CHESAPEAKE BAY TMDL ACTION PLAN

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 satisfies this requirement.

This 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 5.0% of the Level 2 (L2) scoping run reduction for existing development during the first 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 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 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 West Area 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". Section 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 backbone of LaRC's program. LaRC has incorporated 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 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 submittal has been developed to provide detailed information regarding LaRC's compliance with all regulatory requirements. This detailed program guide discussing 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 facilitates. LaRC is planning to demolish over 100 structures throughout this process. 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 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 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. The EMS has been and will continue to be used to bring the TMDL visibility to senior management.

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 to address discharges from new sources are in place. 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 to that, LaRC has a specific Environmental Construction Specification (Spec # 01 35 40.00 01) 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 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. Additionally, LaRC has seen an immense amount of demolition over the last five years. 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 sources 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 first permit cycle:

LaRC's Calculation Sheet for Determining Total POC Reductions Current Permit Cycle				
Sub source	Pollutant	Total Acres (6/30/2009)	2009 Loading Rate (lbs/acre)	Load Reductions Required
Regulated Urban Impervious	TN	217.66	0.032895	**7.16**
Regulated Urban Pervious		250.77	0.02295	**5.76**
Regulated Urban Impervious	TP	217.66	0.01208	**2.63**
Regulated Urban Pervious		250.77	0.00184875	**0.46**
Regulated Urban Impervious	TSS	217.66	4.5668	**994.01**
Regulated Urban Pervious		250.77	0.3184125	**79.85**

Means and Methods to Meet the Required Reductions and Schedule

This section describes the management practices and retrofit programs that have or will be implemented between July 1, 2009 and June 30, 2018 (end of the first permit cycle) to achieve 5.0% reductions for existing sources. No nutrient credit trading is proposed. The information has been broken down and presented by MS4 permit year (July to June timeframes) from 2009 through 2018. **For a simplified summary spreadsheet of this extensive section please see the attached Excel spreadsheet.**

Timeframe: July 1, 2009 to June 30, 2010

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

From July 1, 2009 to June 30, 2010 a total of twenty-eight (28) impervious structures were demolished and returned to grass. These were primarily small structures and buildings across the Center. These impervious areas are now managed as grass. While these areas are mowed periodically, they do not receive any nutrient applications allowing them to be classified as grass. The 28 structures equate to a total of 1.67 acres of impervious areas converted to grass.

Building	Name	Demolish Date	Acres Reduced
1223A	WELDING & FABRICATION SHOP	6/29/2009	.04
1212B	HIGH-SPEED 7 X 10 FOOT TUNNEL	6/30/2009	.02
1223	PUMP STATION	6/30/2009	.005
1276	TEMPORARY HOUSING FACILITY	6/30/2009	.01
1155	IMAGING & PHOTOGRAPHIC TECHNOLOGY	7/28/2009	.31
1204	RESEARCH LAB	7/28/2009	.03
1270	PRNTD CIRC & ENCAPSUL LAB (CLOSED)	7/28/2009	.10
1273	RESEARCH LAB	7/28/2009	.07
1229A	LAB FACILITY	7/29/2009	.03
1183	OFFICE FACILITY	9/23/2009	.17
1156	GENERAL EQUIPMENT STORAGE	1/27/2010	.11
1162	OFFICE COMPLEX	1/27/2010	.08
1162A	OFFICE COMPLEX	1/27/2010	.20
1163	OFFICE FACILITY	1/27/2010	.08
1164	OFFICE FACILITY	1/27/2010	.08
1165	STORAGE FACILITY	1/27/2010	.02
1259A	REFRIGERATION FACILITY	1/27/2010	.01
1284C	1284 RESEARCH LAB	1/27/2010	.03
1299B	1299 RESEARCH COMPLEX	1/27/2010	.01
1299C	1299 RESEARCH COMPLEX	1/27/2010	.01
1218	CONFERENCE CENTER	3/24/2010	.04
1218A	RESEARCH LAB	3/24/2010	.09
1232B	1232 OFFICE COMPLEX	3/24/2010	.02

Building	Name	Demolish Date	Acres Reduced
1287	FLOW IMPEDANCE TEST LAB	3/24/2010	.03
1295D	VACUUM SPHERE FACLITY	3/24/2010	.01
1299D	1299 RESEARCH COMPLEX	3/24/2010	.01
1299E	1299 RESEARCH COMPLEX	3/24/2010	.01
1203	STORAGE FACILITY	5/5/2010	.04
		Total	**1.67 ac**

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit Earned
TN	6.06 lbs/ac/year	1.67 ac * 6.06 TN/ac/yr	**10.12 TN/yr**
TP	1.17 lbs/ac/year	1.67 ac * 1.17 TP/ac/yr	**1.95 TP/yr**
TSS	430.00 lbs/ac/year	1.67 ac * 430.00 TSS/ac/yr	**718.10 TSS/yr**

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2010 to June 30, 2011

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

From July 1, 2010 to June 30, 2011 a total of two (2) impervious areas were demolished and returned to grass. These included a small building and an area of asphalt parking lot that were removed. These impervious areas are now managed as grass. While these areas are mowed periodically, they do not receive any nutrient applications allowing them to be classified as grass. The two areas equate to a total of 0.30 acres of impervious surface converted to grass.

Building	Name	Demolish Date	Acres Reduced
Water Tower Parking Area	ASPHALT REMOVAL	8/1/2010	0.29
1229B	STORAGE FACILITY	5/13/2011	0.01
		Total	**0.30 ac**

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit Earned
TN	6.06 lbs/ac/year	0.30 ac * 6.06 TN/ac/yr	**1.82 TN/yr**
TP	1.17 lbs/ac/year	0.30 ac * 1.17 TP/ac/yr	**0.35 TP/yr**
TSS	430.00 lbs/ac/year	0.30 ac * 430.00 TSS/ac/yr	**129.00 TSS/yr**

Project/BMP: Forest Buffer near Water Tower

A 0.32 acre impervious parking lot along Tabbs Creek was removed and converted to a forest/riparian buffer. This project was implemented on 4/30/2011 and meets the minimum requirements to be classified as a forest buffer. The land draining to this BMP is primarily impervious, but the drainage acreage has not been verified. Therefore, the BMP efficiency is only being credited to the BMP size of .032 pervious acres (not the allowable additional upland impervious/pervious acres).

Part 1: Land Use Conversion (Impervious to Forest)

	Loading Rate for Land Conversion	Loading Equation	Land Use Reduction Credit
TN	6.83 lbs/ac/year	.32 ac * 6.83 TN/ac/yr	**2.19 lbs TN/yr**
TP	1.49 lbs/ac/year	.32 ac * 1.49 TP/ac/yr	**.48 lbs TP/yr**
TSS	749.05 lbs/ac/year	.32 ac * 749.05 TSS/ac/yr	**239.70 lbs TSS/yr**

Part 2: Forest Buffer Credit

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

	Loading Rate for Pervious	BMP Efficiency	Adjusted Loading Rate after BMP Install
TN	7.65 lbs/ac	.25	1.94
TP	0.51 lbs/ac	.50	.23
TSS	72.28 lbs/ac	.50	36.14

	Treatment Acres	Adjusted Loading Rate	Loading Equation	Forest Buffer Reduction Credit
TN	0.32 acres Pervious	1.94	.32 ac * 1.94 TN/Ac/yr =	.62 lbs TN/yr
TP	0.32 acres Pervious	.23	.32 ac * .23 TP/ac/yr =	.07 lbs TP/yr
TSS	0.32 acres Pervious	36.14	.32 ac * 36.14 lbs/ac/yr =	11.56 lbs TSS/yr

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2011 to June 30, 2012

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

From July 1, 2011 to June 30, 2012 a total of two (2) impervious areas were demolished and returned to green space. While these areas are mowed periodically, they do not receive any nutrient applications allowing them to be classified as grass. The two structures equate to a total of .10 acres of impervious areas converted to grass. Several other larges facilities were demolished during this time period; however, credit was not taken since they were footprints for future construction activity.

Building	Name	Demolish Date	Acres Reduced
1234	JET EXIT TEST FACILITY	9/30/2011	0.07
1296A	REFRIGERATION SYSTEM (Cooling tower)	3/23/2012	0.03
		Total	**0.10 ac**

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit Earned
TN	6.06 lbs/ac/year	.10 ac * 6.06 TN/ac/yr	**0.61 TN/yr**
TP	1.17 lbs/ac/year	.10 ac * 1.17 TP/ac/yr	**0.12 TP/yr**
TSS	430.00 lbs/ac/year	.10 ac * 430.00 TSS/ac/yr	**43.00 TSS/yr**

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2012 to June 30, 2013

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

From July 1, 2012 to June 30, 2013 a total of ten (10) impervious structures were demolished and returned to green space. These areas included an observatory, facilities, sheds, and trailers. These impervious areas are now managed as green space. While these areas are mowed periodically, they do not receive any nutrient applications allowing them to be classified as grass. The ten structures equate to a total of .53 acres of impervious areas converted to grass.

Building	Name	Demolish Date	Acres Reduced
1133B	NASA TELEVISION (NTV) EARTH STATION	8/9/2012	.01
1133B	Other Structure/improvement	8/9/2012	.21
1231A	OBSERVATORY	8/9/2012	.03
1284A	SECURITY STORAGE FACILITY	11/26/2012	.08
1284B	1284 RESEARCH LAB	11/26/2012	.04
1130T4	TEMPORARY HOUSING FACILITY (T103)	1/8/2013	.03
1130T5	TEMPORARY HOUSING FACILITY (T166)	1/8/2013	.03
1247T1	TEMPORARY HOUSING (T118)	1/8/2013	.02
1267B	1267 RESEARCH COMPLEX	2/8/2013	.004
1259	ALDF COMPLEX	5/24/2013	.08
		Total	**.53**

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit Earned
TN	6.06 lbs/ac/year	.53 ac * 6.06 TN/ac/yr	**3.21 TN/yr**
TP	1.17 lbs/ac/year	.53 ac * 1.17 TP/ac/yr	**0.62 TP/yr**
TSS	430.00 lbs/ac/year	.53 ac * 430.00 TSS/ac/yr	**227.90 TSS/yr**

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2013 to June 30, 2014

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

From July 1, 2013 to June 30, 2014 a total of two (2) impervious areas were demolished and returned to green space. These areas were all old office and storage buildings. These impervious areas are now managed as green space. While these areas are mowed periodically, they do not receive any nutrient applications allowing them to be classified as grass. The two structures equate to a total of .57 acres of impervious areas converted to grass.

Building	Name	Demolish Date	Acres Reduced
1260	ALDF COMPLEX	9/6/2013	0.07
1229	OFFICE FACILITY	2/4/2014	0.50
		Total	0.57

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	6.06 lbs/ac/year	.57 ac * 6.06 TN/ac/yr	3.45 TN/yr
TP	1.17 lbs/ac/year	.57 ac * 1.17 TP/ac/yr	0.67 TP/yr
TSS	430.00 lbs/ac/year	.57 ac * 430.00 TSS/ac/yr	245.10 TSS/yr

Project/BMP: Earth Day Forest Buffer Expansion (Land Use Change/Pervious to Forest and Forest Buffer)

A 0.30 acre section of land along the edge of Tabbs Creek was being mowed, but served no purpose to Center operations. This area was identified as an area that could be transitioned back to forest cover and provide a forest buffer. Per Table V.F.2, a minimum of 120 seedlings had to be planted to reclassify the land as forest land. On April 23, 2014, a group of employees planted 130 seedlings. The seedlings consisted of Eastern Red Cedar, Bald Cypress, Silky Dogwood, American Elderberry, Black Locust, Willow Oak, and Lespedeza Bicolor. On 5/21/2015, employees went back and replanted 50 additional river birch and bald cypress trees to ensure adequate tree establishment (counteract seedling loss).

Credit for this project is being taken as both a land use change and efficiency BMP.

Part 1: Land Use Conversion

	Loading Rate for Land Conversion	Loading Equation	Land Use Reduction Credit
TN	5.18 lbs/ac/year	.30 ac * 5.18 TN/ac/yr	1.55 lbs TN/yr
TP	0.40 lbs/ac/year	.30 ac * 0.40 TP/ac/yr	0.12 lbs TP/yr
TSS	78.30 lbs/ac/year	.30 ac * 78.30 TSS/ac/yr	23.49 lbs TSS/yr

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

0.30 acres * 2 = 0.60 upland acres treated

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	0.6 acres Pervious	1.94	0.60 ac * 1.94 TN/Ac/yr = 1.16 lbs TN/yr	1.16 lbs TN/yr
TP	0.6 acres Pervious	0.23	0.60 ac * .23 TP/ac/yr = .14 lbs TP/yr	0.14 lbs TP/yr
TSS	0.6 acres Pervious	36.39	0.60 ac * 36.14 lbs/ac/yr = 21.68 lbs TSS/yr	21.68 lbs TSS/yr

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2014 to June 30, 2015

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

From July 1, 2014 to June 30, 2015 a total of one (1) impervious areas was demolished and returned to green space. This facility was the old Cafeteria (B1213). This impervious area is now managed as green space. While this area is mowed periodically, it does not receive any nutrient applications allowing it to be classified as grass. B1213 equates to a total of 0.66 acres of impervious areas converted to grass.

Building	Name	Demolish Date	Acres Reduced
1213	CAFETERIA	6/30/2015	0.66

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	6.06 lbs/ac/year	.66 ac * 6.06 TN/ac/yr	4.00 TN/yr
TP	1.17 lbs/ac/year	.66 ac * 1.17 TP/ac/yr	0.77 TP/yr
TSS	430.00 lbs/ac/year	.66 ac * 430.00 TSS/ac/yr	283.80 TSS/yr

Project/BMP: Tree Box Filter #1, 6'x8' "Filterra" Unit

This was a stormwater retrofit project to treat stormwater from B1189's roadway and parking lot area as well as some pervious areas. The treatment area for this Filterra unit is 0.55 acres of which 0.29 acres was impervious and .26 acres was pervious. The VA Stormwater Clearinghouse BMP criteria of a 50% TP removal efficiency was utilized. The removal efficiency for TN and TSS was calculated using the CB Program retrofit curves. This is considered a Stormwater Treatment Practice (ST). This BMP's runoff storage volume is 0.004 acre-feet.

Runoff Depth Treated = (RS)(12)/IA = (.004)(12)/.29 = 0.17 inches
TP = 50% (assigned in VA BMP Clearinghouse)
TN = 12% (assigned from ST Retrofit Curve)

TSS = 24% (assigned from ST Retrofit Curve)

	Treatment Acres	Loading Rate	Loading Equation	BMP Efficiency and Reduction Credit
TN	.29 acres Impervious	7.31 lbs/ac	.29 ac * 7.31 TN/ac/yr = 2.12 lbs TN/yr	2.12 *.12 = **.25 lbs TN/yr**
	.26 acres Pervious	7.65 lbs/ac	.26 ac * 7.65 TN/Ac/yr = 1.99 lbs TN/yr	1.99 * .12= **.24 lbs TN/yr**
TP	.29 acres Impervious	1.51 lbs/ac	.29 ac *1.51 TP/ac/yr = .44 lbs TP/yr	.44 * 0.50 = **.22 lbs TP/yr**
	.26 acres Pervious	0.51 lbs/ac	.26 ac*0.51 TP/ac/yr = .13 lbs TP/yr	.13 * 0.50 = **.07 lbs TP/yr**
TSS	.29 acres Impervious	456.68 lbs/ac	.29 ac * 456.68 TSS/ac/yr = 132.44 lbs TSS/yr	132.44 * .24 = **31.79 lbs TSS/yr**
	.26 acres Pervious	72.78 lbs/ac	.26 ac * 72.78 lbs/ac/yr = 18.92 lbs TSS/yr	18.92 *.24= **4.54 lbs TSS/yr**

Project/BMP: Tree Box Filter #2, 4' x 6' Filterra Unit

This was a stormwater retrofit project to treat stormwater from Langley Blvd. and B1251. The treatment area for this Filterra unit is 0.24 acres of which .06 acres was impervious and 0.18 acres was pervious. The VA Stormwater Clearinghouse BMP criteria of a 50% TP removal efficiency was utilized. The removal efficiency for TN and TSS were calculated using the CB Program retrofit curves.

This BMP's runoff storage volume is .002 acre-feet.

Runoff Depth Treated = (RS)(12)/IA = (.002)(12)/.06 = 0.4 inches
TP = 50% (assigned in VA BMP Clearinghouse)
TN = 23% (assigned from ST Retrofit Curve)
TSS = 45% (assigned from ST Retrofit Curve)

	Treatment Acres	Loading Rate	Loading Equation	BMP Efficiency and Reduction Credit
TN	.06 acres Impervious	7.31 lbs/ac	.06 ac * 7.31 TN/ac/yr = .44 lbs TN/yr	.44 * .23 = **.10 lbs TN/yr**
	.18 acres Pervious	7.65 lbs/ac	.18 ac * 7.65 TN/Ac/yr = 1.38 lbs TN/yr	1.38 * .23 = **.32 lbs TN/yr**
TP	.06 acres Impervious	1.51 lbs/ac	.06 ac *1.51 TP/ac/yr = .09 lbs TP/yr	.09 * 0.50 = **.05 lbs TP/yr**
	.18 acres Pervious	0.51 lbs/ac	.18 ac*0.51 TP/ac/yr = .09 lbs TP/yr	.09 * 0.50 = **.05 lbs TP/yr**
TSS	.06 acres Impervious	456.68 lbs/ac	.06 ac * 456.68 TSS/ac/yr = 27.40 lbs TSS/yr	27.40 * .45 = **12.33 lbs TSS/yr**
	.18 acres Pervious	72.78 lbs/ac	.18 ac * 72.78 lbs/ac/yr = 13.10 lbs TSS/yr	13.10 * .45 = **5.90 lbs TSS/yr**

Project/BMP: Tree Box Filter #3, 4'x6' Filterra Unit

This was a stormwater retrofit project to treat stormwater from a roadway near B1250. The treatment area for this Filterra unit is 0.15 acres of which 0.02 acres was impervious and 0.13 acres was pervious. The VA Stormwater Clearinghouse BMP criteria of a 50% TP removal efficiency was utilized. The removal efficiency for TN and TSS was calculated using the CB Program retrofit curves.

This BMP's runoff storage volume is .002 acre-feet.

Runoff Depth Treated = (RS)(12)/IA = (.002)(12)/.02 = 1.2 inches
TP = 50% (assigned in VA BMP Clearinghouse)
TN = 37% (assigned from ST Retrofit Curve)
TSS = 73% (assigned from ST Retrofit Curve)

	Treatment Acres	Loading Rate	Loading Equation	BMP Efficiency and Reduction Credit
TN	.02 acres Impervious	7.31 lbs/ac	.02 ac * 7.31 TN/ac/yr = .15 lbs TN/yr	.15 * .37 = **.06 lbs TN/yr**
	.13 acres Pervious	7.65 lbs/ac	.13 ac * 7.65 TN/Ac/yr = .99 lbs TN/yr	.99 * .37 = **.37 lbs TN/yr**
TP	.02 acres Impervious	1.51 lbs/ac	.02 ac *1.51 TP/ac/yr = .03 lbs TP/yr	.03 * 0.50 = **.02 lbs TP/yr**
	.13 acres Pervious	0.51 lbs/ac	.13 ac*0.51 TP/ac/yr = .07 lbs TP/yr	.07 * 0.50 = **.04 lbs TP/yr**
TSS	.02 acres Impervious	456.68 lbs/ac	.02 ac * 456.68 TSS/ac/yr = 9.13 lbs TSS/yr	9.13 * .73 = **6.66 lbs TSS/yr**
	.13 acres Pervious	72.78 lbs/ac	.13 ac * 72.78 lbs/ac/yr = 9.46 lbs TSS/yr	9.46 * .73 = **6.91 lbs TSS/yr**

Project/BMP: Tree Box Filter #4, 4'x6' Filterra Unit

This was a stormwater retrofit project to treat stormwater from the roadway and parking lot area at the rear of B1189. The treatment area for this Filterra unit is 0.12 acres of which 0.09 acres was impervious and .03 acres was pervious. The VA Stormwater Clearinghouse BMP criteria of a 50% TP removal efficiency was utilized. The removal efficiency for TN and TSS was calculated using the CB Program retrofit curves.

This BMP's runoff storage volume is .002 acre-feet.

Runoff Depth Treated = (RS)(12)/IA = (.002)(12)/.09 = 0.27 inches
TP = 50% (assigned in VA BMP Clearinghouse)
TN = 17% (assigned from ST Retrofit Curve)
TSS = 34% (assigned from ST Retrofit Curve)

	Treatment Acres	Loading Rate	Loading Equation	BMP Efficiency and Reduction Credit
TN	.09 acres Impervious	7.31 lbs/ac	.09 ac * 7.31 TN/ac/yr = .66lbs TN/yr	.66 *.17 = **.11 lbs TN/yr**
	.03 acres Pervious	7.65 lbs/ac	.03 ac * 7.65 TN/Ac/yr = .23 lbs TN/yr	.23 *.17 = **.04 lbs TN/yr**
TP	.09 acres Impervious	1.51 lbs/ac	.09 ac *1.51 TP/ac/yr = .14 lbs TP/yr	. 14 * 0.50 = **.07 lbs TP/yr**
	.03 acres Pervious	0.51 lbs/ac	.03 ac*0.51 TP/ac/yr = .02 lbs TP/yr	.02 * 0.50 = **.01 lbs TP/yr**
TSS	.09 acres Impervious	456.68 lbs/ac	.09 ac * 456.68 TSS/ac/yr = 41.10 lbs TSS/yr	41.10*.34= **13.97 lbs TSS/yr**
	.03 acres Pervious	72.78 lbs/ac	.03 ac * 72.78 lbs/ac/yr = 2.18 lbs TSS/yr	2.18 * .34= **.74 lbs TSS/yr**

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2015 to June 30, 2016

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

From July 1, 2015 to June 30, 2016 a total of three (3) impervious areas are planned to be demolished and returned to green space. These impervious areas are now managed as green space. While these areas are mowed periodically, they do not receive any nutrient applications allowing them to be classified as grass. The 3 structures equate to a total of 5.28 acres of impervious areas converted to grass.

Building	Name	Demolish Date	Acres Reduced
1261 Complex and Parking Areas	AIRCRAFT LANDINGS	9/1/2015	4.61
1231	CHILD CARE FACILITY	8/1/2015	.27
1145 and Parking Area	1145	8/1/2015	.40
		Total	**5.28**

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	6.06 lbs/ac/year	5.28 ac * 6.06 TN/ac/yr	**32.00 lbs TN/yr**
TP	1.17 lbs/ac/year	5.28 ac * 1.17 TP/ac/yr	**6.18 lbs TP/yr**
TSS	430.00 lbs/ac/year	5.28 ac * 430.00 TSS/ac/yr	**2270.40 lbs TSS/yr**

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

NASA is planning to convert several areas of the "North 40" that are currently mowed (pervious areas) to forested cover. These areas have no value to being mowed/maintained and would serve better as forested habitat. This will be 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). It is anticipated that during this timeframe the 1.0 acre plot will serve as a "pilot" project to get experience and a better understanding of costs, planting techniques, and ideal tree protection measures before undertaking larger reforestation efforts. NASA is currently working with the Virginia Department of Forestry to look at tree costs 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 via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2016 to June 30, 2017

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

From July 1, 2016 to June 30, 2017 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 2 structures equate to a total of 1.14 acres of impervious areas converted to grass.

Building	Name	Demolish Date	Acres Reduced
1222	REID CONFERENCE CENTER	9/1/2016	0.55
1283	MULTI-ORGANIZATIONAL STORAGE FACILITY	9/1/2016	0.59
		Total	**1.14**

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	6.06 lbs/ac/year	1.14 ac * 6.06 TN/ac/yr	**6.91 TN/yr**
TP	1.17 lbs/ac/year	1.14 ac * 1.17 TP/ac/yr	**1.33 TP/yr**
TSS	430.00 lbs/ac/year	1.14 ac * 430.00 TSS/ac/yr	**490.20 TSS/yr**

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

During Phase II of the North 40 Land Reforestation Plan, it is anticipated that an additional 2.0 acres of pervious grass area will be converted into hardwood forested areas by planting at least 800 seedlings (per Guidance Document Table V.F.2, a minimum of 400 seedlings per acre reclassify the land as forest land).

Part 1: Land Use Change Credits – Pervious to Forest

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	5.18 lbs/ac/year	2.0 ac * 5.18 TN/ac/yr	**10.36 lbs TN/yr**
TP	0.40 lbs/ac/year	2.0 ac * 0.40 TP/ac/yr	**0.80 lbs TP/yr**

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TSS	78.30 lbs/ac/year	2.0 ac * 78.30 TSS/ac/yr	156.60 lbs TSS/yr

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

2.0 acres * 2 = 4.0 upland acres treated

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	72.28lbas/ac	.50	36.14

	Treatment Acres	Adjusted Loading Rate	Loading Equation	Forest Buffer Reduction Credit
TN	4.0 acres Pervious	1.94	4.0 ac * 1.94 TN/Ac/yr =	7.76 lbs TN/yr
TP	4.0 acres Pervious	.23	4.0 ac * .23 TP/ac/yr =	0.92 lbs TP/yr
TSS	4.0 acres Pervious	36.14	4.0 ac * 36.14 lbs/ac/yr =	144.56 lbs TSS/yr

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2017 to June 30, 2018

Project: Land Use Change/Impervious to Grass Credits:

From July 1, 2017 to June 30, 2018 a total of one (1) impervious structure is planned for demolition and will be returned to a grass condition. The structure equates to a total of 1.0 acres of impervious area converted to grass.

Building	Name	Demolish Date	Acres Reduced
1275	CF4 TUNNEL COMPLEX	9/1/2017	1.0
			1.00

	Loading Rate for Land Conversion	Loading Equation	Reduction Credit
TN	6.06 lbs/ac/year	1.00 ac * 6.06 TN/ac/yr	**6.06 lbs TN/yr**
TP	1.17 lbs/ac/year	1.00 ac * 1.17 TP/ac/yr	**1.17 lbs TP/yr**
TSS	430.00 lbs/ac/year	1.00 ac * 430.00 TSS/ac/yr	**430.00 lbs TSS/yr**

Project/BMP: Street Sweeping Program

LaRC has an established street sweeping program that is accomplished via a contract mechanism. All roads and parking surfaces on Center are swept on a quarterly basis. Additional sweeping efforts are done 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 data from the last six 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, 2018

Sub source	Pollutant	Load Reduction Required	Loads Achieved and/or Planned
Regulated Urban Impervious	TN	7.16	**237.32**
Regulated Urban Pervious		5.76	**31.48**
Regulated Urban Impervious	TP	2.63	**80.57**
Regulated Urban Pervious		.46	**3.08**
Regulated Urban Impervious	TSS	994.01	**25112.95**
Regulated Urban Pervious		79.85	**526.56**

Means and Methods to offset New Load Sources - July 1, 2009 and June 30, 2014

NASA has determined that there are no needed offsets for increased loads from new sources that initiated construction between July 1, 2009, and June 30, 2014. There were two major redevelopment/construction projects that disturbed over one acre during this time period; however, due to NASA's aggressive LEED goals and the Federal EISA Section 438 design standards, these facilities provided more stormwater treatment and stormwater quantity reduction then required. Additionally, both of 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 bioretention 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 bioretention ponds, and extensive pervious pavers to treat and capture stormwater. This building met all necessary load reductions.

Note: Outside of the two 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.

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. Currently, there is one active construction project that was designed to comply with Technical Criteria Part II B.

List of Future projects that Qualify as Grandfathered

No future projects and zero acreage qualifies 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, 20111	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.

Time Period	Project	Cost ($)	Notes
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.
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	Filterra/Tree Boxes x4	180,000	This included design and installation of 4 units.
Total cost paid		**2,593,450**	

The following table depicts estimated costs for projects that are planned from July 1, 2015 to the close of the MS4 permit cycle.

Time Period	Project	Cost	Notes
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	2,500	1-acre reforestation (hardwood)
July 1, 2016 – June 30, 2016	Demolition – Land Use Conversion of	580,000	This cost includes all demolition costs,

Time Period	Project	Cost	Notes
	Impervious to Grass (total of 2 facilities)		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	5,000	1-acre reforestation (hardwood)
July 1, 2017 – June 30, 2018	Demolition – Land Use Conversion of Impervious to Grass (total of 1 facility)	2,000,000	This cost includes all demolition costs, contract fees, and site restoration work.
July 1, 2017 – June 30, 2018	Street Sweeping Program	5,000	Annual cost for street sweeping via contract.
Total cost projected =		**3,602,500**	

NASA LaRC will have spent over 6 million dollars directly and indirectly in TMDL-related projects by the end of the permit cycle.

Public Comments on Draft Action Plan

LaRC solicited public comments on the draft Action Plan on the communication website for LaRC employees called the @LaRC announcement system. This announcement page is viewable and accessible to all LaRC employees. LaRC solicited employee feedback utilizing the @LaRC system on the following dates: 6/10/2015, 6/11/2015 and 6/12/2015. Only two inquiries were received.

Comment One – This employees was interested in any volunteer activities associated with the Plan that he could participate. They were especially interested in tree planting efforts such as forest buffer projects. LaRC responded that any volunteer opportunities (such as Earth Day planting events, maintenance/clean-up events, etc.) would be published on the @LaRC announcement system.

Comment Two – This employee was interested in the Plan because they volunteer on the Chesapeake Bay Advisory Board BMP committee. They were interested if LaRC had run into any issues crediting BMPs that were installed before July 1, 2009. LaRC is not seeking any credit for older BMPs, so LaRC responded no. LaRC also responded with a full copy of the Plan and summary spreadsheet and an offer to discuss the Plan in detail. A follow-up comment was not submitted.

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."

Kristen Poultney 9/28/15

Kristen Poultney, Environmental Branch Head — Date