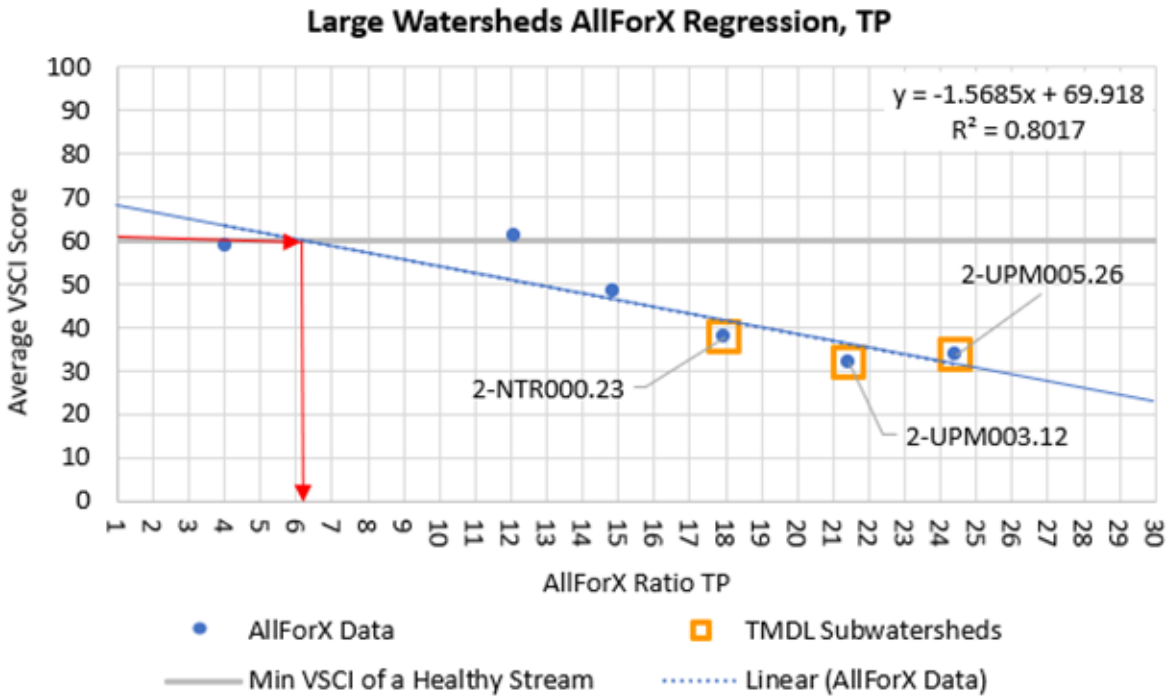


Figure 5. Large Watersheds Regression between the average VSCI scores and the all-forest multiplier for phosphorus, resulting in a TP AllForX target ratio of 6.3.

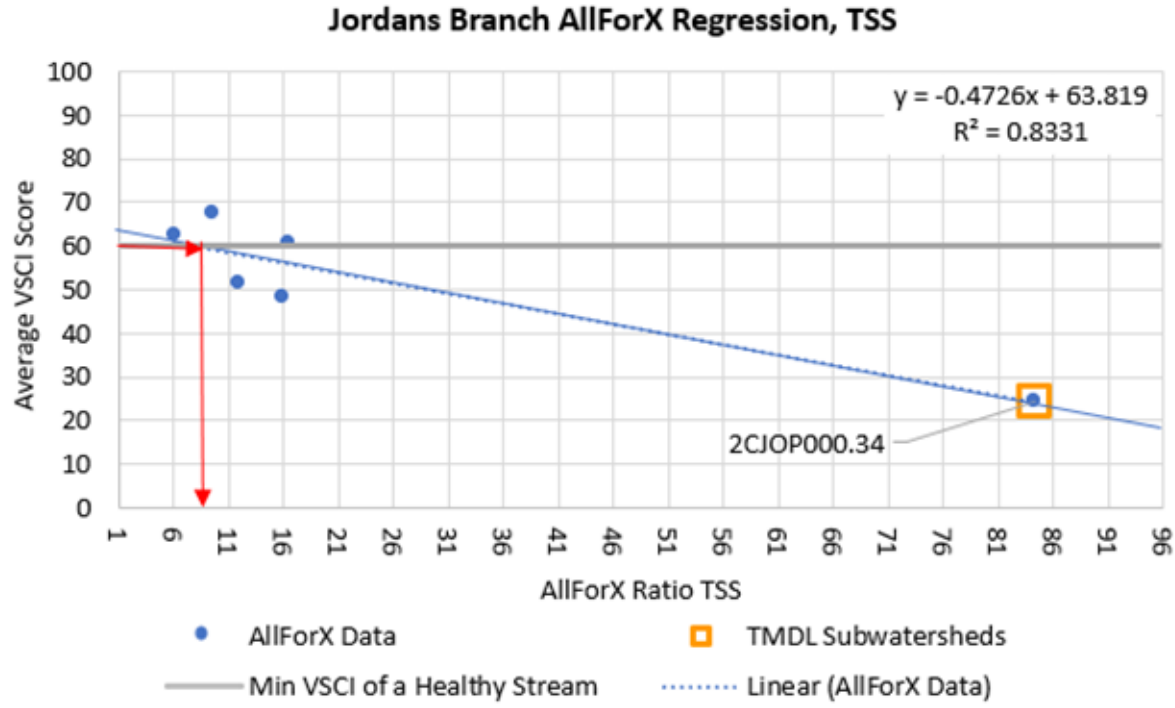


Figure 6. Jordans Branch Watershed Regression between the average VSCI scores and the all-forest multiplier for sediment, resulting in a TSS AllForX target ratio of 8.1.

Using the TMDL Equation to create Allocation Scenarios

The goal of this benthic TMDL study is to determine the amount of pollutant load reductions needed to help the study streams meet the standard for healthy aquatic life communities. Sources of pollutants in a watershed can be as diverse as the watershed itself. In the TMDL equation, these sources are divided into the categories of "Wasteload Allocation" and "Load Allocation."

Wasteload Allocation includes the pollutant load originating from permitted point sources. The permit holders are required to regulate the pollutant load coming from their permitted activity. The permit contains maximum flow rates and concentration thresholds for regulated pollutants that the permittee must meet, along with requirements for effluent monitoring to verify compliance. As these point sources are already regulated, they are not usually allocated further reductions in the TMDL process.

Load Allocation includes all nonpoint sources of pollution not associated with a permit. Runoff carrying pollutants from the watershed into the stream is a nonpoint source of pollution. The sediment and phosphorus concentrations of this runoff vary depending on the specific land use category of the area. Load allocation can also include nonpoint sources such as streambank erosion, groundwater, and residential septic systems.

In order to achieve the target pollutant loads for the watershed, the load reductions are applied to the pollutant sources within the watershed. In order to determine how large the load reduction would have to be to meet the target pollutant load, the following equation is used:

TMDL = Wasteload Allocation + Load Allocation + Margin of Safety

TMDL (Total Maximum Daily Load): The target pollutant load for a specific TMDL study watershed. These targets were determined by the AllForX regressions.
Wasteload Allocation: Pollutant load originating from point sources (permitted facilities that discharge the pollutant of concern), including future growth set-aside for future permitted sources within the watershed.
Load Allocation: Pollutant load originating from nonpoint sources.
Margin of Safety: Since no model is perfect, a margin of safety is also included in the TMDL. This can be explicitly determined (e.g. 10% of the target pollutant load) and/or implicitly defined using conservative assumptions in the model.

Once the TMDL, Wasteload Allocation, and Margin of Safety are known, the TMDL equation can be rearranged to solve for the load allocation that meets the desired TMDL, as shown below.

Load Allocation = TMDL - Wasteload Allocation - Margin of Safety

Reductions can then be recommended as appropriate to develop a scenario that would be anticipated to meet the TMDL target pollutant load and restore stream health.

Total Maximum Daily Load (TMDL)

The target loads for each TMDL watershed were determined using the AllForX method described above to estimate the pollutant load(s) that each watershed is anticipated to be able to handle while maintaining water quality and benthic health. **Table 2** shows the existing and target sediment loads expressed as total suspended solids (TSS). The TMDL study watersheds where sediment is a pollutant of concern are Upham Brook, North Run, Jordans Branch, Deep Run, Stony Run, Stony Run UT, and Dover Creek. **Table 3** shows the existing and target loads for total phosphorus (TP). The TMDL study watersheds that have phosphorus as a pollutant of concern are Upham Brook, Stony Run, and Dover Creek.

Table 2. Target Sediment Loads

Impaired Stream	AllForX TSS Target Ratio	TSS Existing (lb/yr)	Target TMDL for TSS (lb/yr)
Upham Brook	5.7	4,146,846	811,026
North Run	5.7	3,723,019	741,858
Jordans Branch	8.1	1,686,773	161,530
Deep Run	7.5	1,554,697	535,211
Stony Run	7.5	312,810	207,242
Stony Run UT	7.5	222,237	90,624
Dover Creek	7.5	548,999	484,986

Table 3. Target Phosphorus Loads

Impaired Stream	AllForX TP Target Ratio	TP Existing (lb/yr)	Target TMDL for TP (lb/yr)
Upham Brook	6.3	6,726	2,297
Stony Run	4.3	651	187
Dover Creek	4.3	564	472

Wasteload Allocation (Permitted Loads)

Facilities with permits for sediment and phosphorus occur within the study watersheds. These facilities are permitted under the Virginia Pollutant Discharge Elimination System (VPDES) program and include the following categories of permits: concrete production facility (CPF) general permits, industrial stormwater (ISW) general permits, potable water treatment plant (PWTP) general permits, municipal separate storm sewer system (MS4) permits, and construction stormwater general permits (CGP). Permits in the watershed were reviewed in the previous meeting, but are summarized in Tables 3 through 7 below.

There are five active industrial stormwater (ISW) general permits in the study area (**Table 4**). ISW permitted facilities located in the Chesapeake Bay watershed are required to assess their nutrient and sediment loadings and complete discharge monitoring reports to ensure compliance with permit limits. As such, DEQ developed a methodology to estimate the loads from ISW permitted areas. During model simulations, the regulated acreages for the permits are separated from the accounting of total acreages for the watershed. To develop existing loads, the regulated industrial acres for each permit are included in the model at the same loading rate as other developed, impervious acres. The allocated loads to be used in developing the TMDL are calculated using the same methodology but utilize the loading rate of 440 lb/ac/yr TSS and 1.5 lb/ac/yr TP noted in the general permit, which was used to estimate the loading from industrial stormwater facilities for Chesapeake Bay TMDL documentation.

Table 4. Industrial Stormwater General Permits in the study area.

Permit No.	Facility Name	Receiving Stream	Allocated Point Sources (WLA) (lb/yr TSS)
VAR051167	Johns Manville	North Run	1,606
VAR050885	AMF Bakery Systems*	Jordans Branch	-
VAR051821	TRANSFLO Terminal Services TTSI	Jordans Branch	352
VAR051056	CSX Transportation Inc – Bryan Park Terminal	Jordans Branch	2,376
VAR051027	Liphart Steel Company Incorporated	Jordans Branch	1,417

* This permit was closed 10/2023. The facility was permitted to discharge during the monitoring and assessment phases of the process, so it is accounted for in the existing condition, but it is given no WLA due to the permit being closed.

There are two mixed concrete general permits in the Jordans Branch watershed (**Table 5**). These facilities are a permitted source of sediment in the watershed (at 30 mg/L). The sediment waste load allocations for these facilities are calculated using a method developed by DEQ based on the permitted sediment discharge concentration and average flow rate from discharge monitoring report data.

Table 5. Mixed Concrete General Permits in the study area.

Permit No	Facility Name	Receiving Stream	Allocated Point Sources (WLA) (lb/yr TSS)
VAG110227	Bryan Park Ready Mix Concrete Plant	Jordans Branch	2,079
VAG110201	Smyrna Ready Mix Concrete	Jordans Branch	167

There is one VPDES potable water treatment plant (PWTP) general permit in the Deep Run watershed (**Table 6**). The existing loads are calculated based on DMR data and the permitted loads are calculated using the permitted TSS concentration and flow rates for the permit.

Table 6. Sediment load associated with the potable water treatment general permit.

Permit No	Facility Name	Receiving Stream	Allocated Point Sources (WLA) (lb/yr TSS)
VAG640064	Henrico County Water Treatment Plant	Deep Run	3*

* The Henrico County WTP permit contains a discharge concentration limit but does not have a restriction on the flow rate. For WLA calculations, an estimated annual flow rate of 11,000 gal/yr and the TSS concentration permit limit of 30 mg/L were used to determine the load allocation scenarios for this permit.

There are four Municipal Separate Storm Sewer System (MS4) permits within the TMDL watersheds (**Table 7**). These areas are potential sources of sediment and phosphorus and will be assigned waste load allocations in the TMDL. The loads will be based on the extent and type of land cover within the boundaries of the permitted areas.

Table 7. MS4 permits within the study area.

Permit No.	Permitted Entity	Receiving Stream
VA0063177	City of Richmond	Upham Brook, Jordans Branch
VA0088617	Henrico County	Upham Brook, North Run, Jordans Branch, Deep Run, Stony Run, Stony Run UT
VAR040107	J Sargeant Reynolds	North Run
VA0092975	VDOT	Upham Brook, North Run, Jordans Branch, Deep Run, Stony Run, Stony Run UT

Do the MS4 permittees prefer to be included in the TMDL WLA as an aggregate load by watershed, or disaggregate values for each permit?

There are currently 61 active Virginia Stormwater Management Program (VSMP) permits for construction within the study area (**Table 8**). These permits are a potential source of sediment and phosphorus and will be assigned waste load allocations in the TMDL. Each permit contains an estimate of the permitted disturbed area; however, this area is generally not disturbed for the entire

length of the permit's active status. To account for this discrepancy, the acreage estimated to be disturbed for each permit was divided over the length of the permit's active status (no less than one year). Any active permits in process of termination were excluded because, at that stage in the permitting cycle, all areas are stabilized.

Table 8. VSMP Construction General Permits in the study area.

Receiving Stream	Estimated Potential Disturbed Area (ac/yr)	Allocated Point Sources (WLA) (Combined) (lb/yr TSS)	Allocated Point Sources (WLA) (Combined) (lb/yr TP)
Upham Brook	86	100,111	111
North Run	84	98,108	-
Jordans Branch	26	29,848	-
Deep Run	40	30,283	-
Stony Run	11	5,345	6
Stony Run UT	6	7,475	-
Dover Creek	25	29,069	32

Appropriate erosion and sediment control measures are assumed to be utilized on all construction projects, and for developing final WLAs for the allocation scenarios, loads are simulated with an 85% sediment removal efficacy based on Chesapeake Bay Expert Panel Guidance (ESCEP, 2014). The public was asked for feedback and provided discussion on this removal efficacy during previous community meetings.

Future Growth

An allocation of 2% of the TMDL target load is specifically set aside for future growth within the watersheds. This leaves flexibility in the plan for future permitted loads to be added within the watersheds, as the development of a TMDL looks at a snapshot in time of a dynamic system within the watershed and is not meant to prevent future economic growth.

Does a 2% set-aside for future permitted loads seem reasonable for these watersheds?

Margin of Safety

To account for the uncertainties inherent in model outputs, a margin of safety (MOS) is incorporated into the TMDL development process. The MOS can be implicit, explicit, or a combination. An implicit MOS involves incorporating conservative assumptions into the modeling process in an effort to ensure that the final TMDL is protective of water quality in light of the

unavoidable uncertainty in the modeling process. An MOS can also be incorporated explicitly into the TMDL development by setting aside a portion of the TMDL.

This TMDL includes both implicit and explicit MOSs. An example of implicit MOS assumptions incorporated into this TMDL are the inclusion of permitted loads at their maximum permitted rates, even when data shows that they are consistently discharging well below that threshold. Another implicit MOS incorporated is the exclusion of BMPs with lifespans ending prior to the snapshot date of current permits and BMPs, even though some BMPs outside of their noted lifespan may still be providing benefit to the watershed. An explicit MOS of 10% is also included in the TMDLs.

Does the Margin of Safety presented seem reasonable for these watersheds?

Load Allocation Scenarios

Preliminary sediment allocation scenarios are presented for the impaired streams in **Table 9** through **Table 15**, and preliminary phosphorus allocation scenarios are presented in **Table 16** through **Table 18**. Each table presents a range of scenarios based on the individual characteristics of each stream. Scenario 1 always shows a uniform reduction percentage across all anthropogenic pollutant sources, and the other scenarios are created based on the land cover make up of each TMDL stream. The allocation scenario tables do not account for pollutant sources that are included in an upstream TMDL watershed. For example, the allocation scenario table for Upham Brook will not include pollutant sources from North Run or Jordans Branch even though North Run and Jordans Branch are tributaries to Upham Brook.

There are some TMDL watersheds which have a small amount of agricultural land use. The pollutant load coming from these minor land use sources is negligible in comparison to the rest of the watershed and the percent reduction could be anywhere between 0% and 100% without changing the required reduction for urban land uses. These watersheds include scenarios with a 20% reduction on these minor agricultural land use sources to allow the improvement of agricultural lands within the watershed where there is interest.

Which load allocation scenarios do you prefer?
Is a reasonable option presented for each watershed?
Are there other scenarios that would be useful to see?
Is the 20% reduction on agricultural lands preferred, or would another reduction percentage make more sense?

Table 9. Allocation Scenarios for Sediment Loading in Upham Brook Watershed

Upham Brook Sediment (VAP-G05R_UPM01A02, VAP-G05R_UPM01B08)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Reduction Focused on Urban Sources		Scenario 2, but with Less focus on Streambank Erosion	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TSS (lb/yr)	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*
Cropland	644	86.1	89	20.0	515	20.0	515
Hay	66	86.1	9	20.0	52	20.0	52
Forest	21,497	-	21,497	-	21,497	-	21,497
Trees	15,083	-	15,083	-	15,083	-	15,083
Shrub	5,230	-	5,230	-	5,230	-	5,230
Wetland	5,045	-	5,045	-	5,045	-	5,045
Turfgrass	16,128	86.1	2,242	86.1	2,242	91.8	1,322
Developed Pervious	17,353	86.2	2,395	86.2	2,395	91.8	1,423
Developed Impervious	656,753	86.2	90,632	86.2	90,632	91.8	53,854
Streambank Erosion	1,482,626	86.1	206,085	86.1	206,085	76.2	352,865
Construction General Permits	100,111	-	100,111	-	100,111	-	100,111
Henrico County	1,547,646	86.1	215,123	86.1	215,123	91.8	126,907
City of Richmond	168,343	86.1	23,400	86.1	23,400	91.8	13,804
VDOT	187,963	86.1	26,127	86.1	26,127	91.8	15,413
MOS (10%)			81,103		81,103		81,103
Future Growth (2%)			16,221		16,221		16,221
TOTAL	**4,224,488**		**810,392**		**810,861**		**810,445**
	0% red.		**80.8% red.**		**80.8% red.**		**80.8% red.**

Table 10. Allocation Scenarios for Sediment Loading in North Run Watershed

North Run Sediment (VAP-G05R_NTR01A00, VAP-G05R_NTR02A06)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Reduction Focused on Urban Sources		Scenario 2, but with Less focus on Streambank Erosion	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TSS (lb/yr)	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*
Cropland	1,975	85.8	280	20.0	1,580	20.0	1,580
Hay	260	85.8	37	20.0	208	20.0	208
Forest	9,552	-	9,552	-	9,552	-	9,552
Trees	17,793	-	17,793	-	17,793	-	17,793
Shrub	3,161	-	3,161	-	3,161	-	3,161
Disturbed Forest	2,412	-	2,412	-	2,412	-	2,412
Wetland	930	-	930	-	930	-	930
Turfgrass	29,719	85.8	4,220	85.9	4,190	89.8	3,031
Developed Pervious	23,870	85.9	3,366	85.9	3,366	89.8	2,435
Developed Impervious	819,418	85.9	115,538	85.9	115,538	89.8	83,581
Streambank Erosion	1,034,329	85.8	146,875	85.8	146,875	75.9	248,273
Industrial Stormwater General Permits	1,606	-	1,606	-	1,606	-	1,606
Construction General Permits	98,108	-	98,108	-	98,108	-	98,108
Henrico County	1,628,081	85.8	231,188	85.9	229,559	89.8	166,064
JSRCC	25,339	85.8	3,598	85.9	3,573	89.8	2,585
VDOT	98,334	85.8	13,963	85.9	13,865	89.8	10,030
MOS (10%)			74,186		74,186		74,186
Future Growth (2%)			14,837		14,837		14,837
TOTAL	**3,794,887**		**741,650**		**741,339**		**740,372**
	0% red.		**80.5% red.**		**80.5% red.**		**80.5% red.**

Table 11. Allocation Scenarios for Sediment Loading in the Jordans Branch Watershed

Jordans Branch Sediment (VAP-G05R_JOP01A14)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Reduction Focused on Urban Sources		Scenario 2, but with Less focus on Streambank Erosion	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TSS (lb/yr)	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*
Cropland	5	93.8	0	20.0	4	20.0	4
Hay	10	93.8	1	20.0	8	20.0	8
Forest	1,979	-	1,979	-	1,979	-	1,979
Trees	801	-	801	-	801	-	801
Shrub	214	-	214	-	214	-	214
Wetland	9	-	9	-	9	-	9
Turfgrass	978	93.8	61	93.8	61	94.2	57
Developed Pervious	8,353	93.8	518	93.8	518	94.2	484
Developed Impervious	244,869	93.8	15,182	93.8	15,182	94.2	14,202
Streambank Erosion	93,873	93.8	5,820	93.8	5,820	87.1	12,110
Industrial Stormwater General Permits	4,145	-	4,145	-	4,145	-	4,145
Construction General Permits	29,848	-	29,848	-	29,848	-	29,848
Concrete Products Facility General Permits	2,247	-	2,247	-	2,247	-	2,247
Henrico County	388,047	93.8	24,059	93.8	24,059	94.2	22,507
City of Richmond	816,480	93.8	50,622	93.8	50,622	94.2	47,356
VDOT	104,841	93.8	6,500	93.8	6,500	94.2	6,081
MOS (10%)			16,153		16,153		16,153
Future Growth (2%)			3,231		3,231		3,231
TOTAL	**1,696,699**		**161,390**		**161,401**		**161,436**
	0% red.		**90.5% red.**		**90.5% red.**		**90.5% red.**

Table 12. Allocation Scenarios for Sediment Loading in the Deep Run Watershed

Deep Run Sediment (VAP-H39R_DPR01A00)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Reduction Focused on Urban Sources		Scenario 2, but with Less focus on Streambank Erosion	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TSS (lb/yr)	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*
Cropland	0	72.6	0	20.0	0	20.0	0
Hay	32	72.6	9	20.0	26	20.0	26
Pasture	270	72.6	74	20.0	216	20.0	216
Forest	7,719	-	7,719	-	7,719	-	7,719
Trees	12,262	-	12,262	-	12,262	-	12,262
Shrub	3,903	-	3,903	-	3,903	-	3,903
Wetland	223	-	223	-	223	-	223
Turfgrass	11,306	72.6	3,098	72.6	3,098	75.0	2,826
Developed Pervious	4,616	72.7	1,260	72.6	1,265	75.0	1,154
Developed Impervious	298,682	72.7	81,540	72.6	81,839	75.0	74,671
Streambank Erosion	190,650	72.6	52,238	72.6	52,238	56.2	83,505
Construction General Permits	30,283	-	30,283	-	30,283	-	30,283
Potable Water Treatment Plant General Permits	0[(1)]	-	3[(2)]	-	3[(2)]	-	3[(2)]
Henrico County	949,542	72.6	260,175	72.7	259,225	75.0	237,386
VDOT	66,402	72.6	18,194	72.7	18,128	75.0	16,600
MOS (10%)			53,521		53,521		53,521
Future Growth (2%)			10,704		10,704		10,704
TOTAL	**1,575,890**		**535,206**		**534,653**		**535,002**
	0% red.		**66.0% red.**		**66.1% red.**		**66.1% red.**

[(1)] The Henrico County WTP (VAG640064) is permitted to discharge but has not yet reported a discharge.
[(2)] The Henrico County WTP permit contains a discharge concentration limit but does not have a restriction on the flow rate. For WLA calculations, an estimated annual flow rate of 11,000 gal/yr and the TSS concentration permit limit of 30 mg/L were used to determine the load allocation scenarios for this outfall.

Table 13. Allocation Scenarios for Sediment Loading in the Stony Run Watershed

Stony Run Sediment (VAP-H39R_SNJ01A04, VAP-H39R_SNJ02A04)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Scenario 1 with a Higher focus on Streambank Erosion		Scenario 1 with a Lower focus on Streambank Erosion	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TSS (lb/yr)	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*
Forest	1,730	-	1,730	-	1,730	-	1,730
Trees	3,764	-	3,764	-	3,764	-	3,764
Shrub	838	-	838	-	838	-	838
Wetland	22	-	22	-	22	-	22
Turfgrass	3,156	43.9	1,771	42.5	1,815	45.0	1,736
Developed Pervious	945	43.9	530	42.5	543	45.0	520
Developed Impervious	48,966	43.9	27,470	42.5	28,156	45.0	26,931
Streambank Erosion	16,841	43.9	9,448	70	5,052	26.4	12,395
Construction General Permits	5,345	-	5,345	-	5,345	-	5,345
Henrico County	232,130	44.0	129,993	42.5	133,475	45.0	127,672
VDOT	2,559	44.0	1,433	42.5	1,471	45.0	1,407
MOS (10%)			20,724		20,724		20,724
Future Growth (2%)			4,145		4,145		4,145
TOTAL	**316,296**		**207,213**		**207,080**		**207,229**
	0% red.		**34.5% red.**		**34.5% red.**		**34.5% red.**

Table 14. Allocation Scenarios for Sediment Loading in the Stony Run UT Watershed

Stony Run UT Sediment (VAP-H39R_XYT01A08)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Scenario 1 with a Lower focus on Streambank Erosion		Scenario 2 with a Lower focus on Streambank Erosion	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TSS (lb/yr)	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*
Forest	977	-	977	-	977	-	977
Trees	3,426	-	3,426	-	3,426	-	3,426
Shrub	601	-	601	-	601	-	601
Wetland	998	-	998	-	998	-	998
Turfgrass	4,802	68.9	1,493	69.1	1,484	69.9	1,445
Developed Pervious	2,353	69.0	730	69.1	727	69.9	708
Developed Impervious	128,982	69.0	39,984	69.1	39,856	69.9	38,824
Streambank Erosion	1,905	68.9	593	50.0	953	10.0	1,715
Construction General Permits	7,475	-	7,475	-	7,475	-	7,475
Henrico County	53,270	68.9	16,567	69.2	16,407	69.9	16,034
VDOT	22,158	68.9	6,891	69.2	6,825	69.9	6,669
MOS (10%)			9,062		9,062		9,062
Future Growth (2%)			1,812		1,812		1,812
TOTAL	**226,947**		**90,609**		**90,603**		**89,746**
	0% red.		**60.1% red.**		**60.1% red.**		**60.5% red.**

Table 15. Allocation Scenarios for Sediment Loading in the Dover Creek Watershed

Dover Creek Sediment (VAP-H39R_DOV01A00)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Reduction Focused Solely on Agricultural Sources		Reduction Focused on Agricultural Sources, but including Urban Sources	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TSS (lb/yr)	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*	*%*	*TSS (lb/yr)*
Cropland	157,018	25.3	117,293	32.4	106,144	28.7	111,954
Hay	32,055	25.3	23,945	32.4	21,669	28.7	22,855
Pasture	157,199	25.3	117,427	32.4	106,266	28.7	112,083
Forest	36,087	-	36,087	-	36,087	-	36,087
Trees	5,425	-	5,425	-	5,425	-	5,425
Shrub	8,135	-	8,135	-	8,135	-	8,135
Disturbed Forest	4,094	-	4,094	-	4,094	-	4,094
Wetland	111	-	111	-	111	-	111
Turfgrass	4,345	25.2	3,250	-	4,345	13.0	3,780
Developed Pervious	3,294	25.2	2,464	-	3,294	13.1	2,863
Developed Impervious	93,132	25.2	69,663	-	93,132	13.1	80,932
Streambank Erosion	13,111	25.2	9,807	32.3	8,876	28.7	9,348
Construction General Permits	29,069	-	29,069	-	29,069	-	29,069
MOS (10%)			48,499		48,499		48,499
Future Growth (2%)			9,700		9,700		9,700
TOTAL	**543,075**		**484,969**		**484,846**		**484,935**
	0% red.		**10.7% red.**		**10.7% red.**		**10.7% red.**

Table 16. Allocation Scenarios for Phosphorus Loading in the Upham Brook Watershed

Upham Brook Phosphorus (VAP-G05R_UPM01A02, VAP-G05R_UPM01B08)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Reduction Focused on Urban Sources		Scenario 2, but with Less focus on Streambank Erosion	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TP (lb/yr)	*%*	*TP (lb/yr)*	*%*	*TP (lb/yr)*	*%*	*TP (lb/yr)*
Cropland	1	74.6	0	20.0	1	20.0	1
Hay	1	74.6	0	20.0	1	20.0	1
Forest	8	-	8	-	8	-	8
Trees	9	-	9	-	9	-	9
Shrub	1	-	1	-	1	-	1
Wetland	1	-	1	-	1	-	1
Turfgrass	103	74.7	26	74.7	26	76.0	25
Developed Pervious	17	74.7	4	74.7	4	76.0	4
Developed Impervious	1,412	74.7	357	74.7	357	76.0	339
Groundwater	273	-	273	-	273	-	273
Septic	7	74.6	2	74.6	2	74.6	2
Streambank Erosion	519	74.6	132	74.6	132	59.5	210
Construction General Permits	111	-	111	-	111	-	111
Henrico County	3,534	74.7	894	74.7	894	76.0	848
City of Richmond	392	74.7	99	74.7	99	76.0	94
VDOT	398	74.7	101	74.7	101	76.0	95
MOS (10%)			230		230		230
Future Growth (2%)			46		46		46
TOTAL	**6,787**		**2,294**		**2,296**		**2,298**
	0% red.		**66.2% red.**		**66.2% red.**		**66.1% red.**

Table 17. Allocation Scenarios for Phosphorus Loading in the Stony Run Watershed

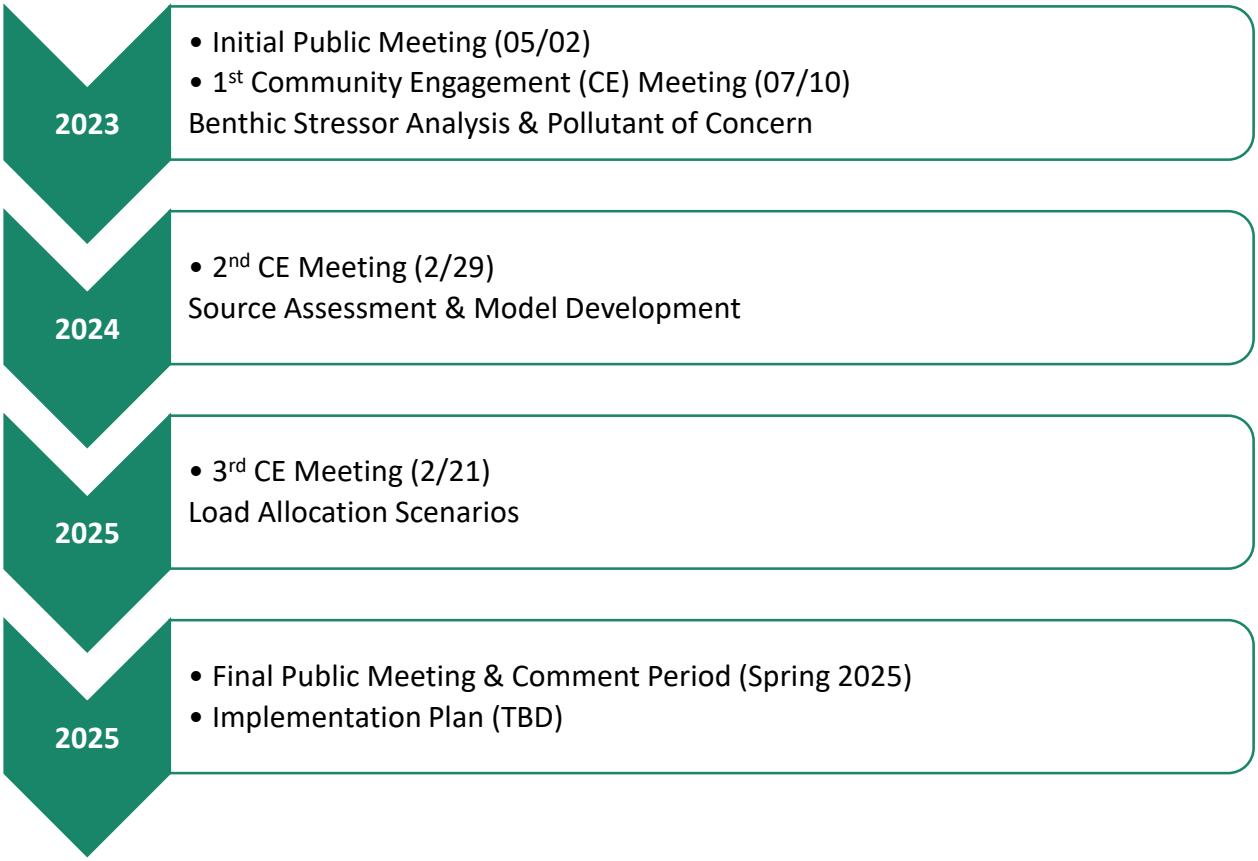
Stony Run Phosphorus (VAP-H39R_SNJ01A04, VAP-H39R_SNJ02A04)		**Scenario 1**		**Scenario 2**		**Scenario 3**	
		Uniform Reduction		Scenario 1 with a Lower focus on Streambank Erosion		Scenario 2 with a Lower focus on Streambank Erosion	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TP (lb/yr)	*%*	*TP (lb/yr)*	*%*	*TP (lb/yr)*	*%*	*TP (lb/yr)*
Forest	1	-	1	-	1	-	1
Trees	2	-	2	-	2	-	2
Shrub	0	-	0	-	0	-	0
Wetland	0	-	0	-	0	-	0
Turfgrass	9	79.7	2	79.9	2	80.2	2
Developed Pervious	1	79.7	0	79.9	0	80.2	0
Developed Impervious	108	79.7	22	79.9	22	80.2	21
Groundwater	31	-	31	-	31	-	31
Streambank Erosion	6	79.6	1	50.0	3	30.0	4
Construction General Permits	6	-	6	-	6	-	6
Henrico County	485	79.7	98	80.0	97	80.2	96
VDOT	6	79.7	1	80.0	1	80.2	1
MOS (10%)			19		19		19
Future Growth (2%)			4		4		4
TOTAL	**655**		**187**		**188**		**187**
	0% red.		**71.5% red.**		**71.3% red.**		**71.5% red.**

Table 18. Allocation Scenarios for Phosphorus Loading in the Dover Creek Watershed

Dover Creek Phosphorus (VAP-H39R_DOV01A00)		**Scenario 1**		**Scenario 2**		**Scenario 3**		**Scenario 4**	
		Uniform Reduction		Reduction Focused Solely on Agricultural Sources		Reduction Focused Solely on Urban Sources		More Balanced Reductions with a Focus on Agricultural Sources	
Source	Existing	Red.	Allocation	Red.	Allocation	Red.	Allocation	Red.	Allocation
	TP (lb/yr)	*%*	*TP (lb/yr)*	*%*	*TP (lb/yr)*	*%*	*TP (lb/yr)*	*%*	*TP (lb/yr)*
Cropland	46	36.7	29	74.0	12	-	46	53.8	21
Hay	84	36.8	53	74.1	22	-	84	53.8	39
Pasture	79	36.8	50	74.1	20	-	79	53.8	36
Forest	8	-	8	-	8	-	8	-	8
Trees	2	-	2	-	2	-	2	-	2
Shrub	1	-	1	-	1	-	1	-	1
Disturbed Forest	1	-	1	-	1	-	1	-	1
Wetland	0	-	0	-	0	-	0	-	0
Turfgrass	10	36.7	6	-	10	71.6	3	20.0	8
Developed Pervious	2	36.7	1	-	2	71.6	1	20.0	1
Developed Impervious	205	36.7	129	-	205	71.6	58	20.0	164
Groundwater	91	-	91	-	91	-	91	-	91
Septic	13	36.7	8	36.7	8	36.7	8	36.7	8
Streambank Erosion	5	36.7	3	74.0	1	71.6	1	53.8	2
Construction General Permits	32	-	32	-	32	-	32	-	32
MOS (10%)			47		47		47		47
Future Growth (2%)			9		9		9		9
TOTAL	**579**		**470**		**471**		**471**		**470**
	0% red.		**18.8% red.**		**18.7% red.**		**18.7% red.**		**18.8% red.**

What's next?

Once the load allocation scenarios are selected, a draft TMDL report will be completed and shared with the group for review. A final public meeting will be conducted followed by a 30-day public comment period.



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