



CHESAPEAKE BAY TMDL ACTION PLAN PHASE 2



NASA Langley Research Center

MS4 Permit #VAR040092

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Purpose

The Special Condition for the Chesapeake Bay Total Maximum Daily Load (TMDL) within the General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (VAR04), requires the National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC) to develop a Chesapeake Bay TMDL Action Plan (“Action Plan”) and submit it to the Virginia Department of Environmental Quality (DEQ). This submittal is for Phase 2 of the Action Plan and satisfies the Special Condition requirement.

This Phase 2 Action Plan provides a review of the current Municipal Separate Storm Sewer System (MS4) program, demonstrates LaRC’s ability to ensure compliance with the Special Condition, and includes the means and methods LaRC will use to meet an additional 35.0% of the Level 2 (L2) scoping run reduction for existing development during the second permit cycle. In combination with the 5.0% reduction of L2 that has already been achieved, this will result in a total reduction of 40% of L2 at the end of this permit cycle. Level 2 implementation equates to an average reduction of 9.0% of nitrogen loads, 16% of phosphorus loads, and 20% of sediment loads from impervious regulated acres and 6.0% of nitrogen loads, 7.25% of phosphorus loads, and 8.75% of sediment loads from pervious regulated acres beyond 2009 progress loads and beyond urban nutrient management reductions for pervious regulated acreage.

LaRC Background

NASA LaRC is situated near the southern end of the lower Virginia Peninsula, approximately 150 miles south of Washington, D.C. and 50 miles southeast of Richmond, Virginia. The cities of Hampton, Poquoson, Newport News, and York County form a major metropolitan statistical area around LaRC. The Center contains several wind tunnels, research facilities, and administrative offices. The Center owns and operates 764 acres of property. LaRC is located within close proximity to several surface water bodies within the tidal zone of the Chesapeake Bay.

LaRC is considered to be in the York River drainage basin, specifically river segment YLO_7370_0000. This river segment is part of the Mobjack Bay segmentshed which is part of the overall York River basin. The Brick Kiln Creek runs along the western boundary of LaRC, joining the northwest branch of the Back River, and drains approximately 40 percent of the Center. Tabbs Creek, which drains a majority of the rest of the Center, flows in a northerly direction to join the Back River near the confluence of its northwest and southwest branches. A small portion of the property in the south drains to Tides Mill Creek. The local waterways are influenced by tides in the Chesapeake Bay. The waters in the local streams are designated by the State as Class IIa, estuarine waters where shellfish can be found.

Current Program and Existing Legal Authority

LaRC has a robust stormwater management program that has the required regulatory mechanisms in place to ensure compliance with the MS4 General Permit, the Chesapeake Bay TMDL Special Condition, and this Action Plan. The following is a list of applicable mechanisms and a brief description:

- **Langley Procedural Requirements (LPR) 8500.1 “Environment and Energy Program Manual”** - This LPR sets forth procedural requirements and responsibilities to ensure that LaRC personnel comply with the Center’s environmental and energy management program. This is the closest document LaRC has to a traditional “ordinance.” Chapter 5 of LPR 8500.1 covers the Water Quality Program. TMDLs are discussed in this section and it is specifically stated that it is LaRC’s policy to comply with the Chesapeake Bay TMDL and to reduce pollutant loadings to the maximum extent practicable. The document also details responsibilities for Center personnel to ensure water quality regulations and goals are met.
- **DEQ-approved NASA LaRC Standards and Specifications for Erosion and Sediment Control (ESC) and Stormwater Management (SWM)** – This is the foundation of LaRC’s program. LaRC has Annual Standards and Specifications for ESC and SWM that are integral components of LaRC’s design, construction, maintenance, and management of the Center’s facilities and operations. The primary regulatory driver for NASA LaRC Annual Standards and Specifications is the Virginia Stormwater Management Program (VSMP) regulations (9 VAC 25-870), the General VPDES Permit for Discharges of Stormwater from Construction Activities (9 VAC 25-880/VAR10), Erosion and Sediment Control Law (9 VAC 25-840), and LaRC’s MS4 permit (VAR040092). The NASA LaRC Annual Standards and Specifications for ESC and SWM has been developed to provide detailed information regarding LaRC’s compliance with all regulatory requirements. This program guide discusses staffing, covers all the necessary design standards, discusses how LaRC reviews and approves stormwater-related Plan submittals, and how LaRC enforces its program.
- **LaRC Master Plan and Revitalization Plan** – As this Action Plan will show, LaRC is going through a significant transformation. Through long-term Master Planning, the Center is transforming and creating the LaRC of 2050. This transformation requires significant demolition of older, unsustainable facilities. LaRC has planned to demolish over 100 structures throughout this process and is on target to meet this goal. Many of these demolished impervious areas are being transitioned back to green space and the overall LaRC footprint is being pulled into a central campus concept. These reductions in impervious surface are an essential element to TMDL compliance for LaRC. In addition, any new construction under this revitalization program is required to be environmentally sustainable with a Leadership in Energy and Environmental Design (LEED) silver or greater rating. All new construction is required to meet State stormwater design standards.
- **Environmental Management System (EMS)** – LaRC has an active EMS. LaRC’s EMS is a system that does the following: (1) incorporates people, procedures, and work practices into a formal structure to ensure that the important environmental impacts of the organization are identified and addressed; (2) promotes continual improvement, including periodically evaluating environmental performance; (3) involves all members of the organization, as appropriate; and (4) actively involves senior management in support of the EMS. LaRC senior management approved the creation of the Environmental Management Committee (EMC) in July 2009. The EMC meets quarterly and reports annually to the Center Leadership Council regarding the status, progress, and challenges of LaRC’s Environmental Management System. The EMS is as an excellent tool to assist

in Chesapeake Bay TMDL compliance and continues to be used to bring the TMDL visibility to senior management.

- **Additional Guidance Documents – (NASA LaRC Design Standards FES-ENVENE; NASA LaRC Environmental Master SPEC Section 01 35 40.00 40)** – These two documents are incorporated by reference into the NASA LaRC Annual Standards and Specifications for ESC and SWM. In combination, these documents guide NASA on proper ESC and SWM program implementation. The NASA LaRC Environmental Design Standards FES-ENVENE primarily apply to design aspects of projects. They are implemented into project requirements and into contract award packages to ensure projects are designed in accordance with all applicable requirements. The NASA LaRC Master SPEC Section 01 35 40.00 41 primarily apply to construction activities to ensure projects are constructed in compliance with all applicable requirements and that best management practices are utilized throughout the duration of the project.
- **EISA Section 438** - Section 438 states that federal projects exceeding 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature rate, volume, and duration of flow. This is another driver for projects that help achieve compliance with the Chesapeake Bay TMDL.

New or Modified Legal Authority

No new legal authorities are needed to ensure implementation of the Action Plan or compliance with the Chesapeake Bay TMDL. LaRC has implemented the necessary regulatory controls to ensure compliance.

Means and Methods to Address Discharges from New Sources

The previous regulatory mechanisms discussed adequately ensure that the necessary means and methods are in place to address discharges from new sources. In particular, NASA's DEQ-approved Annual Standards and Specifications for ESC and SWM detail these means and methods and ensure compliance with Technical Criteria Part II b of the SWM regulations. In addition, LaRC has a specific Environmental Construction Specification (Section 01 35 40.00 41) that ensures all construction contracts on Center are compliant with the most current state stormwater regulations. The construction specification requires sites with over an acre of land disturbance to submit an ESC Plan, SWM Plan, Stormwater Pollution Prevention Plan (SWPPP), Virginia Runoff Reduction Method (VRRM) spread sheets, and Construction General Permit (CGP) coverage (when applicable). Lastly, neither specification allows any land disturbing activities to occur until all required Plan submittals are reviewed and approved by NASA's certified Dual Combined Administrator for ESC and SWM.

Existing Source Loads and Calculated Total Pollutant of Concern (POC) Required Reductions

The first step in determining source loads POC reductions was to perform an in depth analysis of the size and extent of the regulated MS4 as of June 30, 2009. LaRC utilized extensive GIS

resources to accurately determine the total regulated urban pervious and impervious surface acres. Forested acres were excluded from the land use totals through GIS. Many of the buildings that were present in 2009 had been demolished. As such, great effort was given to “rebuild” the impervious state for the 2009 TMDL Base map. Demolished buildings and structure “polygons” in the GIS system were added back in and compared against previous year aerial photos to ensure that an adequate picture of the Center on June 30, 2009 was developed. LaRC’s GIS team also built an impervious surfaces tool that allows staff to easily visualize the types of impervious surfaces in each outfall drainage basin. The tool generates automatic data reports. A breakdown of LaRC’s 764 acreage is summarized in the table below:

Size and Extent of the MS4	
Regulated Urban Impervious	217.66
Regulated Urban Pervious	250.77
Excluded Forested Lands	295.57
Total	764 Acres

The POC loads and required reductions have been calculated using the tools described in the TMDL Guidance document. The following tables showcase the existing source loads:

LaRC’s Calculation Sheet for Estimating Existing Source Loads for York River Basin				
Sub source	Pollutant	Total Acres (6/30/2009)	2009 Loading Rate (lbs/acre)	Total POC Load Based on 2009 Progress Run
Regulated Urban Impervious	Total Nitrogen (TN)	217.66	7.31	1591.09
Regulated Urban Pervious		250.77	7.65	1918.39
Regulated Urban Impervious	Total Phosphorous (TP)	217.66	1.51	328.67
Regulated Urban Pervious		250.77	0.51	127.89
Regulated Urban Impervious	Total Suspended Solids (TSS)	217.66	456.68	99400.97
Regulated Urban Pervious		250.77	72.78	18251.04

The table below shows the required reductions during the second permit cycle:

LaRC's Calculation Table for Load Reductions Needed through 2023				
Sub source	Pollutant	Total Acres (6/30/2009)	Loading Rate (lbs/acre) to achieve 40% of L2 Run	Load Reductions Required
Regulated Urban Impervious	TN	217.66	0.26316	57.28
Regulated Urban Pervious		250.77	0.1836	46.04
Regulated Urban Impervious	TP	217.66	0.09664	21.03
Regulated Urban Pervious		250.77	0.01479	3.71
Regulated Urban Impervious	TSS	217.66	36.5344	7952.08
Regulated Urban Pervious		250.77	2.5473	638.79

Previous Permit Cycle Reduction Achievements (July 1, 2009 to June 30, 2018)

Several management practices and retrofit programs were utilized and implemented during the first permit cycle to achieve at least 5.0% reductions for existing sources. No nutrient trading was used.

In summary, a total of fifty (50) impervious structures were demolished and returned to a grass condition. While these areas are mowed periodically, they do not receive nutrient applications, allowing them to be classified as a grass condition. The fifty demolished structures equate to a total of 10.7 acres of impervious areas converted to grass. Street sweeping was utilized during all years of permit cycle one; all roads and parking surfaces on Center were swept on a quarterly basis. Additionally, 3.62 acres were converted to a forested condition (0.32 acres converted from impervious to forest; 3.3 acres converted from pervious to forest). Stormwater retrofits were also completed via the installation of four tree-box filters around the Center.

Cumulative Progress Report of Reduction Achievements through the End of the Previous Permit Cycle				
Sub source	Pollutant	Load (lbs) Reduction Required by end of Permit Cycle 1	Load (lbs) Reduction Achieved by End of Permit Cycle 1	Total Load (lbs) Reduction Planned by end of Permit Cycle 1
Regulated Urban Impervious	TN	7.16	233.99	237.32
Regulated Urban Pervious		5.76	31.48	31.48
Regulated Urban Impervious	TP	2.63	79.93	80.57
Regulated Urban Pervious		.46	3.08	3.08
Regulated Urban Impervious	TSS	994.01	24876.45	25112.95
Regulated Urban Pervious		79.85	526.56	526.56

Note: Differences in reduction achieved versus reduction planned in the first MS4 permit cycle are due to a 0.55 acre land use change (impervious to grass) that was moved from FY18 to FY19. The project was originally planned for permit year (PY) 5 of the first permit cycle, but was delayed due to budget constraints. This delay moved the project to PY 1 of the second permit cycle (this Planning cycle). These planned reduction credits will still be achieved and count towards LaRC's TMDL load reductions.

Means and Methods to Meet the Required Reductions and Schedule

This section describes the management practices and retrofit programs that have been or will be implemented between July 1, 2018 and June 30, 2023 (end of the second permit cycle) to achieve an additional 35% reduction for existing sources. In combination with the 5.0% reduction of L2 that has already been achieved, the result will be a 40% total reduction at the end of this permit cycle. No nutrient credit trading is proposed. The information has been broken down and presented by MS4 permit year (July to June timeframes) from 2018 through 2023.

Timeframe: July 1, 2018 to June 30, 2019

Project/BMP: Land Use Change - Impervious to Grass Credit

From July 1, 2018 to June 30, 2019, a total of one (1) impervious structure is listed in the Center's Demolition Plan. The plan is to return this area to a grass condition. The structure equates to a total of 0.55 acres of impervious area converted to grass.

Building	Name	Demolish Date	Acres Reduced
1222	REID CONFERENCE CENTER	4/1/2019	0.55
Total			0.55

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	6.06 lbs/ac/year	0.55 ac * 6.06 TN/ac/yr	3.33 TN/yr
TP	1.17 lbs/ac/year	0.55 ac * 1.17 TP/ac/yr	0.64 TP/yr
TSS	430.00 lbs/ac/year	0.55 ac * 430.00 TSS/ac/yr	236.5 TSS/yr

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished through a grounds maintenance contract. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping is completed if conditions warrant (post-winter sand cleaning, post-storm events, etc.). LaRC has chosen to use the Mass Loading Approach for an annual average credit from this BMP. To accomplish this, LaRC averaged the sweeping data from previous permit years (MS4 Annual Report data). The average volume of debris collected has been 95.10 cubic yards. Each cubic yard of debris has been conservatively estimated to weigh 1,000 pounds.

$95.10 \text{ cubic yard/year} * 1000 \text{ pounds} = 95,100 \text{ pounds/year}$

$95,100 \text{ pounds} * .7 \text{ lbs dry/weight} = 66,570 \text{ pounds}$

TN lbs/yr	TP lbs/yr	TSS lbs/yr
0.0025	0.001	0.3
$66570 * .0025 = \mathbf{166.43}$	$66570 * .001 = \mathbf{66.57}$	$66570 * 0.3 = \mathbf{19,971}$

Timeframe: July 1, 2019 to June 30, 2020

Project/BMP: Land Use Change - Impervious to Grass Credit

From July 1, 2019 to June 30, 2020, a total of two (2) impervious structures are listed in the Center's Demolition Plan. The plan is to return these areas to a grass condition. The structures equate to a total of 0.61 acres of impervious areas converted to grass.

Building	Name	Estimated Demolish Date	Acres Reduced
1194	FLOYD L. THOMPSON TECHNICAL LIBRARY	11/1/2019	0.53
1194A	TRAINING CLASSROOMS	11/1/2019	0.08
1200	RESEARCH COMPLEX	12/1/2021	1.1
Total			1.62

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit Earned
TN	6.06 lbs/ac/year	0.61 ac * 6.06 TN/ac/yr	3.70 TN/yr
TP	1.17 lbs/ac/year	0.61 ac * 1.17 TP/ac/yr	0.71 TP/yr
TSS	430.00 lbs/ac/year	0.61 ac * 430.00 TSS/ac/yr	262.3 TSS/yr

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished through a grounds maintenance contract. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping is completed if conditions warrant (post-winter sand cleaning, post-storm events, etc.). LaRC has chosen to use the Mass Loading Approach for an annual average credit from this BMP. To accomplish this, LaRC averaged the sweeping data from previous permit years (MS4 Annual Report data). The average volume of debris collected has been 95.10 cubic yards. Each cubic yard of debris has been conservatively estimated to weigh 1,000 pounds. 95.10 cubic yard/year * 1000 pounds = 95,100 pounds/year

95,100 pounds *.7 lbs dry/weight = 66,570 pounds

TN lbs/yr	TP lbs/yr	TSS lbs/yr
0.0025	0.001	0.3
66570 *.0025 = 166.43	66570 * .001 = 66.57	66570 * 0.3 = 19,971

Timeframe: July 1, 2020 to June 30, 2021

Project/BMP: Phase I North 40 Land Conversions (Land Use Change - Pervious to Forest) – Phase 1

LaRC has been converting several areas of its “North 40” that are currently mowed (pervious areas) to forested cover. These areas have no value in being mowed/maintained and would serve better as forested habitat. This is a multi-stage project within the Reforestation Plan to convert 1.0 acres from grass to hardwood forested areas by planting 400 seedlings (per Guidance Document Table V.F.2, a minimum of 400 seedlings per acre reclassify the land as forest land). LaRC works with the Virginia Department of Forestry when evaluating tree costs and species, and ideal planting techniques for scope of work development.



Part 1: Land Use Change Credits – Pervious to Forest

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	5.18 lbs/ac/year	1.0 ac * 5.18 TN/ac/yr	5.18 lbs TN/yr
TP	0.40 lbs/ac/year	1.0 ac * 0.40 TP/ac/yr	0.40 lbs TP/yr
TSS	78.30 lbs/ac/year	1.0 ac * 78.30 TSS/ac/yr	78.30 lbs TSS/yr

Part 2: Forest Buffer (Upland Acre treatment ratio of 2:1) Efficiency Credit

1.0 acres * 2 = 2.0 upland acres treated (verified)

Forest Buffer Efficiency	TN	TP	TSS
	25%	50%	50%

	Loading Rate	BMP Efficiency	Adjusted Loading Rate after BMP Install
TN	7.65 lbs/ac	.25	1.94

TP	0.51 lbs/ac	.50	0.23
TSS	72.28 lbs/ac	.50	36.14

	Treatment Acres	Adjusted Loading Rate	Loading Equation	Forest Buffer Reduction Credit
TN	2.0 acres Pervious	1.94	2.0 ac * 1.94 TN/Ac/yr =	3.88 lbs TN/yr
TP	2.0 acres Pervious	.23	2.0 ac * .23 TP/ac/yr =	0.46 lbs TP/yr
TSS	2.0 acres Pervious	36.14	2.0 ac * 36.14 lbs/ac/yr =	72.28 lbs TSS/yr

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished through a grounds maintenance contract. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping is completed if conditions warrant (post-winter sand cleaning, post-storm events, etc.). LaRC has chosen to use the Mass Loading Approach for an annual average credit from this BMP. To accomplish this, LaRC averaged the sweeping data from previous permit years (MS4 Annual Report data). The average volume of debris collected has been 95.10 cubic yards. Each cubic yard of debris has been conservatively estimated to weigh 1,000 pounds. 95.10 cubic yard/year * 1000 pounds = 95,100 pounds/year

95,100 pounds *.7 lbs dry/weight = 66,570 pounds

TN lbs/yr	TP lbs/yr	TSS lbs/yr
0.0025	0.001	0.3
66570 *.0025 = 166.43	66570 * .001 = 66.57	66570 * 0.3 = 19,971

Timeframe: July 1, 2021 to June 30, 2022

Project/BMP: Land Use Change - Impervious to Grass Credit

From July 1, 2021 to June 30, 2022, a total of six (6) impervious structures are listed in the Center's Demolition Plan. The plan is to return these areas to a grass condition. The structures equate to a total of 7.81 acres of impervious areas converted to grass.

Building	Name	Demolish Date	Acres Reduced
1200A	RESEARCH COMPLEX	12/1/2021	0.02
1202	RESEARCH LAB	12/1/2021	3.01
1202A	PEARL YOUNG CONFERENCE CENTER	12/1/2021	0.16
1299	RESEARCH COMPLEX	12/1/2021	0.75
Total			5.04

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit Earned
TN	6.06 lbs/ac/year	5.04 ac * 6.06 TN/ac/yr	30.54 TN/yr
TP	1.17 lbs/ac/year	5.04 ac * 1.17 TP/ac/yr	5.89 TP/yr
TSS	430.00 lbs/ac/year	5.04 ac * 430.00 TSS/ac/yr	2167.20 TSS/yr

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished through a grounds maintenance contract. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping is completed if conditions warrant (post-winter sand cleaning, post-storm events, etc.). LaRC has chosen to use the Mass Loading Approach for an annual average credit from this BMP. To accomplish this, LaRC averaged the sweeping data from previous permit years (MS4 Annual Report data). The average volume of debris collected has been 95.10 cubic yards. Each cubic yard of debris has been conservatively estimated to weigh 1,000 pounds. 95.10 cubic yard/year * 1000 pounds = 95,100 pounds/year

95,100 pounds *.7 lbs dry/weight = 66,570 pounds

TN lbs/yr	TP lbs/yr	TSS lbs/yr
0.0025	0.001	0.3
66570 *.0025 = 166.43	66570 * .001 = 66.57	66570 * 0.3 = 19,971

Timeframe: July 1, 2022 to June 30, 2023

Project/BMP: Phase I North 40 Land Conversions (Land Use Change - Pervious to Forest) – Phase 1

LaRC has been converting several areas of its “North 40” that are currently mowed (pervious areas) to forested cover. These areas have no value in being mowed/maintained and would serve better as forested habitat. This is a multi-stage project within the Reforestation Plan to convert 1.0 acres from grass to hardwood forested areas by planting 400 seedlings (per Guidance Document Table V.F.2, a minimum of 400 seedlings per acre reclassify the land as forest land). LaRC works with the Virginia Department of Forestry when evaluating tree costs and species, and ideal planting techniques for scope of work development.

Part 1: Land Use Change Credits – Pervious to Forest

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	5.18 lbs/ac/year	1.0 ac * 5.18 TN/ac/yr	5.18 lbs TN/yr
TP	0.40 lbs/ac/year	1.0 ac * 0.40 TP/ac/yr	0.40 lbs TP/yr
TSS	78.30 lbs/ac/year	1.0 ac * 78.30 TSS/ac/yr	78.30 lbs TSS/yr

Part 2: Forest Buffer (Upland Acre treatment ratio of 2:1) Efficiency Credit

1.0 acres * 2 = 2.0 upland acres treated (verified)

Forest Buffer Efficiency	TN	TP	TSS
	25%	50%	50%

	Loading Rate	BMP Efficiency	Adjusted Loading Rate after BMP Install
TN	7.65 lbs/ac	.25	1.94
TP	0.51 lbs/ac	.50	0.23
TSS	72.28 lbs/ac	.50	36.14

	Treatment Acres	Adjusted Loading Rate	Loading Equation	Forest Buffer Reduction Credit
TN	2.0 acres Pervious	1.94	2.0 ac * 1.94 TN/Ac/yr =	3.88 lbs TN/yr
TP	2.0 acres Pervious	.23	2.0 ac * .23 TP/ac/yr =	0.46 lbs TP/yr
TSS	2.0 acres Pervious	36.14	2.0 ac * 36.14 lbs/ac/yr =	72.28 lbs TSS/yr

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished through a grounds maintenance contract. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping is completed if conditions warrant (post-winter sand cleaning, post-storm events, etc.). LaRC has chosen to use the Mass Loading Approach for an annual average credit from this BMP. To accomplish this, LaRC averaged the sweeping data from previous permit years (MS4 Annual Report data). The average volume of debris collected has been 95.10 cubic yards. Each cubic yard of debris has been conservatively estimated to weigh 1,000 pounds. 95.10 cubic yard/year * 1000 pounds = 95,100 pounds/year

95,100 pounds *.7 lbs dry/weight = 66,570 pounds

TN lbs/yr	TP lbs/yr	TSS lbs/yr
0.0025	0.001	0.3
66570 *.0025 = 166.43	66570 *.001 = 66.57	66570 * 0.3 = 19,971

Summary Table of Projects and Loads Reduced through June 30, 2023

Sub source	Pollutant	Load Reduction Required by 2023	Total Load Reduction Achieved 2009 through Permit Cycle 1	Load Reductions Planned Permit Cycle 2	Cumulative Load Reductions Planned/Achieved through 6/30/2023
Regulated Urban Impervious	TN	57.28	233.99	204	437.99
Regulated Urban Pervious		46.04	31.48	18.12	49.6
Regulated Urban Impervious	TP	21.03	79.93	73.81	153.74
Regulated Urban Pervious		3.71	3.08	1.72	4.8
Regulated Urban Impervious	TSS	7952.08	24876.45	22637	47513.45
Regulated Urban Pervious		638.79	526.56	301.16	827.72

Means and Methods to offset New Load Sources - July 1, 2009 through June 30, 2019

LaRC has determined that there are no needed offsets for increased loads from new sources that initiated construction between July 1, 2009, and June 30, 2019.

There were three major redevelopment/construction projects that disturbed over one acre during this time period; however, due to NASA's aggressive LEED goals and the Federal Energy Independence and Security Act (EISA) Section 438 design standards, these facilities provided more stormwater treatment and stormwater quantity reduction than required. Additionally, these projects are considered redevelopment projects.

- 2101, Headquarters Building – This was the construction of a LEED Platinum-rated facility. The predevelopment impervious condition was 41.4%. The post-development impervious condition was 22.4%. Additionally, a green roof, two large bio-retention ponds, grass swales, and pervious pavers were installed to treat and capture stormwater (primarily for LEED credits). This building met all necessary load reductions.

- 2102, Integrated Engineering Services Building – This was the construction of a LEED Gold-rated facility. The predevelopment impervious condition was 60.5%. The post-development impervious condition was 53%. The facility utilizes eight bio-swales, two bio-retention ponds, and extensive pervious pavers to treat and capture stormwater. This building met all necessary load reductions.
- 2103, Computational Research Facility – This was the construction of a LEED Silver-rated facility. The predevelopment impervious condition was 14.6%. The post-development impervious condition was 54.4% and the site exceeded the target reduction by 0.4lbs/yr. additionally, the facility utilizes two compost amended grass channels, three large bio-retention systems, a tree box filter, and extensive pervious pavers to treat and capture stormwater. This building met and exceeded all necessary regulatory load reductions.

Note: Outside of the three redevelopment projects discussed above, there were a number of regulated demolition projects (as discussed and highlighted in the previous section) that were over one acre in size. However, these sites are all compliant (no offset of new sources needed) since they went from an impervious condition to a 100% pervious grass condition. No further reductions are needed from the demolition projects over one acre.

There is one major redevelopment/construction project planned that will disturb over one acre during this permit cycle; however, this facility will provide more stormwater treatment and stormwater quantity reduction than required. Therefore, there are no needed offsets for increased loads from new sources.

- 2104, Measurement Systems Laboratory – This project provides a new 175,000 square foot laboratory facility. Stormwater for the building and adjacent site areas will be collected via urban bio-retention, a combination of overland flow, curb and gutter, storm sewer piping, and inlets. The majority of the site will drain into BMPs and discharge into existing storm sewer system. The predevelopment impervious condition was 65.5%. The post-development impervious condition will be 58.8%. The construction will be ongoing until 2019 and is expected to achieve LEED-gold certification.

Means and Methods to offset Grandfathered projects after July 1, 2014

LaRC made a management decision to not grandfather any projects that began construction after July 1, 2014. All applicable projects that started after July 1, 2014 met or will meet Technical Criteria Part II B design requirements per LaRC's Annuals Standards and Specifications for ESC and SWM.

List of Future projects that Qualify as Grandfathered

No future projects and zero acreage qualify as grandfathered in accordance with 9 VAC 25-870-48.

Real and Projected Costs

The following table depicts actual costs for TMDL compliance-related projects that have been implemented since July 1, 2009.

Time Period	Project	Cost (\$)	Notes
July 1, 2009 – June 30, 2010	Demolition – Land Use Conversion of Impervious to Grass (total of 28 facilities)	1,336,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2009 – June 30, 2010	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2010 – June 30, 2011	Demolition – Land Use Conversion of Impervious to Grass (total of 2 facilities)	20,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2010 – June 30, 2011	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2011 – June 30, 2012	Demolition – Land Use Conversion of Impervious to Grass (total of 2 facilities)	46,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2011 – June 30, 2012	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2012 – June 30, 2013	Demolition – Land Use Conversion of Impervious to Grass (total of 10 facilities)	231,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2012 – June 30, 2013	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2013 – June 30, 2014	Demolition – Land Use Conversion of Impervious to Grass (total of 2 facilities)	350,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2013 – June 30, 2014	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2013 – June 30, 2014	Forest Buffer	450	Labor was in-house Environmental staff. Only the costs of the trees.

Time Period	Project	Cost (\$)	Notes
July 1, 2014 – June 30, 2015	Demolition – Land Use Conversion of Impervious to Grass (total of 1 facility)	400,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2014 – June 30, 2015	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2014 – June 30, 2015	Tree Boxes x4	180,000	This included design and installation of 4 units.
July 1, 2015 – June 30, 2016	Demolition – Land Use Conversion of Impervious to Grass (total of 3 facilities)	1,005,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2015 – June 30, 2016	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2015 – June 30, 2016	Land Use Conversion of Pervious to Forest	5477.55	1-acre reforestation (hardwood)
July 1, 2016 – June 30, 2017	Demolition – Land Use Conversion of Impervious to Grass (total of 2 facilities)	580,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2016 – June 30, 2017	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2016 – June 30, 2017	Land Use Conversion of Pervious to Forest	890.25	1-acre reforestation (pines and hardwood)
July 1, 2017 – June 30, 2018	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2017 – June 30, 2018	Land Use Conversion of Pervious to Forest	2362.23	1-acre reforestation (pines and hardwood)
Total cost paid		4,202,180	

The following table depicts estimated costs for projects that are planned from July 1, 2018 to the close of the MS4 permit cycle 2.

Time Period	Project	Cost	Notes
July 1, 2018 – June 30, 2019	Demolition – Land Use Conversion of Impervious to Grass (total of 1 facility)	372,368	This cost includes all demolition costs, contract fees, and site restoration work.

Time Period	Project	Cost	Notes
July 1, 2018 – June 30, 2019	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2019 – June 30, 2020	Demolition – Land Use Conversion of Impervious to Grass (total of 2 facilities)	500,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2019 – June 30, 2020	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2020 – June 30, 2021	Land Use Conversion of Pervious to Forest	2,500	1-acre reforestation (hardwood)
July 1, 2020 – June 30, 2021	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2021 – June 30, 2022	Demolition – Land Use Conversion of Impervious to Grass	1,000,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2021 – June 30, 2022	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
July 1, 2022 – June 30, 2023	Land Use Conversion of Pervious to Forest	2,500	1-acre reforestation (hardwood)
July 1, 2022 – June 30, 2023	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
Total cost projected =		1,902,368	

Public Comments on Draft Action Plan

Prior to the submittal of the action plan required in Part II A 11 of 9VAC25-890-40 (General Permit) LaRC will provide an opportunity for public comment on the additional BMPs proposed to meet the reductions not previously approved by the department in the first phase of the Chesapeake Bay TMDL action plan. The opportunity for public comment will be provided no less than 15 days prior to the submittal of the plan to the DEQ, and will be completed via the communication website for LaRC employees called the @LaRC announcement system. This announcement page is viewable and accessible to all LaRC employees.

Signed Certification Statement

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

//////TO BE SIGNED ON FINAL VERSION//////

Kristen Poultney, Environmental Branch Head

Date

Appendix 1: Phase I TMDL Action Plan DEQ Approval Letter