Tidewater Community College

Chesapeake Bay TMDL Action Plan

Phase II

See supplemental "Preliminary Engineering Report for Chesapeake Bay TMDL Action Plan Phase II Compliance Assessment" provided after this action plan and dated July 2022.

Effective: November 1, 2019

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Appendices

Executive Summary

Tidewater Community College (TCC) is permitted to discharge stormwater from the college's municipal separate storm sewer systems (MS4s) by maintaining coverage under the General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Small MS4s (MS4 General Permit). In part, the MS4 General Permit requires the college to meet special conditions for the Chesapeake Bay Total Maximum Daily Load (TMDL). Included as a special conditions is the development of this Action Plan and the specific information contained herein; most notably, the description of past progress and proposed practices to achieve additional pollutant reductions within stormwater discharge from the college's MS4s.

TCC successfully achieved the pollutant reductions required during the last MS4 General Permit cycle that spanned from 2013 – 2018, representing a minimum of 5% of the total reductions that are to be achieved by 2028. The best management practices (BMPs) to achieve the pollutant reductions were described in the college's Phase I Action Plan developed during the previous permit cycle. The Phase I Action Plan includes computations that demonstrate available pollutant reduction credit from applicable existing BMPs far exceeded the required reductions for the last permit cycle. The achievement of the required reductions is also summarized in TCC's 2017-2018 MS4 annual reporting provided to the Department of Environmental Quality.

The current MS4 General Permit requires reduction of an additional 35% of the total required pollutant reductions (40% cumulative) be achieved prior to the conclusion of the current permit cycle that expiries on October 31, 2023. TCC plans to achieve the cumulative reductions with implementation of a street sweeping program initiated in 2019. The program utilizes a regenerative-air street sweeper owned by the college. Towards measuring effectiveness of sweeping and quantifying reductions, TCC has participates in a program with other MS4s that includes compiling and analyzing data resulting from annual sample analysis of swept material and the documentation of specific variables associated with sweeping operations. Quantification of pollutant reductions achieved in 2019 from street sweeping indicates sweeping has potential to achieve the remainder of the reductions required to annually be achieved by 2023. Changes to this plan may occur, as necessary, as part of an iterative process to ensure the annual pollutant reduction target can consistently be met.

1.0 Introduction

TCC has developed, implements and enforces a municipal separate storm sewer system (MS4) program designed to reduce the discharge of pollutants from the college's MS4s to the maximum extent practicable (MEP) in accordance with the General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Small MS4s (MS4 General Permit). The purpose of the program is to protect water quality, and to satisfy the appropriate water quality requirements of the State Water Control Law and its attendant regulations. TCC utilizes the legal authority provided by the laws and regulations of the Commonwealth of Virginia to control discharges to and from the college MS4s through the MS4 General Permit, college policies and specific contract language, as applicable.

Compliance with the MS4 General Permit is dependent on the implementation of best management practices (BMPs) to address minimum control measures described in the permit and Special Condition requirements associated with applicable total maximum daily loads (TMDLs). The TCC MS4 program plan describes the BMPs to address each permit requirement, including reference to this action plan to achieve specific pollutant reductions in accordance with Chesapeake Bay TMDL Special Conditions. This action plan serves as the second phase of a plan to ultimately achieve 100% of the required reductions in three phases by 2028. This second phase of the TCC action plan, as required by the MS4 General Permit, includes:

- ✓ Loading and cumulative reduction calculations, as specified by the permit;
- ✓ Total pollutant reductions achieved during the last permit cycle that concluded in 2018, along with the BMPs implemented and reductions achieved by each;
- ✓ A description of the BMPs to be implemented as part of the Phase II Action Plan to achieve the reductions required by the MS4 General Permit prior to the expiration of the current permit that expires in 2023; and
- ✓ A description of legal authorities necessary to implement the BMP to be employed to achieve the pollutant reductions required by the permit.

1.1 Chesapeake Bay TMDL

A total maximum daily load (TMDL) is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and maintain water quality standards for the pollutant(s) impairing the water body. A TMDL assigns a pollutant

reduction target and allocates load reductions to the source(s) of the pollutant, including discharges from regulated MS4s.

On December 29, 2010, the U.S. Environmental Protection Agency (EPA) established the Chesapeake Bay TMDL. The TMDL is a historic and comprehensive "pollution diet" to restore clean water in the Chesapeake Bay and the region's streams, creeks, and rivers. The TMDL is the largest ever developed by EPA, encompassing a 64,000-square-mile watershed. The TMDL identifies the necessary pollution reductions from major sources of total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) across the Bay jurisdictions. Subsequently, the Bay jurisdictions, that include Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia, have developed Watershed Implementation Plans (WIPs) that include detailed steps each of the watershed jurisdictions will take to meet the pollution reduction goals of the Chesapeake Bay TMDL. In part, Virginia's Phase I and Phase II WIPs identify municipal separate storm sewer system (MS4) permits as a mechanism for ensuring nutrient and sediment reductions equivalent to the MS4 General Permit-referenced Level 2 (L2) Scoping Run of the Chesapeake Bay Model 5.3.2.

2.0 MS4 Pollutant Discharge Characterization

Pollutant load and cumulative reduction calculations are provided in this Section for the four regulated campuses under the MS4 General Permit, each of which lies within the James River Basin. The loading and required reduction calculations are determined using the James River Basin calculation sheet provided within the MS4 General Permit and are dependent on the regulated impervious and pervious area draining to the college's MS4 outfalls, as reflected in **Table 2.1** and **Appendix 'A'** mapping.

Table 2.1 Summary of regulated impervious and pervious area for the TCC campuses.

TCC Campus	MS4 Regulated Area (acres)[1]	
	Impervious	Pervious
Chesapeake campus	19.36	23.62
Norfolk campus	2.23	0.30
Portsmouth campus	17.8	15.61
Virginia Beach campus	55.84	59.56
Total	95.23	99.09

[1] Areas vary from the Phase I plan as a result of the refined mapping reflected in Appendix A.

2.1 Pollutant Loadings

Pollutant loading are computed for the MS4 regulated areas within the TCC campuses listed in Table 2.1 using the calculation sheet provided in the MS4 General Permit for the respective basin within which the campuses reside. The calculation sheets provide the loading rates as pounds (lbs), per acre (ac), per year (yr) for computing the loads provided in **Table 2.2**. The sum of the campus areas is used since each lies within the same basin.

Table 2.2 TCC loadings based on the James River Basin calculation sheet provided in the MS4 General Permit.

Pollutant	Subsource	Loading Rate (lbs/ac/yr)	Area (acres)[1]	Load (lbs/yr)	Total Load (lbs/yr)
TN	Impervious	9.39	95.23	894	1,587
	Pervious	6.99	99.09	693	
TP	Impervious	1.76	95.23	168	217
	Pervious	0.50	99.09	50	
TSS	Impervious	676.94	95.23	64,465	74,481
	Pervious	101.08	99.09	10,016	

[1] Summed regulated MS4 area served by the TCC campuses listed in Table 2.1 within the 2010 Census Urbanized Area.

2.2 Required Cumulative Pollutant Reductions

The required cumulative pollutant reductions for the MS4 regulated areas within the TCC campuses listed in **Table 2.1** are determined using the calculation sheet provided in the MS4 General Permit for the respective basin within which the campuses resides. The calculation sheet provides the total percentage of the loadings required for the L2 Scoping Run of the Chesapeake Bay Model, as reflected in **Table 2.3**, for computing required reductions. Additional pollutant reductions as a result of: (1) new sources initiating construction between July 1, 2009, through June 30, 2019 with total phosphorus loadings exceeding 0.45 lbs/acre/yr, or (2) grandfathered projects initiating construction after July 1, 2014, with total phosphorus loadings exceeding 0.45 lbs/acre/yr, are not necessary since neither occurred at either regulated campus.

Table 2.3 TCC required load reductions based on the James River Basin calculation sheet provided in the MS4 General Permit.

Pollutant	Subsource	Load (lbs/yr)[1]	Total Load Reduction (%)[2]	Required Reduction by 2023 (lbs/yr)[3]	Total Load Reduction by 2023 (lbs/yr)[3]
TN	Impervious	894	9	32	49
	Pervious	693	6	17	
TP	Impervious	168	16	11	12
	Pervious	50	7.25	1.44	
TSS	Impervious	64,465	20	5,157	5,508
	Pervious	10,016	8.75	351	

[1] From Table 2.2.
[2] Percentage of total load reduction per the L2 Scoping Run of the Chesapeake Bay Model.
[3] Represents 40% of the total load reduction, as required for the current permit cycle.

3.0 Pollutant Reduction – Phase I Milestones

TCC's Phase I Chesapeake Bay TMDL Action Plan, dated October 1, 2015, provided computations identifying excess (surplus) credit from applicable existing BMPs to achieve, in excess, the 5% of the total required reductions by July 1, 2018. The following subsection presents the total reductions that were demonstrated to be available to be applied to the Chesapeake Bay TMDL from the existing BMPs.

3.1 Compliance Summary

TCC exceeded the 5% of the total reductions required during the previous permit cycle with pollutant reduction offsets (surplus) provided by applicable existing BMPs as presented in the TCC Chesapeake Bay TMDL Action Plan, dated October 1, 2015, prepared by Vanasse Hangen Brustlin, Inc (VHB). Specifically, five BMPs were identified to have provided surplus credit in excess to the reductions required by their associated capital improvement projects (CIPs), as listed in **Table 3.1**.

Table 3.1 Reductions provided by existing BMPs per the Virginia Department of Environmental Quality (DEQ)-approved TCC Chesapeake Bay TMDL Action Plan, dated October 1, 2015.

Campus	Project Name	BMP	TP Removal Required (lbs/yr)	TP Removal Achieved (lbs/yr) [1]	Surplus Pollutant Removal[1]		
					TP	TN	TSS
Chesapeake	Student Center & Academic Building	Wet Pond	10.82	13.04	2.22	11.54	934.40
Norfolk	Student Center	WQ Inlet	0.42	0.51	0.09	0.47	37.88
Portsmouth	Student Center	Bioretention	2.36	3.09	0.73	3.80	307.26
Virginia Beach	Regional Health Professions Center	Bioretention	6.68	11.03	4.35	22.62	1,830.92
	Learning Resource Center	Detention Basin	-	0.40	0.40	2.08	168.36
Total Surplus for Chesapeake Bay TMDL Reduction Credit:					7.79	40.51	3,278.82

[1] Supporting computations provided in the DEQ-approved TCC Chesapeake Bay TMDL Action Plan dated October 1, 2015.

The surplus pollutant reductions provided by the applicable existing BMPs exceeded 5% of the total reductions required during the previous permit cycle by greater than fivefold for TP and TSS and greater than sixfold for TN, as reflected in **Table 3.2**. TCC annually inspects and maintains, as needed, each of the BMPs listed in Table 3.1 to ensure their continued functionality, as designed. Documentation of inspections and any necessary maintenance is retained by the college and has been reflected in annual reporting.

Table 3.2 TCC Chesapeake Bay TMDL Action Plan compliance summary towards achieving 5% of the total reductions required during the previous permit cycle.

Pollutant	Reduction Required for the Phase I Action Plan (5% of total)	Reduction Provided by existing BMPs per Phase I Action Plan[1]
TN	6.67	40.51
TP	1.46	7.79
TSS	638.22	3,278.81

[1] Exceeds reductions required by July 1, 2018.

4.0 Phase II Pollutant Reduction Practices

TCC will continue annual inspection and maintenance, as needed, for the BMPs listed in **Table 3.1** to continue to ensure functionality of the BMPs; and therefore, maintain the surplus credit applied towards Chesapeake Bay TMDL reduction requirements. TCC will implement a street sweeping program to obtain the additional reductions necessary to achieve the cumulative 40% of the total reductions by the 2023 expiration date of the current MS4 General Permit, as shown in **Table 4.1**.

Table 4.1 Summary of reductions achieved and remaining towards achieving 40% of the total reductions required by the expiration of the current permit cycle.

Pollutant	Load Reduction Req'd by 2023 (lbs/yr)[1]	Reduction Provided by existing BMPs per Phase I Action Plan[2]	Remaining Load Reduction Req'd by 2023 (lbs/yr)[3]
TN	49	40.51	8.49
TP	12	7.79	4.21
TSS	5,508	3,278.81	2,229

[1] From Table 2.3.
[2] From Table 3.1.
[3] Additional reduction necessary from street sweeping.

Supporting information regarding the implementation of street sweeping to achieve the remainder of the required reductions is provided in the following subsections.

4.1 Plan to Achieve Remainder of the Cumulative 40% Reductions

TCC will implement a street sweeping program towards achieving the remainder of cumulative 40% of the total reductions by the expiration date of the current permit cycle. However, past computational methods or quantifying reductions from street sweeping such as the Mass Loading Approach based on a study by Law (2008) and as previously accepted by the Virginia DEQ (VDEQ 2015), have been phased out. The phasing out of previous quantification methods were based on recommendations by an expert panel that concludes data regarding the impact to water quality from street sweeping is sparse and more studies are needed, suggesting challenges to measure impact in receiving waters may prevent the ability to measure effectiveness in receiving streams altogether (Schueler et al. 2016). As an alternative, the expert

panel presents pollutant reduction efficiency values generated from a modeling application dependent on sweeping frequency and the type of sweeper employed. The model predicts rigorous sweeping frequency as necessary to achieve any appreciable pollutant reductions which is not practicable, nor feasible, for a community college. Further, due to difficulties measuring impacts downstream, the model cannot be calibrated to real world conditions in receiving streams.

In response, TCC participates in an ongoing study with other MS4 permittees that includes collecting and analyzing swept material samples as a means to assist in quantifying reductions achieved by the practice. Results from the study obtained during the previous permit cycle are presented by Hixon and Dymond (2019) and find association of pollutants within a fraction of swept material that is susceptible to downstream transport and therefore removed from contributing to TMDLs. At this time, approximately 80 samples have been collected and analyzed. The study includes laboratory analysis of the samples for moisture content, particles size distribution, and TN and TP concentrations. More recently, laboratory analysis has been refined to only test for TN and TP concentrations within the particle size range susceptible to runoff. Variables that could potentially impact the contents of swept material are also collected, resulting in insight published in an American Society of Engineers (ASCE) peer-reviewed journal regarding, in part:

- ✓ The fraction of collected material removed from the swept surface as a result of runoff. Specifically, particles < 840 µm are much less abundant in swept material collected within 2 days after a rainfall event compared to those collected after 2 days since rainfall;
- ✓ The association of TP with particles < 250 µm within the range of particles < 840 µm that are washed from the surface;
- ✓ The association of TN with the full range of particles that are < 840 µm washed from the surface; and
- ✓ Variations in the particles washed from the surface and nutrient concentrations dependent on the type of surface swept, whether sweeping parking lots or streets.

Exponential regression of the collected data was used to correlate and extrapolate values for computing pollutant reductions for the mass of swept material susceptible to transport downstream to surface waters, reflected in **Table 4.2**. The values allow for computation of the

TN, TP and TSS reductions achieved from within the MS4 regulated area based on the total mass of the swept material. Reductions vary dependent on the duration since the last rainfall when sweeping occurs and the type of surface area swept.

Table 4.2 Estimate of pollutant reduction to surface waters per ton of swept materials (Hixon and Dymond 2019).

Surface Type	Days Since Rain	TP (< 250 µm) (lbs/ton)[1]	TN (< 841 µm) (lbs/ton)[1]	TSS (< 841 µm) (lbs/ton)[1]
Streets	≤ 2	0.149	0.335	571
	> 2	0.257	0.585	998
Parking Lots	≤ 2	0.141	0.466	794
	> 2	0.320	0.766	1,307

[1] Adjusted using a moisture content of 2.2% to compute dry weight, the median value measured in samples presented by Hixon and Dymond (2019).

TCC applied the results of the study summarized in **Table 4.2**, conservatively based on sweeping parking lots within 2 days since rainfall, for quantifying pollutant reductions achieved by street sweeping in 2019, as summarized in **Table 4.3**. Results find that TCC's 2019 street sweeping program efforts, that collected 28.4 tons of material, achieved the remaining reductions necessary to reach the cumulative 40% of the total reductions annually required for TN and TSS. Whereas TN is typically the limiting pollutant when utilizing sweeping alone to address the pollutant reductions, TP is the limiting pollutant for TCC after surplus credits from existing BMPs have been applied. Assuming the values from **Table 4.2** for sweeping parking lots within 2 days since rainfall are applied to the mass of annually swept material, TCC would need to increase sweeping efforts slightly from the 2019 effort to an annual mass of approximately 30 tons to meet the target for each of the pollutants. However, the total swept mass required could fluctuate depending on:

1. Planning associated with sweeping, specifically with scheduling sweeping when rainfall has not occurred for several days thus increasing the presence of the smaller particles susceptible to transport in runoff; and
2. Refinement of the values in Table 4.2 as additional data is obtained, incorporated, and assessed with the initial dataset.

Table 4.3 TCC pollutant reductions achieved in 2019 from street sweeping compared to remaining annual reductions required after credit from existing BMPs surplus.

Pollutant	Remaining Annual Load Reduction Req'd by 2023 (lbs/yr)[1]	Reduction Achieved in 2019 with Sweeping Program (lbs)[2]	Percentage of 2023 Req'd Reduction Achieved (%)
TN	8.49	13	> 100
TP	4.21	3.95	95
TSS	2,229	22,578	>100

[1] From Table 4.1 after credit from existing BMPs described in the Phase I Action Plan.
[2] Based on values from Table 4.2 for sweeping parking lots swept within 2 days since rain and total of 28.4 tons swept.

4.1.1 Implementation and Measures of Effectiveness

The results from **Table 4.3** demonstrate street sweeping as an effective practice for TCC to achieve the remainder of the cumulative 40% of the total reductions by the 2023 expiration date of the MS4 General Permit. Further, the sampling study and resulting publication provide a measure of effectiveness and values for quantifying reductions based on actual measures that vary based on efforts of the sweeping program. As part of an iterative process, TCC will utilize and maintain a college-owned street sweeper as part of performing the following annual activities respective to the street sweeping program BMP:

1. Continue to perform street sweeping on the TCC campuses' parking lots and streets with incremental increases towards achieving the remainder of the required reductions by the expiration date of the current MS4 General Permit.
2. Continue to conduct analysis on samples extracted from swept material for inclusion into the initial set of data presented by Hixon and Dymond (2019); specifically for verification and refinement of the exponential regression correlation for quantifying pollutants associated with the fraction of swept material susceptible to transport to receiving waters.
3. Documentation of variables during sweeping instances that impact the contents of swept material to include, at a minimum, duration since the previous rainfall and type of surface swept. Other variables will also be collected on a previously developed data collection form so assessment of results can determine other potential impacts, such as time of year

and type of sweeper used for sweeping instances. As part of an iterative program, this information will be used to develop a sweeping program that minimizes discharge of pollutants from TCC MS4 outfalls.

4. Documentation of the total mass of material swept annually.

If subsequent annual assessments indicate that street sweeping alone will not consistently provide the required pollutant reductions annually, TCC will provide modifications to this plan as part of the annual reporting process.

4.2 Legal Authority to Implement BMPs

As a non-traditional MS4 operating on state property, TCC has operational control of the totality of the regulated MS4 area at the regulated campuses. Therefore, no new or modified legal authorities are necessary to implement the BMPs proposed to achieve cumulative pollutant reduction requirements described in the current MS4 General Permit for the Chesapeake Bay TMDL. Specifically, the following demonstrate legal authorities are in place:

- ✓ TCC has the authority to inspect on perform maintenance of the existing BMPs from which surplus pollutant reduction credits have been applied to achieving pollutant reductions associated with the Special Conditions for the Chesapeake Bay TMDL; and
- ✓ TCC has the authority to conduct street sweeping on parking lots and streets within the regulated areas of each campus.

5.0 References

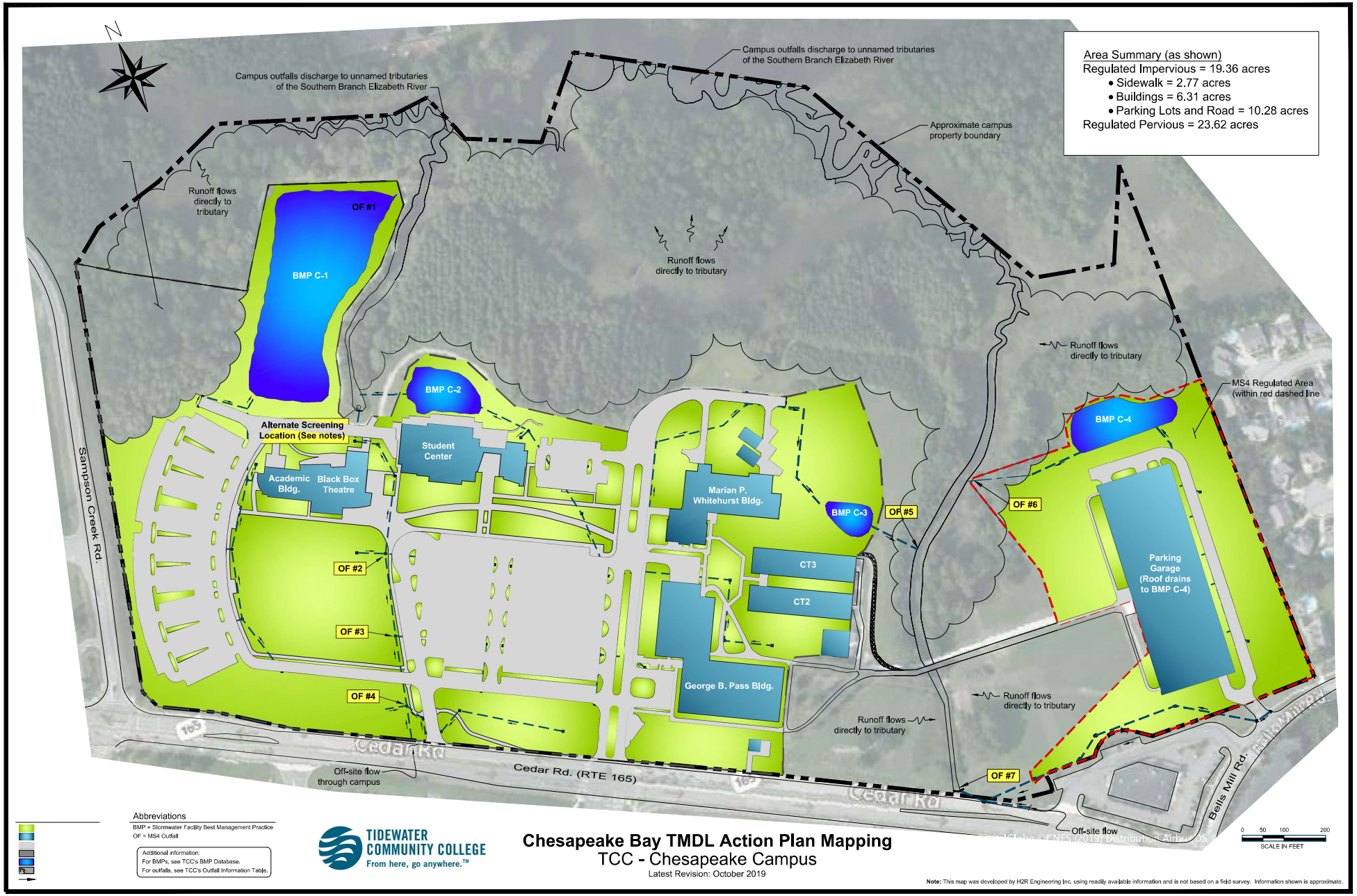
Hixon, L. F. and Dymond, R. L. (2018). "State of the Practice: Assessing Water Quality Benefits from Street Sweeping." *J. Sustainable Water Built Environ*, 10.1061/JSWBAY.0000860, 1-11.

Law, N. L., DiBlasi, K., and Ghosh, U. (2008). "*Deriving reliable pollutant removal rates for municipal street sweeping and storm drain cleanout programs in the Chesapeake Bay basin*." USEPA Chesapeake Bay Program Grant CB-973222-01. Ellicott City, MD: Center for Watershed Protection.

Schueler, T., Giese, E., Hanson, J., Wood, D. (2016). "*Recommendations of the expert panel to define removal rates for street and storm drain cleaning practices*." Chesapeake Bay Program Office. Final report to the Chesapeake Bay Program Management Board.

Virginia Department of Environmental Quality (VDEQ). (2015). "Guidance memo No. 15-2005." Commonwealth of Virginia Department of Environmental Quality Water Division.

Appendix A-1
Chesapeake Bay TMDL Action Plan Mapping – Chesapeake Campus


N
Campus outfalls discharge to unnamed tributaries of the Southern Branch Elizabeth River
Campus outfalls discharge to unnamed tributaries of the Southern Branch Elizabeth River
Approximate campus property boundary
Area Summary (as shown)
Regulated Impervious = 19.36 acres
• Sidewalk = 2.77 acres
• Buildings = 6.31 acres
• Parking Lots and Road = 10.28 acres
Regulated Pervious = 23.62 acres
Runoff flows directly to tributary
OF #1
BMP C-1
Runoff flows directly to tributary
Runoff flows directly to tributary
MS4 Regulated Area (within red dashed line
BMP C-2
BMP C-4
Alternate Screening Location (See notes)
Student Center
Academic Bldg.
Black Box Theatre
Marian P. Whitehurst Bldg.
BMP C-3
OF #5
OF #6
Parking Garage (Roof drains to BMP C-4)
Sampson Creek Rd.
OF #2
CT3
CT2
OF #3
George B. Pass Bldg.
OF #4
Runoff flows directly to tributary
Runoff flows directly to tributary
Off-site flow through campus
Cedar Rd. (RTE 165)
OF #7
Off-site flow
Bells Mill Rd.
Abbreviations
BMP = Stormwater Facility Best Management Practice
OF = MS4 Outfall
Additional information:
For BMPs, see TCC's BMP Database.
For outfalls, see TCC's Outfall Information Table.
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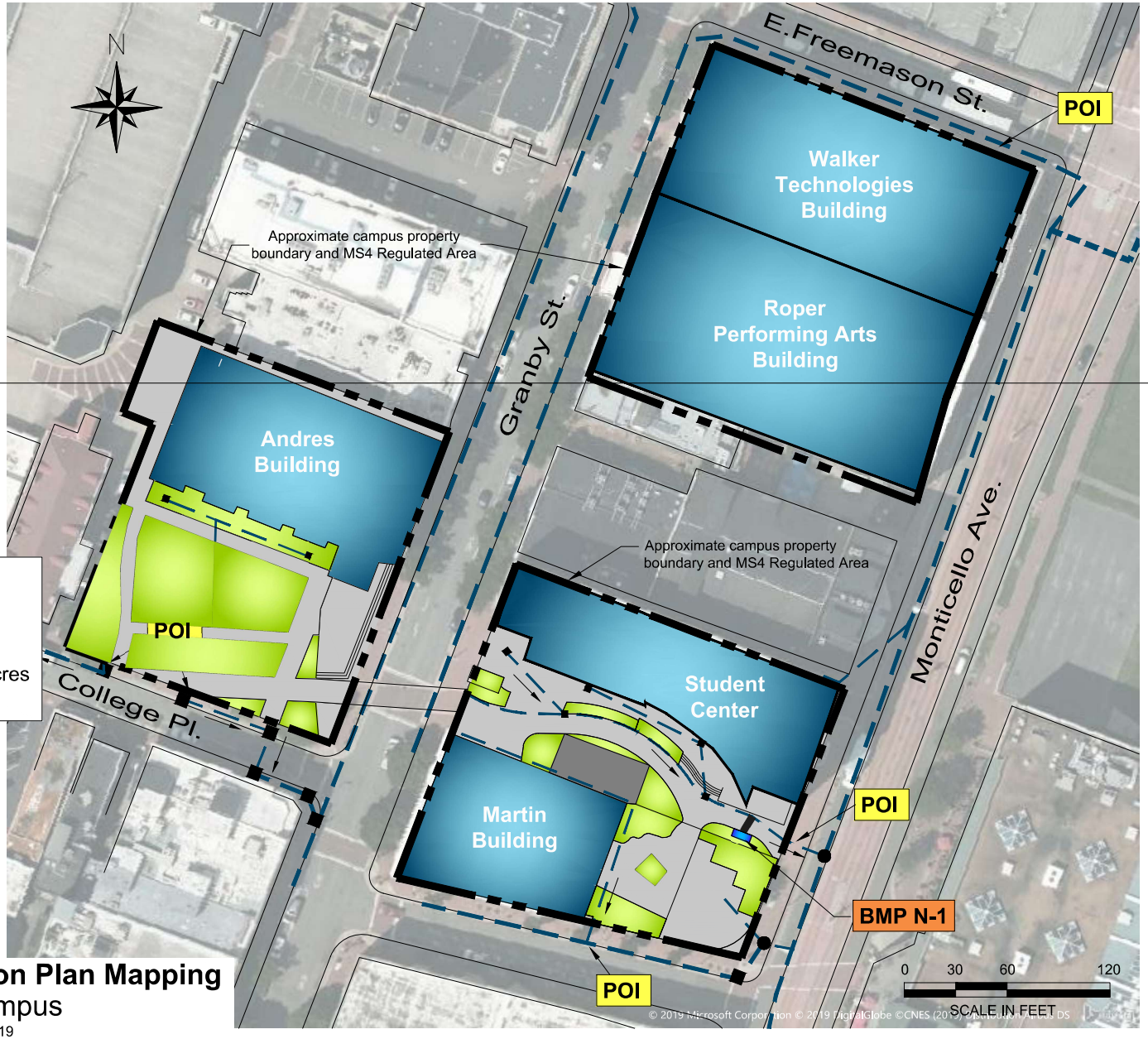
Chesapeake Bay TMDL Action Plan Mapping
TCC - Chesapeake Campus
Latest Revision: October 2019
0 50 100 200
SCALE IN FEET
Note: This map was developed by H2R Engineering Inc. using readily available information and is not based on a field survey. Information shown is approximate.

Appendix A-2
Chesapeake Bay TMDL Action Plan Mapping – Norfolk Campus



Storm channel

Storm structure

BMP = Stormwater Facility Best Management Practice

POI = Point of Interconnection to City MS4

For additional information regarding stormwater see the TCC BMP Database.

Note: This map was developed by H2R Engineering Inc. using readily available information and is not based on a field survey. Information shown is

Area Summary (as shown)

Regulated Impervious = 2.23 acres

Sidewalk = 0.54 acres

Buildings = 1.68 acres

Parking Lots and Road = 0.00 acres

Regulated Pervious = 0.30 acres

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Chesapeake Bay TMDL Action Plan Mapping

TCC - Norfolk Campus

Latest Revision: October 2019

Appendix A-3
Chesapeake Bay TMDL Action Plan Mapping – Portsmouth Campus

N

Legend
- Pervious
- Building
- Road
- Sidewalk
- Water
- Forest / undeveloped
- Flow direction
- Storm sewer
- Storm channel
- Storm structure

Abbreviations

BMP = Stormwater Facility Best Management Practice
POI = Point of Interconnection to City MS4

For additional information regarding stormwater facility BMPs, see the TCC BMP Database.

Area Summary (as shown)

Regulated Impervious = 17.8 acres
- Sidewalk = 5.16 acres
- Buildings = 2.93 acres
- Parking Lots and Road = 9.71 acres

Regulated Pervious = 15.61 acres

Chesapeake Bay TMDL Action Plan Mapping

TCC - Portsmouth Campus

Latest Revision: October 2019

0 50 100 200
SCALE IN FEET

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This map was developed by H2R Engineering Inc. using readily available information and is not based on a field survey. Information shown is approximate.

Appendix A-4
Chesapeake Bay TMDL Action Plan Mapping – Virginia Beach Campus

Area Summary (as shown)
Regulated Impervious = 55.84 acres
- Sidewalk = 5.73 acres
- Buildings = 10.89 acres
- Parking Lots and Road = 39.22 acres

Regulated Pervious = 59.56 acres

Legend
- Pervious
- Building
- Road
- Sidewalk
- SWM Facility
- Forest / undeveloped
- Flow direction
- Storm sewer
- Storm channel
- Storm structure

Abbreviations
BMP = Stormwater Facility Best Management Practice
OF = MS4 Outfall
POI = Point of interconnection with City MS4

For additional information regarding stormwater facility BMPs, see the TCC BMP Database.

0 75 150 300
SCALE IN FEET

Note: This map was developed by H2R Engineering Inc. using readily available information and is not based on a field survey. Information shown is approximate.

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Chesapeake Bay TMDL Action Plan Mapping

TCC - Virginia Beach Campus

Latest Revision: October 2019

Public Input

TCC will maintain this Chesapeake Bay TMDL Action Plan on the college's stormwater management webpage and solicit public comment on the plan. A summary of any comments received from the TCC public (students, faculty, and staff) will be provided below with a response from the college. Any changes to this Action Plan resulting from public comment will also be referenced below.

1. **Comment:** (Pending Comment)
   Response: (Pending Comment)
   Plan Modification: (Pending Comment)

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Preliminary Engineering Report for Chesapeake Bay TMDL Action Plan Phase II - Compliance Reassessment

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Prepared: July 2022

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The current MS4 General Permit requires reduction of an additional 35% of the total required pollutant reductions (40% cumulative) be achieved prior to the conclusion of the current permit cycle that expiries on October 31, 2023. These reductions are partially achieved with the excess credit from existing BMPs described in the Phase I Action Plan. TCC's Phase II Action Plan proposes to achieve the remaining reductions with implementation of a street sweeping program initiated in 2019. The Phase II Action Plan describes quantification of pollutant reductions based on a program that includes continued compilations of data from swept material chemical analyses in context to past studies. Since the development of the Phase II Action Plan, quantification of reductions and sample analyses has been refined to only determine the pollutant concentrations in the fraction of swept particles characterized as total suspended solids (TSS), with only the TSS-associated particles quantified as reductions (Refined Sampling Method).

Quantification of pollutant reductions achieved in the two previous reporting years from street sweeping indicates that sweeping has potential to achieve the remainder of the reductions required to annually be achieved by 2023. However, the ability to achieve the required reductions with sweeping is based on continued quantification using the Refined Sampling Method. Although the Refined Sampling Method is based on a published study and continued sampling, it is not yet

known if the Department of Environmental Quality (DEQ) will continue to accept this quantification method.

Alternatively, DEQ issued guidance for quantifying pollutant reductions from street sweeping in DEQ Guidance Memo No. 20-2003 (DEQ Guidance), dated November 11, 2020. Although guidance and not regulation, DEQ may *require* the guidance be used for quantifying pollutant reductions. The DEQ Guidance method is based on data from street solids information and uses a model to determine street sweeping credit. However, the determinations are not based on calibrated sampling information in surface waters and the results are suspect, conflicting with the Refined Sampling Method and dramatically reducing the pollutant reduction credits provided in previous DEQ Guidance. If the DEQ Guidance quantification method is required, sweeping frequency must increase to once every two months and an additional BMP, forest buffer, be implemented, to achieve the 2023 reductions.

As is described in this Preliminary Engineering Report (PER), a reassessment of the Phase II Action Plan, with consideration of the new DEQ Guidance and applicable BMP alternatives, suggest the following Action Plan scenario be implemented:

- ✓ An increase in sweeping frequency of the 56 acres illustrated in Appendix A mapping once per two-month period beginning the 2022-2023 reporting period; and
- ✓ Installation of the 740 LF of forest buffer (70’ width) in the locations shown in Appendix A mapping.

Note: The suggested practices reflect the necessary compliance scenario in the case that DEQ *requires* the DEQ Guidance quantification be used to quantify pollutant reductions achieved by sweeping. This scenario is suggested since:

- ➢ There is potential DEQ will not continue to accept the Refined Sampling Method, although the DEQ Guidance states alternatives “should be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.” Implementing the suggested scenario provides a compliance “fail-safe” in case the DEQ Guidance for quantification is required.
- ➢ In the case the “fail-safe is not needed with the continued acceptance of the Refined Sampling Method, the scenario provides significant pollutant reductions that can be applied towards the remaining required reductions for the 2023-2028 permit cycle, including the total required reductions for TN and TSS.

1.0 Introduction

TCC has developed, implements and enforces a municipal separate storm sewer system (MS4) program designed to reduce the discharge of pollutants from the college's MS4s to the maximum extent practicable (MEP) in accordance with the General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Small MS4s (MS4 General Permit). The purpose of the program is to protect water quality and to satisfy the appropriate water quality requirements of the State Water Control Law and its attendant regulations. TCC utilizes the legal authority provided by the laws and regulations of the Commonwealth of Virginia to control discharges to, and from, the college MS4s through the MS4 General Permit, college policies and specific contract language, as applicable.

Compliance with the MS4 General Permit is dependent on the implementation of best management practices (BMPs) to address minimum control measures described in the permit and Special Condition requirements associated with applicable total maximum daily loads (TMDLs). The TCC MS4 program plan describes the BMPs to address each permit requirement to achieve specific pollutant reductions in accordance with Chesapeake Bay TMDL Special Conditions. The previously developed TCC's Phase II Action Plan (Action Plan), dated November 1, 2019, serves as the second phase of an anticipated three-phase plan to ultimately achieve 100% of the required reductions by 2028. The Action Plan, as required by the MS4 General Permit, includes:

1. Loading and cumulative reduction calculations, as specified by the permit;
2. Total pollutant reductions achieved during the last permit cycle that concluded in 2018, along with the BMPs implemented and reductions achieved by each;
3. A description of the BMPs to be implemented to achieve the reductions required prior to the expiration of the current permit that expires in 2023; and
4. A description of legal authorities necessary to implement the BMP to be employed to achieve the pollutant reductions required by the permit.

For context, this PER also includes Items 1, 2 and 3 listed above, with modifications to Item 3 as part of a reassessment of the Action Plan to ensure compliance with pollutant reduction targets for this permit cycle.

2.0 MS4 Pollutant Discharge Characterization

Pollutant load and cumulative reduction calculations are provided in this Section for the four regulated campuses under the MS4 General Permit, each of which lies within the James River Basin. The loading and required reduction calculations are determined using the James River Basin calculation sheet provided within the MS4 General Permit and are dependent on the regulated impervious and pervious area draining to the college's MS4 outfalls, as summarized in **Table 2.1** and as shown in the Action plan mapping.

Table 2.1 Summary of regulated impervious and pervious area for the TCC campuses.

TCC Campus	MS4 Regulated Area (acres)	
	Impervious	Pervious
Chesapeake campus	19.36	23.62
Norfolk campus	2.23	0.30
Portsmouth campus	17.8	15.61
Virginia Beach campus	55.84	59.56
Total	95.23	99.09

2.1 Pollutant Loadings

Pollutant loading are computed for the MS4 regulated areas within the TCC campuses listed in **Table 2.1** using the calculation sheet provided in the MS4 General Permit for the James River Basin. The calculation sheet provides the loading rates as pounds (lbs), per acre (ac), per year (yr) for computing the loads provided in **Table 2.2**. The sum of the campus areas is used since all lies within the same basin.

Table 2.2 TCC loadings based on the James River Basin calculation sheet provided in the MS4 General Permit.

Pollutant	Subsource	Loading Rate (lbs/ac/yr)	Area (acres)[1]	Load (lbs/yr)	Total Load (lbs/yr)
TN	Impervious	9.39	95.23	894	1,587
	Pervious	6.99	99.09	693	
TP	Impervious	1.76	95.23	168	217
	Pervious	0.50	99.09	50	
TSS	Impervious	676.94	95.23	64,465	74,481
	Pervious	101.08	99.09	10,016	

[1] Summed regulated MS4 area served by the TCC campuses listed in Table 2.1 within the 2010 Census Urbanized Area.

2.2 Required Cumulative Pollutant Reductions

The required cumulative pollutant reductions for the MS4 regulated areas within the TCC campuses listed in **Table 2.1** are determined using the calculation sheet provided in the MS4 General Permit for the James River basin. The calculation sheet provides the total percentage of the loadings required for the L2 Scoping Run of the Chesapeake Bay Model, as reflected in **Table 2.3**, for computing required reductions. Additional pollutant reductions as a result of: (1) new sources initiating construction between July 1, 2009, through June 30, 2019 with total phosphorus loadings exceeding 0.45 lbs/acre/yr, or (2) grandfathered projects initiating construction after July 1, 2014, with total phosphorus loadings exceeding 0.45 lbs/acre/yr, are not necessary since neither occurred at either regulated campus.

Table 2.3 TCC required load reductions based on the James River Basin calculation sheet provided in the MS4 General Permit.

Pollutant	Subsource	Load (lbs/yr)[1]	Total Load Reduction (%)[2]	Required Reduction by 2023 (lbs/yr)[3]	Total Load Reduction by 2023 (lbs/yr) [3]
TN	Impervious	894	9	32	49
	Pervious	693	6	17	
TP	Impervious	168	16	11	12
	Pervious	50	7.25	1.44	
TSS	Impervious	64,465	20	5,157	5,508
	Pervious	10,016	8.75	351	

[1] From Table 2.2.
[2] Percentage of total load reduction per the L2 Scoping Run of the Chesapeake Bay Model.
[3] Represents 40% of the total load reduction, as required for the current permit cycle.

3.0 Pollutant Reduction – Phase I Milestones

TCC's Phase I Chesapeake Bay TMDL Action Plan, dated October 1, 2015, provided computations identifying excess (surplus) credit from applicable existing BMPs to achieve, in excess, the 5% of the total required reductions by July 1, 2018. The following subsection presents the total reductions that were demonstrated to be available and applied to the Chesapeake Bay TMDL from the existing BMPs.

3.1 Compliance Summary

TCC exceeded the 5% of the total reductions required during the previous permit cycle with pollutant reduction offsets (surplus) provided by applicable existing BMPs as presented in the TCC Chesapeake Bay TMDL Action Plan, dated October 1, 2015, prepared by Vanasse Hangen Brustlin, Inc (VHB). Specifically, five BMPs were identified to have provided surplus credit in excess of the reductions required for their associated capital improvement projects (CIPs), as listed in **Table 3.1**.

Table 3.1 Reductions provided by existing BMPs per the Virginia Department of Environmental Quality (DEQ)-approved TCC Chesapeake Bay TMDL Action Plan, dated October 1, 2015.

Campus	Project Name	BMP	TP Removal Required (lbs/yr)	TP Removal Achieved (lbs/yr) [1]	Surplus Pollutant Removal[1]		
					TP	TN	TSS
Chesapeake	Student Center & Academic Building	Wet Pond	10.82	13.04	2.22	11.54	934.40
Norfolk	Student Center	WQ Inlet	0.42	0.51	0.09	0.47	37.88
Portsmouth	Student Center	Bioretention	2.36	3.09	0.73	3.80	307.26
Virginia Beach	Regional Health Professions Center	Bioretention	6.68	11.03	4.35	22.62	1,830.92
	Learning Resource Center	Detention Basin	-	0.40	0.40	2.08	168.36
Total Surplus for Chesapeake Bay TMDL Reduction Credit:					7.79	40.51	3,278.82

[1] Supporting computations provided in the DEQ-approved TCC Chesapeake Bay TMDL Action Plan dated October 1, 2015.

The surplus pollutant reductions provided by the applicable existing BMPs exceeded the 5% target of the total reductions required during the previous permit cycle by greater than fivefold for TP and TSS and greater than sixfold for TN, as reflected in **Table 3.2**.

Table 3.2 TCC Chesapeake Bay TMDL Action Plan compliance summary towards achieving 5% of the total reductions required during the previous permit cycle.

Pollutant	Reduction Required for the Phase I Action Plan (5% of total)	Reduction Provided by existing BMPs per Phase I Action Plan[1]
TN	6.67	40.51
TP	1.46	7.79
TSS	638.22	3,278.81

[1] Exceeds reductions required by July 1, 2018.

TCC continues annual inspection and maintenance, as needed, for the BMPs listed in **Table 3.1** to continue to ensure functionality of the BMPs; and therefore, maintain the surplus credit applied towards Chesapeake Bay TMDL reduction requirements. Documentation of inspections and any necessary maintenance is retained by the college and has been reflected in annual reporting. The remaining pollutant reductions required within the current permit cycle are summarized in **Table 3.3**.

Table 3.3 Summary of reductions achieved and remaining towards achieving 40% of the total reductions required by the expiration of the current permit cycle.

Pollutant	Annual Load Reduction Req'd by 2023 (lbs/yr)[1]	Annual Reduction Provided by existing BMPs per Phase I Action Plan[2]	Remaining Annual Load Reduction Req'd by 2023 (lbs/yr)
TN	49	40.51	**8.49**
TP	12	7.79	**4.21**
TSS	5,508	3,278.81	**2,229**

[1] From Table 2.3.
[2] From Table 3.1.

4.0 Phase II Pollutant Reduction Practices

TCC has implement a street sweeping program since 2019 intended to obtain the remaining reductions, listed in **Table 3.3**, to achieve the cumulative 40% of the total reductions by the 2023 expiration date of the current MS4 General Permit. Quantifications of reductions in **Table 4.1** have been based on the study described in TCC's Phase II Action Plan, based on use of an ongoing dataset with results of chemical analysis on the fraction of swept materials associated with total suspended solids (TSS), referred to as the Refined Sampling Method. Current values for quantification of pollutant reductions from total mass of swept material are provided in **Table 4.2**.

Table 4.1 Summary of reductions achieved by street sweeping the past two reporting periods using the values presented by Hixon and Dymond (2019). **Red** indicates targets not achieved.

Pollutant	Remaining Annual Load Reduction Req'd by 2023 [1] (lbs/yr)	Reduction Achieved in 2019-2020 (lbs/yr) ***(29 tons swept)***	Reduction Achieved in 2020-2021 (lbs/yr) ***(25.3 tons swept)***
TN	**8.49**	14.31	**8.27**
TP	**4.21**	**2.82**	**3.70**
TSS	**2,229**	38,845	14,267

[1] From Table 3.3.

Table 4.2 Estimate of pollutant reduction to surface waters per ton of swept materials, revised values based on refined sampling and growing dataset added to each year from continued sampling.

Days Since Rain	TP (lbs/ton)[1]	TN (lbs/ton)[1]	TSS (≤ 841 µm) (lbs/ton)[2]
≤ 2	0.044	1.188	794 (39.7%)
> 2	0.324	1.336	1,308 (65.4%)

[1] Values applied to material swept < 841 µm (computed with last column).
[2] Adjusted using a moisture content of 2.2% to compute dry weight, the median value measured in samples presented by Hixon and Dymond (2019).

Although results in **Table 4.1** indicate sweeping, with relatively small increases in efforts, can achieve the targets, there is uncertainty the Refined Sampling Method will be accepted. The uncertainty is due to new DEQ guidance for quantifying pollutant reductions from street sweeping (DEQ Guidance Memo No. 20-2003), dated November 11, 2020. Although guidance, and not regulation, DEQ may *require* the guidance be used for quantifying pollutant reductions.

4.1 Street Sweeping for Achieving 2023 Reduction Targets

This Section provides an assessment of the potential for street sweeping to achieve the required 2023 pollutant reductions based on both the Refined Sampling Method and the new DEQ Guidance method based on frequency of sweeping and sweeper type. Note the assessment of both methods is based on sweeping being performed with a regenerative-air or vacuum type sweeper.

4.1.1 Street Sweeping - Refined Sampling Method Quantification

To estimate the annual sweeping effort necessary to achieve the reduction targets, the refined values for quantifying pollutant reductions from **Table 4.2** are applied as:

$$Required\ Mass\ Swept\ (tons) = \frac{TN\ or\ TP\ Mass\ Removed\ (lb)}{(\%\ as\ TSS \times Concentration\ of\ TP\ or\ TN\ in\ lb/ton)} \quad (1)$$

Use of Equation 1 solves for required tonnage necessary as the values provided in **Table 4.3**. Typically, TN is the limiting pollutant, meaning the most difficult reduction target to achieve. However, due to reductions achieved from structural BMPs, **Table 4.3** shows TP as the limiting pollutant, whereas, tonnage of swept material to achieve all pollutant reductions is dependent on the values to achieve the TP reductions. Based on quantification of reductions with the Refined Sampling Method, 33 tons of material would be required to be swept annually if sweeping occurs within 2 days since rainfall. If sweeping occurs when more than 2 days has passed since rainfall, 20 tons would need to be swept annually. Conservatively, TCC should sweep a minimum of 33 tons annually if the Refined Sampling Method is used. Further, this amount may fluctuate over time as the values in the dataset of further refined with continued sampling.

Table 4.3 Estimate of required tonnage of swept material to achieve the 2023 required reductions using the Refined Sampling Method for reduction quantification.

Days Since Rain	TN	TP	TSS
	Material Swept (tons)	Material Swept (tons)	Material Swept (tons)
≤ 2	16	**33**	3
> 2	10	**20**	2
Target Achieved →	8.49 lbs/yr	4.21 lbs/yr	2,229 lbs/yr

4.1.2 Street Sweeping - New DEQ Guidance Quantification

The DEQ Guidance provides pollutant reduction credit based on the frequency a specified area is swept. The credit values are provided as a percentage of removal from the annual pollutant load generated from the swept area using the loading rates in **Table 2.2** for impervious cover. The values in the Guidance are based on data from street solids information and a model to determine street sweeping credit. However, these values are not based on calibrated sampling information in surface waters and the results are suspect. In contrast, the Refined Sampling Method is based on years of continuing sampling data that provides an actual measure of the portion of swept material and associated pollutants that would be transported from the surface downstream, and ultimately to surface waters. The DEQ Guidance values dramatically reduce the pollutant reduction credits provided in previous DEQ Guidance and are significantly lower than reductions quantified with the Refined Sampling Method.

An analysis of campus mapping for TCC's Chesapeake, Portsmouth and Virginia Beach campuses finds a total available area of approximately 56 acres for sweeping, including parking lots and campus-interior streets. Potential reductions based on various sweeping frequency over the 56 acres are provided in **Table 4.3**. Results in the Table show that sweeping of the entire 56 acres on the three campuses would need to be performed once every two weeks to achieve the required 2023 pollutant reduction targets, with sweeping alone. This would be a dramatic increase in TCC's current street sweeping frequency, and assumed not feasible or productive. Sweeping less frequently is shown to still provide significant portions of the required reductions.

Table 4.3 Potential reductions from street sweeping at TCC using DEQ Guidance (GM20-2003). Equivalent curb lane miles available = 56 acres.

Pollutant	Loading Rate (lbs/ac/yr)	Load (lbs/yr)	Total Load Reduction Credit (lbs/yr)*			
			Every 2 Months	Every Month	Every 2 Weeks	Every Week
TN	9.39	525.84	3.68 (43%)	5.26 (62%)	10.52 (124%)	15.78 (186%)
TP	1.76	98.56	1.97 (47%)	2.96 (70%)	4.93 (117%)	7.88 (187%)
TSS	676.94	37,908.64	1,516.35 (68%)	2,274.52 (102%)	4,169.95 (187%)	6,065.38 (272%)

* Within parenthesis are the percentage of total reductions achieved of those required by 2023.

4.2 Alternative Practices for Achieving 2023 Reduction Targets

Section 4.1 demonstrates the potential of street sweeping towards achieving the 2023 target pollutant reductions. In the case the Refined Sampling Method is accepted by DEQ, sweeping efforts with slight increase to those being performed would be adequate for achieving the 2023 reduction targets. In the case the Refined Sampling Method is not accepted by DEQ and the DEQ Guidance must be used, additional means and methods to achieve reductions will be necessary unless sweeping occurs over all 56 acres available for sweeping every two weeks (twice monthly). For the latter scenario, of the available means and methods available for achieving reductions, the following were identified to have suitability to supplement sweeping for TCC: (1) forest buffers and (2) structural SWM facility.

4.2.1 Forest Buffer

Assessment of the TCC campuses finds potential to utilize forest buffering as a means for achieving the 2023 reduction targets in combination with sweeping every other month, based on the results shown in **Table 4.3**. To achieve the remaining reductions if sweeping every other month was implemented, 740 linear feet (LF) of a 70-foot forest buffer would need to be established at the locations shown in Appendix A at the Virginia Beach campus (500 LF) and the Chesapeake campus (240 LF). Summary calculations, that include land use conversion and a removal efficiency applied to area draining to the buffer, are provided in **Tables 4.4 and 4.5,** respectively. Calculations result in total annual reductions of 11.73 pounds and 2.25 pounds for TN and TP, respectively. A compliance summary with these reductions combined with sweeping every other month is provided in **Table 4.6**. See **Appendix B** for planting density.

Table 4.4 Reductions achieved with the land use change component of forest buffering.

Available Length of Stream for Buffer (LF)	Buffer Width (ft)	Total Area Converted (ac)	Conversion Efficiency Value (lb./ac/yr) [1]			Conversion Reductions Achieved (lb./yr)		
			TN	TP	TSS	TN	TP	TSS
740	70	1.19	6.37	1.39	465	7.57	1.65	553

[1] Per DEQ Guidance for the James River Basin – conversion from pervious to forested.

Table 4.5 Reductions achieved with the upland drainage area component of forest buffering.

Upland Area Treated (ac)	Upland Loading Rates (lb./ac/yr)			Upland Area Credit (lb./ac/yr) [1]			Total Reduction Credit from Forest Buffering (lb./yr) [2]		
	TN	TP	TSS	TN	TP	TSS	TN	TP	TSS
2.38	6.99	0.50	101.08	4.16	0.59	120	11.73	2.25	673

[1] Based on DEQ Guidance efficiencies of 25% for TN and 50% for TP and TSS

[2] Sum of upland credits and land use credits from Table 4.4.

Table 4.6 Summary of reductions achieved with sweeping every 2 months (based on DEQ Guidance quantification method) and installing 740 LF of forest buffer.

Pollutant	Remaining Annual Load Reduction Req'd by 2023 (lbs/yr)	Reduction Achieved with Sweeping every 2 Months (lbs/yr) [1]	Reduction Achieved with Forest Buffer (lbs/yr)	Total Reductions Achieved (lbs/yr)
TN	8.49	3.68	11.73	15.41
TP	4.21	1.97	2.25	4.22
TSS	2,229	1,516.35	673	2,902

[1] From Table 4.3.

4.2.2 Structural BMP(s)

Assessment of the installation of a structural BMP towards addressing the required 2023 pollutant reduction targets is based on the computation of area that would need to be treated to achieve the targets, both alone, and in combination with street sweeping. The assessment also depends on available locations on the college campus to install BMP(s) that can treat the computed drainage areas. **Table 4.7** summarize the amount of impervious cover needing treatment by a high-efficiency BMP (bioretention) based on the Chesapeake Bay Program established pollutant removal efficiencies provided in the DEQ Guidance, both (1) with a sweeping program implemented using the DEQ Guidance for reduction quantification (sweeping twice every other month) and (2) without implementation of a sweeping program. Impervious area only is used to identify a minimum area that would require treatment.

A review of the college campuses finds the scenario that does not include sweeping would require 4.12 acres be treated, removing this as a feasible option since the majority of the existing impervious areas on the campuses are already being treated by SWM facilities. This

option would require a "treatment train" approach necessitating the need for many distributed SWM facilities to achieve the 2023 reductions. TSS is the limiting pollutant in this scenario.

The scenario that includes sweeping every other month would require 1.74 acres of area treated to achieve the remainder of the 2023 reductions. TP is limiting in this scenario. A review of the campuses finds only the Chesapeake Campus to have an untreated contiguous impervious area of parking lot (~1.9 acres) that exceeds the required impervious area. However, the scenario would likely require a minimum of two bioretention facilities and the locations would conflict with master planning build-out (see Appendix A mapping). Alternatively, proprietary SWM facilities could potentially be used underneath the parking lot; but would be very costly in comparison to the forest buffer option and removal efficiency would be lower than bioretention; thus, requiring more area to be treated. In summary of these findings, a structural BMP is not recommended for installation to address the 2023 reductions if sweeping. However, structural options may need to again be assessed for the larger reductions required to be achieved by 2028.

Table 4.7 Required impervious aera needed for treatment by a structural BMP for scenario with sweeping every two months and without sweeping.

Pollutant	Remaining Annual Load Reduction Req'd by 2023 (lbs/yr)	Reduction Achieved with Sweeping every 2 Months (lbs/yr) [1]	Impervious Area Treated with Bioretention Facility (acres)	Reduction Achieved with BMP (lbs/yr) [2]	Total Reductions Achieved (lbs/yr)
TN	8.49	3.68		12.25	15.93
TP	4.21	1.97	**1.74**	2.14	4.22
TSS	2,229	1,516		942	2,458
TN	8.49	0		29.02	29.02
TP	4.21	0	**4.12**	5.07	5.07
TSS	2,229	0		2,231	2,231

[1] From Table 4.3 for scenario with sweeping.

[2] Based on the Chesapeake Bay Program removal efficiencies: TN=75%, TP=70%; and TSS=80%

5.0 Phase II Compliance Practices

Findings in this Preliminary Engineering Report identify street sweeping for TCC as a foundational practice towards achieving the Chesapeake Bay TMDL pollutant reductions. Sweeping may either annually achieve the 2023 reductions on its own, or need to be supplemented with installation of the forest buffer described herein. The two scenarios are as follows:

- **Scenario 1**: In the case of continued DEQ acceptance of the Refined Sampling Method, TCC can achieve the 2023 pollutant reductions with a minimal increase in current sweeping in the frequency and level conducted over the past two years; or
- **Scenario 2**: In the case that DEQ requires pollutant reduction quantification using the DEQ Guidance, TCC would need to increase current the frequency of sweeping to once every two months (6 passes per year) over the 56 acres identified in Appendix A. In addition, the forest buffer described in Section 4.2.1 would need to be established for 740 linear feet at the Virginia Beach and Chesapeake campuses.

In regards to Scenario 1 listed above, the DEQ Guidance states, the Guidance "… does not mandate any particular method nor does it prohibit any alternative method." The Guidance also states, "If alternative proposals are made, such proposals should be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations." Therefore, the continued acceptance of the sampling methods performed by TCC and other Virginia Community College System (VCCS) colleges over the current permit cycle are dependent on DEQ review and acceptance. The Refined Sampling Method is suggested to have technical compliance based on the following:

- ✓ Quantification is only based on the portion of collected material that could be expected to be transported in runoff to downstream receiving waters.
- ✓ TN and TP concentrations are determined based on chemical analysis at a certified laboratory for the sieved portion of material associated with the particles expected to be transported in runoff to downstream receiving waters.
- ✓ Participating colleges take multiple samples each year of swept material as a measure of effectiveness, with results included in a database to continue tightening the statical

significance of the data. Quantification values are revised, as necessary, for annual reporting.

5.1 Recommended Compliance Approach

Based on the potential that DEQ will require quantifying pollutant reductions for sweeping using the DEQ Guidance, it is suggested that TCC implement Scenario 2 described in the previous section. Implementation of this scenario provides a compliance "fail-safe" in the case of unacceptance of the Refined Sampling Method, ensuring compliance as summarized in **Table 5.1**. If the Refined Sampling Method is accepted, the excess reductions achieved with this scenario would be able to be applied towards the remaining reductions required during the next permit cycle (see **Table 5.2**). Implementation of Scenario 2 would require:

- ✓ An increase in sweeping frequency of the 56 acres illustrated in Appendix A mapping once per two-month period beginning the 2022-2023 reporting period; and
- ✓ Installation of the 740 LF of forest buffer (70' width) in the locations shown in Appendix A mapping.

Table 5.1 Scenario where Refined Sampling Method NOT Accepted: Summary of reductions achieved with sweeping every 2 months (based on DEQ Guidance quantification method) and installing 740 LF of forest buffer.

Pollutant	Remaining Annual Load Reduction Req'd by 2023 (lbs/yr) [1]	Reduction Achieved with Sweeping every 2 Months (lbs/yr) [2]	Reduction Achieved with Forest Buffer (lbs/yr) [3]	Total Reductions Achieved (lbs/yr)
TN	8.49	3.68	11.73	15.41
TP	4.21	1.97	2.25	4.22
TSS	2,229	1,516.35	673	2,902

[1] From Table 3.3.

[2] From Table 4.3.

[3] From Table 4.6.

Table 5.2 Scenario where Refined Sampling Method Accepted: Summary of reductions achieved with sweeping 33 tons annually, near the current level of sweeping (based on Refined Sampling Method), and installing 740 LF of forest buffer.

Pollutant	Remaining Annual Load Reduction Req'd by 2023 (lbs/yr)	Reduction Achieved with Sweeping approx. near current level (lbs/yr) [1]	Reduction Achieved with Forest Buffer (lbs/yr)	Total Reductions Achieved (lbs/yr) [2]
TN	8.49	17.51	11.73	29.24 (137%)
TP	4.21	4.24	2.25	6.49 (62%)
TSS	2,229	26,202	673	26,875 (482%)

[1] Based on conservative assumption of sweeping within 2 days since rainfall, values based on acceptance of Refined Sampling Method and could fluctuate as data is refined.
[2] Value in parenthesis is the fraction of total reductions achieved towards achieving the full 2028 reductions.

5.2 Cost Estimates for Recommend Scenario

The Chesapeake Assessment Scenario Tool developed by the Chesapeake Bay Program Office was used as a basis of estimating the costs in **Table 5.3**. TCC currently owns and operates its own sweeper; however, it is understood that the current sweeper is in needed of replacement. Estimates are provided both for: (1) the cost of a new sweeper and (2) if sweeping were contracted. Estimate for contracted sweeping is based on costs at another VCCS college.

Table 5.3 Cost estimate for achieving the 2023 Chesapeake Bay TMDL reductions, along with the entirety of the 2028 reduction requirements for TN and TSS.

Practice	Area (acres)	Unit Capital Cost ($/acre)	Total Capital Cost ($)	O&M Cost ($/yr)
Forest Buffer (740 LF with 70 ft. width)	1.19	$3,018	$4,000	Negligible
Sweeping Twice Monthly with Purchase of Sweeper [1]	~56	N/A	$280,000	$8,000
Sweeping Twice Monthly - Contracted	~56	N/A	N/A	$75,000
Swept material laboratory chemical testing (4 samples annually) [2]	N/A	N/A	N/A	$1,600

[1] Assumes new regenerative-air sweeper based on recent locality purchases in Virginia. Anticipated operational life-span of minimum of 8 years. Capital cost may vary and could be partially mitigated with surplus purchase of existing sweeper.
[2] Only necessary in the case that the Refined Sampling Method is accepted by DEQ.

Appendix A-1
Chesapeake Bay TMDL Action Plan Mapping – Chesapeake Campus

N

Campus outfalls discharge to unnamed tributaries of the Southern Branch Elizabeth River

Campus outfalls discharge to unnamed tributaries of the Southern Branch Elizabeth River

Approximate campus property boundary

IMPERVIOUS AREAS AVAILABLE FOR SWEEPING WITHIN RED DASHED LINE = ±9 ACRES

MS4 Regulated Area (within red dashed line)

Runoff flows directly to tributary

OF #1

BMP C-1

Runoff flows directly to tributary

Runoff flows directly to tributary

MS4 Regulated Area (within red dashed line

BMP C-2

BMP C-4

Alternate Screening Location (See notes)

Student Center

Academic Bldg.

Black Box Theatre

Marian P. Whitehurst Bldg.

BMP C-3

CT3

CT2

Parking Garage (Roof drains to BMP C-4)

George B. Pass Bldg.

Runoff flows directly to tributary

Runoff flows directly to tributary

Sampson Creek Rd.

POTENTIAL LOCATION OF BIORETENTION FACILITIES

Off-site flow through campus

Cedar Rd. (RTE 165)

LOCATION FOR 240 LINEAR FEET OF 70' AVERAGE WIDTH FOREST BUFFER

TIDEWATER COMMUNITY COLLEGE
From here, go anywhere.™

MS4 Mapping - Chesapeake Campus

Latest Revision: June 2019

Legend
- Pervious
- Building
- Road
- Sidewalk
- Water
- Forest / undeveloped
- Flow direction

0 50 100 200
SCALE IN FEET

Notes
1. This map was developed by H2R Engineering Inc. using readily available information and is not based on a field survey. Information shown is approximate.

Appendix A-2
Chesapeake Bay TMDL Action Plan Mapping – Portsmouth Campus

TIDEWATER COMMUNITY COLLEGE
From here, go anywhere.™

MS4 Mapping - Portsmouth Campus

Latest Revision: June 2019

Notes
1. This map was developed by H2R Engineering Inc. using readily available information and is not based on a field survey. Information shown is approximate.

Appendix A-3
Chesapeake Bay TMDL Action Plan Mapping – Virginia Beach Campus

Note: This map was developed by H2R Engineering Inc. using readily available information and is not based on a field survey. Information shown is approximate.

TIDEWATER COMMUNITY COLLEGE
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MS4 Mapping - Virginia Beach Campus

Latest Revision: June 2019

Appendix B
Required Density for Forest Buffer

Table. Minimum Number of Trees Required Per Acre to Determine 30 Square Feet of Tree Basal Area of 40% Normal Stocking for Classification as Forest Land. DBH = diameter at breast height

DBH Range	DBH in 2" Classes	Basal Area Per Tree	Per Acre	Per 1/5 Acre	Per 1/10 Acre
up to 2.9"	Seedlings		400	80	40
3.0-4.9"	4	0.0873	343	80	40
5.0-6.9"	6	0.1964	153	31	15
7.0-8.9"	8	0.3491	86	17	9
9.0-10.9"	10	0.5454	55	11	6
11.0-12.9"	12	0.7854	38	8	4
13.0-14.9"	14	1.069	28	6	3
15.0-+	16+	1.3963	21	4	2