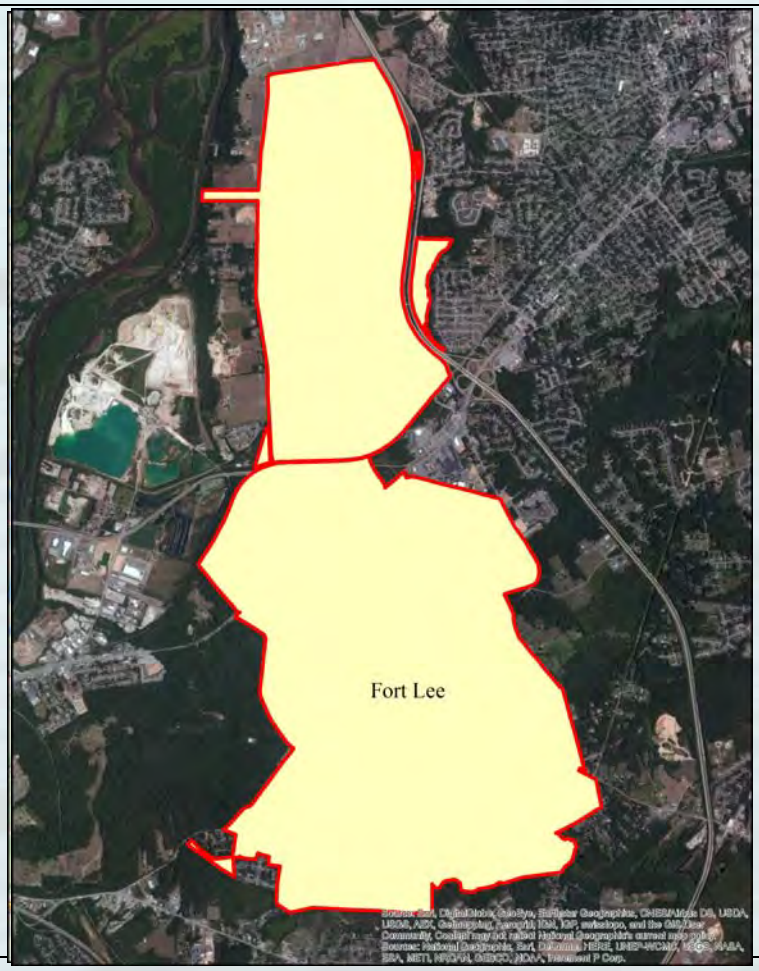
CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD (TMDL) STUDY FOR FORT GREGG-ADAMS (FORT LEE)



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Updated October 2024

CHESAPEAKE BAY TOTAL MAXIMUM DAILY LOAD (TMDL) STUDY FOR FORT LEE

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January 2016

EXECUTIVE SUMMARY

Introduction

United States Installation Management Command (IMCOM) tasked the United States Army Corps of Engineers (USACE) to provide technical data pertaining to Chesapeake Bay pollutant load reduction requirements for Fort Lee, Virginia.

The Clean Water Act (CWA) established a basic structure for regulating pollutants in United States waters to keep them "fishable and swimmable". States are responsible for implementing these requirements through Watershed Implementation Plans (WIP), and the Environmental Protection Agency (EPA) is responsible for enforcing the regulation.

There are three pollutants identified as having the greatest impact on the Chesapeake Bay: total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). States have identified impaired waters; and together with the EPA, developed a "pollution diet" to restore them. This pollution diet is known as a Total Maximum Daily Load (TMDL), or the amount of pollutant a waterbody can carry and still achieve its designated uses (drinking water, recreation, etc.). The Commonwealth of Virginia will utilize Municipal Separate Storm Sewer System MS4 permits to ensure developed lands achieve nutrient and sediment reduction requirements. This study will satisfy the MS4 Phase II General Permit, Chesapeake Bay TMDL Action Plan requirement (Section I C) and will contribute to the next scheduled MS4 progress report in October 2015.

Data Collection and Mapping

Land use, soils, stormwater infrastructure and drainage area data were collected and mapped in order to calculate baseline and current load rates for TN, TP, and TSS running off of the installation and to determine methods for reducing those pollutant loads.

Field Investigation

Existing infrastructure that is designed to treat stormwater runoff on the installation, or Best Management Practices (BMPs) were inventoried, inspected and entered into a database. The database was designed as a tracking and record keeping tool to help the installation manage their stormwater program over time. It can be used to track required pollutant reductions and to generate annual progress reports.

Establishment of Baseline Pollutant Loads

Virginia Department of Environmental Quality (DEQ) published guidance for pollutant load reduction requirements (DEQ, 2014). They used Chesapeake Bay Program (CBP) models to provide load rates for the James River to be used to calculate installation specific baseline load rates using land use data. Using 2009 land use data and the methods provided in the DEQ guidance, an estimated 18,062 lbs of TN, 2,127 lbs of TP and 676,479 lbs of TSS per year are deposited into waterways from Fort Lee.

Pollutant Load Reductions

The Phase I WIP provides a general framework for meeting Chesapeake Bay TMDL requirements. The Phase II WIP provides a more specific plan and schedule for meeting the requirements. It details that based on the 2009 baseline conditions; 9 percent of TN loads, 16 percent of TP loads, and 20 percent of TSS loads from impervious regulated acres, and 6 percent of TN loads, 7.25 percent of

TP loads and 8.75 percent TSS loads be reduced by the end of the third permit cycle in 2027. This equates to 1,235 lbs of TN, 216 lbs of TP and 116,041 lbs of TSS that need to be reduced from Fort Lee per year by 2027. Five percent of these reductions are required to be completed by the end of the first permit cycle in 2017, and 35 percent are required to be completed by the end of the second permit cycle in 2022.

Since the 2009 baseline, some pollutant reduction has already been realized at Fort Lee. Stream restoration contributes to 41.25 lbs of TN, 37.4 lbs of TP and 24,684 lbs of TSS of the required reductions. Street sweeping contributes 963 lbs of TN, 385 lbs of TP and 115,500 lbs of TSS toward the required reductions. Land use change reduces 34.2 lbs/yr of TN, 3.3 lbs/yr of TP and 393 lbs/yr of TSS. Forest buffers reduce 2.2 lbs/yr of TN, 0.5 lbs of TP, and 135 lbs/yr of TSS. The remaining reductions required may be achieved through proposed structural BMPs. Areas in Fort Lee where BMPs can be implemented to achieve these reductions are identified in Section 6 of this report. A schedule for BMP implementation is included in Section 6.2. Detailed information about these areas of interest (AOIs) and BMPs are included in Appendix A.

Costs

Leebcor Services LLC prepared a cost proposal for design and construction of structural BMPs in the AOIs selected by Fort Lee (Appendix D).

Installation Point of Contact

Dana Bradshaw, Fort Lee DPW, Environmental Management Office 804-734-5080

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ATTACHMENTS

Project Disc containing:

- GIS Data
- BMP Database
- Digital Report

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LIST OF ACRONYMS

Area of Interest....AOI
Best Management Practices....BMP
Chesapeake Bay Foundation....CBF
Chesapeake Bay Program....CBP
Chesapeake Bay Program Watershed Model....CBPWM
Clean Water Act....CWA
Department of Environmental Quality....DEQ
Digital Elevation Modeling....DEM
Edge of stream....EOS
Environmental Site Design....ESD
Executive Order....EO
Geographic Information System....GIS
Global Positioning System....GPS
Hydrologic Soil Group....HSG
Installation Management Command....IMCOM
Level 2....L2
Light Detection and Ranging....LiDAR
Low Impact Development....LID
Municipal Storm Water Sewer System....MS4
National Pollutant Discharge Elimination System....NPDES
Natural Resource Conservation Service....NRCS
North American Vertical Datum of 1988....NAVD88
Pollutants of concern....POC
Total Maximum Daily Load....TMDL
Total nitrogen....TN
Total phosphorus....TP
Total suspended solids....TSS
United States....US
United States Army Corps of Engineers....USACE
United States Environmental Protection Agency....EPA
Universal Transverse Mercator....UTM
Virginia....VA
Virginia Pollution Discharge Elimination System....VPDES
Watershed Implementation Plans....WIP
Web Soil Survey....WSS

1 INTRODUCTION

1.1 BACKGROUND AND PURPOSE

The Clean Water Act (CWA) established a basic structure for regulating pollutants in United States (US) waters (USEPA, 1972). Despite efforts to comply with these requirements, the Chesapeake Bay continues to fall short of State water quality standards and CWA goals (CBF, 2014). Additional legislation has since been developed to assure the Bay is "fishable and swimmable". States are responsible for implementing the requirements of the CWA, and United States Environmental Protection Agency (USEPA) is tasked with regulating the restoration efforts.

Section 303 of the CWA requires States to: establish water quality standards based on achieving their designated uses for that water (drinking, recreation, etc…), develop lists of impaired waters that fail to meet those standards, and estimate the amount of a pollutant that the waterbody can receive and still meet those standards. The amount of a pollutant a waterbody can carry and satisfy its water quality standards is now known as a Total Maximum Daily Load (TMDL).

CWA Section 402 regulates any point sources discharging pollution into U.S. waters through the National Pollutant Discharge Elimination System (NPDES) program. Municipalities with stormwater conveyance systems are required to obtain a Municipal Storm Water Sewer System (MS4) Phase II General Permit for coverage under the NPDES program. States have chosen to use these permits to enforce the TMDL requirements.

The Chesapeake Bay Protection and Restoration Executive Order (EO) 13508 (FLCC, 2009) describes the Chesapeake Bay as a "national treasure" and intends to bring more accountability to Bay cleanup efforts. In response to the EO, USEPA published guidance for Federal Facilities describing how to comply with the Federal regulations implemented by the States.

In December 2010, USEPA published a TMDL for all impaired segments of the Chesapeake Bay watershed in order to help the States establish load allocations. They determined that total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) are the pollutants of concern (POC), causing the most environmental damage to the Chesapeake Bay. They then required those states within the Chesapeake Bay watershed to submit Watershed Implementation Plans (WIPs) detailing how they will achieve TMDL requirements for nitrogen, phosphorus and sediment. The Phase II WIP presented pollutant load reductions, referred to as Level 2 (L2) scoping run reductions requiring of 9 percent of TN loads, 16 percent of TP loads, and 20 percent of TSS loads from impervious regulated acres and 6 percent of TN loads, 7.25 percent of TP loads and 8.75 percent TSS loads be reduced by the end of the third MS4 permit cycle.

United States Army Corps of Engineers (USACE) has been tasked by the Installation Management Command (IMCOM) to provide technical data pertaining to the Chesapeake Bay TMDL for Fort Lee. The technical data collected and/or developed during this investigation includes:

existing land use; soils; Best Management Practices (BMP) and stormwater infrastructure locations and conditions; contributing drainage area to each stormwater BMP; and baseline pollutant load computations. Table 1-1 provides additional description of the data collected

TABLE 1-1 DATA COLLECTED

Data	Applicability
Facility Boundary	The facility boundary is the first piece of information to be collected. The facility boundary is needed to begin collecting land use, soils, BMP, and stormwater infrastructure data.
Land Use	A land use category determines the type(s) of practices conducted on that land area. Different practices yield different types and concentrations of pollutants. For example, agricultural land is typically high in nitrogen, due to certain types of fertilizer use.
Soils	Soil characteristics impact the infiltration. For example, urban areas are typically comprised of very compacted soils, which result in more stormwater and pollutant runoff rates.
BMPs and Drainage to BMP	Drainage areas to BMPs were identified, so new BMPs were not proposed to treat overlapping areas.
Stormwater Infrastructure	Stormwater infrastructure data shows how the stormwater is managed within the facility. It was used to delineate BMP drainage areas.

The data collected and developed were used to conduct an opportunity assessment to determine if stormwater BMP retrofits will be favorable to reduce pollutant loads to the Chesapeake Bay. The database on attached project disk will provide a mechanism for managing data and assisting the localities and states with implementing WIPs. Current, accurate Geographic Information System (GIS) data used to conduct this assessment will also assist Fort Lee with future stormwater BMP maintenance and compliance requirements.

This study will satisfy the MS4, Chesapeake Bay TMDL Action Plan requirement (Section I C) and will be part of the next scheduled MS4 progress report in October 2015.

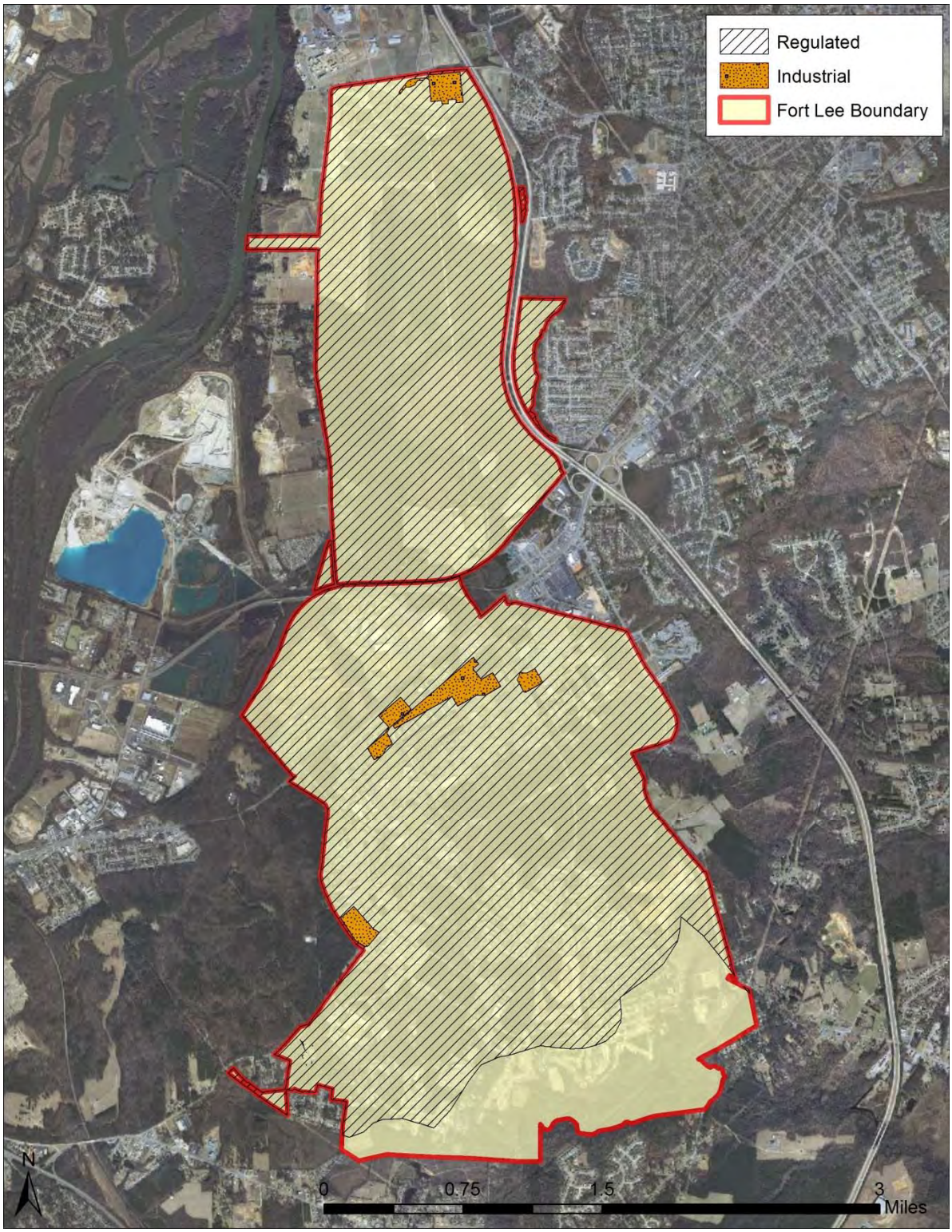
1.2 STUDY AREA

The study area for this investigation is Fort Lee, which occupies approximately 5,677 acres within Chesterfield, Dinwiddie and Prince George Counties. Fort Lee is located in the James River watershed, which is part of the Chesapeake Bay Watershed (Figure 1-1).

A 661.6 acre area in the southeastern corner of Fort Lee is not covered by the MS4 permit and therefore is not included in this assessment. The remainder of the Garrison drains to the Chesapeake Bay through the James River. Approximately 89 acres regulated by an industrial MS4 permit is also excluded from consideration in this assessment as this TMDL regulation does not apply to industrial permitted areas (Figure 1-2 Fort Lee Regulated Area). The Fort Lee POC was not aware of any grandfathered projects. USACE confirmed the absence of grandfathered projects with the DEQ. The DEQ POC expressed that grandfathered status would not have been granted to military installations.

FIGURE 1-1 FORT LEE LOCATION MAP

FIGURE 1-2 FORT LEE REGULATED AREA



1.3 REPORT OUTLINE

The tasks required to complete this study and satisfy General MS4 Permit Section I.C.2.a requirements are described in the following sections of this report. Section 1 of this report provides background information and addresses grandfathered projects (I.C.2.a (7, 8, and 10)). Section 2 reviews the current and future MS4 program and legal authorities (I.C.2.a (1, 2)). Section 3 describes the development of GIS data layers that were used in the calculation of current baseline pollutant loads. Section 4 describes the stormwater BMP database created for Fort Lee. Section 5 describes calculation of baseline loads (I.C.2.a (4). Section 6 details the nutrient reduction requirements and a plan to meet those requirements (I.C.2.a (3, 5, and 6). Section 7 explains the costs to complete the reduction requirements (I.C.2.a. (11). Section 8 includes conclusions from this study (I.C.2.a. (9 and 12) (Commonwealth of Virginia, 2013).

The sections of this report are to provide general information on the methodology and results of the study. Specific results for each Area of Interest (AOI) are described in factsheets located in Appendix A. Each factsheet contains five Sections. Section I includes general information, including a description of its location, size and an accompanying map. Section II includes a breakdown of the existing land use, including a map identifying the land use area. Section III displays and discusses a map of existing stormwater and proposed BMPs. The calculated baseline pollutant and reduction loads are highlighted in Section IV. Section V contains a cost assessment to construct the proposed BMPs.

TABLE 1-2 RELATING MS4 PERMIT TO THIS REPORT

General MS4 Permit Section I.C.2.a subsection*	Section in this report addressing the permit requirement
1,2	Section 2
3,5,6,	Section 6
7,8,10	Section 1
4	Section 5
11	Section 7
12	Section 8

*Subsection 9 is not addressed in this report because it simply states, “The operator shall address any modification to the TMDL or watershed implementation plan that occurs during the term of this state permit as part of its permit reapplication and not during the term of this state permit.”

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2 MS4 PROGRAM AND LEGAL AUTHORITIES

- Virginia Pollution Discharge Elimination System (VPDES)
- General MS4 Permit
- Clean Water Act
- Virginia Stormwater Management Act
- Virginia Stormwater Management Program Regulations
- Energy Independence and Security Act
- See Appendix C for related Garrison Standard Operating Procedures

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3 DATA COLLECTION AND MAPPING

GIS was used to create, analyze and plan all geographically related information. These data were created as shapefiles, which can be used to accurately measure the spatial area needed to perform land use and load reduction calculations. Each data set is in Universal Transverse Mercator (UTM) Zone 18 North American Vertical Datum of 1988 (NAVD88) horizontal coordinate system.

3.1 LAND USE

Accurate land use data is essential for baseline and reduction load calculations. Considerable effort was made to collect and develop the most accurate data and categorize it in two different ways for multiple uses. Virginia TMDL Guidance classification was necessary for Action Plan calculations; Chesapeake Bay Program (CBP) classifications will be used for model runs. Land use polygons were attributed with land uses relevant to Virginia Guidance calculations and CBPWM (see Table 3-1 Land Use).

EPA required each state to submit guidance for how to achieve the goals set forth in the WIP. Virginia Department of Environmental Quality provided draft guidance to USACE in 2013, which provided instructions to permittees for estimating pollutant source loads as of June 30, 2009 (DEQ, 2014). Before guidance was released setting 2009 as the baseline year, land use layers were developed using the most up to date information at the time (2013 aerial imagery). In response to that draft guidance, existing land use was digitized using the 2009 aerial imagery. As a result, land use layers were developed for both 2009 and 2013 conditions and will be provided in the attached project disk. The digitized imagery was used to calculate baseline load rates and the baseline load rates were then used to establish L2 reductions (see Section 5-1).

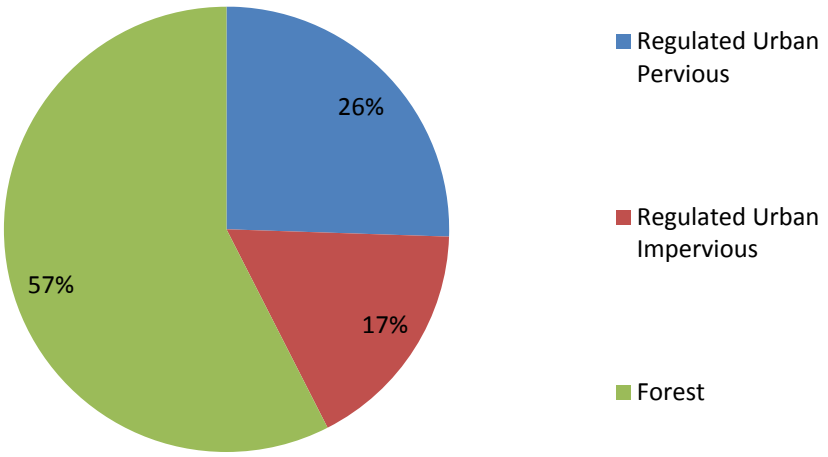
TABLE 3-1 LAND USE CLASSIFICATIONS

VA Land Use	CBP Land Use	General Description
Regulated Urban Impervious	High Intensity Impervious Urban/ Low Intensity Impervious urban	building, road, parking
Regulated Urban Pervious	High Intensity Pervious Urban/ Low Intensity Pervious urban	beach, gravel, lawn, shrubs
N/A	construction	bare earth
N/A	forest	forest, wetland
N/A	hay	row crops, not fertilized
N/A	hay with nutrients	row crops, fertilized
N/A	unfertilized grass	brush
N/A	water	water

Seventeen percent of Fort Lee's regulated area is categorized as regulated urban impervious land cover (767 acres). This includes building rooftops, parking areas, sidewalks, and recreational courts. An estimated 26 percent (1,553 acres) is categorized as regulated urban pervious land cover, or beach, gravel, lawn, or shrubs. Forest comprises 57 percent of the land (2,598 acres). Another 7.3 acres of the installation's regulated area

is comprised of water, which accounts for less than 1 percent of the installations total area (Figure 3-1 Land Use Summary for Fort Lee).

FIGURE 3-1 LAND USE SUMMARY FOR FORT LEE



3.2 SOILS

Soil type was used to determine preliminary BMP site locations for planning purposes. Reduction efficiency and cost effectiveness are generally maximized when BMPs are implemented in A and B soils, which make up 28.5 percent of the installation. It is more expensive and fewer nutrients are reduced when BMPs are built in C and D soils, which make up 14% of the installation. The predominant soil group is a mixture of B and D type characteristics, which makes up 41% of the installation. Soils data were obtained from the Natural Resource Conservation Service (NRCS) Web Soil Survey (WSS) (USDA NCRS, 2013). The county-wide soils layer obtained from the WSS was clipped to the installation boundary to create a shapefile specific for Fort Lee (Figure 3-2 Soil Type Map). The shapefiles are attributed with soil type and Hydrologic Soil Group (HSG).

FIGURE 3-2 SOIL TYPE MAP

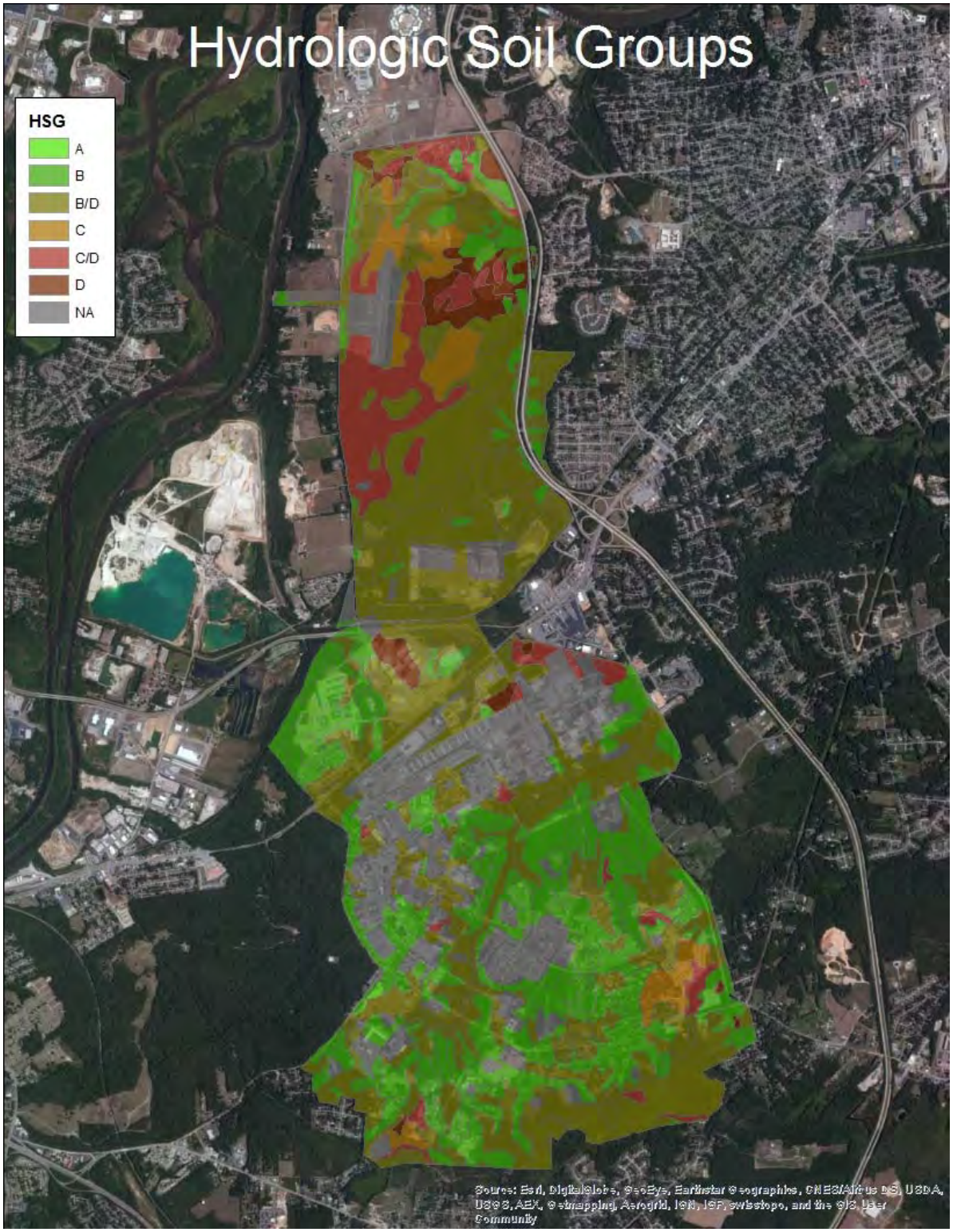


TABLE 3-2 SOIL GROUP DISTRIBUTION

HSG	Total Area (AC)	Percentage of Installation Area
A	5	0.1%
B	1,612	28%
B/D	2,337	41%
C	212	4%
C/D	411	7%
D	160	3%
NA	922	16%

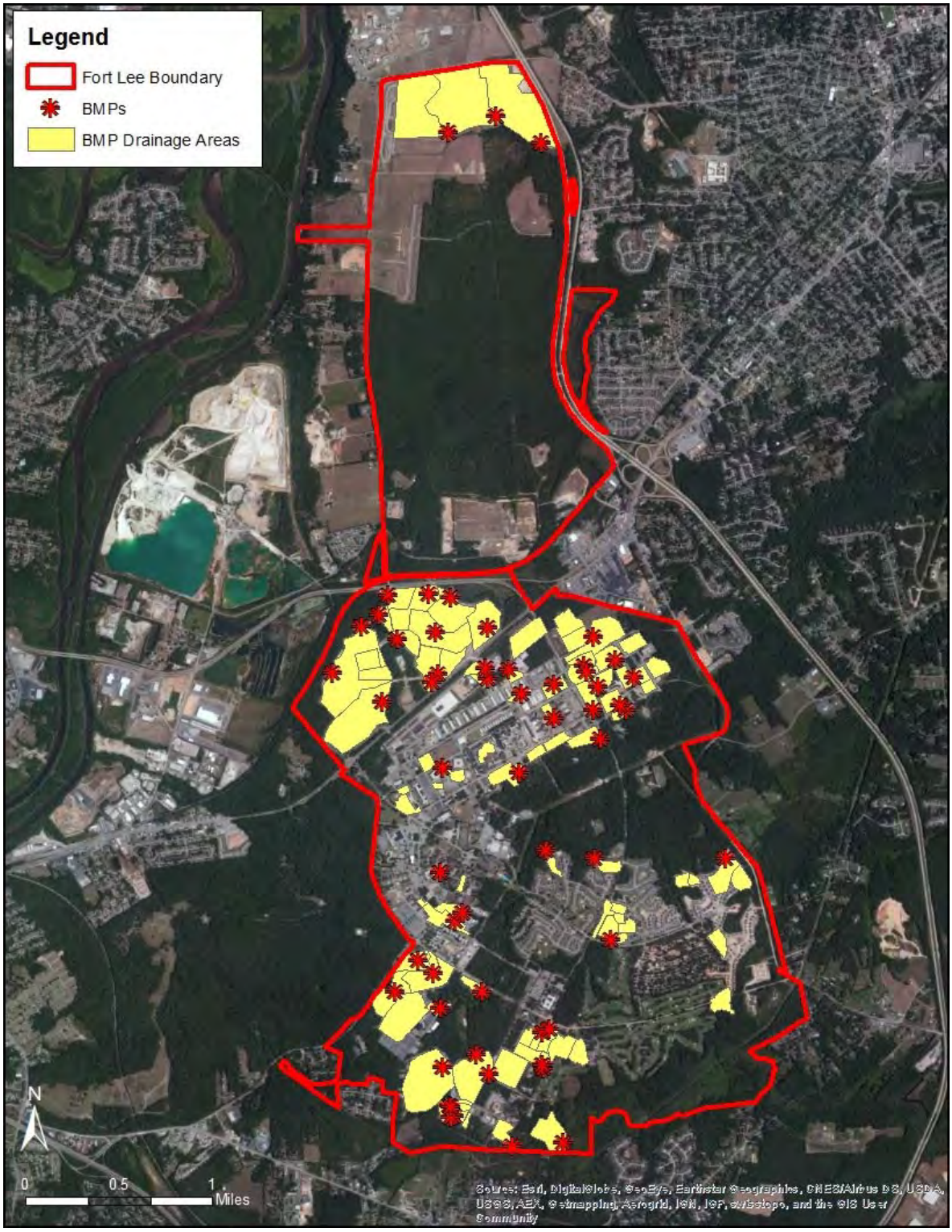
3.3 DRAINAGE AREAS

Since as-built and stormwater management plans were not available for planning; drainage areas were delineated using light Detection and Ranging (LiDAR) data, Digital Elevation Modeling (DEM), topographic contours and 2009 aerials. BMPs were delineated to include all stormwater conveyed to them through existing infrastructure. These areas were portrayed as polygons in GIS (Figure 3-3 Fort Lee BMP Drainage Areas). Once these individual watersheds were identified, they were used to exclude these areas from consideration for new BMP treatment opportunities. Drainage areas to BMPs recommended to meet TMDL requirements were also delineated. These drainage areas are shown in the fact sheets in Appendix A.

3.4 STORMWATER INFRASTRUCTURE

The stormwater layers used for this investigation were provided by the installation and prepared by Versar, Inc. Separate shapefiles were created for stormwater lines, points and BMPs. Storm lines were categorized as pipe, structure, culvert, drainage, masonry, and sewer. Storm points were categorized as cleanout, culvert, inlet, manhole, outfall, and pipe end. All GIS data created for this project and analyses are included on the attached project disk.

FIGURE 3-3 FORT LEE BMP DRAINAGE AREAS



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4 FIELD INVESTIGATION

A field assessment was performed in August 2013 to inventory and assess existing BMPs. Project members traveled to Fort Lee and coordinated with installation points of contact to locate BMP facilities and inspect structural features.

4.1 STORMWATER BMP INVENTORY AND INSPECTION

Several pieces of data were compiled for each stormwater BMP. A field team documented the type of BMP installed (i.e. ponds, infiltration, filtration, manufactured/underground), and the geographic location, using Global Positioning System (GPS) technology. A visual assessment of the condition of the BMP was performed using The Virginia Stormwater Management Handbook (DCR, 1999). Digital photographs were also taken to document the location and condition of the BMP at the time of the inventory and assessment.

The end product of the stormwater BMP inventory and inspections is the BMP database, which is discussed in Section 3.2. Based upon the results of the field inspection, an overall rating was assigned to each BMP. A description of the ratings is provided in Table 4-1 Stormwater BMP Rating Description. These ratings will assist the installation in prioritizing maintenance and improvement activities for each facility.

TABLE 4-1 STORMWATER BMP RATING DESCRIPTION

Rating	Description
A	The BMP is functioning as designed with no problem conditions identified. No signs of impending deterioration.
B	Minor problems are observed, however BMP is functioning as designed with no problem conditions in critical parameters.
C	Minor problems are observed, however BMP is functioning as designed with no problem conditions in critical parameters, but BMP performance is being compromised.
D	Major problems are observed and BMP is not functioning as designed with problem conditions in several critical parameters. Conditions have compromised the BMP performance.
E	Major problems are observed and BMP is not functioning as designed with problem conditions in several critical parameters. Conditions have compromised the BMP performance. BMP shows signs of impending failure.

All stormwater BMPs were assigned a Permanent ID that includes an abbreviation for the type of stormwater BMP (i.e. "P" for pond or "I" infiltration), and then an identification number.

Eighty-six stormwater BMPs were identified within the study area. Fifty-nine were inventoried by the USACE field crew in 2011 (Table 4-2 BMP Inventory Results) and 49 were inspected. The remaining BMPs were added since the 2011 inspection and information was supplied by the installation contact. The location and type of BMPs are recorded for the inventoried BMPs, and ratings were given to the inspected BMPs. A description of these ratings is shown in Table 4-3.

TABLE 4-2 BMP INVENTORY RESULTS

BMP type	Number
Bioretention	1
Dry Basin	16
Infiltration Basin	5
Infiltration Trench	2
Permeable Pavement	1
Wet Basin	34

TABLE 4-3 BMP INSPECTION RATING RESULTS

Rating	Number
A	18
B	30
C	1

4.2 STORMWATER BMP DATABASE

The data collected from the field assessments was used to create the BMP Database. The BMP database serves as a tracking and record keeping tool, and can also be used to determine the pollutant reductions provided by implementing various BMPs. The BMP Database can be used to create a map of all BMP locations within the installation, by exporting a GIS shapefile. The database is in Microsoft Access format, with forms containing all the inspection results and a digital photograph of each BMP. Should the installation implement any additional stormwater BMPs, the database can be expanded so installation staff can use it to manage their stormwater program over time. A brief user's guide for the BMP Database is located in Appendix B.

5 ESTABLISHMENT OF BASELINE POLLUTANT LOADS

Knowledge of baseline (existing) loading conditions for TN, TP and TSS is needed to guide the facilities in their management and implementation of stormwater BMPs to meet the overall Chesapeake Bay TMDL pollution reduction requirements. The Chesapeake Bay Program Watershed Model (CBPWM) is at a macro-scale and typically does not have the level of detail in land use and installation boundary data as was collected in this study. Therefore, independent calculations of baseline pollutant loads, using the best data available, is needed to better understand the actual baseline pollutant contribution from these facilities and what level of improvements, if any, are needed to meet overall Chesapeake Bay TMDL goals. Baseline load rates calculated for this study exclude area covered by industrial permits and area draining to a watershed other than the Chesapeake Bay. These load rates include only area on Fort Lee covered by the General VSMP Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems.

5.1 METHODOLOGY

Tables provided in the Virginia TMDL Guidance were used to calculate pollutant load rates from Fort Lee (DEQ, 2014) This approach uses tables with established "Edge of Stream" (EOS) loading rates for pervious and impervious land uses in each of the four regional river basins within the Chesapeake Bay watershed – James River, Potomac River, Rappahannock River, and York River. The total existing acreage for each site is then input into the appropriate table and multiplied by the 2009 EOS loading rate to determine the estimated baseline loads.

5.2 RESULTS

Fort Lee falls within the James River watershed. Table 5-1 shows the "Calculation Sheet for Estimating Existing Source Loads for the James River Basin" from the VA TMDL Guidance completed with the total existing acres of regulated urban impervious and pervious land uses served by Fort Lee's MS4 permit and the resulting POC loads calculated by applying the rates provided by DEQ in the fourth column (DEQ, 2015) .

TABLE 5-1 BASELINE CALCULATIONS FOR FORT LEE

	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	2009 EOS Loading Rate (lbs/acre)	Estimated Total POC Load Based on 2009 Progress Run
Regulated Urban Impervious	Nitrogen	767.42	9.39	7,206.07
Regulated Urban Pervious		1,553.05	6.99	10,855.82
Regulated Urban Impervious	Phosphorus	767.42	1.76	1,350.66
Regulated Urban Pervious		1,553.05	0.50	776.53
Regulated Urban Impervious	Total Suspended Solids	767.42	676.94	519,497.30
Regulated Urban Pervious		1,553.05	101.08	156,982.29

Table 2 b: Calculation Sheet for Estimating Existing Source Loads for the James River Basin (Based on Chesapeake Bay Program Watershed Model Phase 5.3.2) (DEQ, 2014).

6 POLLUTANT LOAD REDUCTIONS

L2 scoping run reductions, presented in the Phase II WIP and enforced through the MS4 permit equate to a reduction of 9 percent of TN loads, 16 percent of TP loads, and 20 percent of TSS loads from impervious regulated acres and 6 percent of TN loads, 7.25 percent of TP loads and 8.75 percent TSS loads beyond 2009 progress loads for pervious regulated acreage by the end of the third permit cycle. Virginia (VA) TMDL Guidance provides flexibility in the implementation of specific management technologies employed to meet the required reductions, while stipulating standards and/or objectives. MS4 operators will be able to adjust the levels of reduction between pervious and impervious land uses within their service area, provided the total load reduction for each pollutant is met.

Offsets for new sources of POCs initiating construction after 2009 are also required in VA TMDL Guidance. No new sources of POCs should occur on Fort Lee because The Energy Independence and Security Act of 2007 requires that development on a federal facility should be designed to return the area of construction to predevelopment hydrological conditions.

TABLE 6-1 POLLUTION REDUCTION REQUIREMENTS

Pollutant	Regulated Acreage % Load Reduction Target	
	Impervious	Pervious
TN	9%	6%
TP	16%	7.25%
TSS	20%	8.75%

Table 6-2 shows the "Calculation Sheet for Determining Total POC Reductions Required during the Permit Cycle for the Potomac River Basin" provided in the VA TMDL Guidance completed with total existing acres served by Fort Belvoir's MS4 permit for regulated urban impervious and pervious land uses and the resulting reduction required by applying the reduction loading rate provided in the fourth column (DEQ, 2015).

TABLE 6-2 FIRST PERMIT CYCLE REDUCTIONS

Subsource	Pollutant	Total Existing Acres Served by MS4 (06/30/09)	First Permit Cycle Required Reduction in Loading Rate (lbs/acre/yr)	Total Reduction Required First Permit Cycle (lbs/yr)[8]
Regulated Urban Impervious	Nitrogen	767.42	0.04	30.70
Regulated Urban Pervious		1,553.05	0.02	31.06
Regulated Urban Impervious	Phosphorus	767.42	0.01	7.67
Regulated Urban Pervious		1,553.05	0.002	3.11
Regulated Urban Impervious	Total Suspended Solids	767.42	6.67	5,118.69
Regulated Urban Pervious		1,553.05	0.44	683.34

Table 3a: Calculation Sheet for Determining Total POC Reductions Required During the Permit Cycle for the James River Basin (*Based on Chesapeake Bay Program Watershed Model Phase 5.3.2) (DEQ 2014)

2009 progress run estimated pollutant loads were applied to the load reduction targets to calculate pollutant load reductions required for each of the three permit cycles at Fort Lee, shown in Table 6.3.

TABLE 6-3 POLLUTANT REDUCTIONS REQUIRED FOR FORT LEE, BY PERMIT CYCLE

Pollutant	First Permit Cycle Reductions (lbs) 5% by 2017	Second Permit Cycle Reductions (lbs) 35% by 2022	Third Permit Cycle Reductions (lbs) 100% by 2027
N	65.00	454.97	1,299.90
P	13.62	95.34	272.41
SS	5,881.77	41,172.39	117,635.41

6.1 STRUCTURAL BMPS

Areas of Interest (AOIs) were identified by studying the digitized land use maps for concentrated areas of urban impervious and pervious land uses, which are untreated and within the regulated MS4 area. Those areas that have existing stormwater infrastructure were given higher priority, as that infrastructure makes it easier and less expensive to convey the water running off of that area to a BMP, as long as there is adjacent land available to accommodate a BMP. Certain soil types require less work to build BMPs, so soil type was considered for BMP site recommendations as well. Choosing specific BMP types and sizing requires extensive engineering design analysis, which is appropriate for the design phase of a project and too detailed for this planning study.

VA TMDL Guidance provided a table of CBP BMP load reduction efficiencies, which were used to calculate BMP pollutant removal rates. Soil, site conditions and high pollutant removal rates narrowed structural BMP choices recommended for Fort Lee to bioretention, permeable pavement and swales. These BMP types and efficiencies are shown in Table 6-4.

TABLE 6-4 CHESAPEAKE BAY PROGRAM BMPS AND EFFICIENCIES

Chesapeake Bay Program BMPs, Established Efficiencies			
A. Bioretention A/B soils, no underdrain	80%	85%	90%
B. Bioswale	70%	75%	80%
C. Permeable Pavement w/ Sand, Veg. A/B soils, no underdrain	80%	80%	85%

Load reductions estimated for each proposed AOI and the percentage of the total reduction requirements are shown in Table 6-5. Details for each of the AOIs can be found in Appendix A.

TABLE 6-5 LOAD REDUCTIONS FOR EACH AOI

	Baseline Load (lb/yr)			Proposed BMP Reduction (lb/yr)			Percent of Total Goal		
AOI	N	P	TSS	N	P	TSS	N	P	TSS
1A	33.62	5.18	1,864.43	26.90	4.40	1,677.99	2%	2%	1%
1B	33.62	5.18	1,864.43	23.54	3.88	1,491.55	2%	2%	1%
1C	33.62	5.18	1,864.43	26.90	4.14	1,584.77	2%	2%	1%
2A	89.34	10.01	3,091.08	71.47	8.51	2,781.97	6%	4%	2%
2B	89.34	10.01	3,091.08	62.53	7.51	2,472.86	5%	3%	2%
2C	89.34	10.01	3,091.08	71.47	8.01	2,627.42	6%	4%	2%
3A	181.98	26.96	9,565.72	145.59	22.92	8,609.15	12%	11%	7%
3B	181.98	26.96	9,565.72	127.39	20.22	7,652.58	10%	9%	7%
3C	181.98	26.96	9,565.72	145.59	21.57	8,130.87	12%	10%	7%
4A	15.03	2.54	945.14	12.03	2.16	850.63	1%	1%	1%
4B	15.03	2.54	945.14	10.52	1.90	756.11	1%	1%	1%
4C	15.03	2.54	945.14	12.03	2.03	803.37	1%	1%	1%
5A	123.57	16.11	5,400.62	98.86	13.69	4,860.56	8%	6%	4%
5B	123.57	16.11	5,400.62	86.50	12.08	4,320.50	7%	6%	4%
5C	123.57	16.11	5,400.62	98.86	12.89	4,590.53	8%	6%	4%
6A	18.33	2.68	946.71	14.67	2.28	852.04	1%	1%	1%
6B	18.33	2.68	946.71	12.83	2.01	757.37	1%	1%	1%
6C	18.33	2.68	946.71	14.67	2.15	804.70	1%	1%	1%
7A	155.07	21.52	7,425.69	124.05	18.29	6,683.12	10%	8%	6%
7B	155.07	21.52	7,425.69	108.55	16.14	5,940.55	9%	7%	5%
7C	155.07	21.52	7,425.69	124.05	17.21	6,311.84	10%	8%	5%
8A	207.09	29.95	10,521.52	165.68	25.46	9,469.37	13%	12%	8%
8B	207.09	29.95	10,521.52	144.97	22.46	8,417.22	12%	10%	7%
8C	207.09	29.95	10,521.52	165.68	23.96	8,943.29	13%	11%	8%
9A	170.51	21.68	7,180.04	136.41	18.43	6,462.03	11%	9%	6%
9B	170.51	21.68	7,180.04	119.36	16.26	5,744.03	10%	8%	5%
9C	170.51	21.68	7,180.04	136.41	17.34	6,103.03	11%	8%	5%
10A	138.07	21.42	7,738.63	110.45	18.21	6,964.76	9%	8%	6%

10B	138.07	21.42	7,738.63	96.65	16.07	6,190.90	8%	7%	5%
10C	138.07	21.42	7,738.63	110.45	17.14	6,577.83	9%	8%	6%
11A	122.66	16.79	5,758.90	98.13	14.27	5,183.01	8%	7%	4%
11B	122.66	16.79	5,758.90	85.86	12.59	4,607.12	7%	6%	4%
11C	122.66	16.79	5,758.90	98.13	13.43	4,895.07	8%	6%	4%
12A	161.00	22.46	7,767.83	128.80	19.09	6,991.05	10%	9%	6%
12B	161.00	22.46	7,767.83	112.70	16.84	6,214.27	9%	8%	5%
12C	161.00	22.46	7,767.83	128.80	17.96	6,602.66	10%	8%	6%
13A	191.00	23.82	7,811.09	152.80	20.24	7,029.98	12%	9%	6%
13B	191.00	23.82	7,811.09	133.70	17.86	6,248.87	11%	8%	5%
13C	191.00	23.82	7,811.09	152.80	19.05	6,639.43	12%	9%	6%
14A	160.37	26.95	10,016.12	128.30	22.91	9,014.51	10%	11%	8%
14B	160.37	26.95	10,016.12	112.26	20.21	8,012.90	9%	9%	7%
14C	160.37	26.95	10,016.12	128.30	21.56	8,513.70	10%	10%	7%
15A	160.85	28.23	10,642.11	128.68	24.00	9,577.90	10%	11%	8%
15B	160.85	28.23	10,642.11	112.59	21.17	8,513.69	9%	10%	7%
15C	160.85	28.23	10,642.11	128.68	22.58	9,045.80	10%	10%	8%
16A	222.33	25.87	8,169.93	177.87	21.99	7,352.93	14%	10%	6%
16B	222.33	25.87	8,169.93	155.63	19.40	6,535.94	13%	9%	6%
16C	222.33	25.87	8,169.93	177.87	20.69	6,944.44	14%	10%	6%
17A	268.37	32.70	10,596.57	214.70	27.80	9,536.91	17%	13%	8%
17B	268.37	32.70	10,596.57	187.86	24.53	8,477.25	15%	11%	7%
17C	268.37	32.70	10,596.57	214.70	26.16	9,007.08	17%	12%	8%
18A	496.55	63.96	21,321.70	397.24	54.36	19,189.53	32%	25%	17%
18B	496.55	63.96	21,321.70	347.59	47.97	17,057.36	28%	22%	15%
18C	496.55	63.96	21,321.70	397.24	51.17	18,123.45	32%	24%	16%
19A	566.54	72.36	24,022.85	453.23	61.51	21,620.56	37%	29%	19%
19B	566.54	72.36	24,022.85	396.58	54.27	19,218.28	32%	25%	17%
19C	566.54	72.36	24,022.85	453.23	57.89	20,419.42	37%	27%	18%
20A	147.50	17.90	5,787.92	118.00	15.22	5,209.13	10%	7%	4%
20B	147.50	17.90	5,787.92	103.25	13.43	4,630.34	8%	6%	4%
20C	147.50	17.90	5,787.92	118.00	14.32	4,919.73	10%	7%	4%

6.2 ALTERNATIVE CREDITS

In addition to structural BMPs, permittees may receive credit for land use change, urban nutrient management, nutrient trading and urban stream restoration. Any conversion of land use from urban impervious or pervious to forest greater in size than one half acre can receive credit for pollutant removal resulting from the forest, as explained in the VA TMDL Guidance (DEQ, 2014). Urban nutrient management plans developed for unregulated, public land smaller than one acre where nutrients are applied may be considered for credit. Permittees may offset pollutant loads trading non-point source nutrients in accordance with Virginia Code. Permittees may also receive credit for urban stream restoration, based on the reduction of nutrients entering streams as a result of the restoration.

USACE coordinated with Fort Lee to obtain information for any alternative credits. Fort Lee provided data for a stream restoration project, a street sweeping program, and land use change.

Using the table provided in the Virginia TMDL Guidance, the 550 linear feet of stream restoration completed at Fort Lee in 2012 resulted in a reduction of 41.25 lbs of TN, 37.4 lbs. of TP and 24,684 lbs of TSS, as shown in Table 6-6 (DEQ, 2014). Documentation regarding subject stream restoration can be found in Appendix E.

TABLE 6-6 STREAM RESTORATION POLLUTANT REDUCTION AT FORT LEE

	TN	TP	TSS
Pollution Reduction Rate in lbs./linear ft.	0.075	0.068	44.88
Pollutant Reduction Calculation for 550 linear ft. of stream at Fort Lee	41.25	37.4	24,684

FIGURE 6-1 STREAM RESTORATION SITE

6.3 STREET SWEEPING

Fort Lee has an existing street sweeping program. The Garrison POC provided lane miles swept per year, the schedule and the type of equipment used. The Qualifying Street Lanes Method was used to calculate the pollutant reductions.

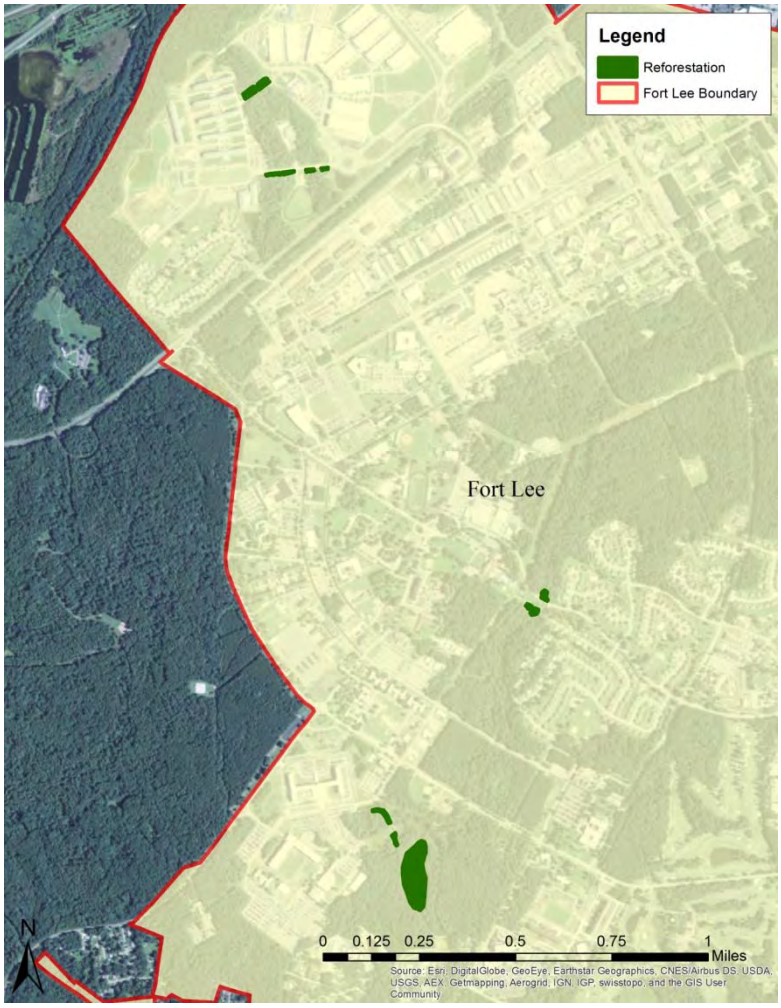
Fort Lee has been sweeping 49 lane miles per year with a regenerative vacuum sweeper. Fort Lee reported their street sweeping program collects an average of 550,000 pounds of materials per year. Using the mass loading approach provided in the VA TMDL Guidance, this equate to removal of 963 lbs per year of TN, 385 lbs per year of TP and 115,500 lbs per year of TSS.

6.4 LAND USE CHANGE

Fort Lee converted several areas throughout the Garrison, along streams from pervious land use to forest (Figure 6-2 Reforested Area. These areas totaled 6.8 acres and reduce 34 lbs/yr of TN, 3 lbs/yr of TP and 393 lbs/yr of TSS.

In addition to the land use change credit, this land use conversion also qualifies for forest buffer reductions. Drainage areas to the reforested area total 0.9 acres of urban pervious land use and 0.3 acres of urban impervious land use, which results in a reduction of 2.2 lbs/yr of TN, .5 lbs/yr of TP and 135 lbs/yr of TSS.

FIGURE 6-2 REFORESTED AREA



6.5 IMPLEMENTATION SCHEDULE

VA TMDL Guidance provides a timeline for when these pollutant load reductions must be implemented, as described in Table 6-3. All three permit cycle reduction goals are satisfied for TP and TSS by pollution reduction programs which have already been implemented. The reduction goals for TN have been satisfied for the first two permit cycles with programs already in place. The reduction goals for TP have been satisfied by current BMPs with 153.71 lbs/yr capacity. The reduction goals for TSS have an excess capacity of 23,076.99 lbs/yr beyond the 3rd permit cycle. The reduction goals for TN still require reductions in the third permit cycle, although with structural BMPs currently in design and construction, that goal will be further reduced. As structural BMPs are implemented Ft. Lee will be updating this report to reflect those revised reduction calculations to be available for annual reporting and tracking purposes.

TABLE 6-7 NON-STRUCTURAL BMPS IMPLEMENTED

Non-Structural BMPs Implemented	TN	TP	TSS
Stream Restoration	41.25	37.40	24,684.00
Street Sweeping	962.50	385.00	115,500.00
Land Use Change	34.20	3.26	393.18
Forest Buffer	2.18	0.46	135.22
Total Reductions from Implemented BMPs	1,040.13	426.12	140,712.40
Total Reductions Required	1,299.90	272.41	117,635.41
Remaining Reductions Required after Implemented BMPs	**259.77**	~~153.71~~	~~23,076.99~~

In addition to the pollution reduction credits attributed to stream restoration, street sweeping, land use change and forest buffers, Fort Lee has selected 6 of the AOIs proposed in this report to construct. Table 6-8 lists these AOIs in priority order, with AOIs 2 and 4 slated for construction if excess funding remains.

AOI 15 is tentatively scheduled for construction to begin on, or near, 15 February 2016. Construction is expected to take 6 weeks.

TABLE 6-8 STRUCTURAL BMP IMPLEMENTATION SCHEDULE

	Proposed BMP Reduction (lb/yr)		
AOI	N	P	TSS
15	123.32	22.58	9,045.80
3	139.52	21.57	8,130.87
12	123.43	17.96	6,602.66
10	105.85	17.14	6,577.83
7	118.88	17.21	6,311.84
9	130.73	17.34	6,103.03

2	68.49	8.01	2,627.42
4	11.52	2.03	803.37

7 COSTS

Leebcor Services LLC prepared a cost proposal for design and construction of the AOIs selected by Fort Lee (see Appendix D).

No costs were available from Fort Lee for stream restoration, street sweeping, or land use change/forest buffers.

TABLE 7-1 BMP CONSTRUCTION COSTS FOR SELECTED AOIS

AOI	Cost
15	$ 533,532
3	$ 749,000
12	$ 504,132
10	$ 531,770
7	$ 335,851
9	$ 345,224
2	$ 567,866
4	$ 265,521

These AOIs in conjunction with the stream restoration, street sweeping program and land use change will exceed all L2 reductions required through all three permit cycles (2027).

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8 CONCLUSIONS

The purpose of this study is to provide technical data pertaining to the Chesapeake Bay TMDL Action Plan for Fort Lee. This was executed by locating, inventorying, and assessing the condition of existing stormwater BMPs, quantifying source loads for TN, TP, and TSS within the installation boundary and identifying opportunities to reduce pollutant loads to the Chesapeake Bay.

The results of this investigation conclude that approximately 18,062 lbs of TN, 2,127 lbs of TP and 676,479 lbs of TSS are loaded into waterways from Fort Lee per year, based on 2009 land use data. Fort Lee must reduce their nutrient loads by 1,299 lbs of TN, 272 lbs of TP and 117,635 lbs of TSS by the end of the third MS4 permit cycle in 2027.

Reduction goals have been met for TP and TSS for all three permit cycles with current BMP practices in place. The reduction goals for TN have been achieved through the 2nd permit cycle with current BMP practices in place. The TN goals for the 3rd permit cycle could be achieved once 6-8 new BMPs (currently in design) are constructed. Reduction calculations will need to be re-evaluated once the new BMPs have been constructed.

Twenty areas where new stormwater structural BMPs may be constructed are identified in this report to complete the pollution reduction requirements. Eight of these areas were selected by Fort Lee for construction. Reductions from these AOIs, as proposed will exceed all three permit cycle L2 reduction requirements and cost approximately $3.8 million to construct.

The TMDL Report was advertised for public comment from 1 August 2015 to 31 August 2015. There were no comments received.

A BMP database was created to store and organize data collected from the BMP inventory and inspection conducted as a part of this study; it also provides the installation with a tool to track L2 reduction progress and generate annual progress reports.

9 2019 UPDATE

Prior to the effective date of Fort Lee's current MS4 permit (01 July 2018), the BMPs described in the text as AOI 15, 3, 12, 10, 7, and 9 had been installed and made functional. Based on design calculations it is estimated that these six BMPs will together remove 741.73 lbs of TN, 113.8 lbs of TP and 42,772.03 lbs of TSS annually. The 500 linear feet of stream reduction on Bailey Creek (sectr. 6.2) will remove an estimated 41.25 lbs TN, 37.4 lbs TP, and 24,684 lbs TSS per year. Finally, Fort Lee conducts quarterly sweeping of primary roads and large parking lots, with additional sweepings done by work order after snow or ice events that require sanding of roads and parking lots for safety. A combined (road miles and parking lots) estimated 276 acres are swept each quarter with a regenerative air vacuum sweeper, resulting in an estimated annual removal of 513.36 lbs TN, 321.66 lbs TP, and 229,632.06 lbs of TSS (Expert Panel Report on Street and Storm Drain Cleaning; Donner, Frost, et. al., May 19, 2016).

Taken together, these efforts result in an estimated total annual reduction of 1296.34 lbs of TN, 321.66 lbs of TP, and 297,088.03 lbs of TSS. These reductions far exceed those required for the Second Permit Cycle (2022) and also exceed the reduction requirements for the Third Permit Cycle, except for TN, which is 94.9% of the goal (Table 6-2). The 68.6 lb per year deficit in TN removal could be accomplished by implementing the BMPs planned for AOI 2, or those for AOI 4 plus some yet to be determined removal strategy. There is currently some discussion underway for a project that would eliminate the parking area that AOI 4's BMP would serve and return that area to turf. Analysis of that change would have to be conducted to determine the resulting pollutant removal should that project be executed. There are currently no funded projects in place to construct the BMPs at AOI 2 or AOI 4. As opportunity arises and funding becomes available Fort Lee will attempt to execute projects with measures that will remove the remaining 68.8 lb annual TN deficit prior to the end of the Third Permit Cycle in 2027.

10 2024 UPDATE

NOTE: Fort Lee was redesignated Fort Gregg-Adams on April 27, 2023 and will be referred to as Fort Gregg-Adams henceforth.

Fort Gregg-Adams continues to make efforts to reduce the remaining TMDL pollutant of concern (TN) below the level needed to meet the 2027 goal. There are several projects in process that we believe, once fully designed and executed, will succeed in removing the remaining 68.6 lb/yr TN deficit that remains from our previous TMDL reduction efforts.

First, funds have been allocated to perform the demolition of 15 excess buildings on the installation, the largest of which exceeds 69,000 square feet. At present the plan is to return the building footprints to turf. The associated parking lots may also be demolished and returned to turf, but that decision has not yet been made. Stormwater mitigation measures may also be incorporated into these efforts, however the SWPPPs for this work have not yet been completed.

Next, there are two stream restoration projects in process. The first, which has been funded, will remove a partial dam from Bailey Creek and restore more than 300 feet of stream downstream from that dam. The second, which is in the design phase, will restore nearly a mile of Bailey Creek upstream of the dam.

Finally, we intend to relook substantial stormwater retrofits that were previously done at two parking lots on the installation, as we are not sure if the nutrient reductions they achieved were captured in the initial 2016 TMDL plan.

Designs for AOIs 2 and 4 that were not executed in the previous TMDL reduction efforts outlined in the plan may also be implemented in the future, should funds become available.

APPENDIX A

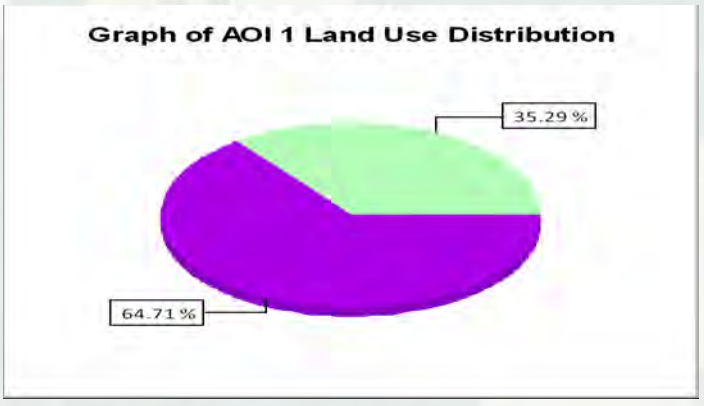
I. Location and General Information — AOI 1

N

0 200 400 800 Feet

Lee Area of Interest 1 is located around the Gerow Reserve Center, off of Rt. 109 Mahone Avenue. It is on the southwestern side of the installation and consists of one building and two parking areas.

N 0 125 250 500 Feet



Fort Lee Area of Interest 1 consists of:
2.5 acres of impervious surface and
1.4 acres of pervious surface.

Seven opportunities for BMP placement are presented for AOI 1. One BMP is proposed for each of the four islands in the southwestern parking lot. One BMP is proposed along the stormwater line running through the vehicle maintenance lot. Two BMPs, one on the north side and one on the east of the Gerow building, are proposed to treat stormwater from the buildings' downspouts.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI1A	33.62	5.18	1,864.43
AOI1B	33.62	5.18	1,864.43
AOI1C	33.62	5.18	1,864.43

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI1B	26.90	4.40	1,677.99
AOI1B	23.54	3.88	1,491.55
AOI1C	26.90	4.14	1,584.77

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI1B	2%	2%	1%
AOI1B	2%	2%	1%
AOI1C	2%	2%	1%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

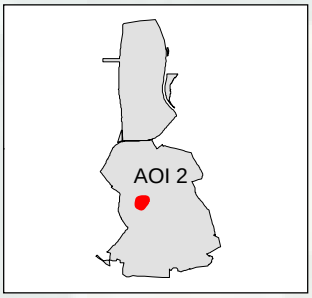
Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
2.5	$	364,441.05

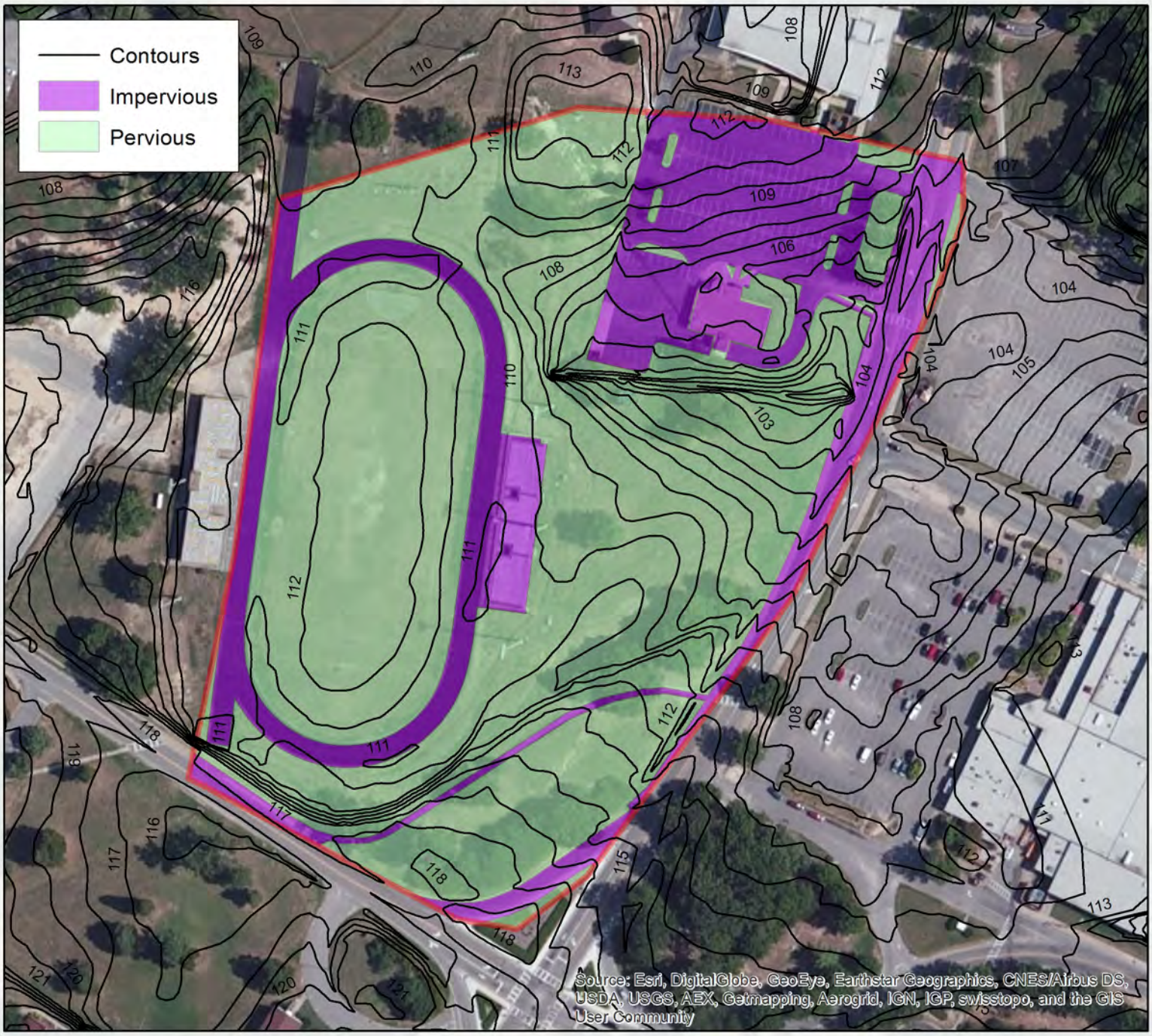
IMCOM
Stormwater Total Maximum Daily Load (TMDL) Factsheet
Fort Lee Areas of Interest (AOIs)

I. Location and General Information **AOI 2**

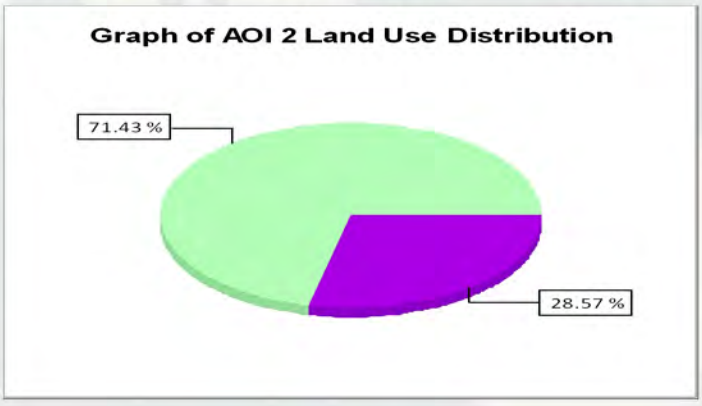
N 0 225 450 900 Feet



Lee Area of Interest 2 is located around Williams Stadium and the SunTrust building, near the intersection of Lee Avenue and Mahone Avenue. It is near the center of the installation and consists of two buildings, a parking lot, a running track and an athletics field.



N 0 125 250 500 Feet



Fort Lee Area of Interest 2 consists of:
8.3 acres pervious area and
3.3 acres impervious area.

Three BMP locations are proposed for AOI 2. Two BMPs are proposed along storm water lines running from the track. The third proposed BMP location ties into the existing stormwater lines and captures sheet flow from the Suntrust parking lot.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI2A	89.34	10.01	3,091.08
AOI2B	89.34	10.01	3,091.08
AOI2C	89.34	10.01	3,091.08

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI2A	71.47	8.51	2,781.97
AOI2B	62.53	7.51	2,472.86
AOI2C	71.47	8.01	2,627.42

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI2A	6%	4%	2%
AOI2B	5%	3%	2%
AOI2C	6%	4%	2%

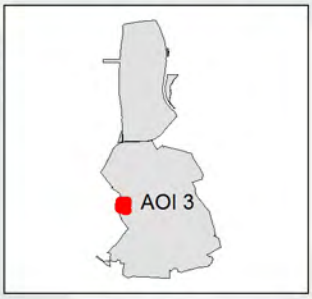
Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

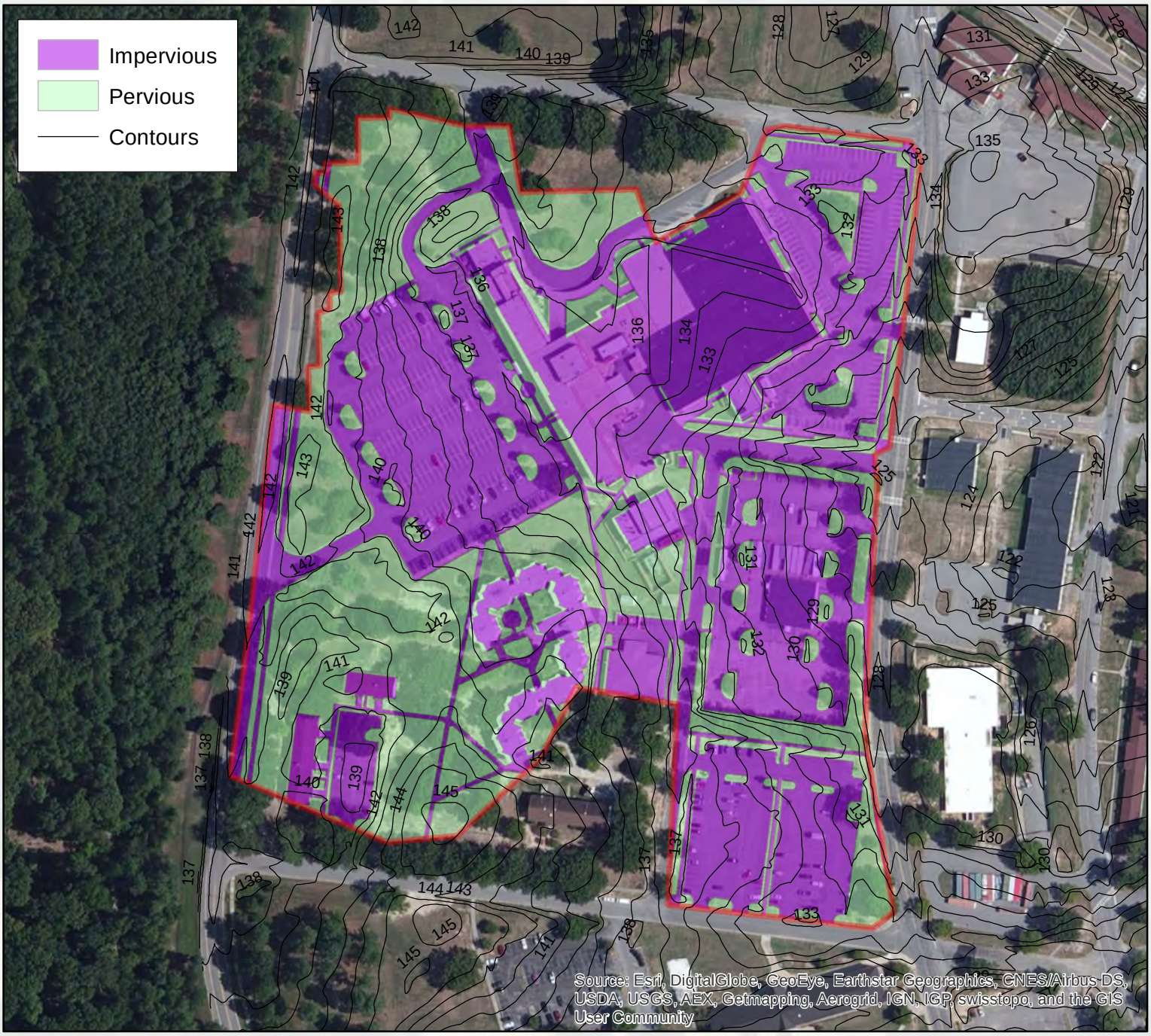
Impervious Acreage	Cost	
3.3	$	475,764.33

I. Location and General Information — AOI 3

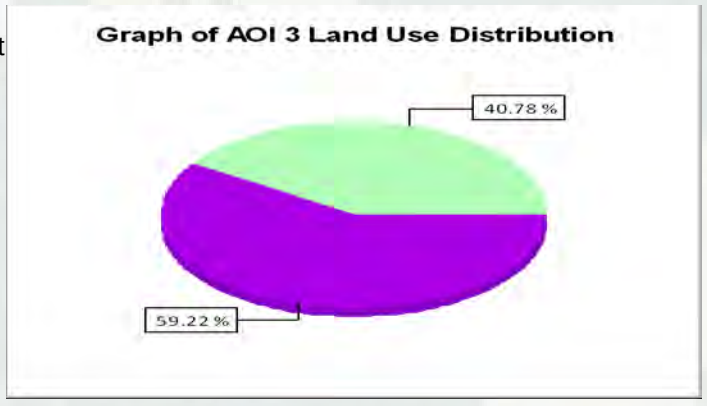
N 0 325 650 1,300 Feet



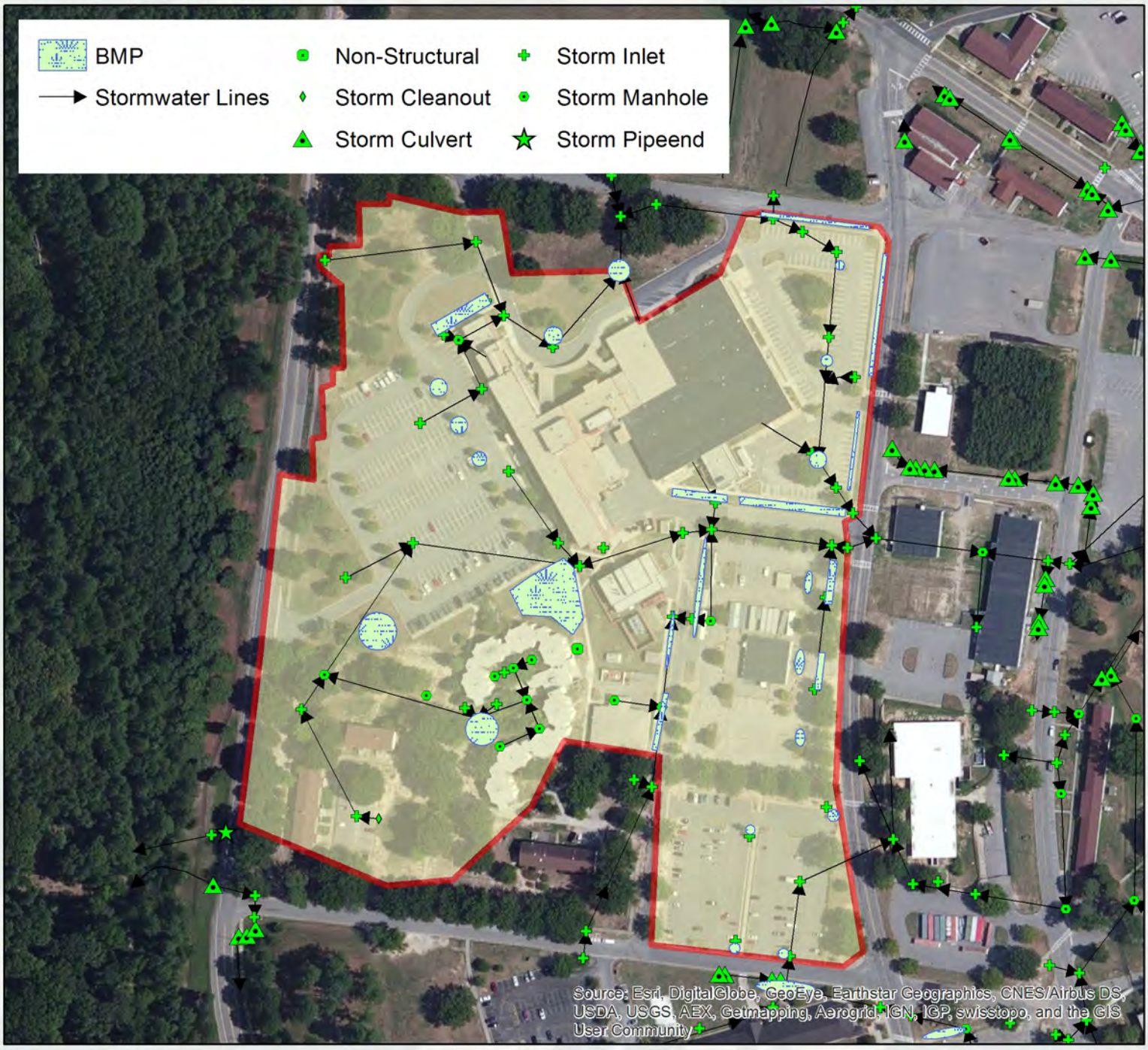
Area of Interest 3 is located around Kenner Health Clinic and 49th QM Barracks, between A and C Avenues and 24th and 27th Streets. It is near the center of the installation on the western side and consists of several buildings and parking areas.



N 0 200 400 800 Feet



Fort Lee Area of Interest 3 consists of:
12.8 acres of impervious surface and
8.8 acres of pervious surface.



Twenty seven BMP location options are presented for AOI 3 to capture and treat sheet flow off of parking lots/roads or along existing stormwater lines.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI3A	181.98	26.96	9,565.72
AOI3B	181.98	26.96	9,565.72
AOI3C	181.98	26.96	9,565.72

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI3A	145.59	22.92	8,609.15
AOI3B	127.39	20.22	7,652.58
AOI3C	145.59	21.57	8,130.87

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI3A	12%	11%	7%
AOI3B	10%	9%	7%
AOI3C	12%	10%	7%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

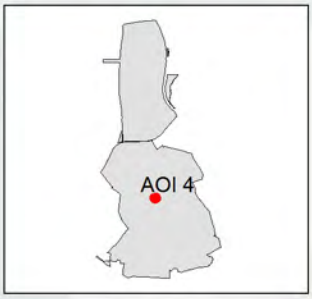
Impervious Acreage	Cost
12.8	$ 1,833,563.05

I. Location and General Information

AOI 4

N

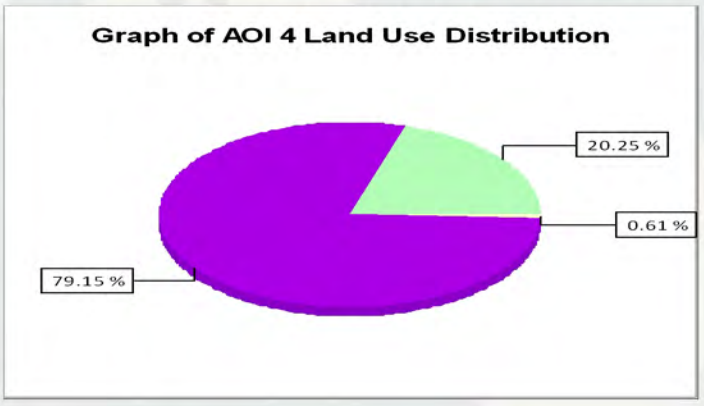
0 125 250 500 Feet



Lee Area of Interest 4 is located at the parking lot for the DMWR Automation Center in the center of the installation, off of Mahone Avenue.

N

0 50 100 200 Feet



Fort Lee Area of Interest 4 consists of:
1.3 acres of impervious surface and
0.3 acres of pervious surface.

One BMP along the southest border of AOI 4 is proposed to treat sheet flow off of the parking area.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI4A	15.03	2.54	945.14
AOI4B	15.03	2.54	945.14
AOI4C	15.03	2.54	945.14

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI4A	12.03	2.16	850.63
AOI4B	10.52	1.90	756.11
AOI4C	12.03	2.03	803.37

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI4A	1%	1%	1%
AOI4B	1%	1%	1%
AOI4C	1%	1%	1%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

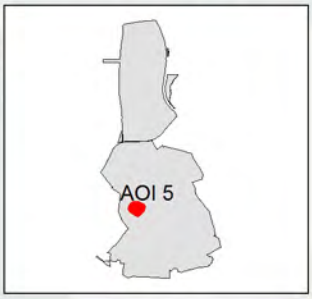
Impervious Acreage	Cost	
1.3	$	192,439.20

I. Location and General Information

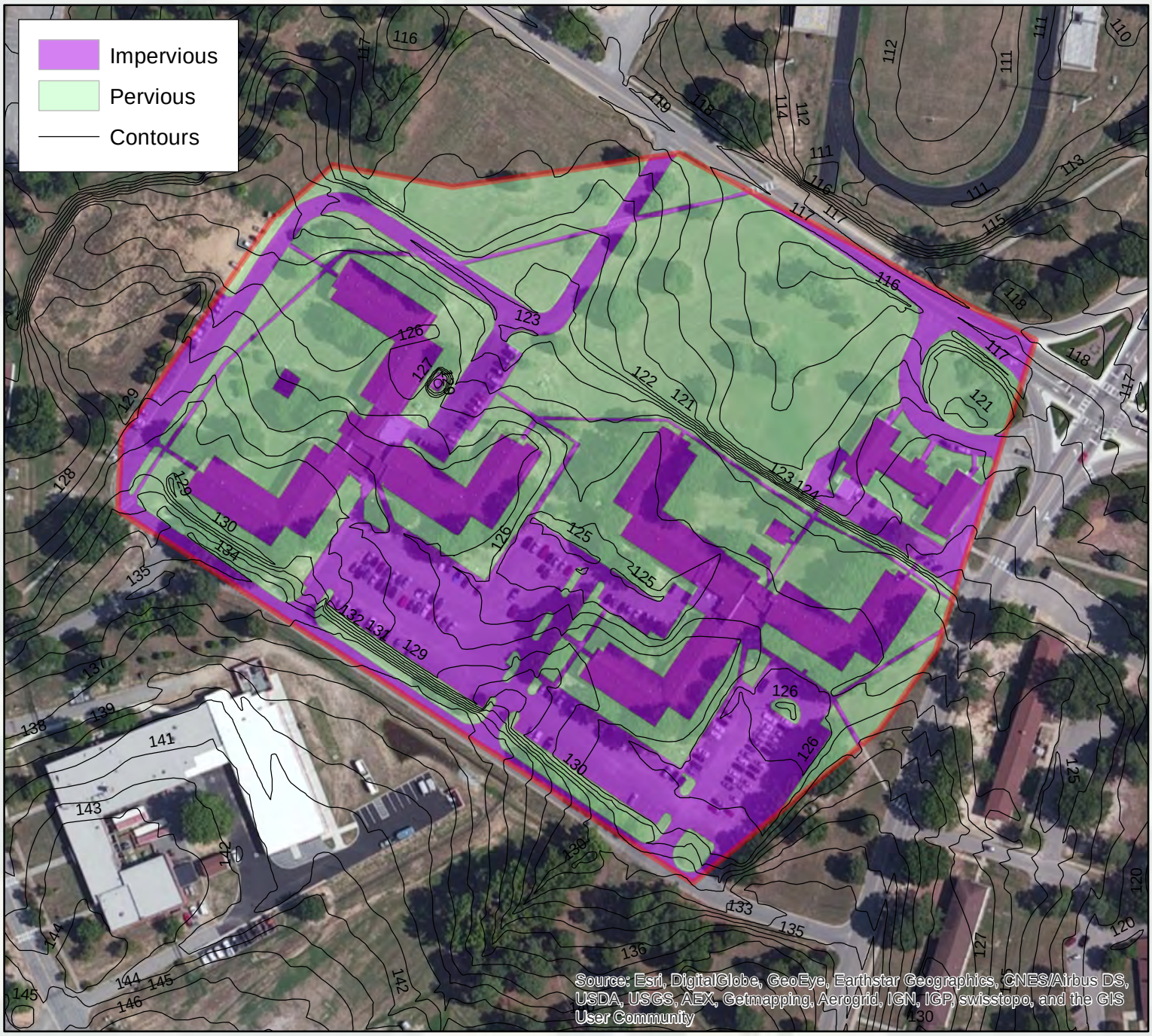
AOI 5

N

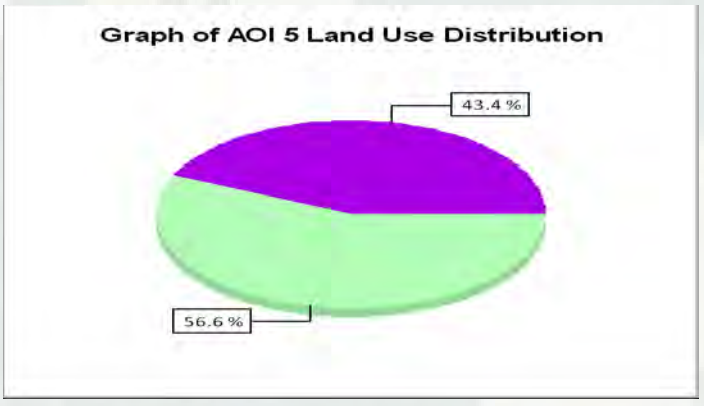
0 250 500 1,000 Feet



Lee Area of Interest 5 includes the Fort Lee Lodging, 27th MP Detachment and Halstead Hall, along Lee and Mahoney Avenues.



N 0 150 300 600 Feet



Fort Lee Area of Interest 5 consists of:
6.7 acres of impervious surface and
8.7 acres of pervious surface.

Four BMP locations along existing stormwater lines are proposed for AOI 5.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI5A	123.57	16.11	5,400.62
AOI5B	123.57	16.11	5,400.62
AOI5C	123.57	16.11	5,400.62

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI5A	98.86	13.69	4,860.56
AOI5B	86.50	12.08	4,320.50
AOI5C	98.86	12.89	4,590.53

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI5A	8%	6%	4%
AOI5B	7%	6%	4%
AOI5C	8%	6%	4%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

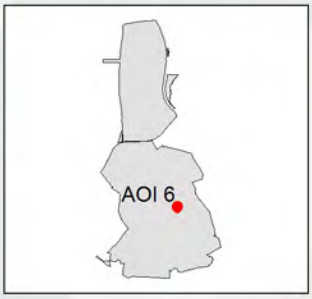
Impervious Acreage	Cost	
6.7	$	955,553.08

I. Location and General Information

AOI 6

N

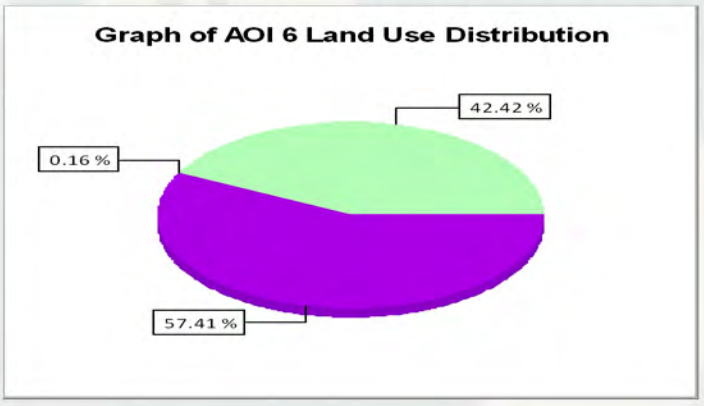
0 100 200 400 Feet



Lee Area of Interest 6 is located near the center of the base, along Sisisky Blvd, at the East Community Center and it's parking lots.

N

0 50 100 200 Feet



Fort Lee Area of Interest 6 consists of:
1.3 acres of impervious surface and
0.9 acres of pervious surface.

One opportunity for BMP placement is proposed for AOI 6 to collect sheet flow off of the parking area and tie in to the existing stormwater line.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI6A	18.33	2.68	946.71
AOI6B	18.33	2.68	946.71
AOI6C	18.33	2.68	946.71

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI6A	14.67	2.28	852.04
AOI6B	12.83	2.01	757.37
AOI6C	14.67	2.15	804.70

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI6A	1%	1%	1%
AOI6B	1%	1%	1%
AOI6C	1%	1%	1%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

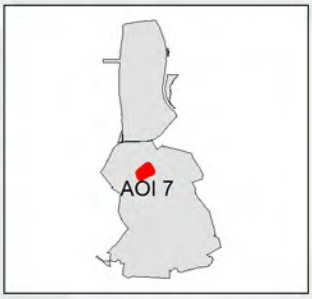
Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost
1.3	$ 180,235.15

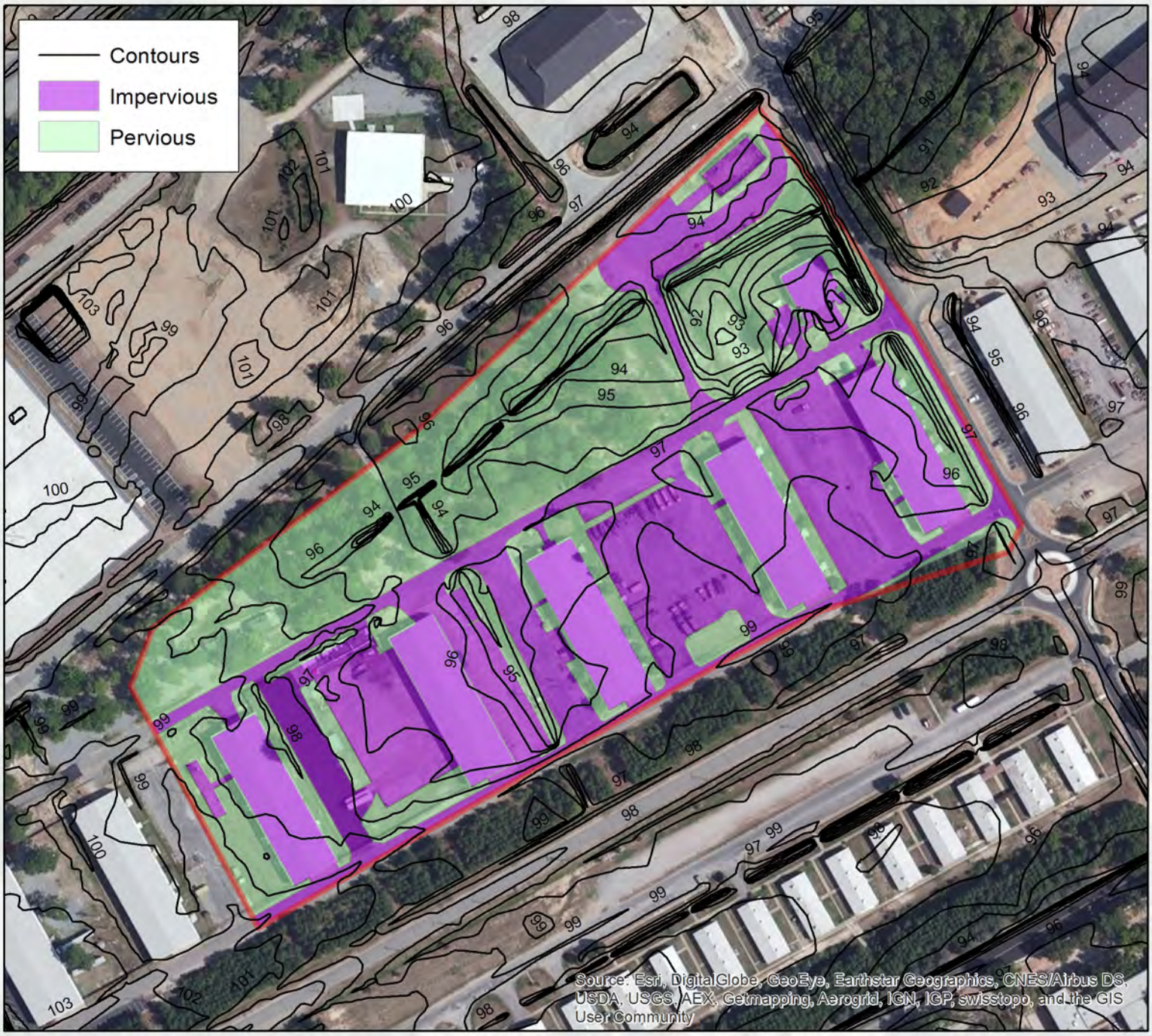
I. Location and General Information — AOI 7

N

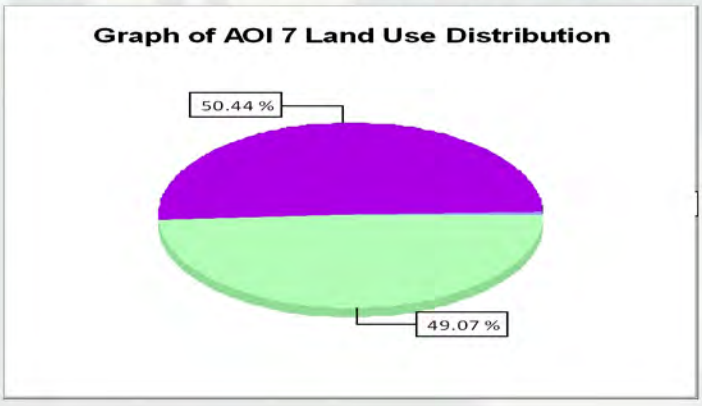
0 325 650 1,300 Feet



Lee Area of Interest 7 includes Walkins Hall, Startwout Hall, Alfonte Hall, Hopping Hall, and a Central Issue Facility building, near the intersection of Shop Road and 11th Street.



N 0 200 400 800 Feet



Fort Lee Area of Interest 7 consists of:
9.6 acres of impervious surface and
9.3 acres of pervious surface.

Seven opportunities for BMP placement are proposed along the existing stormwater lines for AOI 7.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI7A	155.07	21.52	7,425.69
AOI7B	155.07	21.52	7,425.69
AOI7C	155.07	21.52	7,425.69

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI7A	124.05	18.29	6,683.12
AOI7B	108.55	16.14	5,940.55
AOI7C	124.05	17.21	6,311.84

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI7A	10%	8%	6%
AOI7B	9%	7%	5%
AOI7C	10%	8%	5%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

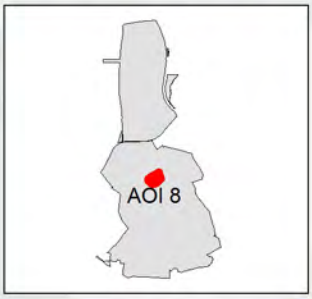
Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
9.6	$	1,370,608.07

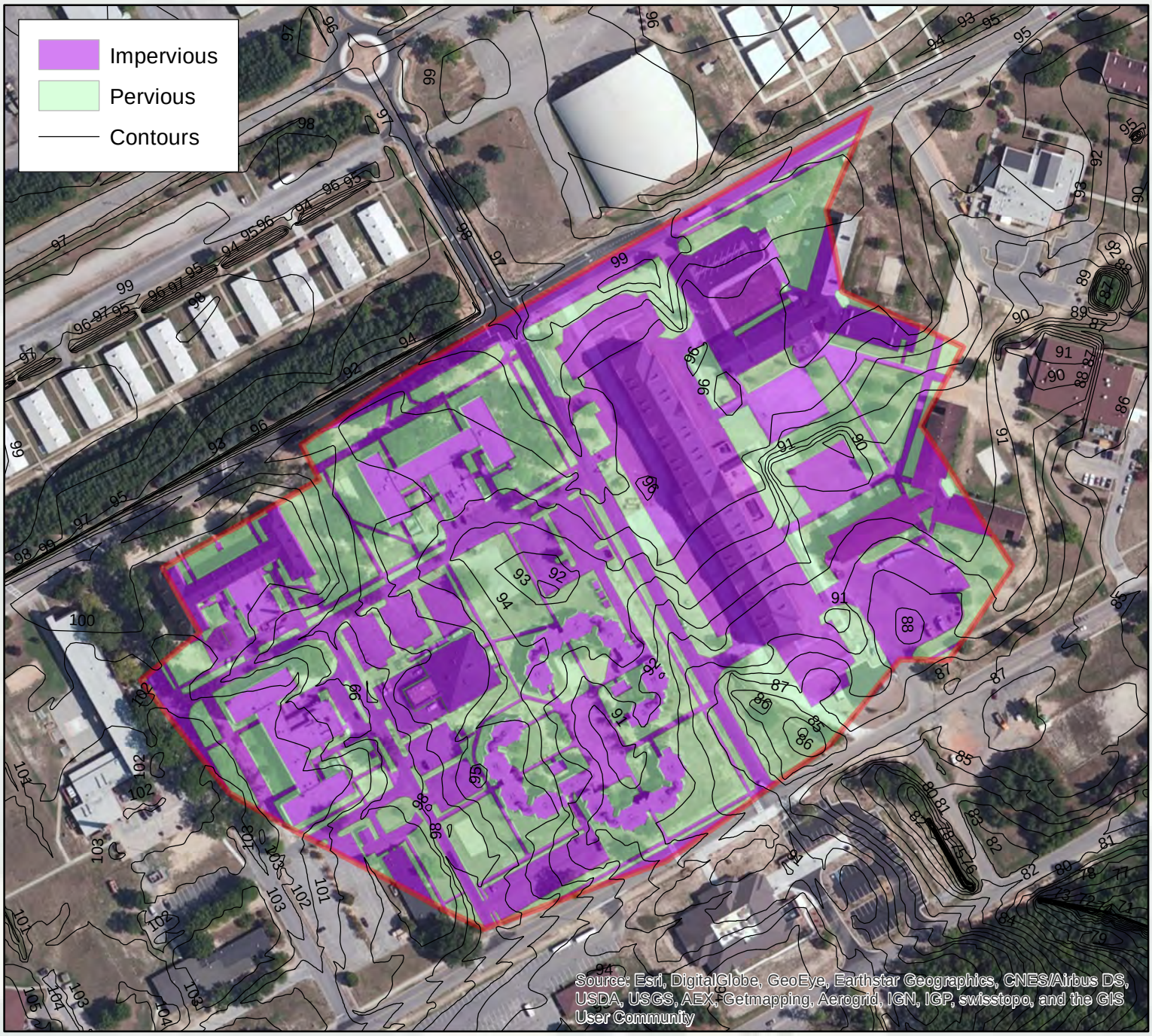
I. Location and General Information — AOI 8

N

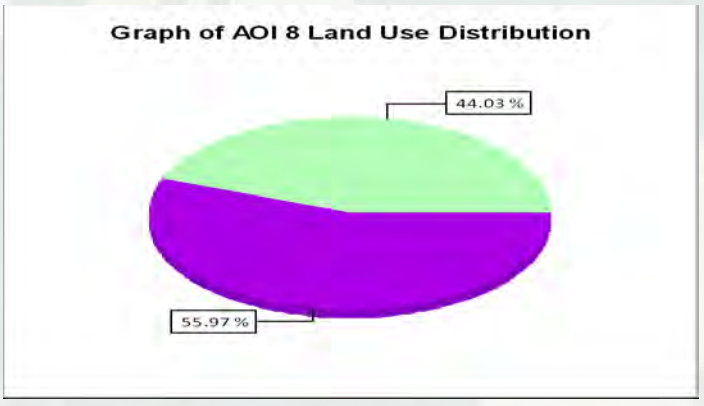
0 325 650 1,300 Feet



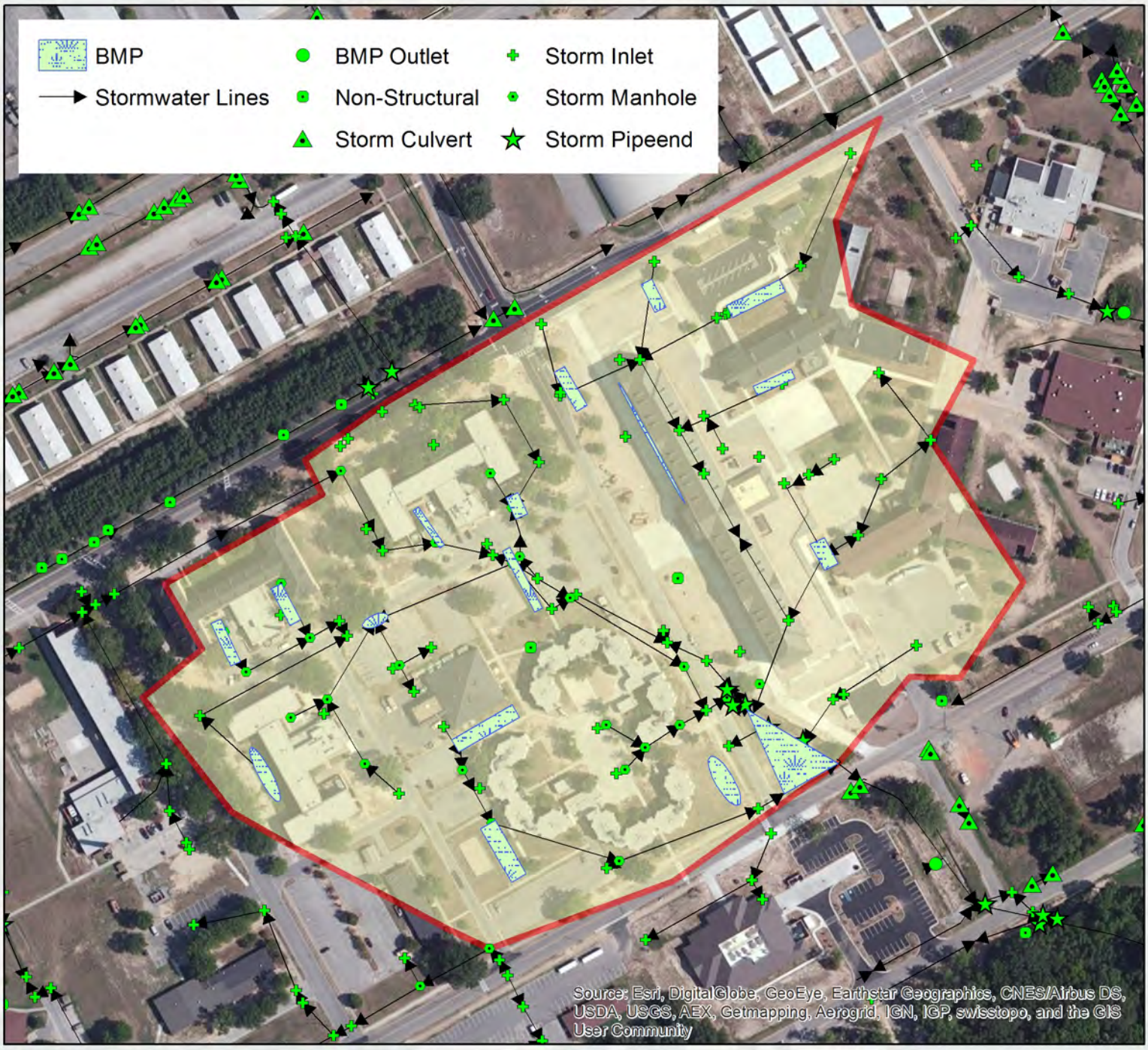
Lee Area of Interest 8 is comprised of several buildings including QM buildings and Navy Dormatory between A and B Avenues on either side of 11th Street.



N 0 200 400 800 Feet



Fort Lee Area of Interest 8 consists of:
13.9 acres of impervious surface and
10.9 acres of pervious surface.



Seventeen opportunities for BMP locations are proposed along existing stormwater lines to treat AOI 8.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI8A	207.09	29.95	10,521.52
AOI8B	207.09	29.95	10,521.52
AOI8C	207.09	29.95	10,521.52

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI8A	165.68	25.46	9,469.37
AOI8B	144.97	22.46	8,417.22
AOI8C	165.68	23.96	8,943.29

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI8A	13%	12%	8%
AOI8B	12%	10%	7%
AOI8C	13%	11%	8%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

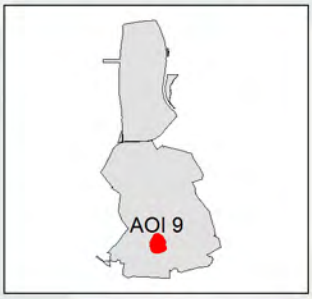
Impervious Acreage	Cost	
13.9	$	1,990,284.86

I. Location and General Information

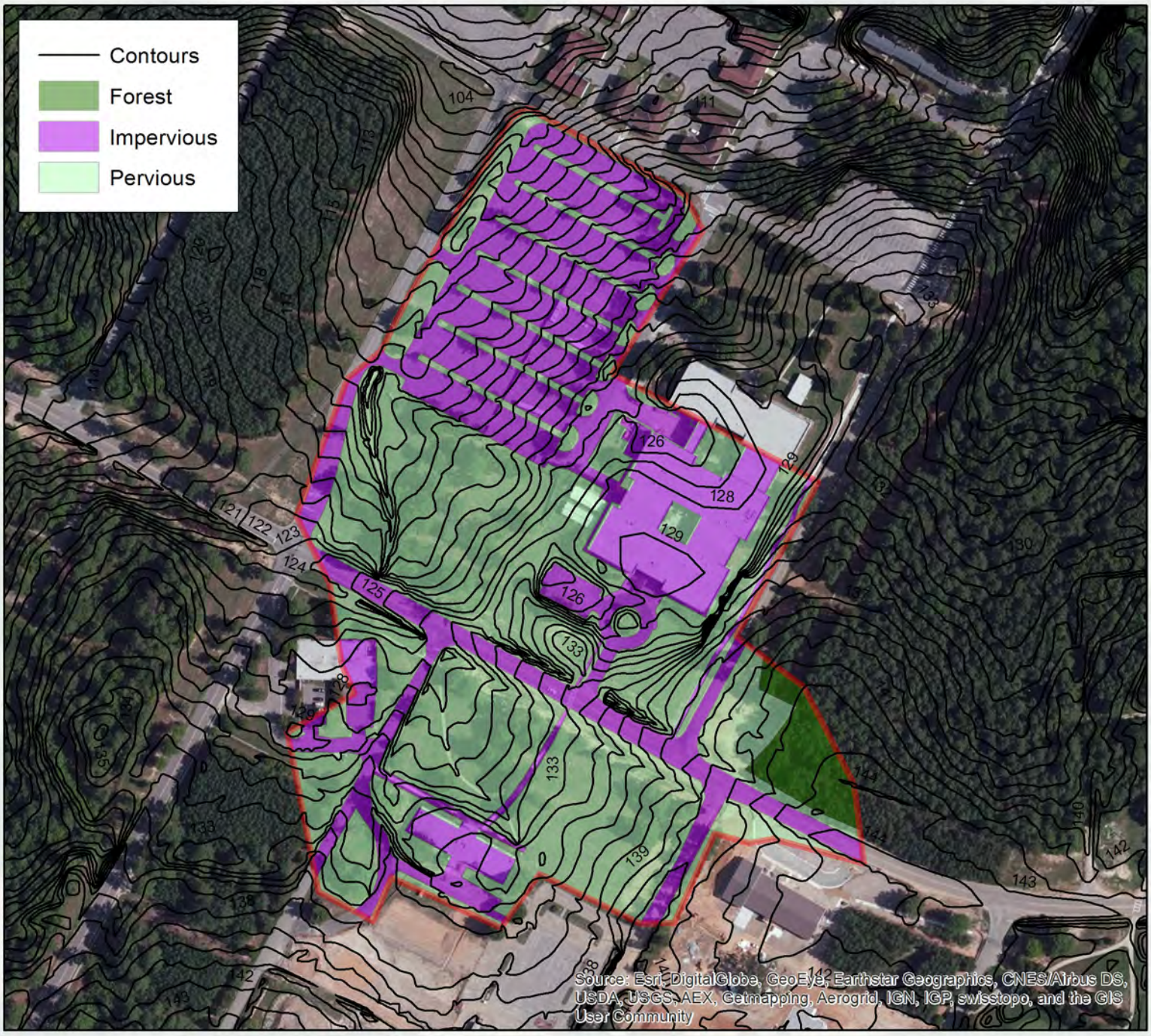
AOI 9

N

0 350 700 1,400 Feet

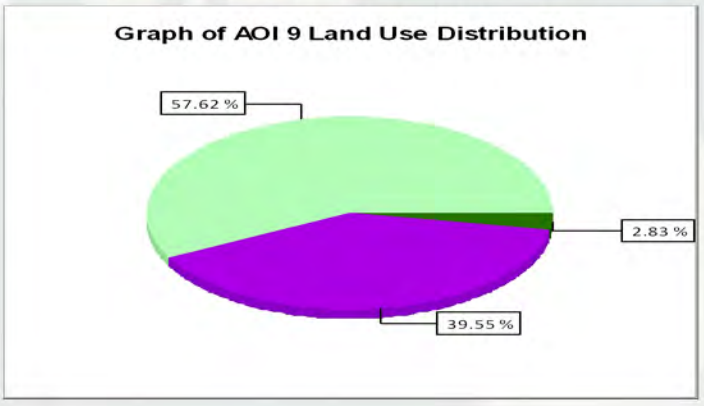


Lee Area of Interest 9 is located in the south central portion of the installation between B and E Avenues and 38 and 40th Streets.

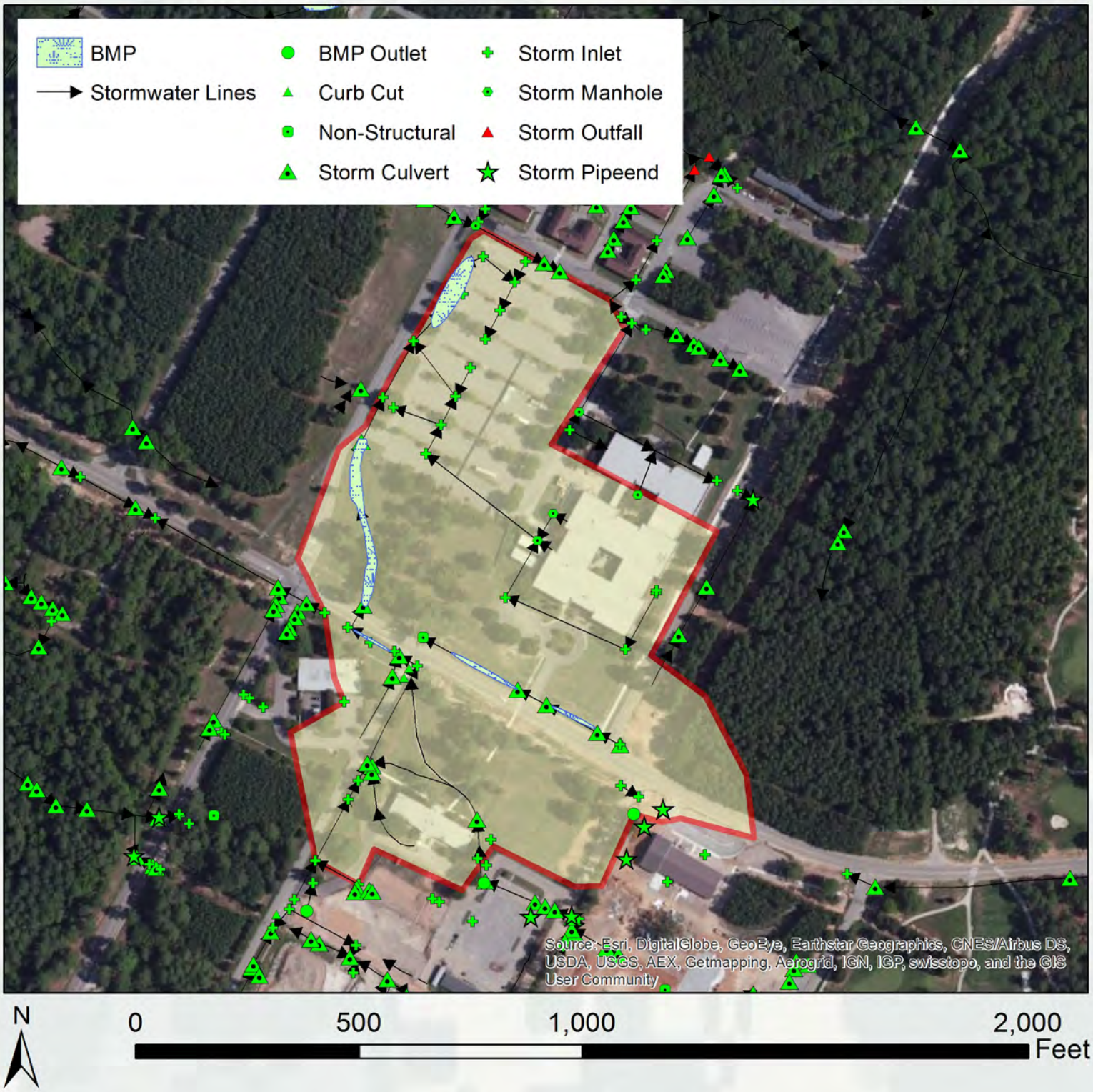


N

0 200 400 800 Feet



Fort Lee Area of Interest 9 consists of:
8.7 acres of impervious surface and
12.7 acres of pervious surface.



Five opportunities for BMP locations are proposed along existing stormwater lines to treat AOI 9.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI9A	170.51	21.68	7,180.04
AOI9B	170.51	21.68	7,180.04
AOI9C	170.51	21.68	7,180.04

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI9A	136.41	18.43	6,462.03
AOI9B	119.36	16.26	5,744.03
AOI9C	136.41	17.34	6,103.03

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI9A	11%	9%	6%
AOI9B	10%	8%	5%
AOI9C	11%	8%	5%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

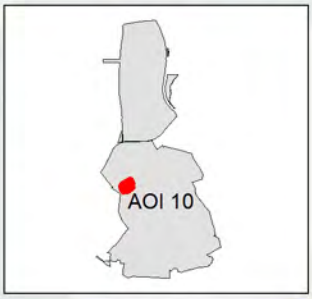
Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
8.7	$	1,246,585.91

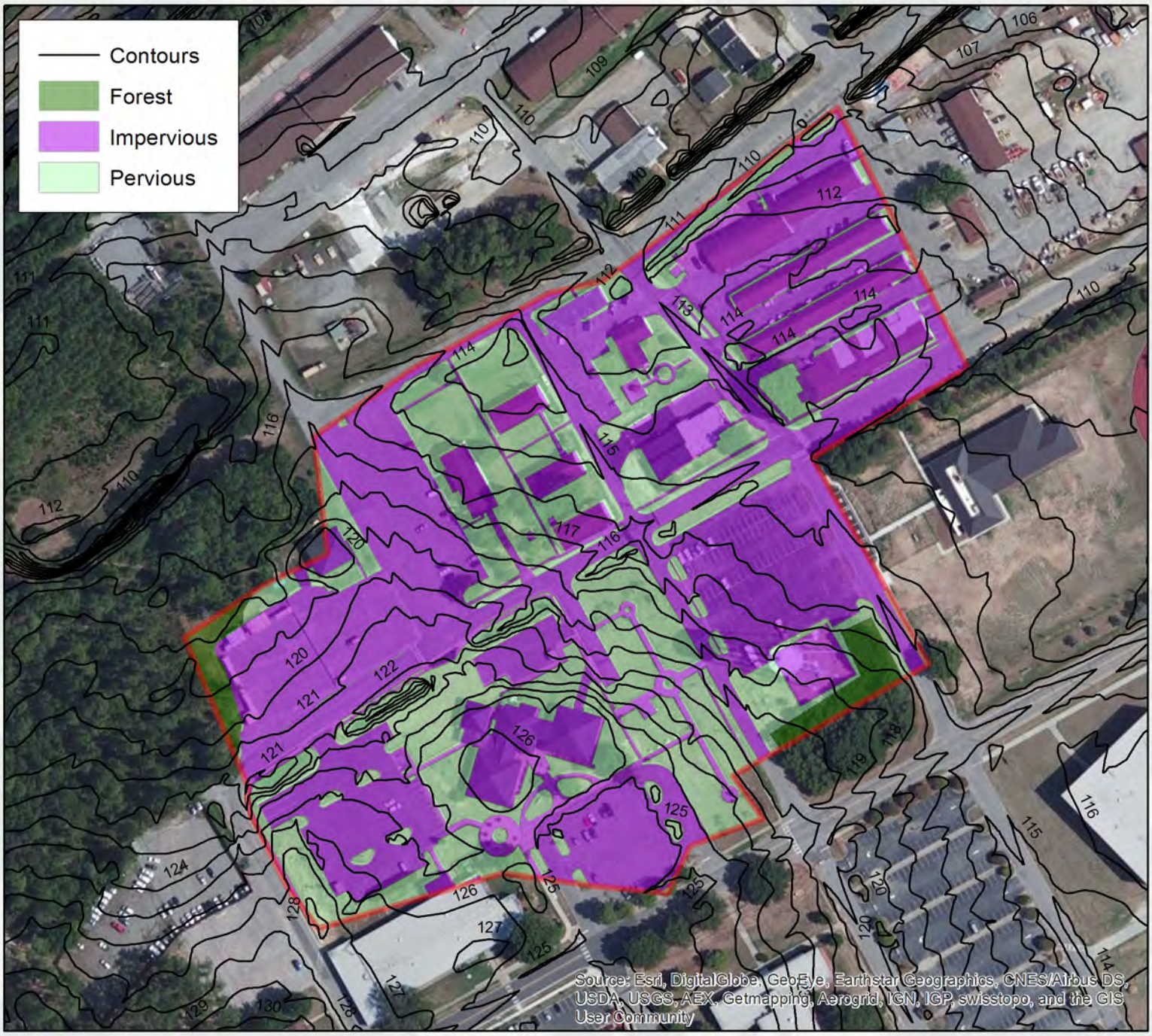
I. Location and General Information — AOI 10

N

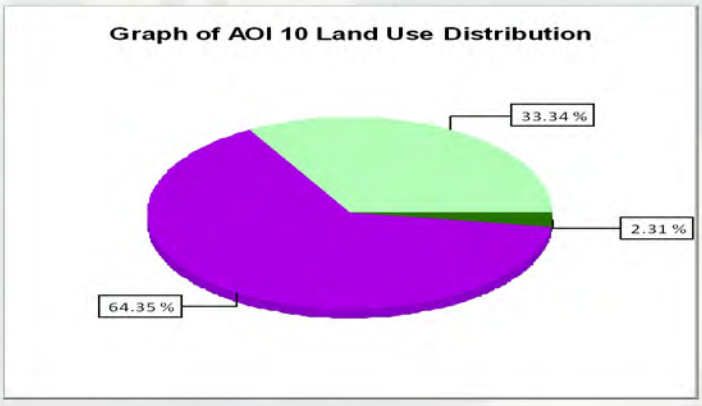
0 275 550 1,100 Feet



Lee Area of Interest 10 is located in the north west portion of the installation, on either side of Shop Road, between 18th and Finance Streets.



N 0 175 350 700 Feet



Fort Lee Area of Interest 10 consists of:
10.6 acres of impervious surface and
5.5 acres of pervious surface.

N

0 325 650 1,300 Feet

Twelve opportunities for BMP placement are proposed to capture sheet flow and along existing stormwater infrastructure for AOI 10.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI10A	138.07	21.42	7,738.63
AOI10B	138.07	21.42	7,738.63
AOI10C	138.07	21.42	7,738.63

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI10A	110.45	18.21	6,964.76
AOI10B	96.65	16.07	6,190.90
AOI10C	110.45	17.14	6,577.83

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

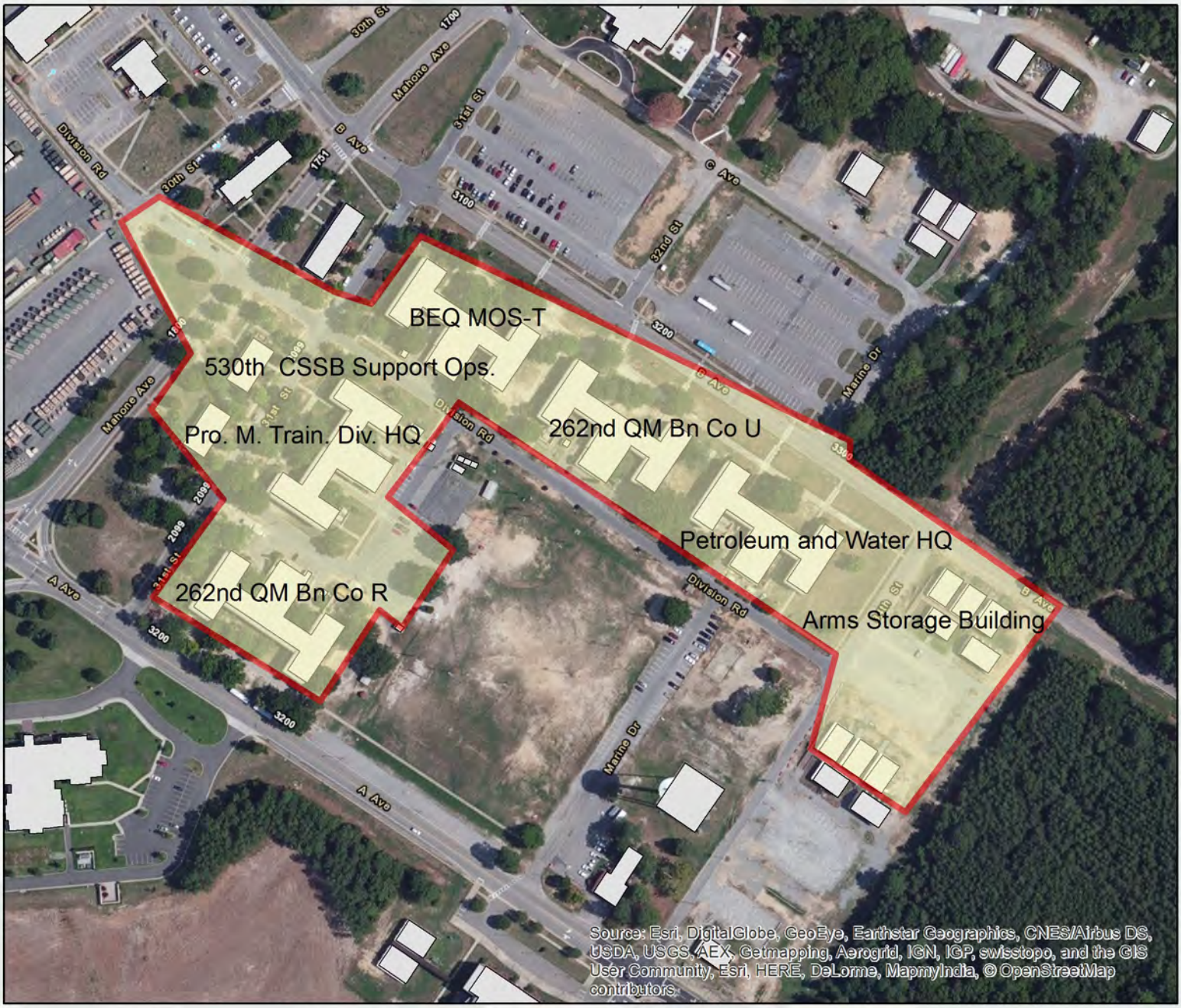
BMP	Percent of Total Goal		
	N	P	TSS
AOI10A	9%	8%	6%
AOI10B	8%	7%	5%
AOI10C	9%	8%	6%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

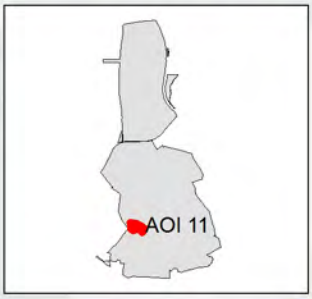
Impervious Acreage	Cost	
10.6	$	1,518,359.93

I. Location and General Information — AOI 11

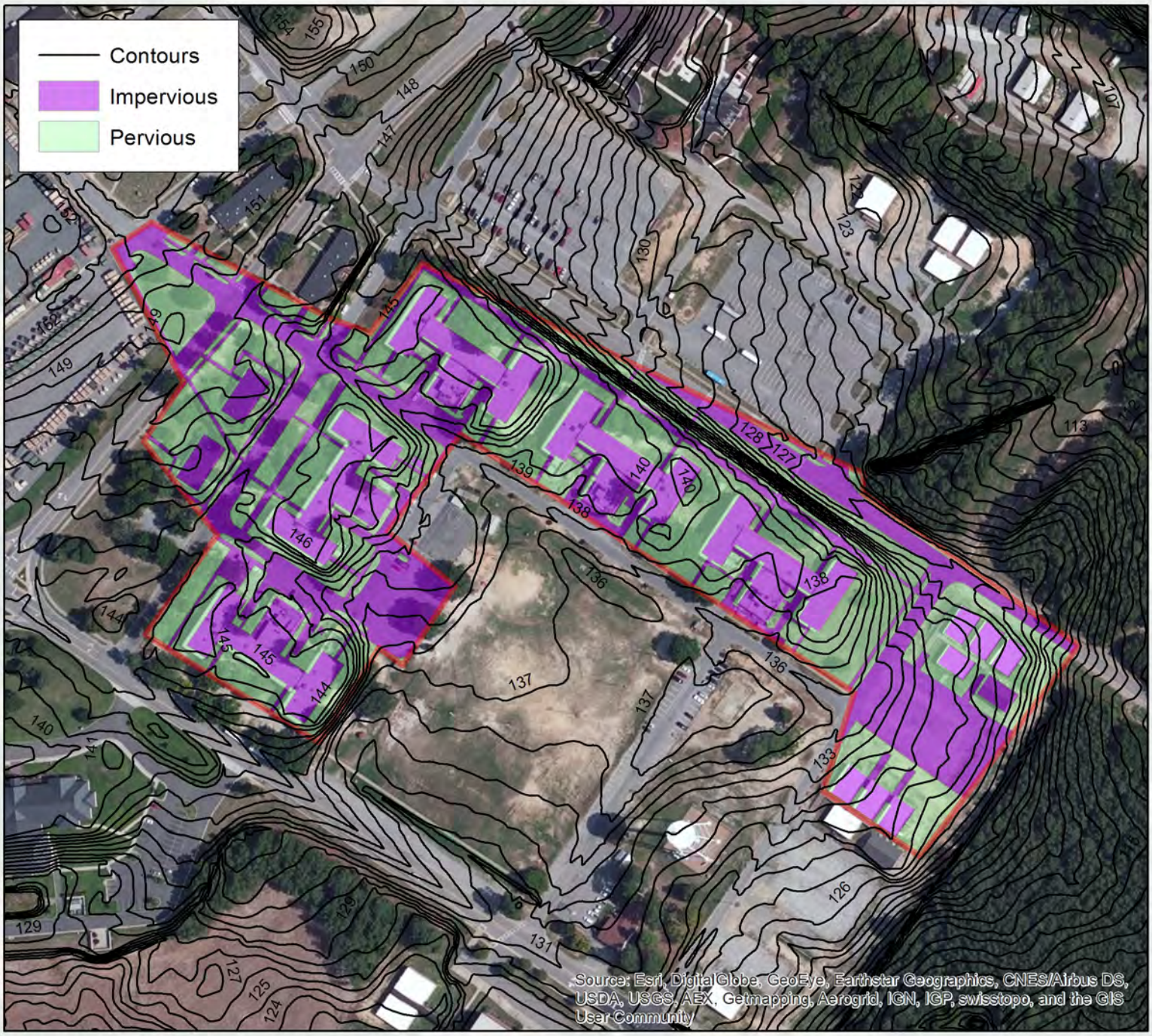


N

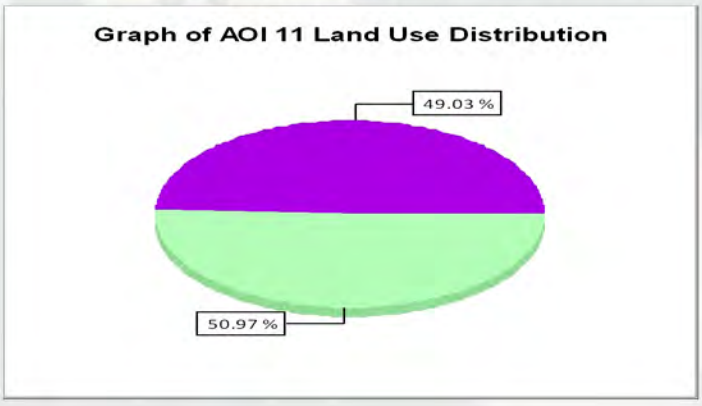
0 325 650 1,300 Feet



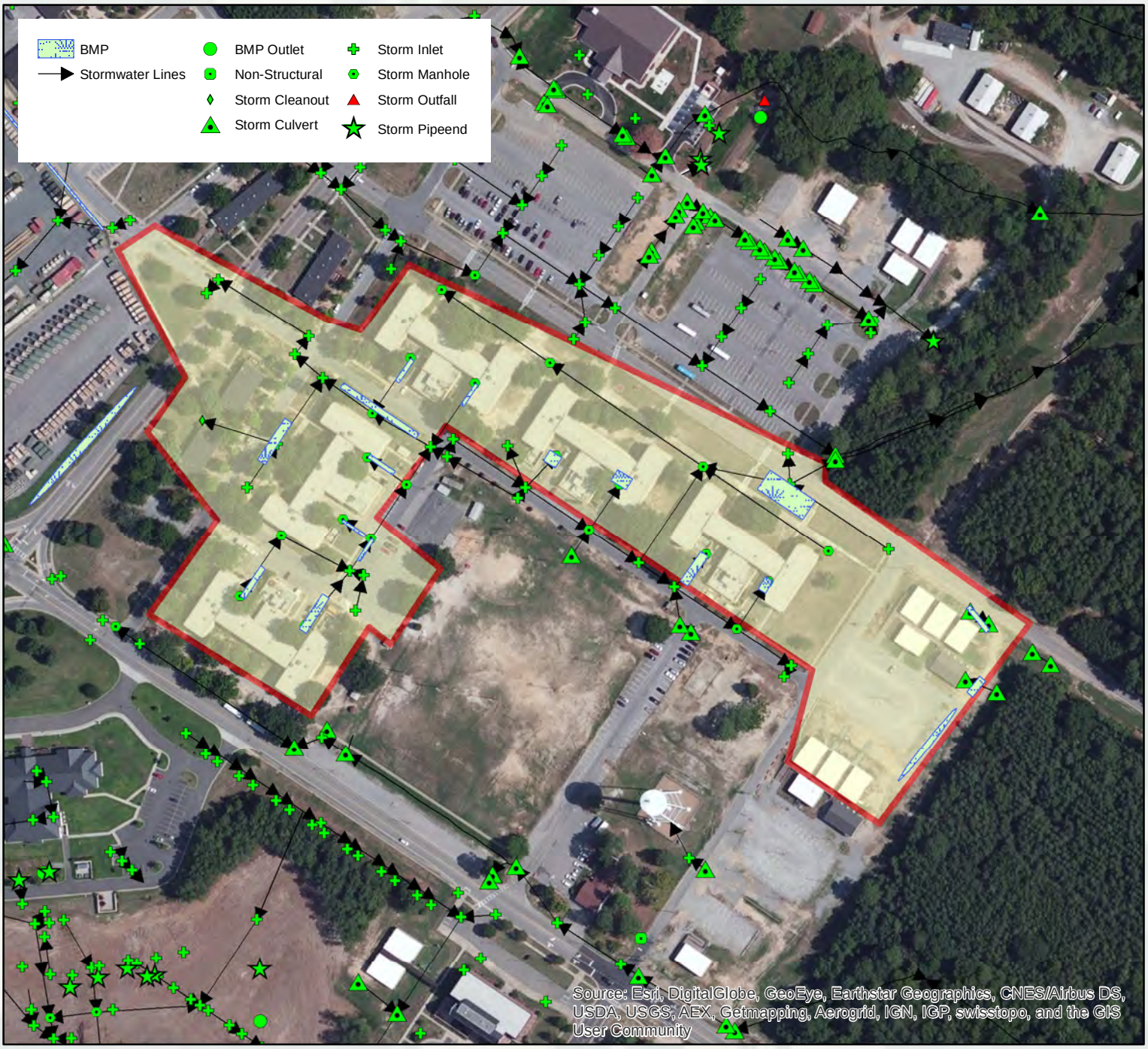
Lee Area of Interest 11 is located between A and B Avenues, southest of Mahone Avenue. It includes several office and storage buildings, roads and parking lots.



N 0 200 400 800 Feet



Fort Lee Area of Interest 11 consists of:
7.4 acres of impervious surface and
7.7 acres of pervious surface.



Seventeen BMP locations are proposed to capture sheet flow and along existing stormwater lines for AOI 11.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI11A	122.66	16.79	5,758.90
AOI11B	122.66	16.79	5,758.90
AOI11C	122.66	16.79	5,758.90

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI11A	98.13	14.27	5,183.01
AOI11B	85.86	12.59	4,607.12
AOI11C	98.13	13.43	4,895.07

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI11A	8%	7%	4%
AOI11B	7%	6%	4%
AOI11C	8%	6%	4%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

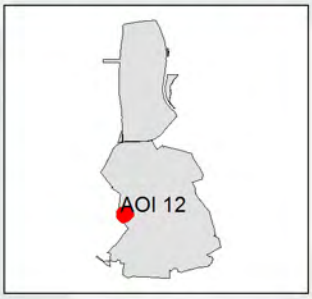
Impervious Acreage	Cost	
7.4	$	1,053,778.10

I. Location and General Information

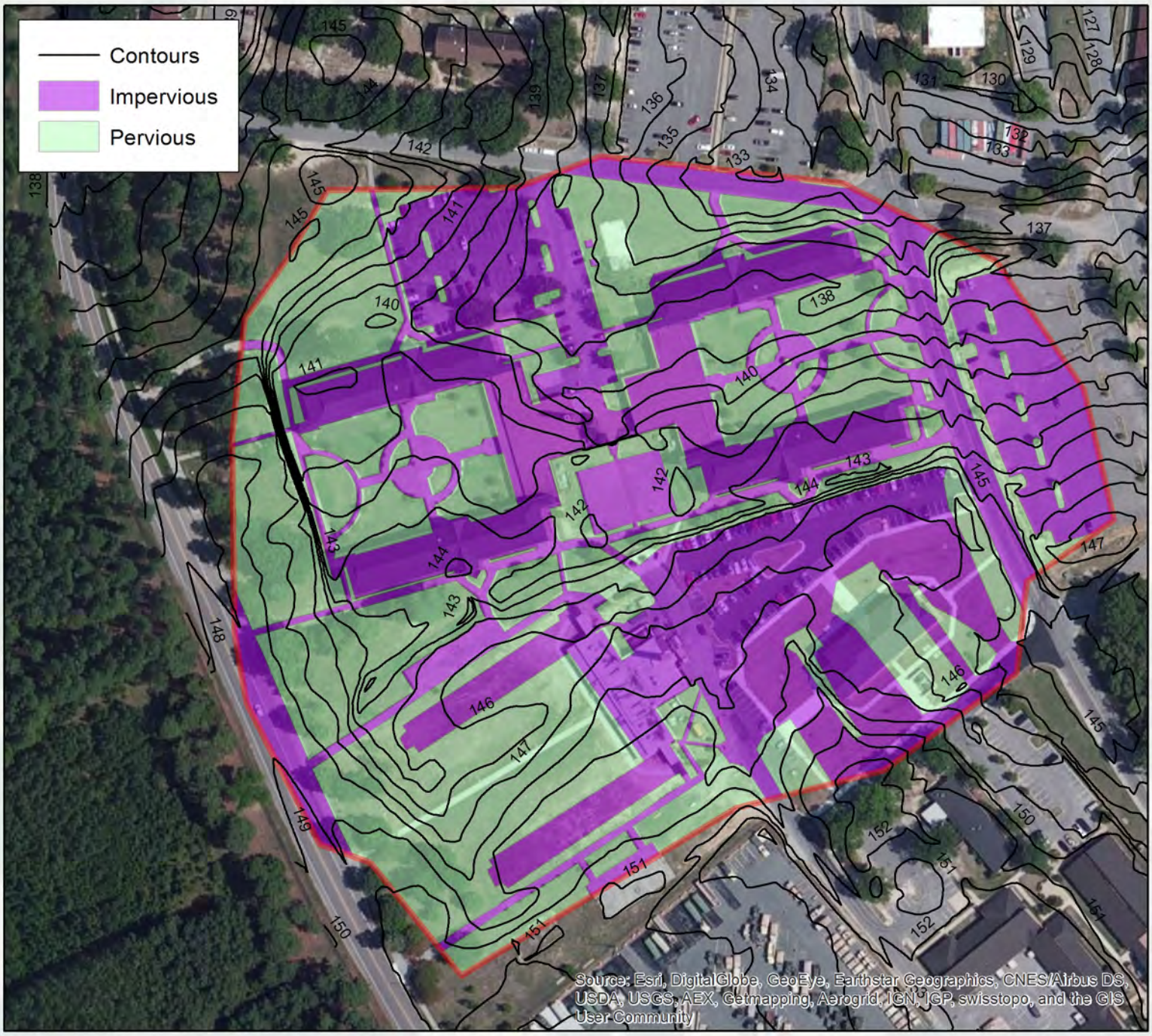
AOI 12

N

0 250 500 1,000 Feet

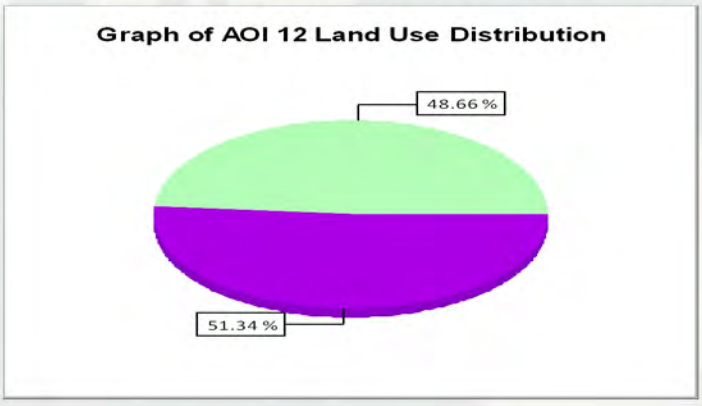


Lee Area of Interest 12 is located in the central western portion of the installation, between A and B Avenues and 27th and 28th Streets. It includes the 1st Sgt. Barracks Program building, the 49th Quarter Master Enlisted Barracks and their parking areas.

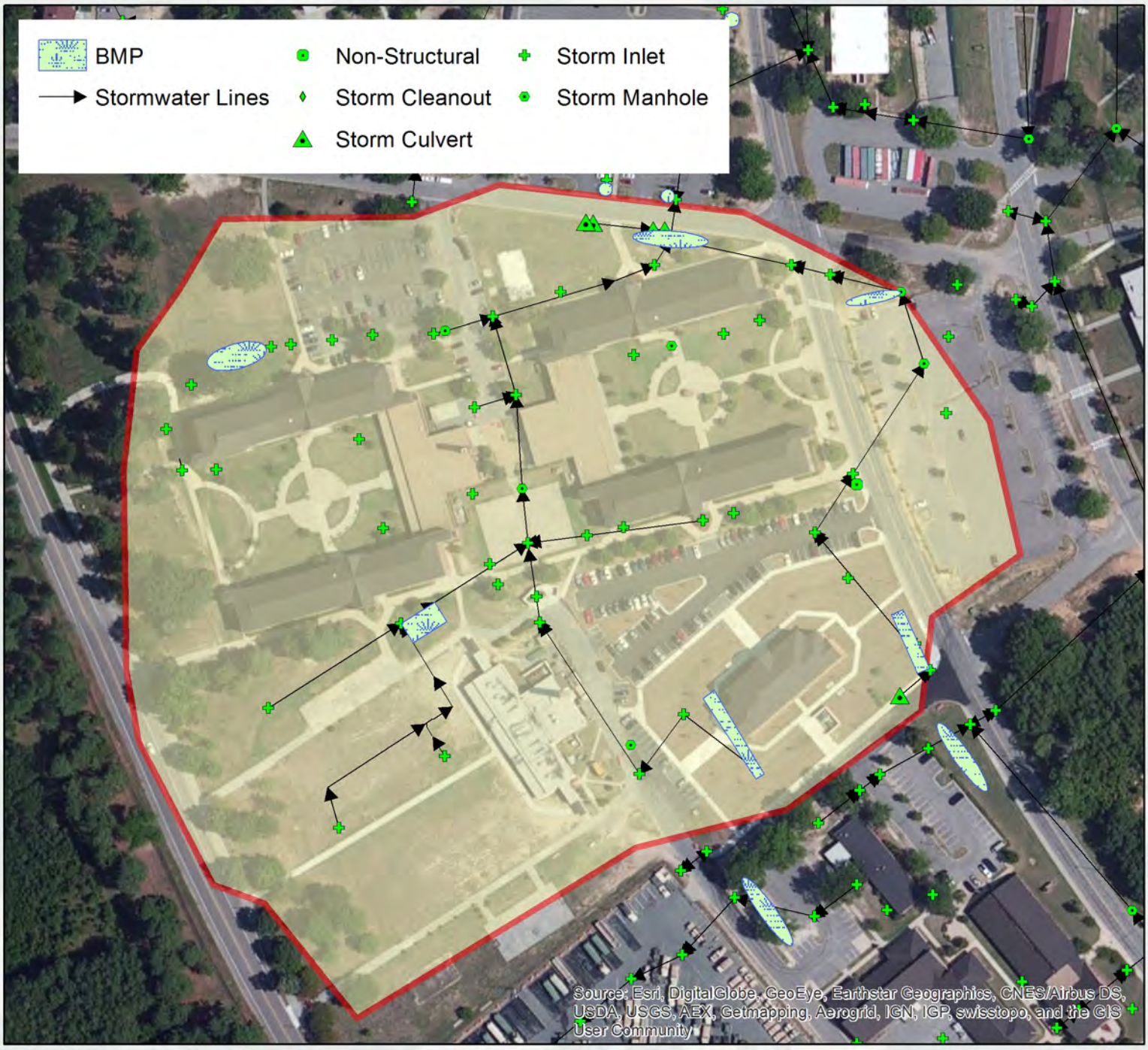


N

0 150 300 600 Feet



Fort Lee Area of Interest 12 consists of:
10.1 acres of impervious surface and
9.5 acres of pervious surface.



Six opportunities for BMP locations are proposed along existing stormwater lines for AOI 12.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI12A	161.00	22.46	7,767.83
AOI12B	161.00	22.46	7,767.83
AOI12C	161.00	22.46	7,767.83

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI12A	128.80	19.09	6,991.05
AOI12B	112.70	16.84	6,214.27
AOI12C	128.80	17.96	6,602.66

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI12A	10%	9%	6%
AOI12B	9%	8%	5%
AOI12C	10%	8%	6%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
10.1	$	1,438,397.64

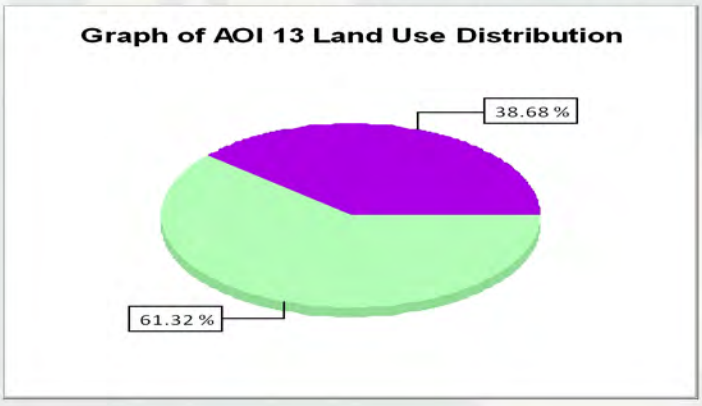
I. Location and General Information — AOI 13

N

0 425 850 1,700 Feet

Lee Area of Interest 13 is located along Battle Drive and covers a portion of the Jefferson Terrace neighborhood.

N 0 250 500 1,000 Feet



Fort Lee Area of Interest 13 consists of:
9.3 acres of impervious surface and
14.8 acres of pervious surface.

Eight BMP location opportunities are proposed along existing stormwater lines for AOI 13.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI13A	191.00	23.82	7,811.09
AOI13B	191.00	23.82	7,811.09
AOI13C	191.00	23.82	7,811.09

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI13A	152.80	20.24	7,029.98
AOI13B	133.70	17.86	6,248.87
AOI13C	152.80	19.05	6,639.43

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI13A	12%	9%	6%
AOI13B	11%	8%	5%
AOI13C	12%	9%	6%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

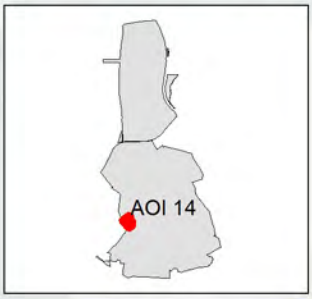
Impervious Acreage	Cost	
9.3	$	1,335,133.80

I. Location and General Information

AOI 14

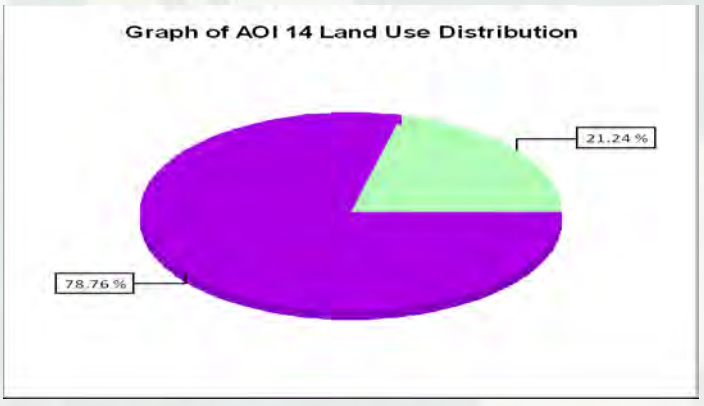
N

0 325 650 1,300 Feet



Lee Area of Interest 14 is located between A and B Avenues, and Mahone Avenue and 28th Street. It includes a vehicle maintenance shop and parking area.

N 0 200 400 800 Feet



Fort Lee Area of Interest 14 consists of:
3.8 acres of impervious surface and
14.2 acres of pervious surface.

Six opportunities for BMP placement are proposed to capture sheet flow and along stormwater lines for AOI 14.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI14A	160.37	26.95	10,016.12
AOI14B	160.37	26.95	10,016.12
AOI14C	160.37	26.95	10,016.12

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI14A	128.30	22.91	9,014.51
AOI14B	112.26	20.21	8,012.90
AOI14C	128.30	21.56	8,513.70

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI14A	10%	11%	8%
AOI14B	9%	9%	7%
AOI14C	10%	10%	7%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

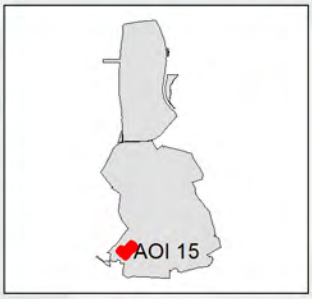
Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
14.2	$	2,035,314.06

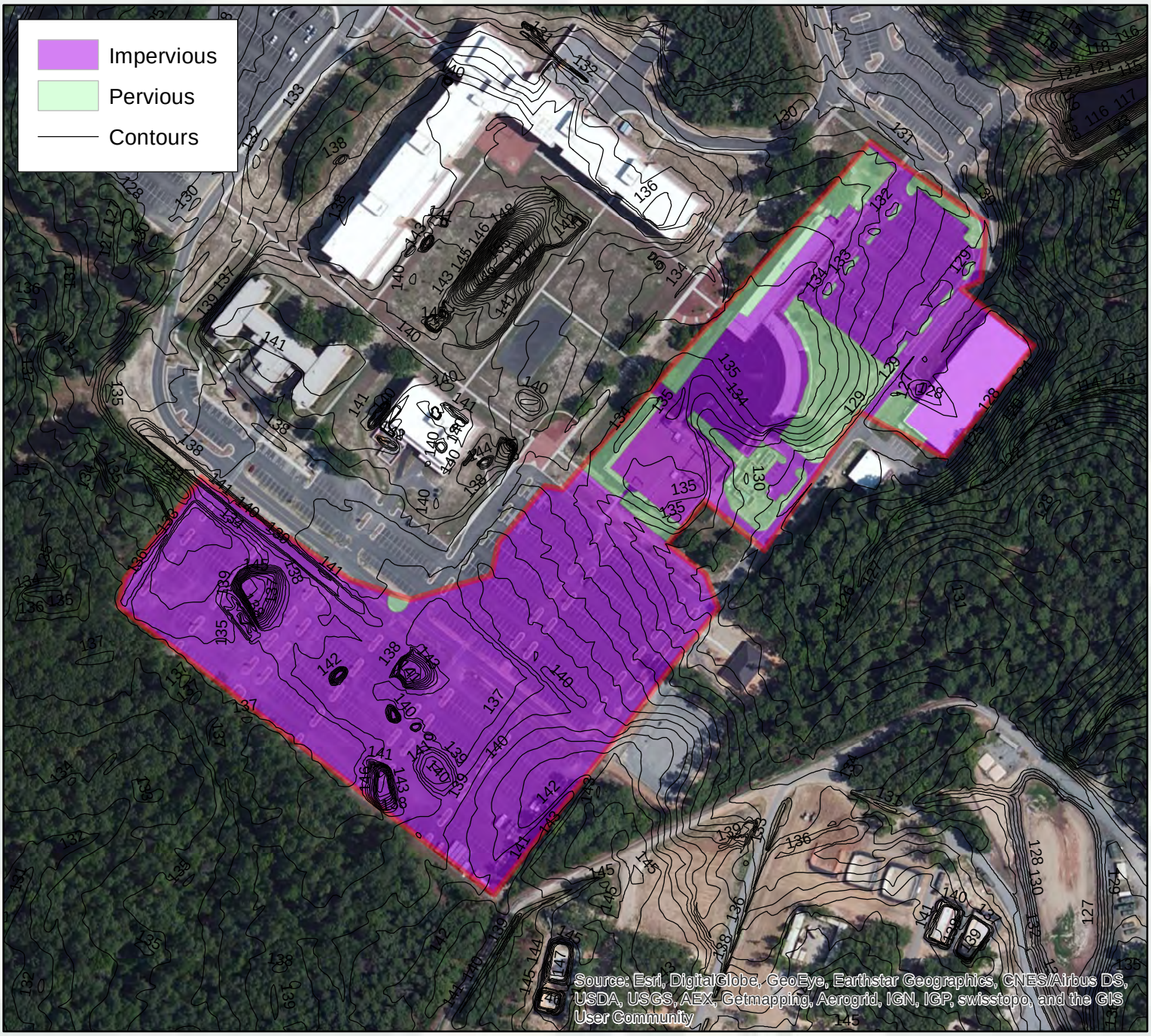
I. Location and General Information — AOI 15

N

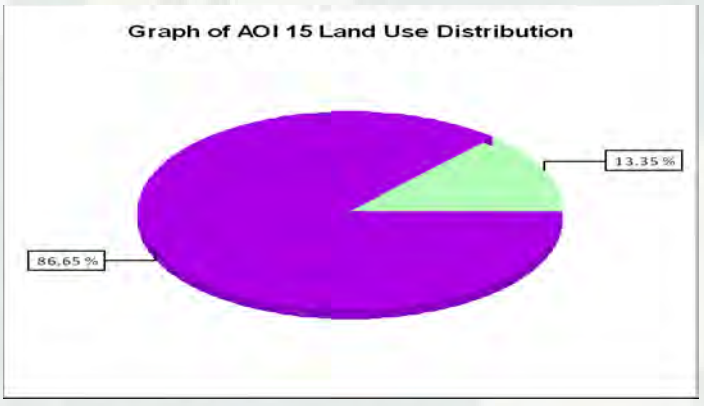
0 350 700 1,400 Feet



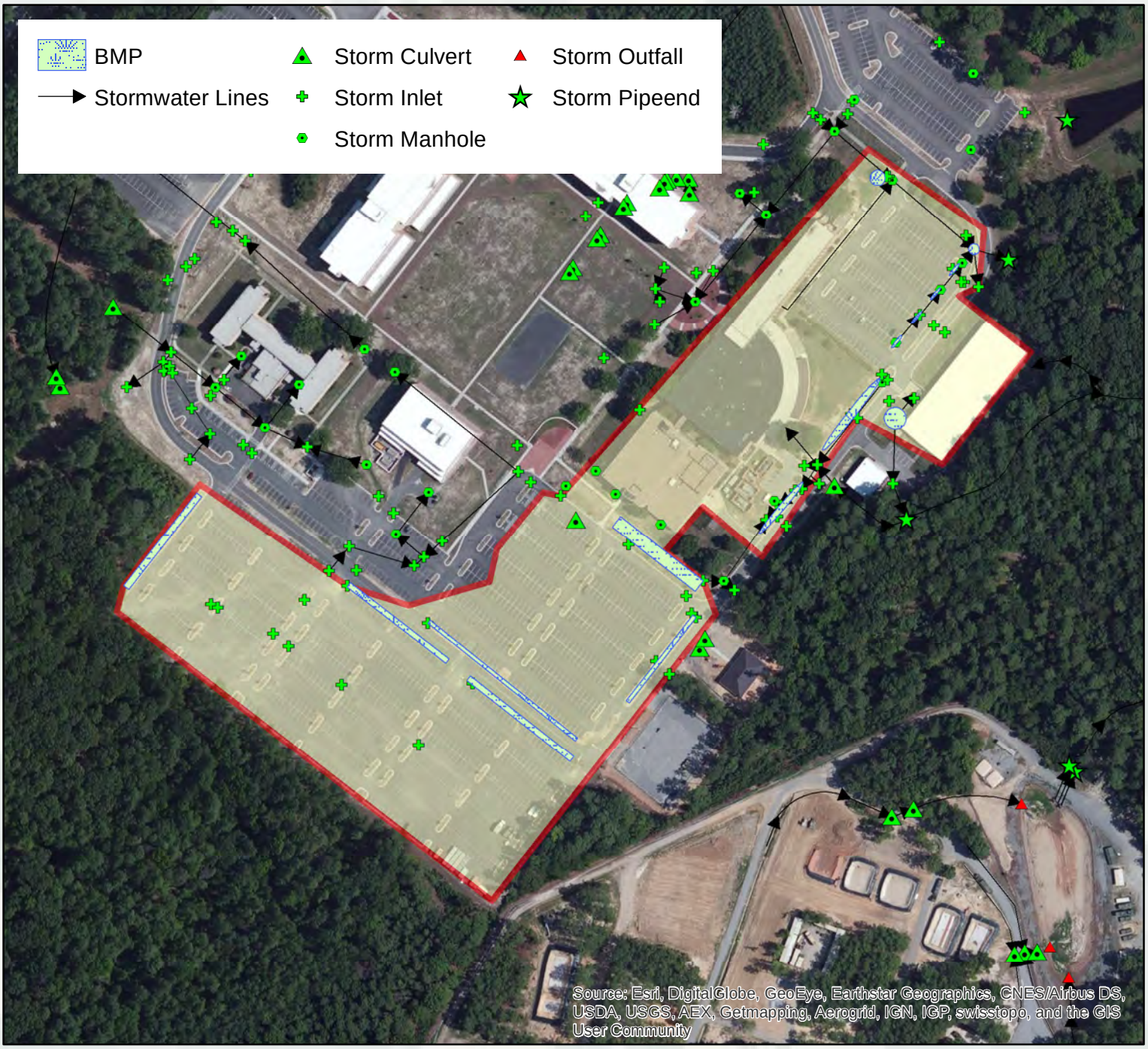
Lee Area of Interest 15 is located along Quarters Road and includes several buildings and parking lots on the Army Logistics University campus.



N 0 225 450 900 Feet



Fort Lee Area of Interest 15 consists of:
15.4 acres of impervious surface and
2.4 acres of pervious surface.



Fifteen opportunities for BMP placement are proposed to capture sheet flow and along stormwater lines for AOI 15.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI15A	160.85	28.23	10,642.11
AOI15B	160.85	28.23	10,642.11
AOI15C	160.85	28.23	10,642.11

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI15A	128.68	24.00	9,577.90
AOI15B	112.59	21.17	8,513.69
AOI15C	128.68	22.58	9,045.80

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI15A	10%	11%	8%
AOI15B	9%	10%	7%
AOI15C	10%	10%	8%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

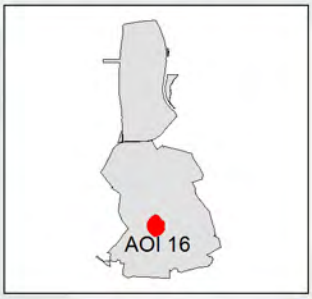
Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
15.4	$	2,199,007.49

I. Location and General Information — AOI 16

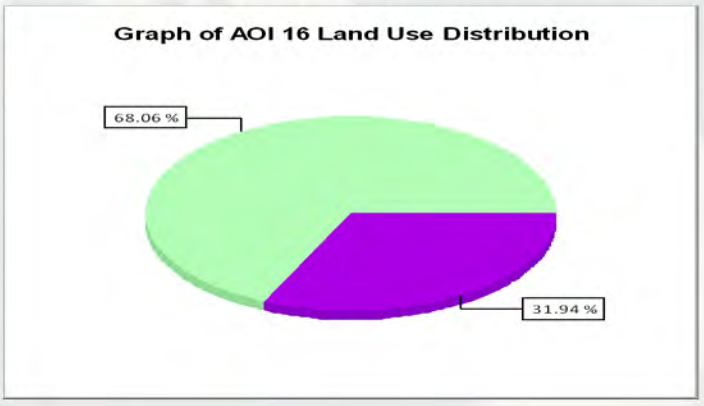
N

0 400 800 1,600 Feet

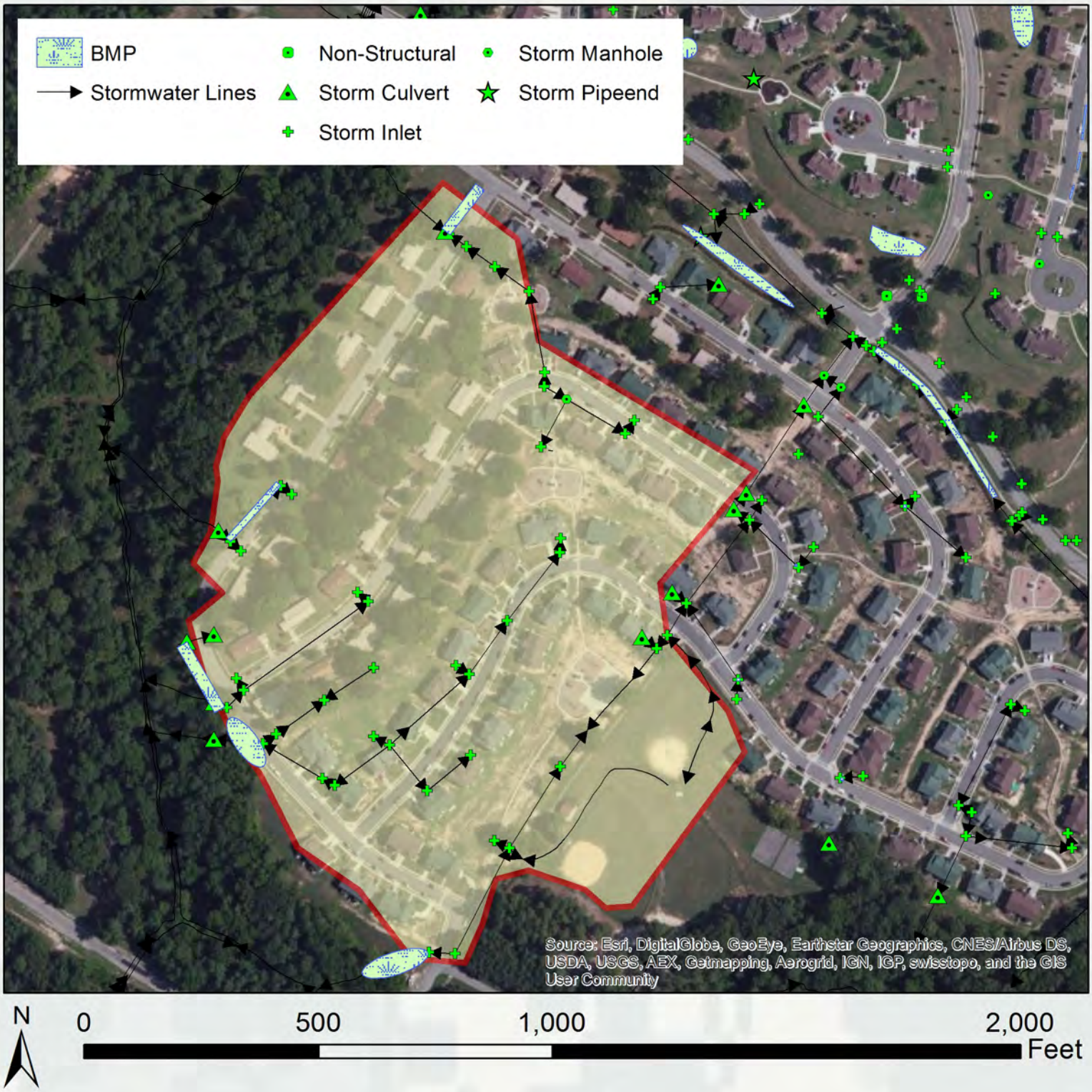


Lee Area of Interest 16 is located at the western portion of the Jefferson Terrace neighborhood. It includes portions of Normandy, St. Lo and Bastogne Roads.

N 0 250 500 1,000 Feet



Fort Lee Area of Interest 16 consists of:
9.2 acres of impervious surface and
19.5 acres of pervious surface.



Five opportunities for BMP locations are proposed along existing stormwater infrastructure for AOI 16.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI16A	222.33	25.87	8,169.93
AOI16B	222.33	25.87	8,169.93
AOI16C	222.33	25.87	8,169.93

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI16A	177.87	21.99	7,352.93
AOI16B	155.63	19.40	6,535.94
AOI16C	177.87	20.69	6,944.44

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI16A	14%	10%	6%
AOI16B	13%	9%	6%
AOI16C	14%	10%	6%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

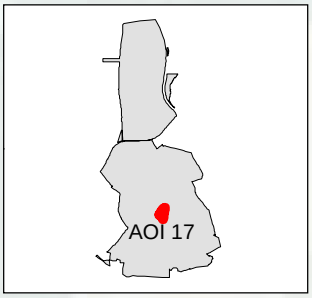
Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
9.2	$	1,310,186.21

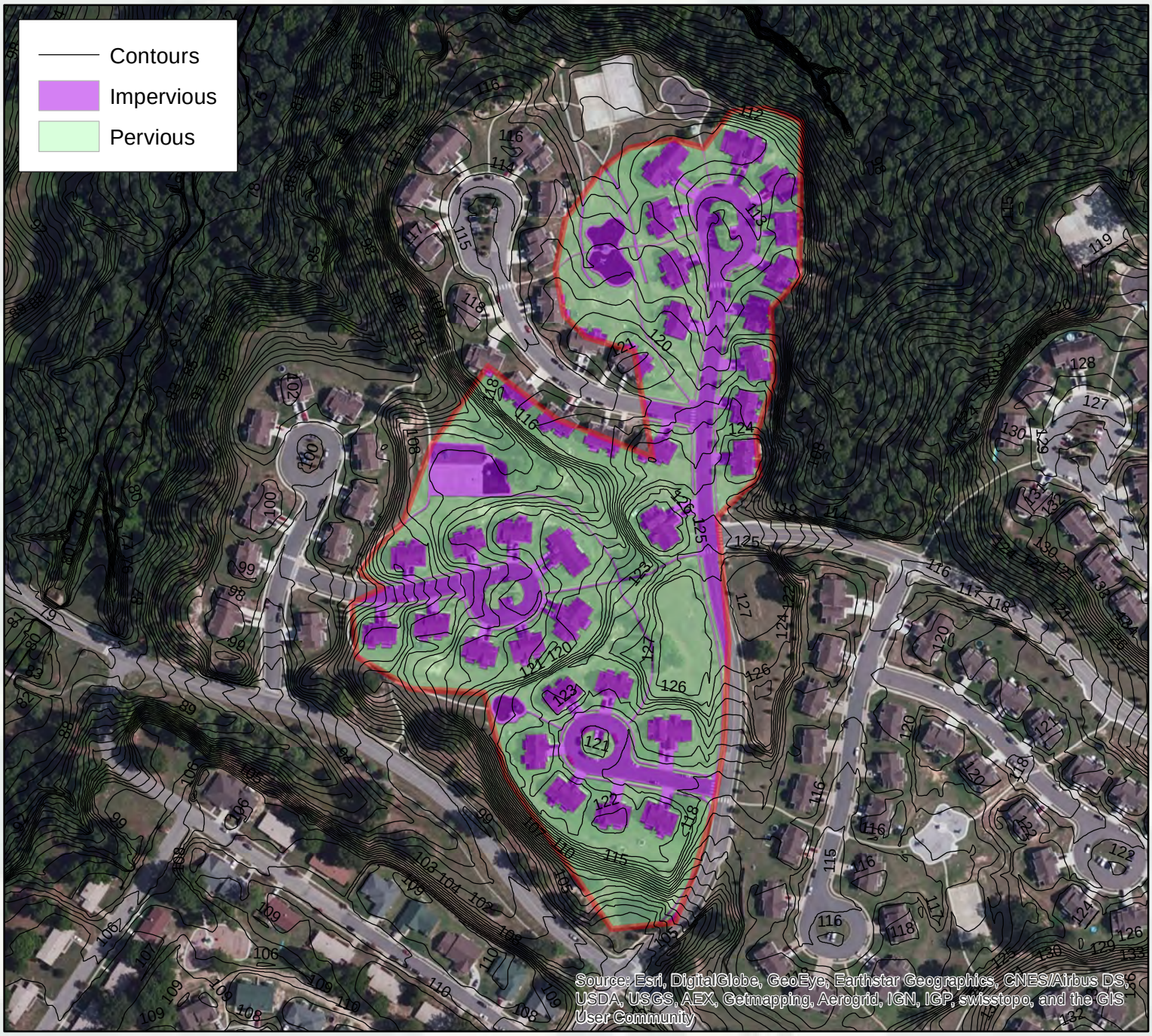
I. Location and General Information — AOI 17

N

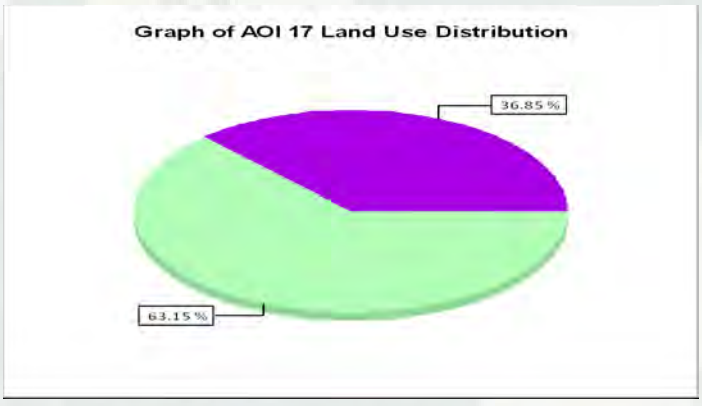
0 375 750 1,500 Feet



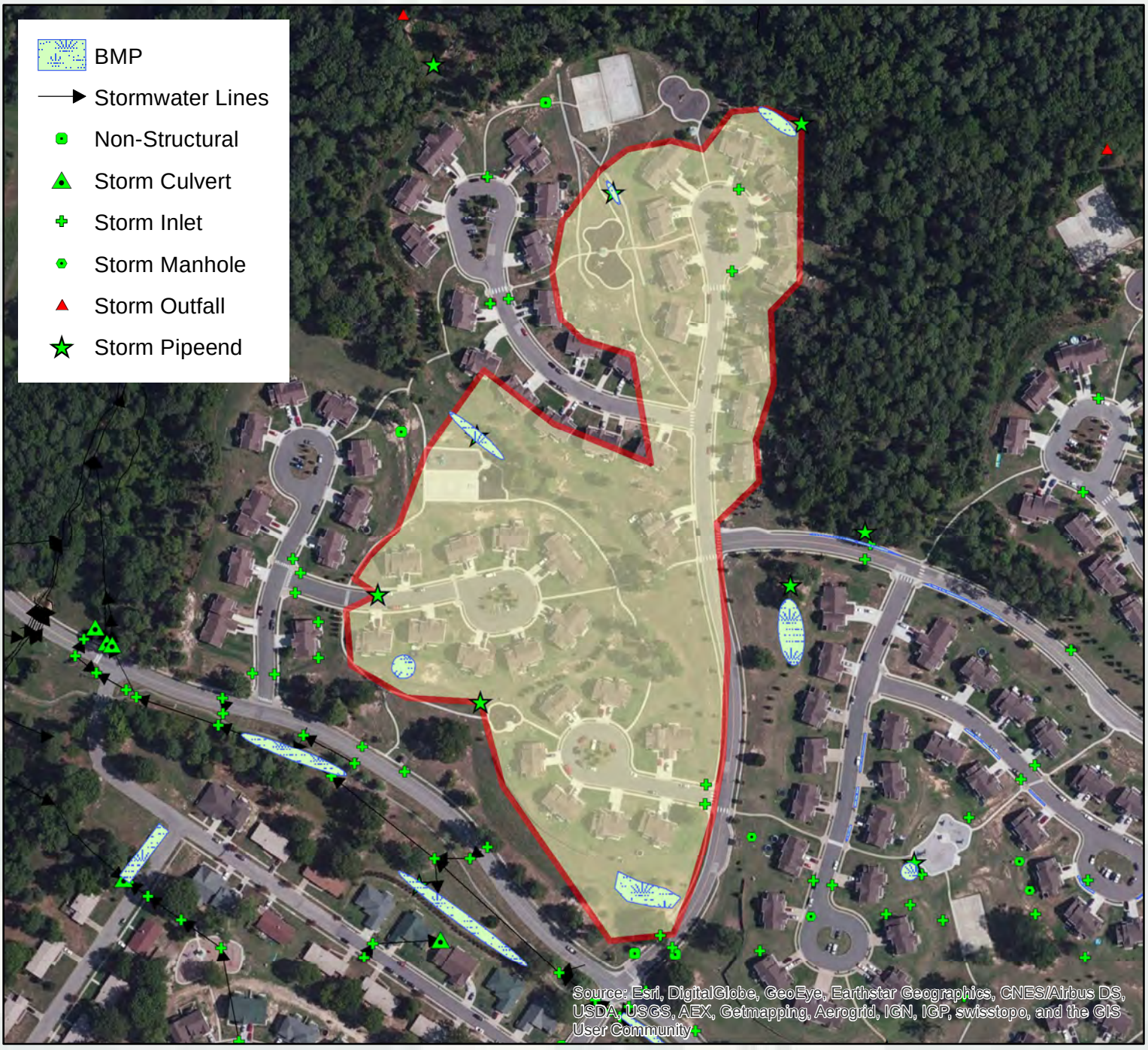
Lee Area of Interest 17 is located in the Harrison Villa neighborhood, along Cedar Mountain Drive.



N 0 225 450 900 Feet



Fort Lee Area of Interest 17 consists of:
5.7 acres of impervious surface and
9.7 acres of pervious surface.



Five opportunities for BMP locations are proposed along existing storrmwater infrastructure for AOI 17.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI17A	268.37	32.70	10,596.57
AOI17B	268.37	32.70	10,596.57
AOI17C	268.37	32.70	10,596.57

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI17A	214.70	27.80	9,536.91
AOI17B	187.86	24.53	8,477.25
AOI17C	214.70	26.16	9,007.08

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI17A	17%	13%	8%
AOI17B	15%	11%	7%
AOI17C	17%	12%	8%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

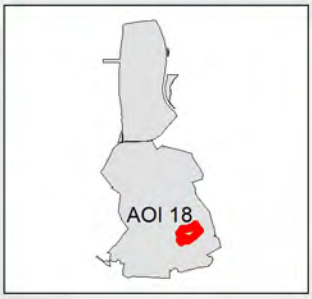
Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
12.4	$	1,775,817.22

I. Location and General Information — AOI 18

N

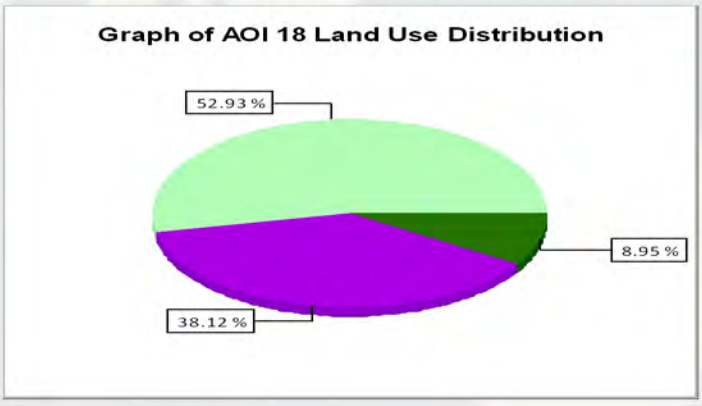
0 500 1,000 2,000 Feet



Lee Area of Interest 18 is located in the Monroe Manor neighborhood, south of Battle Drive and East of Yorktown Drive.

N

0 325 650 1,300 Feet



Fort Lee Area of Interest 18 consists of:
23.6 acres of impervious surface and
32.7 acres of pervious surface.

Nine opportunities for BMP locations are proposed along existing stormwater infrastructure for AOI 18.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI18A	496.55	63.96	21,321.70
AOI18B	496.55	63.96	21,321.70
AOI18C	496.55	63.96	21,321.70

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI18A	397.24	54.36	19,189.53
AOI18B	347.59	47.97	17,057.36
AOI18C	397.24	51.17	18,123.45

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI18A	32%	25%	17%
AOI18B	28%	22%	15%
AOI18C	32%	24%	16%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

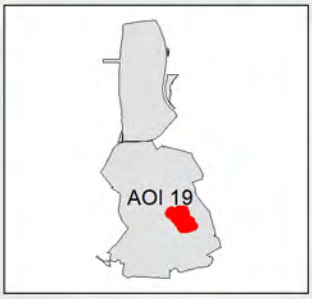
Impervious Acreage	Cost	
26.1	$	3,739,312.43

I. Location and General Information

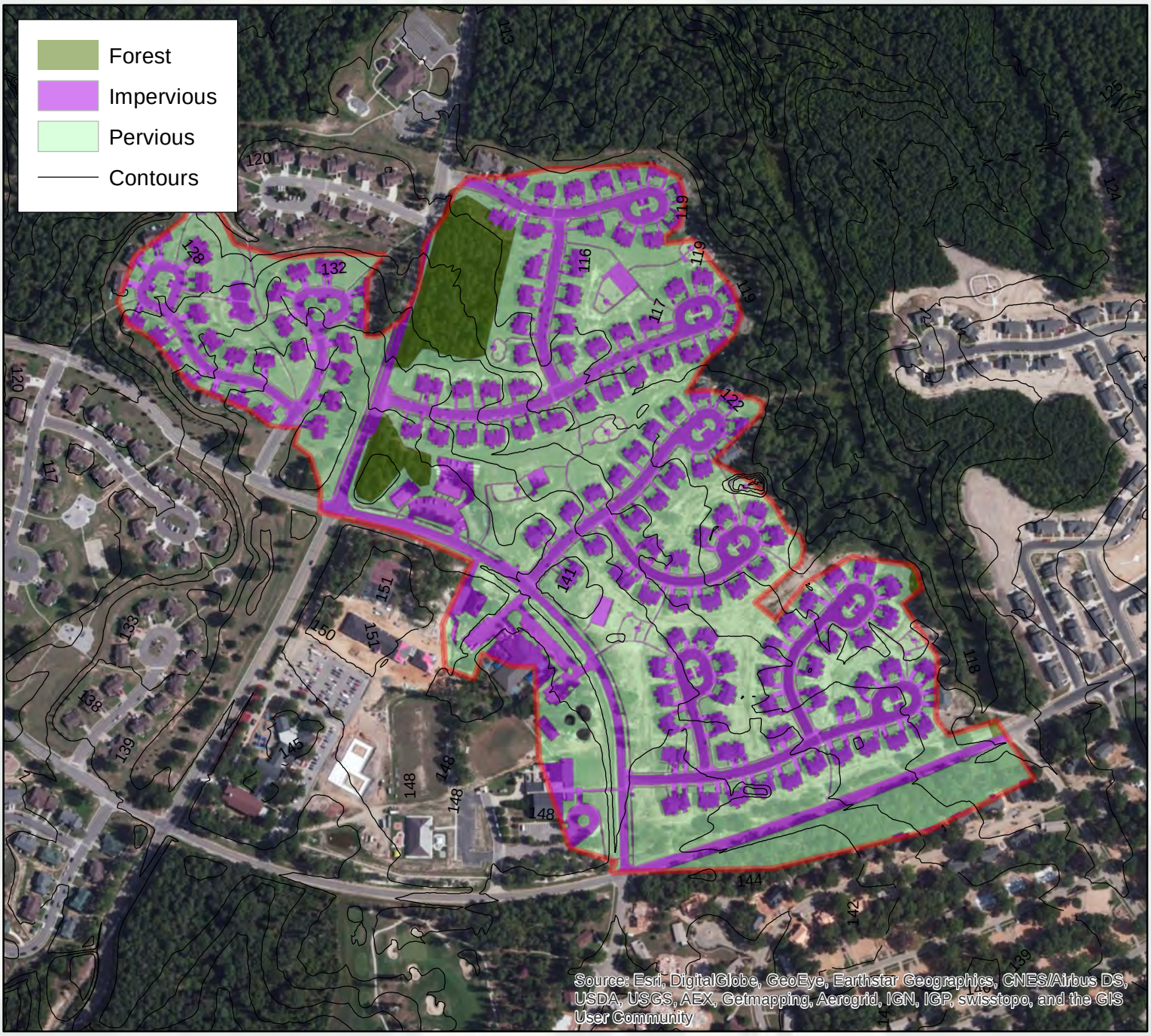
AOI 19

N

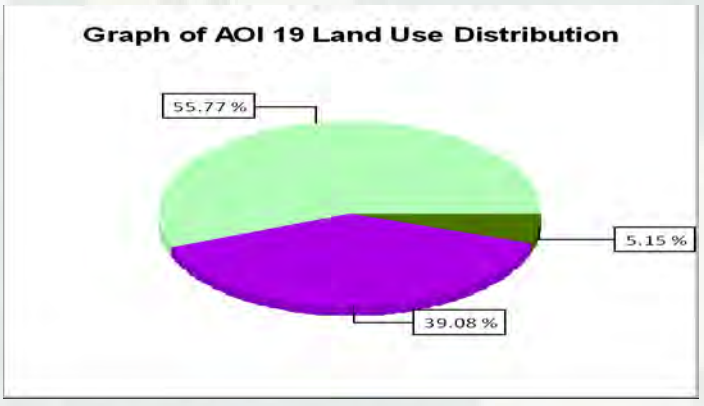
0 600 1,200 2,400 Feet



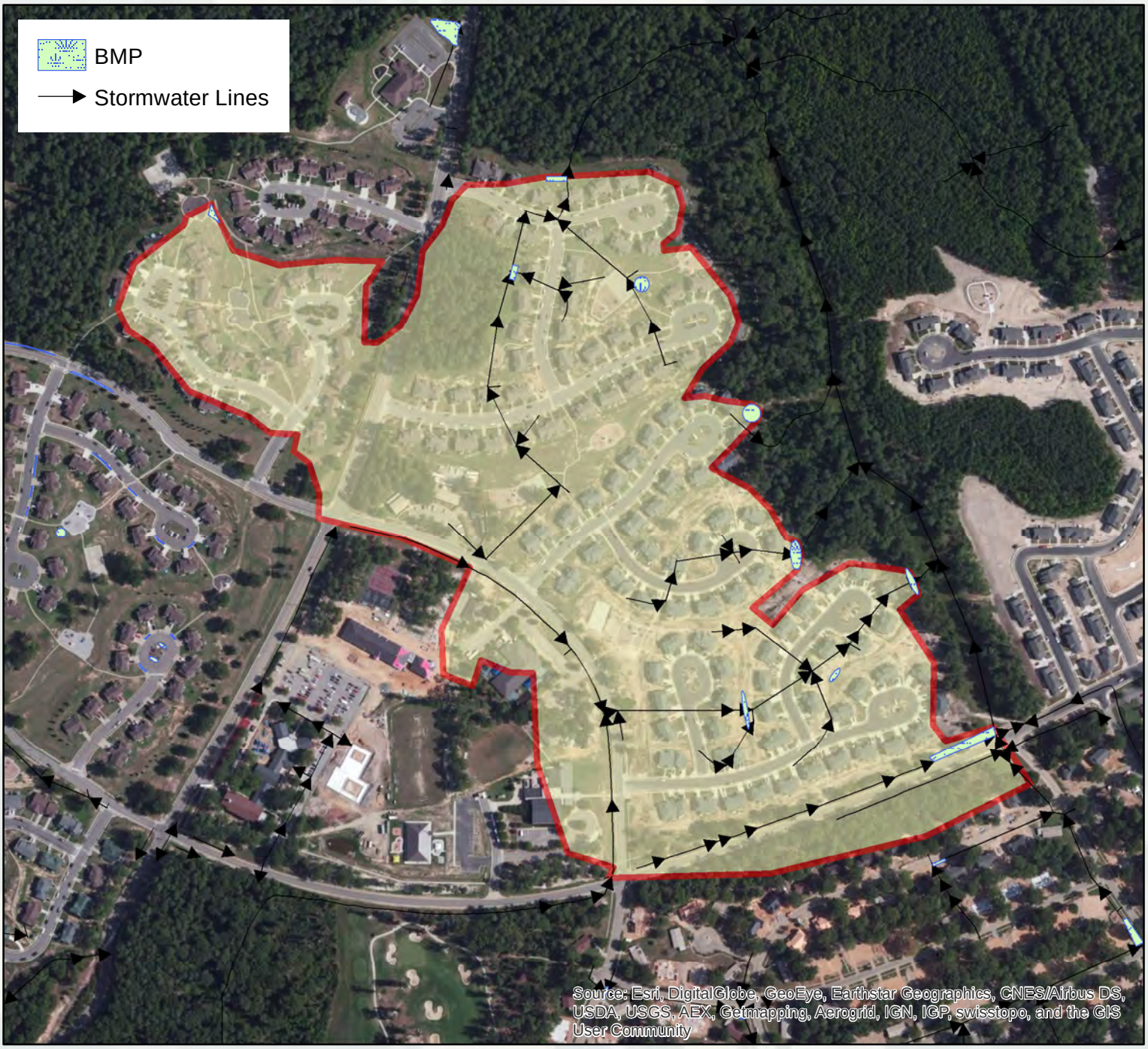
Lee Area of Interest 19 is located in the Madison Park neighborhood, north of Battle Drive, east of Sisisky Drive.



N 0 400 800 1,600 Feet



Fort Lee Area of Interest 19 consists of:
29.3 acres of impervious surface and
41.7 acres of pervious surface.



Ten opportunities for BMP locations are proposed along existing storrmwater infrastructure for AOI 19.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI19A	566.54	72.36	24,022.85
AOI19B	566.54	72.36	24,022.85
AOI19C	566.54	72.36	24,022.85

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI19A	453.23	61.51	21,620.56
AOI19B	396.58	54.27	19,218.28
AOI19C	453.23	57.89	20,419.42

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI19A	37%	29%	19%
AOI19B	32%	25%	17%
AOI19C	37%	27%	18%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost	
29.3	$	4,185,966.09

I. Location and General Information

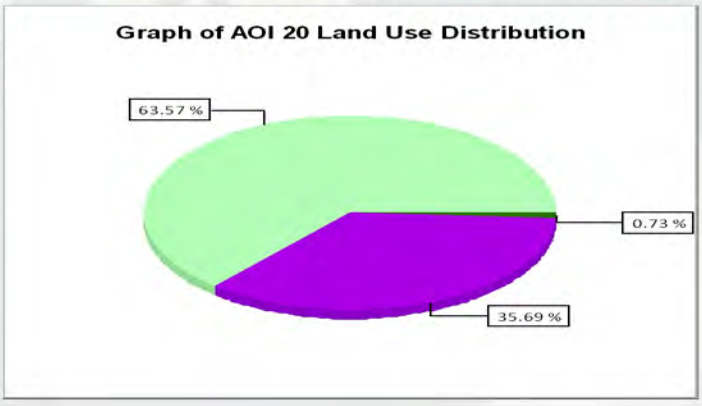
AOI 20

N

0 350 700 1,400 Feet

Lee Area of Interest 20 is located along Rocky Springs Road and Cedar Mountain Drive. It includes portion of Hazel Grove, Cold Harbor and Bannington Courts in the Harrison Villa neighborhood.

N 0 200 400 800 Feet



Fort Lee Area of Interest 20 consists of:
12 acres of impervious surface and
6.8 acres of pervious surface.

Sixteen opportunities for BMP locations are proposed along existing stormwater infrastructure for AOI 20.

The baseline load rates below were calculated using 2009 EOS Rates provided in the Virginia TMDL Guidance and applied to land use delineated by USACE using 2009 aerials.

BMP	Baseline Load (lb/yr)		
	N	P	TSS
AOI20A	147.50	17.90	5,787.92
AOI20A	147.50	17.90	5,787.92
AOI20A	147.50	17.90	5,787.92

The pollution reductions below were calculated by applying CBP reduction effeciency rates to baseline loads shown above. This table shows how many pounds of N, P and TSS will be reduced by the proposed BMPs.

BMP	Proposed BMP Reduction (lb/yr)		
	N	P	TSS
AOI20A	118.00	15.22	5,209.13
AOI20A	103.25	13.43	4,630.34
AOI20A	118.00	14.32	4,919.73

The table below shows the portion of the total L2 Reduction Goals required by 2027 that the proposed treatment will satisfy.

BMP	Percent of Total Goal		
	N	P	TSS
AOI20A	10%	7%	4%
AOI20A	8%	6%	4%
AOI20A	10%	7%	4%

Initial planning level construction costs were calculated using the "Cost of Stormwater Management Practices in Maryland" table. This tool is based on impervious acreage in the AOI and new suburban construction. These estimates include capital, labor, material and overhead costs, but not land or maintenance costs.

Several variables to be explored in later phases of the study can greatly affect the cost to implement a BMP, such as utility placement, regional specific permits, unexploded ordinance surveys, type of contract, acquisition strategy, and real property.

Impervious Acreage	Cost
6.8	$ 966,472.14

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APPENDIX B

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STORMWATER BMP DATABASE USER GUIDE

TABLE OF CONTENTS

1.0 INSTALLATION AND BACKUP INSTRUCTION

1.1 DATABASE STORAGE AND INSTALLATION

The BMP database should be placed in a single centralized location. Ideally, the database will be stored on a server, rather than on a local computer's hard drive. Users should take care to make sure that multiple versions of the database do not exist. If a user must work on the database off of the network the following steps should be taken:

- Download the database to the computer that will be used offline.
- Verify that no users will be editing the database during the time that the user is working offline with the database.
- Upon finishing the offline editing, copy the database back to the server, overwriting the current database stored on the server.
    - Prior to overwriting the database the user may wish to copy the database into a backup folder. This may not be necessary if data is automatically backed up by the network administrators.

1.2 PHOTO STORAGE

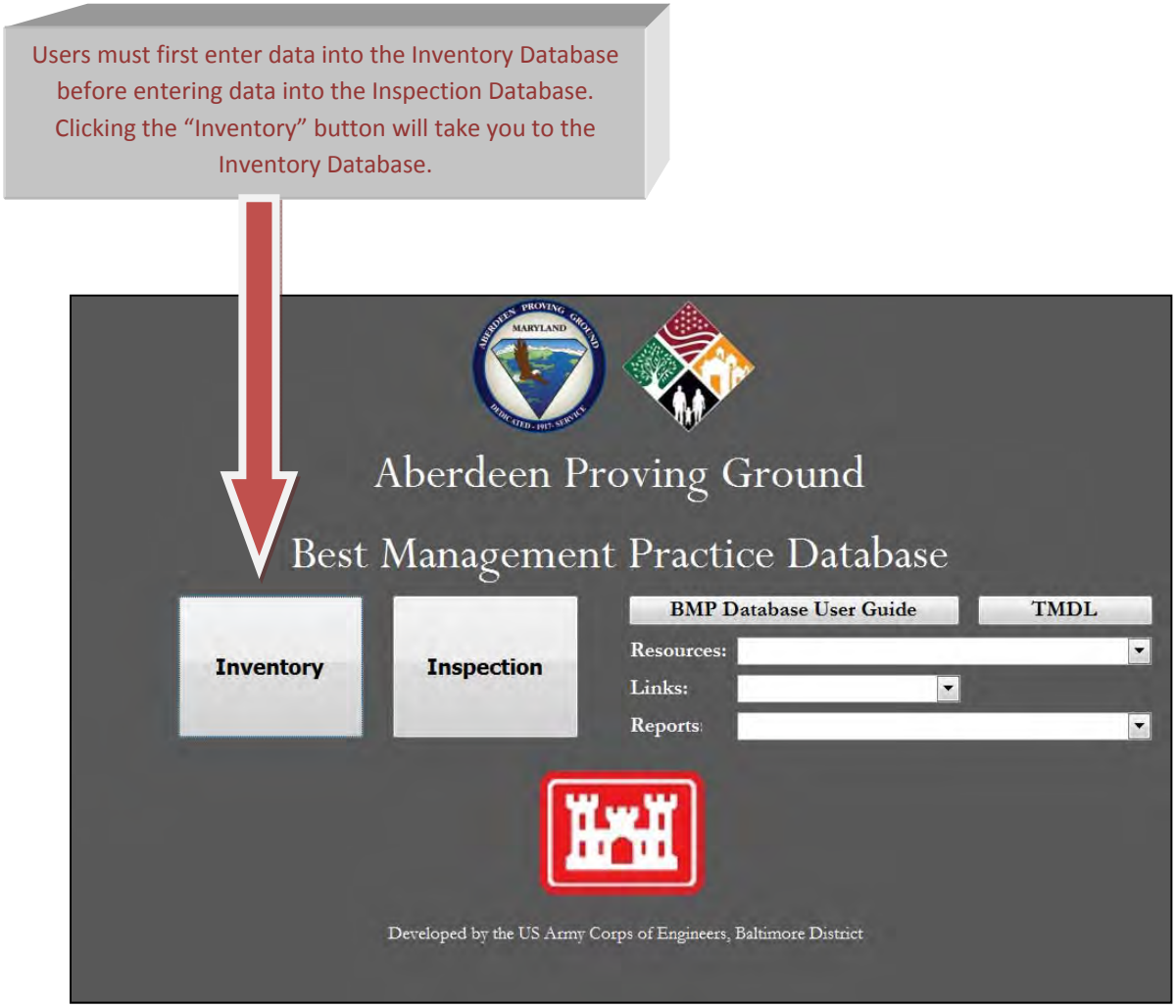
Access databases are limited to a maximum storage size of 2 gigabytes (GB). The attachment field, which is where the photos and other documents can be stored, is the field most likely to impact the size of the database. In instances where it is likely that the total size of the database will exceed 2 GB the following steps should be taken to separate the photos from the database itself.

- Set up a location on a centralized server where the photos will be stored.
- Apply a standardized process for naming photos, for example the names for all photos for a BMP with SWMID ABC12 begin with ABC12.
- Create a field within the database and corresponding field within the forms that will hyperlink to the photos on the servers (Corps will create a separate field to input the hyperlink).

2.0 SWITCHBOARD

2.1 SWITCHBOARD FORM

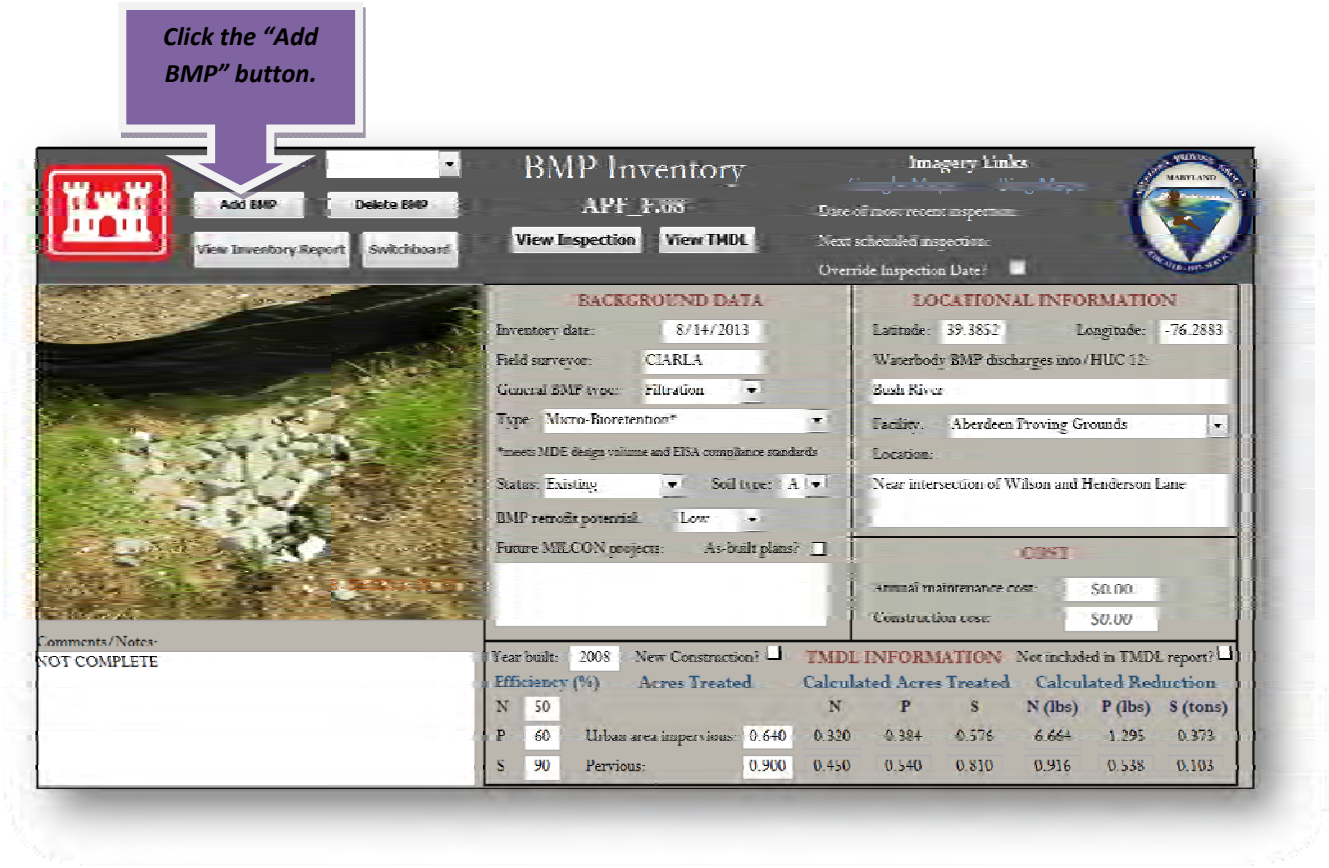
Upon opening the database users will come to a switchboard. The switchboard enables users to navigate between forms, view applicable resources, and produce BMP inventory and TMDL reports specific to the installation or facility. The dropdowns (Resources, Links and Reports) on the switchboard will be explained in more detail later in this tutorial.



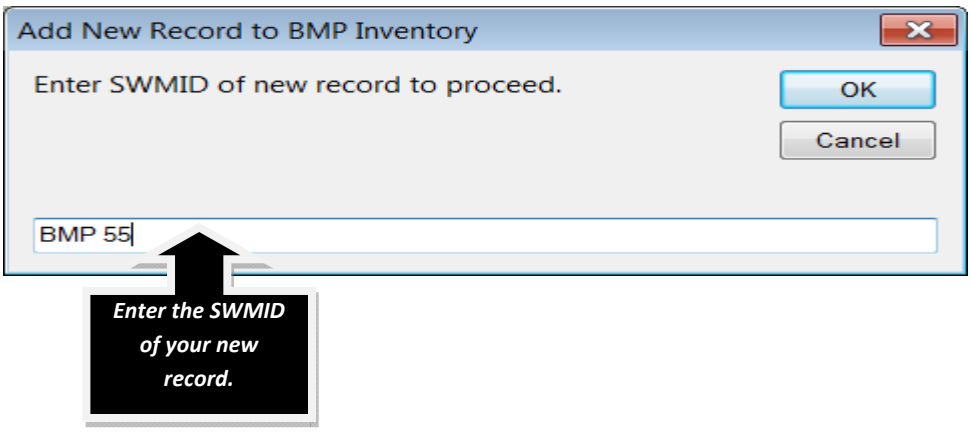
3.0 INVENTORY

3.1 INVENTORY FORM

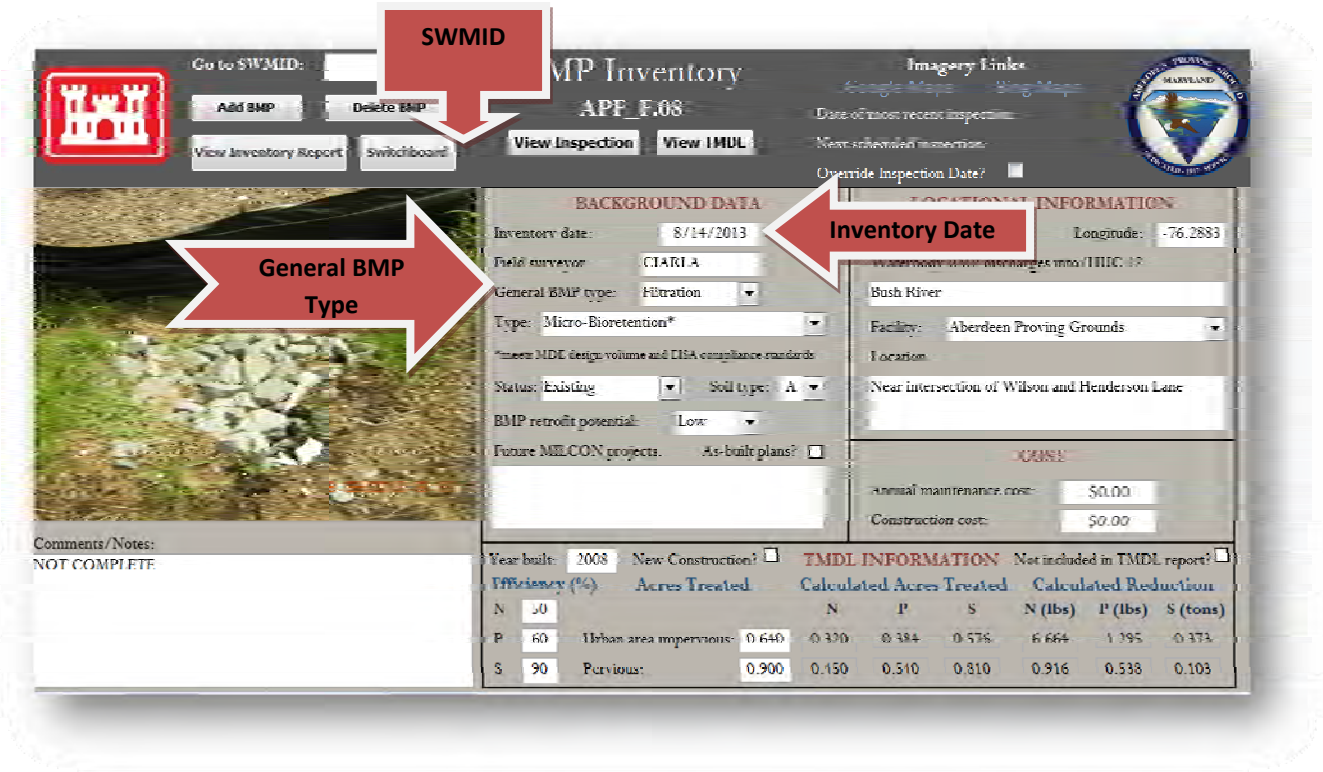
Individual BMPs are entered into the database through the inventory form. Inspection, Maintenance and TMDL data cannot be updated until a BMP has been entered into the inventory. Once a BMP has been entered into the inventory and a unique ID has been established, multiple inspections and annual maintenance can be archived for that individual BMP.



Clicking the "Add Record" button will bring up this prompt:



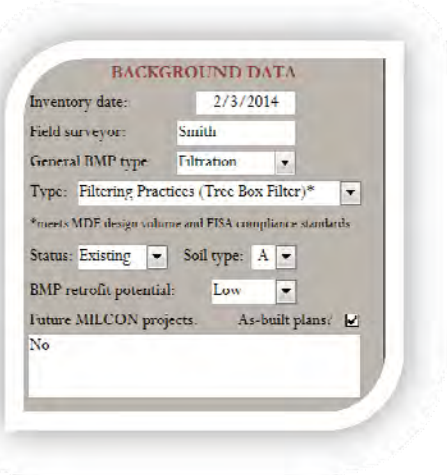
A new record will be created and the SWMID will be populated. Enter information in the form, starting with the "Inventory Date" located under the "Background Data" heading (Field Surveyor, General BMP type, etc.). Your selection for "General BMP Type" will determine what fields must be populated in the area, so be sure this field is accurately filled out.



Adding information to Inventory by heading:

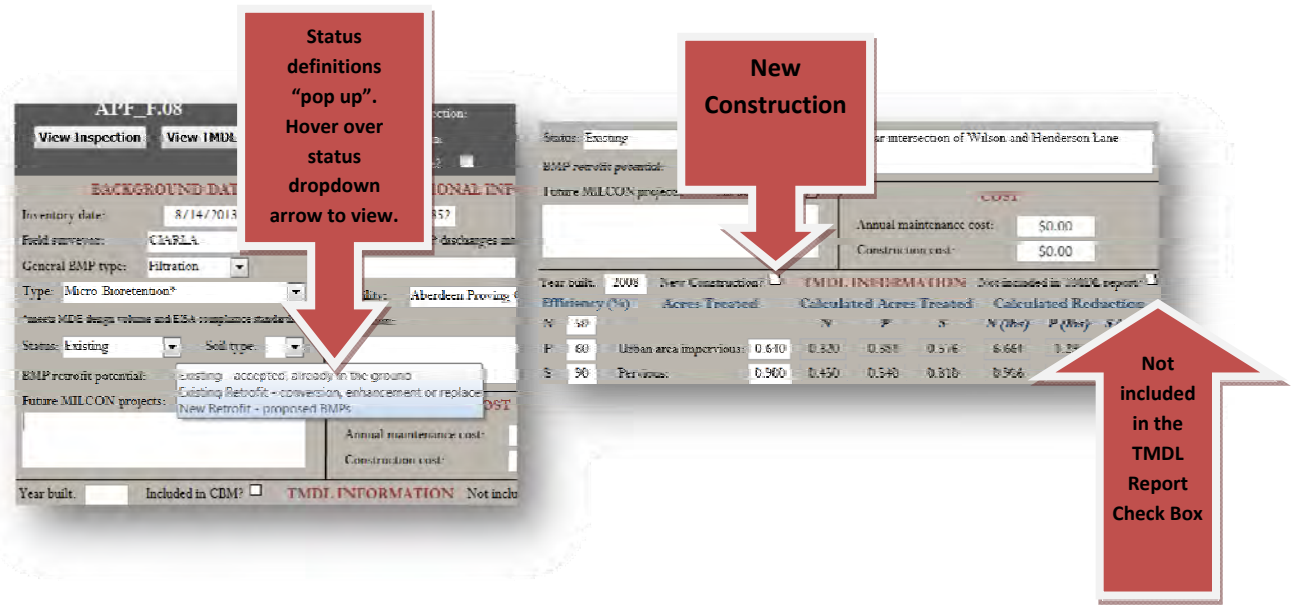
3.1.1 BACKGROUND DATA FOR "NON-BASIN" BMPS:

Field Name	Data Entered
Inventory Date	Date inventory created
Field Surveyor	Name of field surveyor
General BMP Type	Select from Dropdown
Type	Specific "Type" of BMP
Status	Select from Dropdown
Soil Type	Select from Dropdown (dominant soil type of drainage area).
As-built Plans?	Are as-builts available to upload to this database?
Future MILCON projects	Are future MILCON projects planned for area?



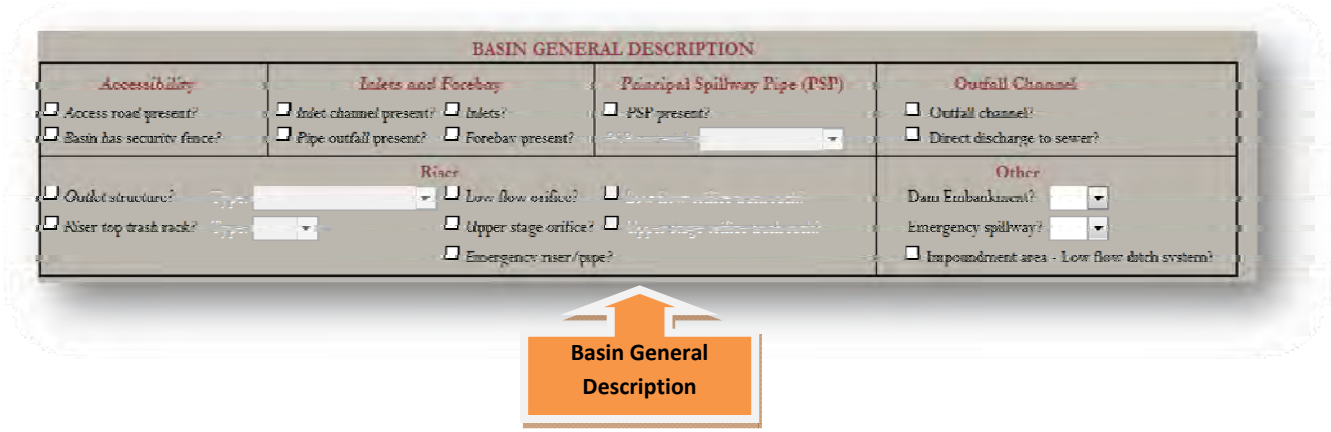
Status Dropdown:

- **Status = "Existing":**
  - The "Existing" designation is for BMPs already in the ground at the time of this report and have been incorporated into the baseline calculation of the TMDL form.
  - For Virginia, "Existing" BMPs constructed before 2009 is included in the baseline load calculation (as per VADEQ TMDL guidance, 2009 is used because the loading rates are based on the 2009 CBM run).
  - For Virginia, "Existing" BMPs constructed after 2009 will count towards TMDL L2 reductions. BMPs that fit the post-2009 criteria will count towards the "VADEQ Current %" section on the TMDL form. The ultimate TMDL % goal to be achieved for Pervious and Impervious is shown under "Reduction Goal 2024%" in the TMDL form.
- **Status = "Existing Retrofit and New Retrofit":**
  - The purpose of this designation is to show the effect of proposed BMPs to the L2 reduction goals.
  - When the "Existing Retrofit" or "New Retrofit" designation is selected for a BMP, the reduction only counts towards the "VADEQ Proposed %".
  - Does not apply to the baseline load calculations in the TMDL Form, in order to disable proposed BMPs to the baseline loading calculations, the user must check the "Not included in the TMDL report box (see figure below for location).
  - **Status = "Existing" and "New Construction" Tab:** When "Existing" status is selected and the "New Construction" check box (see figure below) is checked in the TMDL section of the inventory, the reductions from the BMP count towards the ***"VADEQ Current %" instead of "VADEQ Proposed %"***. This is used when you include new BMPs that weren't part of the original BMP inventory.



3.1.2 General Data for "Basin" BMPs:

When a Basin is selected for a BMP, additional data is required because "Basins" typically have numerous structural components in comparison to other BMPs. The "Basin General Description" fields only show up when Basin is selected, this section will not show up for all other BMPs under "General BMP Type".

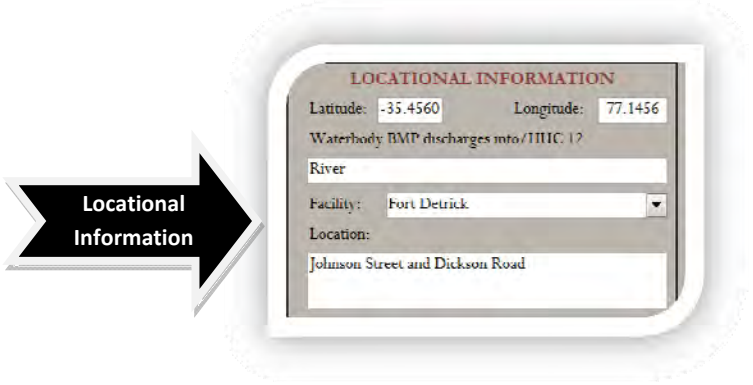


	Data Entered
Accessibility	Check appropriate box if necessary
Inlets and Forebays	Check appropriate boxes. If inlet is selected, additional fields will appear below that require more specific information for the individual inlet.
Principal Spillway Pipe (PSP)	Does PSP exist? List material from dropdown
Outfall Channel	Does a channel extend from BMP or does it discharge directly into sewer/stream (checkbox).
Riser	Fill out appropriate information about Riser. Additional fields will appear for fields that require more information.
Other	Does the Basin have a dam embankment, emergency spillway, impoundment area?

3.1.3 Locational and Cost Information:

It is also important to correctly input the locational section of the inventory sheet with the GPS position coordinates, the watershed discharged into, and the location. The "Cost" information is optional for existing BMPs more than a year old but should be populated if the BMP was constructed in the previous year or is a proposed BMP. The cost information will help the user with various reporting requirements including TMDL milestone reporting.

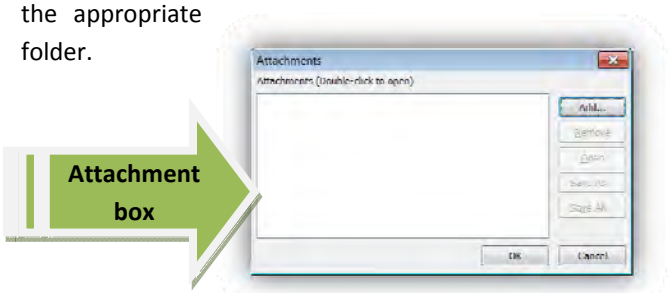
Field Name	Data Entered
Latitude/Longitude	Enter lat/long. Next to SWM ID, this field is the most important in order to spatially reference to be used in other software (GIS or CAD)
Waterbody BMP Discharges into/HUC 12	Populate with name of HUC 12 waterbody and HUC 12 Code
Facility	Name of facility or installation
Location	Any other information to help locate BMP (Road intersection, building #, etc.)
Annual Maintenance Cost	If available, what is the cost to maintain BMP per year?
Construction Cost	If available, what was cost of construction?

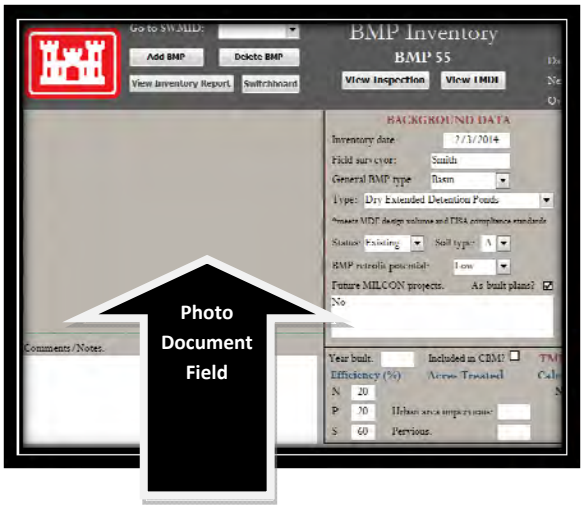


3.1.4 Adding Photo or other Documents:

Photos and documents can be imbedded into the database by clicking inside the box indicated in adjacent figure.

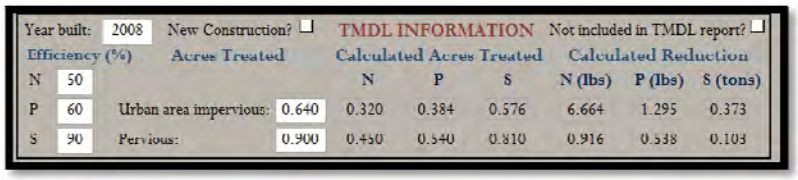
Once clicked, an attachment management box will appear as shown below. Add data by clicking "Add" and find the file in the appropriate folder.





3.1.5 TMDL INFORMATION:

The TMDL information section shown below should be filled out in order to calculate the affect of the individual BMPs with regards to WLAs (Wasteload Allocations) or special conditions within a stormwater permit (such as an MS4 permit). The table below will explain each field of the "TMDL Information" section.



Field Name	Data Entered
Year Built	Year BMP was constructed; if proposed, enter the projected year to be constructed.
Included in CBM?	Optional checkbox field; if the BMP was included in the latest Chesapeake Bay Model run, please indicate.
Not included in TMDL report	Check this box if you don't want to include the BMP in the TMDL form calculations for the facility. This checkbox option is mainly to remove BMPs from the TMDL Baseline Loads calculations on the TMDL Form. This is usually used for BMPs that are structurally damaged limiting the efficiencies, BMPs that are not recognized as water quality BMPs by the regulating entity, and ***proposed BMPs***.
Efficiency %	This field will automatically be populated once a BMP is selected but can be adjusted based on inspection results. VADEQ efficiencies were pre-loaded for nitrogen, phosphorus and sediment. The efficiency in combination with the acres treated and the load per acre field in the TMDL form are used to calculate the "Calculated Acres Treated" and "Calculated Reduction" fields.
Acres Treated	Use the drainage area and landuse to populate the impervious acres treated (i.e. rooftop, pavement, compacted stone, etc.) and pervious acres treated (i.e. grass, mulch areas). The values entered in these fields are the most important segment in calculating TMDL reductions.
Calculated Acres Treated	These values are not entered, they are a result of the efficiency and acres treated fields. These values are ultimately tabulated in the overall installation TMDL form to show aggregate results towards TMDL related requirements.
Calculated Reduction	These values are not entered, they are a result of the efficiency, acres treated, and load per acre (from TMDL form) values. These values are ultimately tabulated in the overall installation TMDL form to show aggregate results towards TMDL related requirements. The "Calculated Reduction" is different than the "Calculated Acres Treated" because the results of the equation show the reduction in quantity not area.

3.1.6 Other Inventory Functions:

The fields located at the top of the inventory form shown below are used to navigate between forms, delete existing BMP entry, and view inspection date information. The table below describes each field.

3.1.7 Inventory Summary:

The inventory form of the database is used to document all BMPs with information that can be used for multiple purposes. Once the BMP is entered into the inventory, all associated inspection and maintenance actions can be archived for the individual BMP to view progress. The inventory form can also be used in combination with the TMDL form to meet TMDL regulatory requirements by giving the user the option of inputting proposed TMDLs to estimate if the required TMDL reductions can be achieved. TMDL milestone progress can be presented to the regulatory entity using the data from the inventory in combination with the TMDL form through various reports located on the switchboard of this database.

Field Name	Data Entered
"Add BMP" and "Delete BMP"	The "Add BMP" button is used to add a BMP to the database. The "Delete BMP" button is used to delete the BMP from the database (this action will delete all associated inspections as well).
"View Inventory Report" and "Switchboard"	Click this button to view the individual BMP report. Use the "Switchboard" button to navigate back to the switchboard.
"View Inspection" and "View TMDL"	Click on the "View Inspection" button to create an existing inspection, view a current inspection or add an inspection as part of an annual inspection program. Click on "View TMDL" button to navigate to the TMDL form where the overall facility TMDL information can be viewed.
Imagery Links	Use the Google Maps and Bing Maps links to view the aerial photos of the BMP. The latitude and longitude field need to be populated in order for this function to work.
Inspection Date Fields	These fields show the "Date of the most recent inspection" and "Next scheduled inspection". The next scheduled inspection is based on a yearly annual inspection which is the default but can be adjusted to meet specific facility inspection program criteria. Use the "Override Inspection Date" checkbox to manually adjust inspection date from the default value.

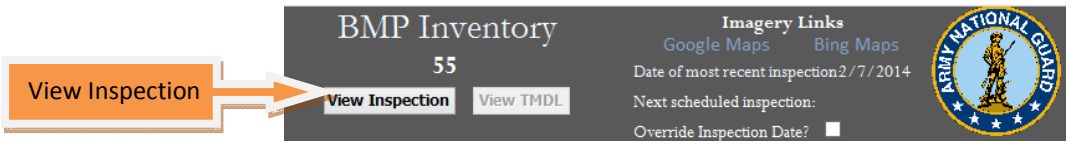
4.0 INSPECTION FORM

4.1 INSPECTION FORM

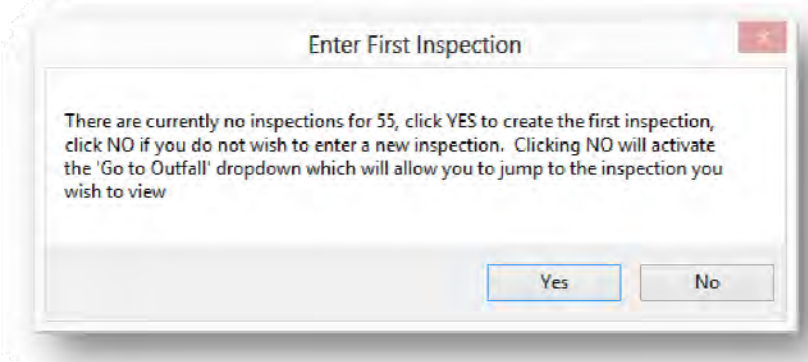
The inspection form is used to evaluate the condition of the individual BMP at a given point in time. The inspection form is linked to the established BMPs unique ID (SWM ID) which was given during the initial inventory of the BMP (you must create a BMP inventory before you conduct an inspection). The inspection form also includes a maintenance section that will be discussed later in this section.

4.1.1 CREATING A BMP INSPECTION:

From the inventory form the user will click the inspection button which will take them to the inspection form.



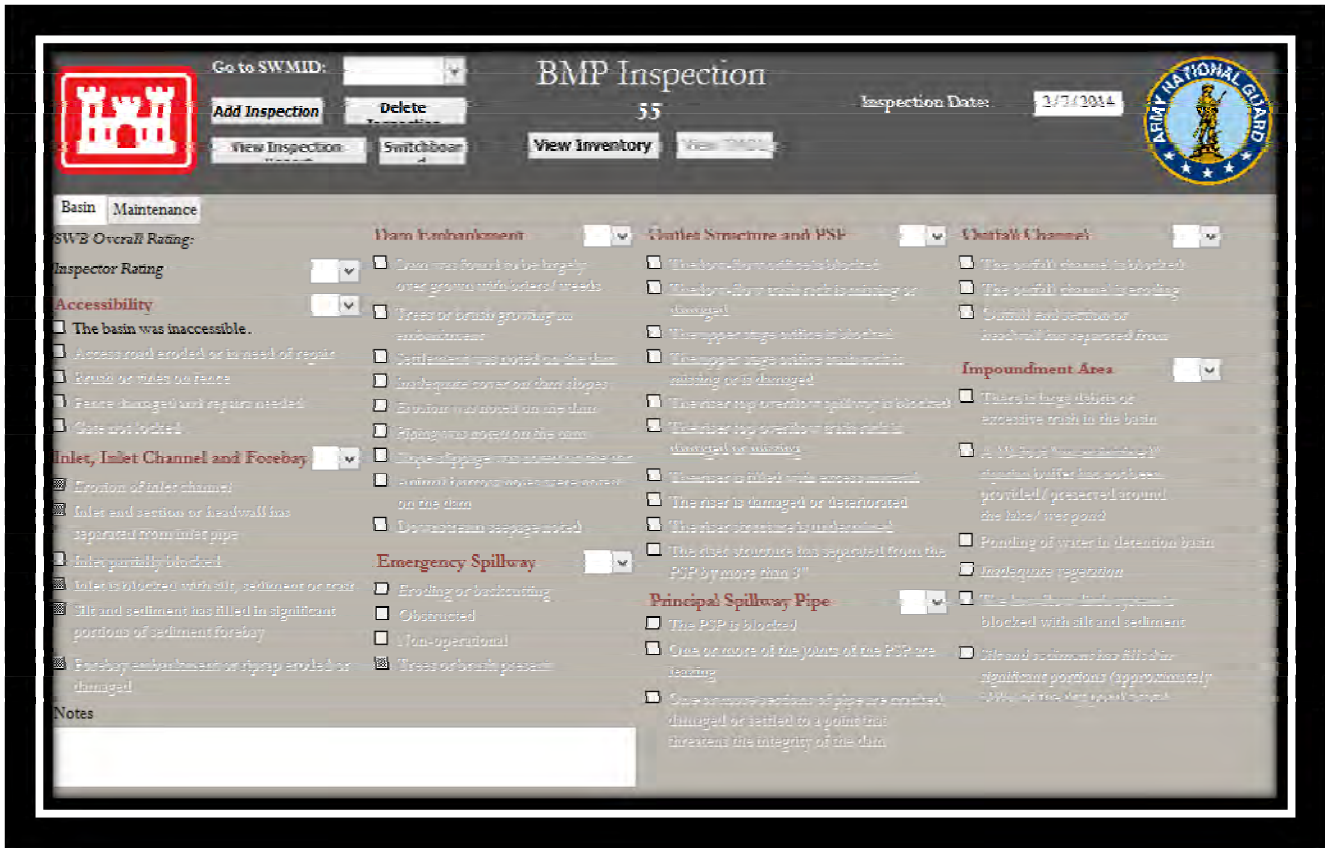
If this is the initial inspection, the box shown to right will appear and the user will click "yes".



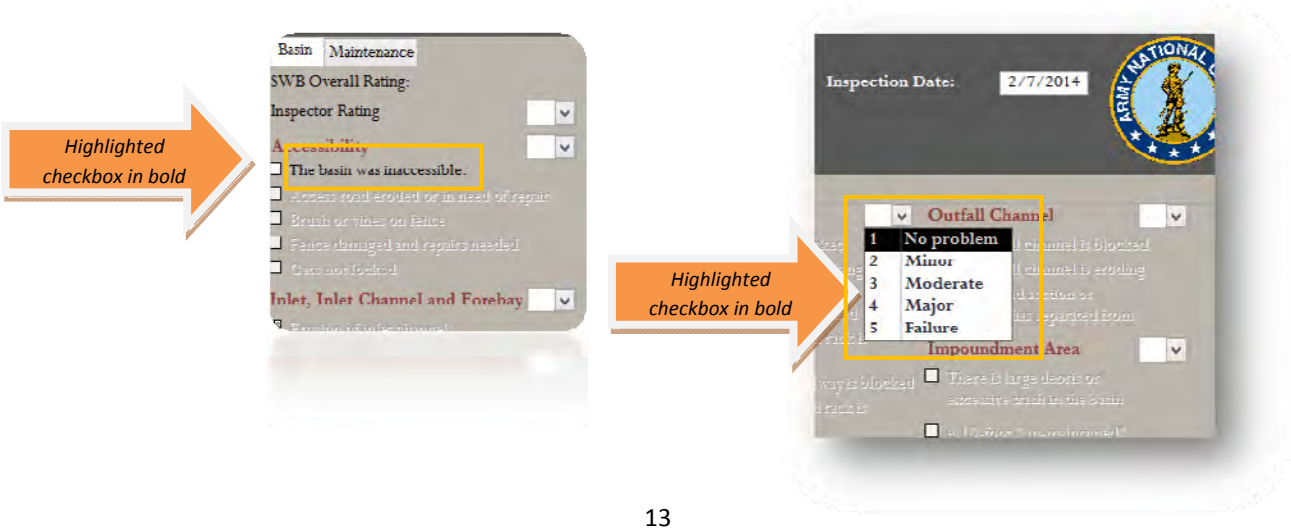
Once the user clicks yes, the database will prompt you to populate the "Inspection Date". You cannot start an inspection until you populate a date.

4.1.2 Conducting an Inspection:

Once the inspection date has been entered, the user will fill out the form shown below. BMP inspectors will need to be qualified to conduct the inspection, as the inspection categories below are standard. The fields change based on the BMP selected in the inventory.

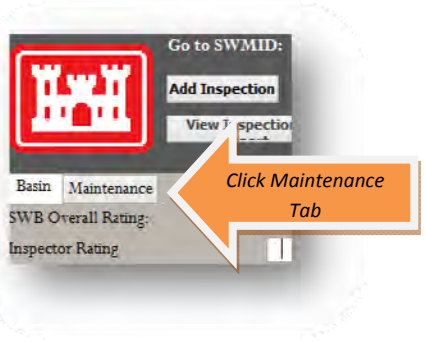


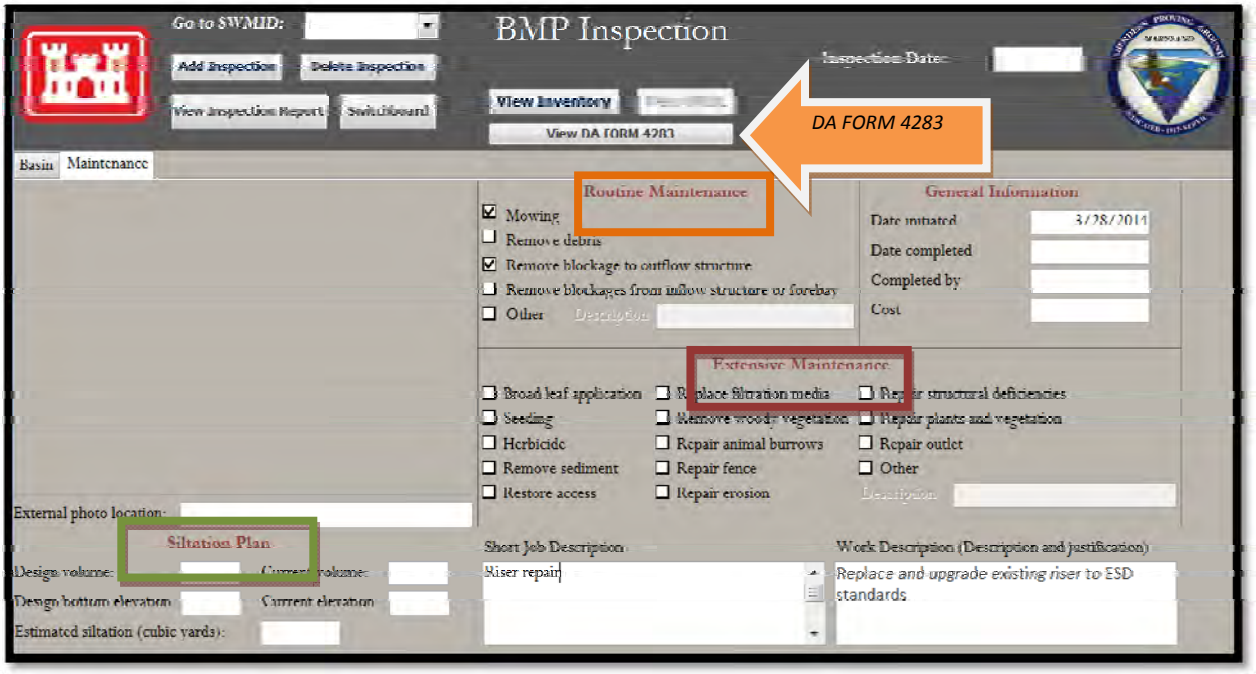
The checkbox's that require data are highlighted based on what is selected on the inventory form, all other inspection fields are grayed out. Each inspection section has a rating dropdown of 1-5, qualified inspectors will determine the rating of the inspection category based on field inspection.



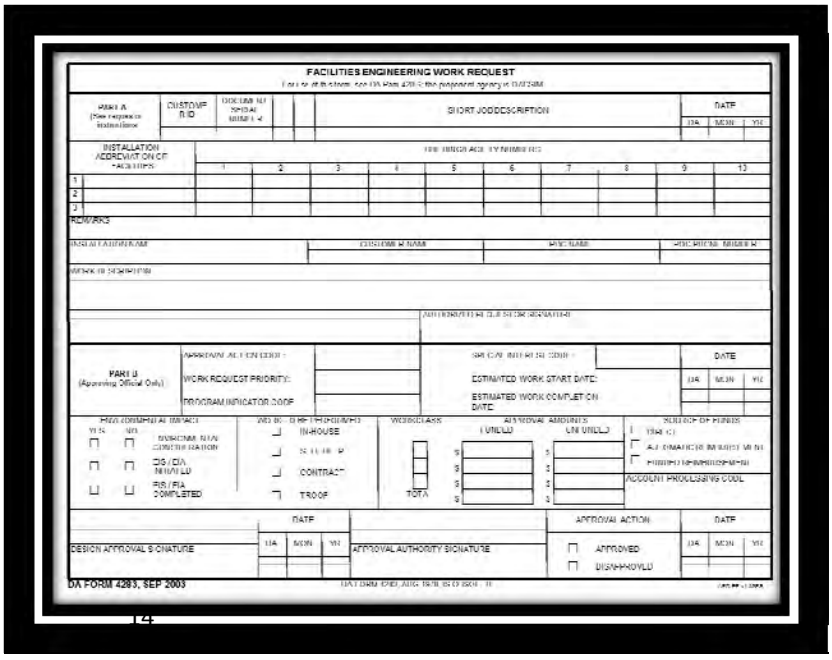
4.1.3 MAINTENANCE SECTION:

If maintenance is required on the BMP based off the inspection or possibly as part of a routine maintenance plan, then click on the maintenance tab shown in the adjacent figure. Once the maintenance tab has been selected you have the option to fill out multiple sections such as "Routine Maintenance", "Extensive Maintenance" and "Siltation Plan" (see figure below). A report can be produced for the maintenance section for maintenance crews or funding request using a replicated version of the ***"FACILITIES ENGINEERS WORK REQUEST"*** form **(DA FORM 4283).**





DA FORM 4283



- **SILTATION PLAN**

If the BMP has a specific siltation plan associated with the original design specs, annual information regarding depth and volume can be documented in this section. This section can be used to monitor siltation over time.

- **ROUTINE MAINTENANCE**

This section can be used to document routine maintenance for specific BMPs. The categories shown in the current "Routine Maintenance" section are typical for stormwater basins and may not apply to other Low Impact Development (LID) BMPs. Use the comments section to add specific maintenance tasks if needed. The user can also input cost of the routine maintenance in order to track total annual cost for documentation and annual funding request.

- **EXTENSIVE MAINTENANCE**

This section can be used when major structural issues are found with the BMP. The categories shown in the current section are typical; all other extensive maintenance issues can be documented in the comments section.

- **GENERAL INFORMATION**

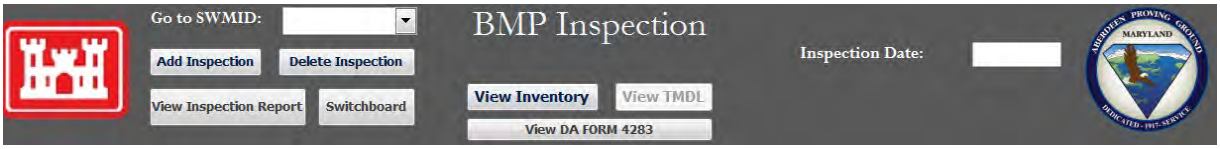
If repairs or routine maintenance are required based on the inspection or scheduled maintenance, the "***date initiated***" will need to be populated. The other information can be updated after the BMP repair has been made.

- **DA FORM 4283**

When a work request is required based on a BMP repair or routine maintenance as a result from an inspection, Click the "View DA FORM 4283" button to show a replicated version of the official form. This form is automatically populated from input information in the maintenance section. The date initiated, job description, and work description automatically populate some of the fields. All other fields are project specific and require manual input before being sent to approving official.

4.1.4 Other Inventory Functions:

The fields located at the top of the inspection form shown below are used to navigate between forms, delete existing BMP entry, and view inspection date information. These fields are explained in section 3.1.6.



4.1.5 Inspection Summary:

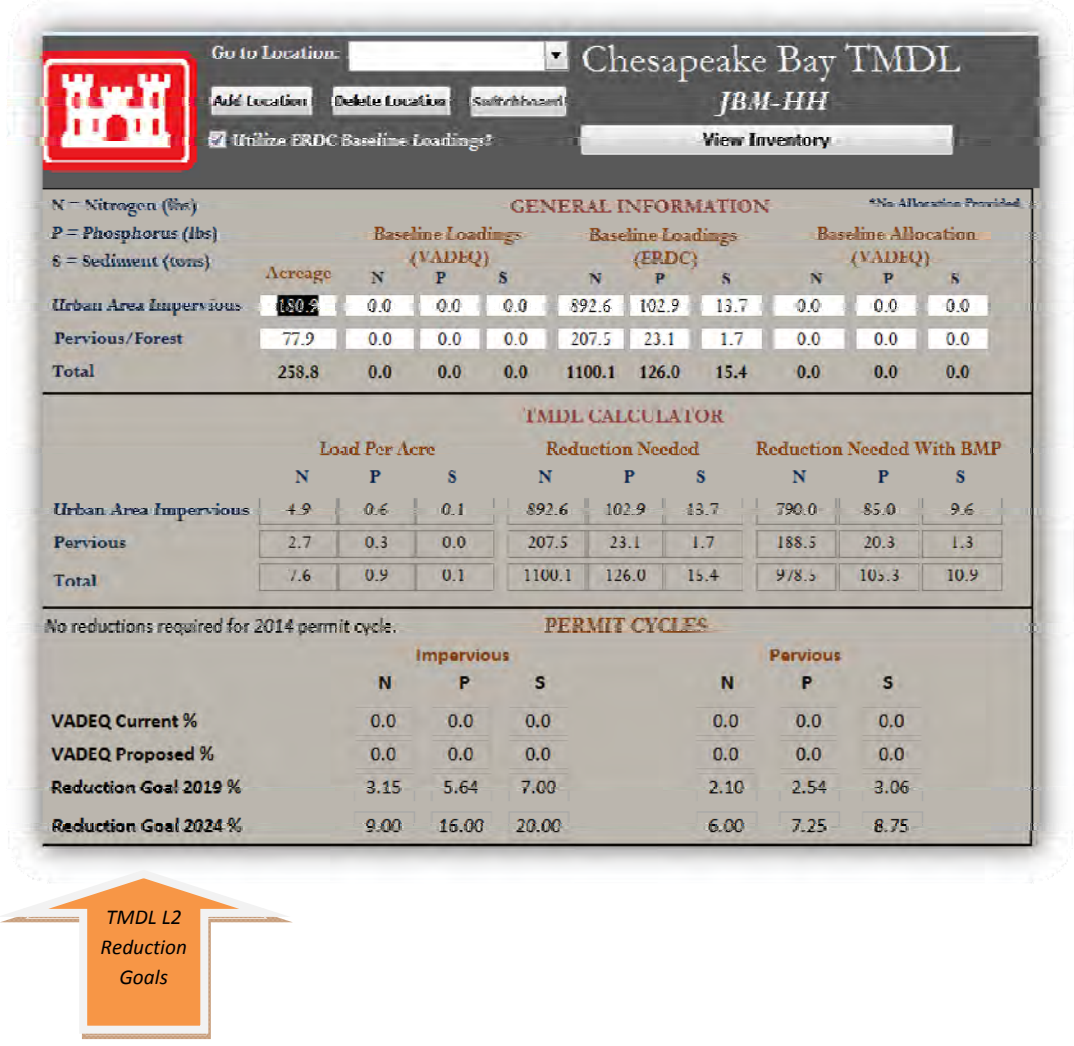
The inspection of the database is used to archive all inspections for each BMP. Much of the new MS4 permits that are written require inspection records. The inspection form can produce a report for the individual inspection, historic report of all inspection of a particular BMP or a list of the latest inspection dates for all the BMPs. The user can use the maintenance section to document all repairs and routine maintenance for the BMP. The overall inspection report for the entire installation can be found on the switchboard of the database under "reports".

5.0 TMDL FORM

5.1 TMDL FORM

The TMDL form is used to track progress towards specific TMDL goals for a given installation. The TMDL form for Virginia (VA) installations is specific to VA TMDL implementation set by the Virginia Department of Environmental Quality (VADEQ). VADEQ has incorporated the TMDL requirements into the new MS4 permit and most VA installations fall under the VA MS4 general permit based on certain criteria.

VADEQ is requiring each installation to reduce pollutant loads by certain percentages (referenced under "Reduction Goal 2019 and 2024") called L2 reductions, which are based on 2009 baseline modeling results. The reduction goals are divided into MS4 permit cycles but the end % goal for pervious and impervious is shown in "Reduction Goal 2024%".



Go to Location:

Add Location | Delete Location | Switchboard

Utilize ERDC Baseline Loadings?

Chesapeake Bay TMDL

JBM-HH

View Inventory

N = Nitrogen (lbs)
P = Phosphorus (lbs)
S = Sediment (tons)

GENERAL INFORMATION

*No Allocation Provided

	Acreage	Baseline Loadings (VADEQ) N	P	S	Baseline Loadings (ERDC) N	P	S	Baseline Allocation (VADEQ) N	P	S
Urban Area Impervious	180.9	0.0	0.0	0.0	892.6	102.9	13.7	0.0	0.0	0.0
Pervious/Forest	77.9	0.0	0.0	0.0	207.5	23.1	1.7	0.0	0.0	0.0
Total	258.8	0.0	0.0	0.0	1100.1	126.0	15.4	0.0	0.0	0.0

TMDL CALCULATOR

	Load Per Acre N	P	S	Reduction Needed N	P	S	Reduction Needed With BMP N	P	S
Urban Area Impervious	4.9	0.6	0.1	892.6	102.9	13.7	790.0	85.0	9.6
Pervious	2.7	0.3	0.0	207.5	23.1	1.7	188.5	20.3	1.3
Total	7.6	0.9	0.1	1100.1	126.0	15.4	978.5	105.3	10.9

No reductions required for 2014 permit cycle.

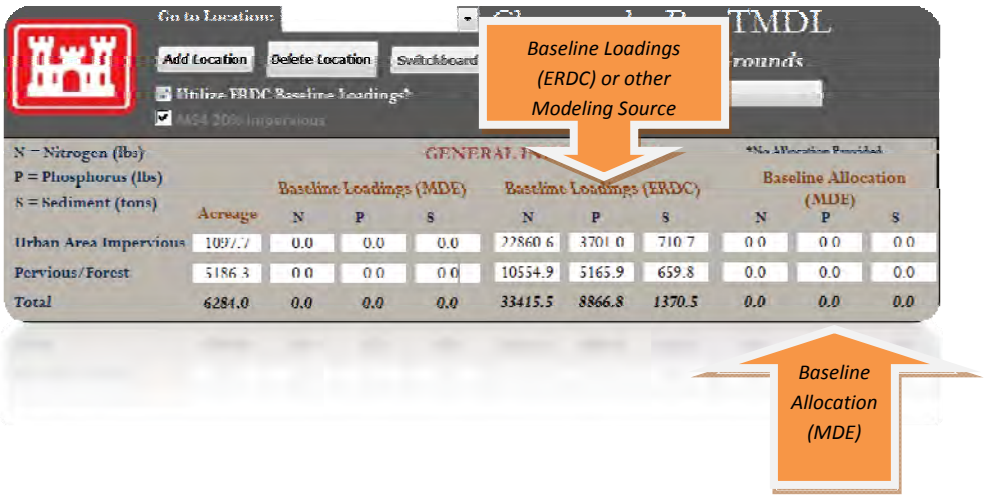
PERMIT CYCLES

	Impervious N	P	S	Pervious N	P	S
VADEQ Current %	0.0	0.0	0.0	0.0	0.0	0.0
VADEQ Proposed %	0.0	0.0	0.0	0.0	0.0	0.0
Reduction Goal 2019 %	3.15	5.64	7.00	2.10	2.54	3.06
Reduction Goal 2024 %	9.00	16.00	20.00	6.00	7.25	8.75

TMDL L2 Reduction Goals

5.1.1 Getting Started:

Calculation shown as the two checkbox's in the adjacent figure. Select the "Utilize ERDC Baseline Loadings" if you want to compare TMDL "Baseline Allocations" from the regulatory body to "Baseline Loadings" from another modeling source. If this box is not checked the resulting "TMDL Calculation" will come directly from the "Baseline Loadings (VADEQ)". See figure below for locations of above mentioned sections.

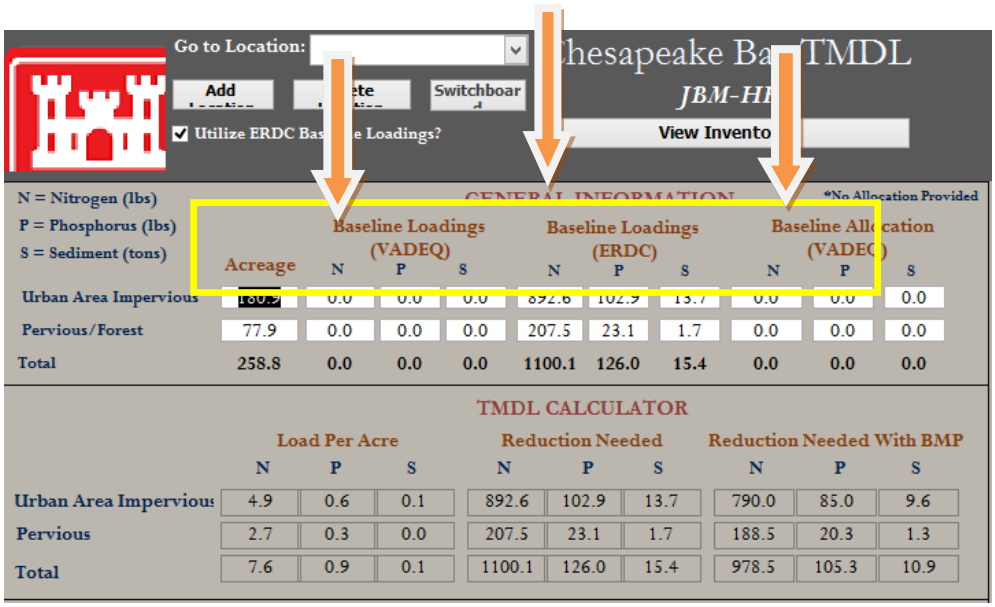


After the appropriate checkbox has been selected, the most important input data field is the impervious and pervious acreages. This data will likely be calculated already but may need to be updated due to new construction or land purchase. This data is typically calculated spatially in GIS. If this data is not populated, no calculations can be made regarding the TMDL.

5.1.2 Modeling Data Input:

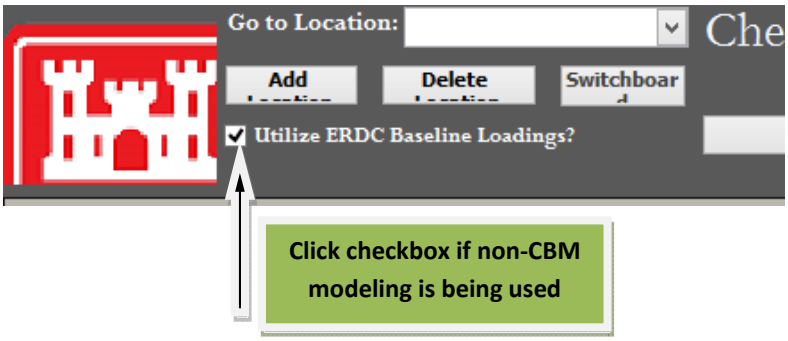
Once the impervious and pervious acreages have been populated the modeling data can be populated (if needed). For Virginia installations, the focus of the MS4 permit is to meet the L2 reductions outlined in the VADEQ TMDL Action Plan Guidance (this will be discussed later in this section). The modeling section has 3 types of entry sections. The first is for VADEQ Loadings which is where you want to enter the baseline loading results using a combination of impervious and pervious surface areas along with loadings rates established by the VADEQ TMDL guidance. The VADEQ Loadings section is the only data that is used in the L2 % reductions section (this section will be discussed in the next section). The second modeling field section is for outside or independent modeling data, this is for comparison purposes and reductions using this data can be shown in the TMDL section below the baseline loading section (Both VADEQ and the Independent modeling can

use the TMDL calculator by simply checking the "Utilize ERDC Baseline Loadings" which activates the independent modeling and when this checkbox is not checked it will automatically default to the VADEQ modeling data. The third modeling section is the "Baseline Allocation" section and this is populated by the user and can be used if the facility is located outside an MS4 area and TMDL reductions are required with specific allocation goals.

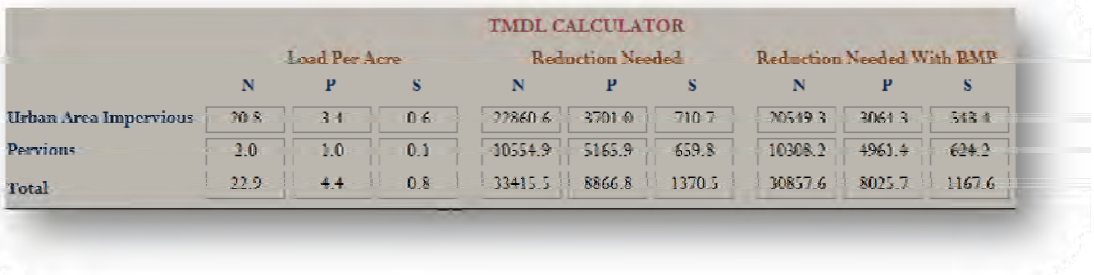


5.1.3 TMDL Calculation:

Once the modeling data has been populated in the above section along with the installation impervious and pervious acreage breakdown, the user must select which modeling results are to be used in the TMDL calculation. Simply select the "Utilize "model x" Baseline Loadings?" if you do not want to use the CBM (which is the default).



Once the appropriate modeling has been selected all the calculations results will be shown in the "TMDL CALCULATION" tables. All formulas are hidden and everything is based what is in the BMP inventory. It is unclear what BMPs were originally included in the Chesapeake Bay Model, but it does appear most individual BMPs were not incorporated for many federal installations so it was assumed that any BMP built after 2002 would be credited towards the nutrient load reduction. The table below breaks down each

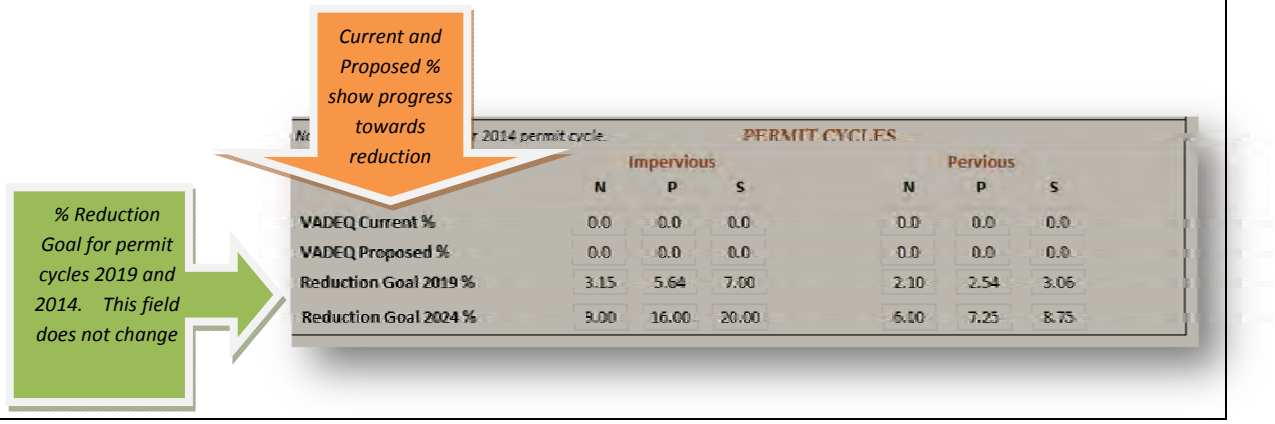


sub-section of the TMDL calculation. Remember, this information cannot be edited, the numeric values shown in the fields is the resultant of a background calculation between the modeling results, acres treated, and BMPs from the inventory.

Sub-Section Name	Explanation
Load per Acre	Depending on what baseline modeling results used (either the regulator or independent modeling), those values are divided by the total acres of impervious and pervious giving a "Load per Acre". This value is used as a multiplier for all BMP efficiency calculations. These fields are for information purposes only and are used in background calculations.
Reduction Needed	This is simply the difference between the baseline modeling and the allocation (if given). The resultant value is the quantity of a given nutrient that needs to be reduced to meet the allocation.
Reduction Needed with BMPs	This is the same calculation as "Reduction Needed" accept that it takes into account qualified BMPs. If BMPs exist that were not accounted for in the CBM, then the value should be lower than the "Reduction Needed" value because the BMPs reduce the nutrient contribution. It's possible that this value is negative if extensive treatment was implemented, in which case nothing would need to be done.

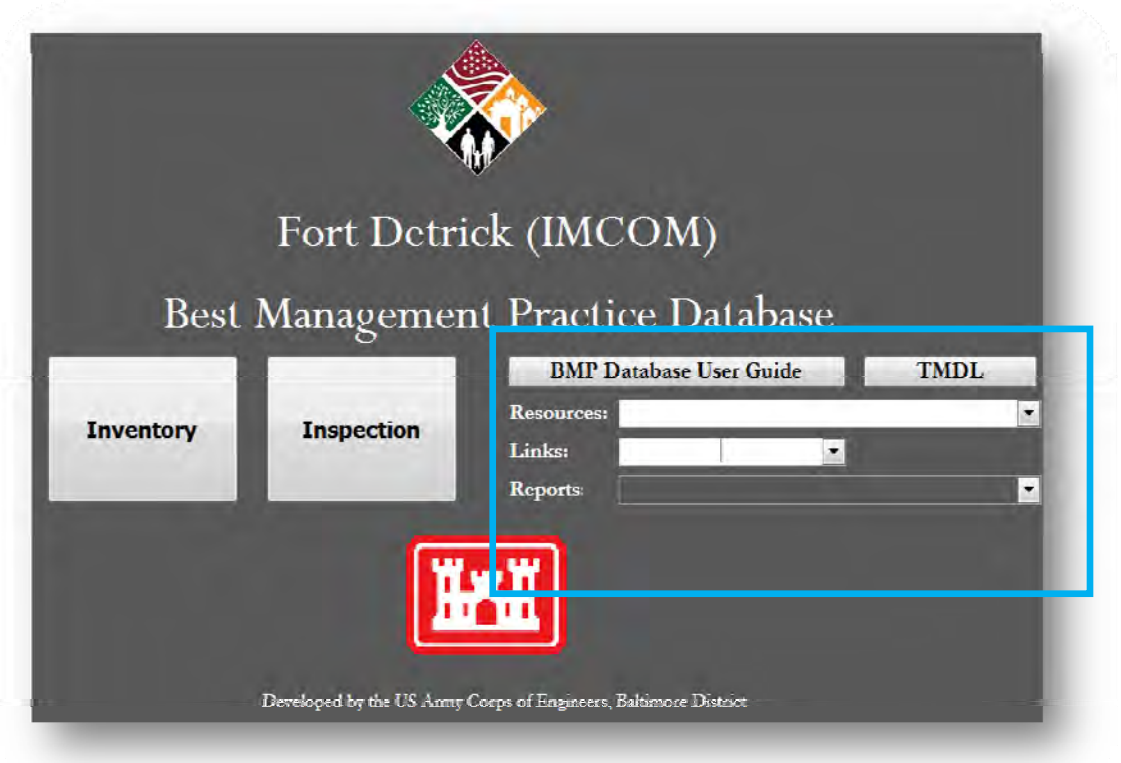
5.1.4 VADEQ TMDL ACTION PLAN L2 % REDUCTION:

The VADEQ "TMDL Action Plan Guidance" should be used to estimate the baseline loads that will need to be put into the "Baseline Loading" section below for VADEQ. Once the baseline loadings have been established the database will calculate any changes that occur towards the L2 reductions outlined in VADEQ guidance document. When BMPs are entered in the inventory and dependent on the phase (proposed, existing etc..), the BMP efficiencies and acres treated will be calculated towards the % reduction required towards the L2 reductions. This will help track progress towards those reductions. The L2 % reductions are based on permit cycles starting in 2014 (no % reduction required for 2014, only action plan to outline strategy to meet overall L2 reductions. The 2019 and 2024 permit cycles are based on the 5-year MS4 permit cycle (all percentages taken from the TMDL Action Plan Guidance).



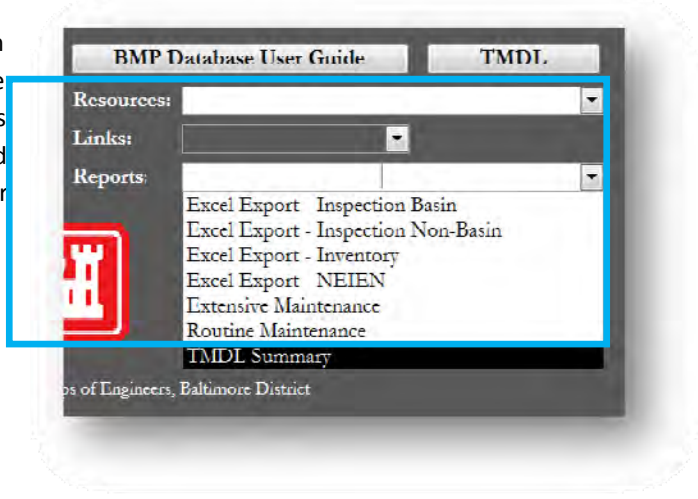
6.0 REPORTS AND RESOURCES

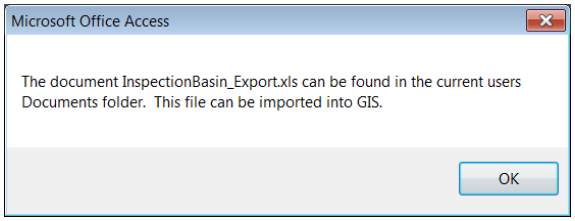
All reports and TMDL related resources can be found on the Switchboard. In addition, the "Links" dropdown has a link to the Low Impact Development (LID) user guide. This tutorial can also be accessed on the switchboard by clicking on the "BMP Database User Guide" button. All reports, resources, and links will be explained in more detail in this section.



6.1 REPORTS

Use the reports dropdown (see figure below) on the switchboard to create specific reports. The table below will explain each report. The reports that are Excel exports are automatically exported to the documents folder and when a particular report is selected the pop-up below will appear.

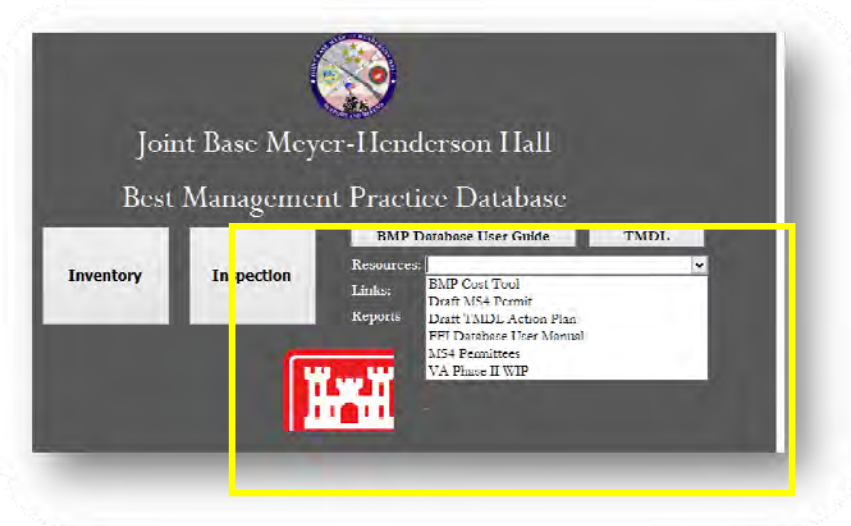




Report Name	Explanation
Inspection Basin	List of latest inspection for all “Basin” BMPs. This can be used if inspection reporting is required through the MS4 permit.
Inspection Non-Basin	List of latest inspection for all “non-basin” BMPs. This can be used if inspection reporting is required through the MS4 permit.
Inventory	List of the Inventory of all BMPs collectively.
NEIEN	The National Environmental Information Exchange Network (NEIEN) is a database run by EPA that collects various types of data including BMP information. EPA requires States in the Chesapeake Bay Watershed to report BMPs with some basic information. Each State may choose to add additional information fields to help other reporting requirements outside the NEIEN. The report output for the BMP database has been customized to match each states NEIEN report.
Extensive Maintenance	All BMPs that have extensive maintenance associated with the most recent inspection. The information will only show up if boxes are checked in the maintenance section.
Routine Maintenance	All BMPs that have routine maintenance associated with the most recent inspection. The information will only show up if boxes are checked in the maintenance section.
TMDL Summary	Summary Report of all the TMDL data shown on the TMDL Form.

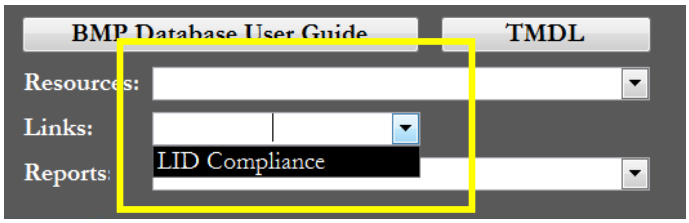
6.2 RESOURCES

The data in the “Resources” dropdown is imbedded in the database unlike the links. Most of the resources are State specific guidance. The table below explains each resource.



Report Name	Explanation
BMP Cost Tool	USACE BMP Cost Tool. Can be used to estimate cost of future BMPs
VA Phase II MS4 Permit	MS4 Permit Document
VADEQ TMDL Action Plan Guidance	Guidance for state and federal jurisdictions to meet State TMDL goals within the MS4 permit.
FFI Database User Manual	The Federal Funding Inventory (FFI) is used to centrally identify what activities have been done using federal funds in a given Fiscal Year. This information is usually requested through HQ level command and then dispersed to installation level. This User Manual goes along with the database (see links dropdown on switchboard) which is required to be populated annually.
MS4 PERMITTES	General Information on Phase II MS4 Permit Holders
VA Phase II WIP	Watershed Implementation Plan (WIP) for State Chesapeake Bay TMDL Allocations

6.3 LINKS



The "Links" dropdown has a hyperlink to the LID Compliance website. The LID Compliance website needs to be referenced for new construction in order to meet Federal EISA requirements. In most cases, when EISA requirements are met, EPA and State requirements are met (although any State design manual should still be referenced since they are the regulators).

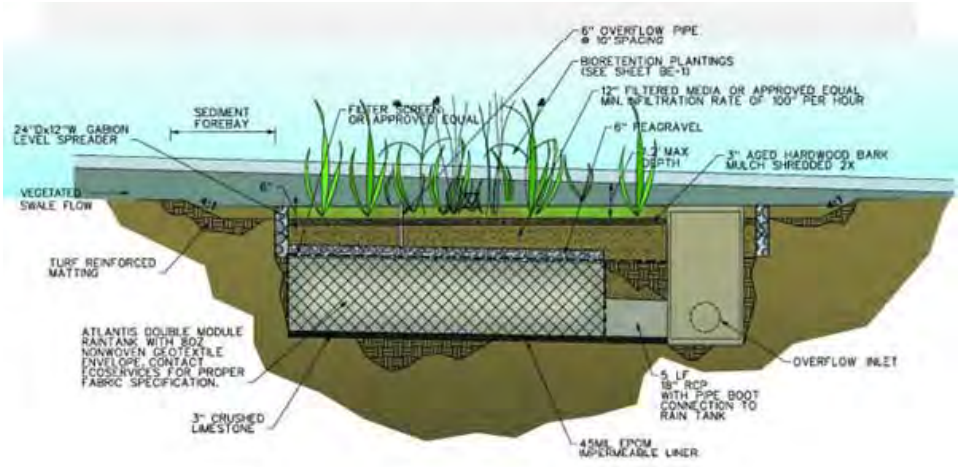
6.4 REPORTS AND RESOURCES SUMMARY

When reports are required either Federal or State, reference the switchboard dropdowns and look for the appropriate report. When designing BMPs for new development or to help meet TDML requirements, all the necessary State and Federal design criteria and guidance can be found under one of the dropdown menus.

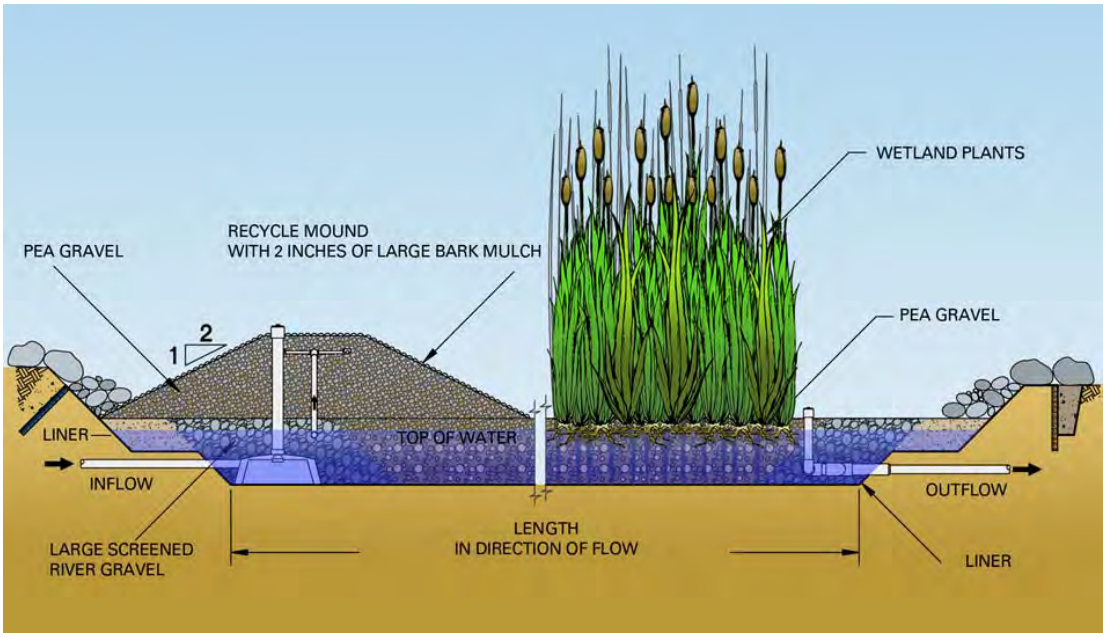
7.0 GENERAL BMP DEFINITION LIST

7.1 FILTRATION:

Bioretention: Bioretention is a flat-bottomed, shallow landscaped depression or basin used to collect and hold stormwater runoff, allowing pollutants to settle and filter out as the water infiltrates into the ground or to an underdrain, depending on soil conditions. Stormwater runoff enters the basin, where it temporarily ponds within the shallow depression and subsequently filters down through the various layers in the bioretention area.



Constructed Wetlands: Constructed wetlands are shallow marsh systems planted with emergent vegetation to treat stormwater runoff.



Filter Strips: Filter strips, or vegetated filter strips, are densely vegetated strips of gently sloping area that receives runoff from an adjacent impervious area as sheet flow. This filter strip slows the velocity of the runoff and allows for removal of sediment and other pollutants as the runoff flows through the filter strip.

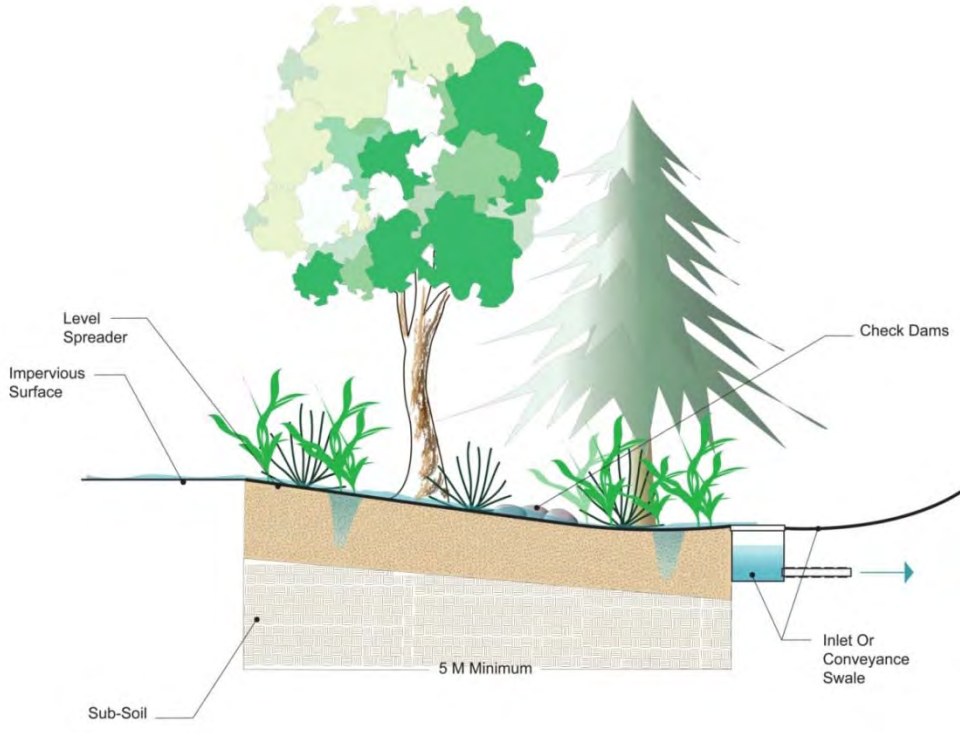
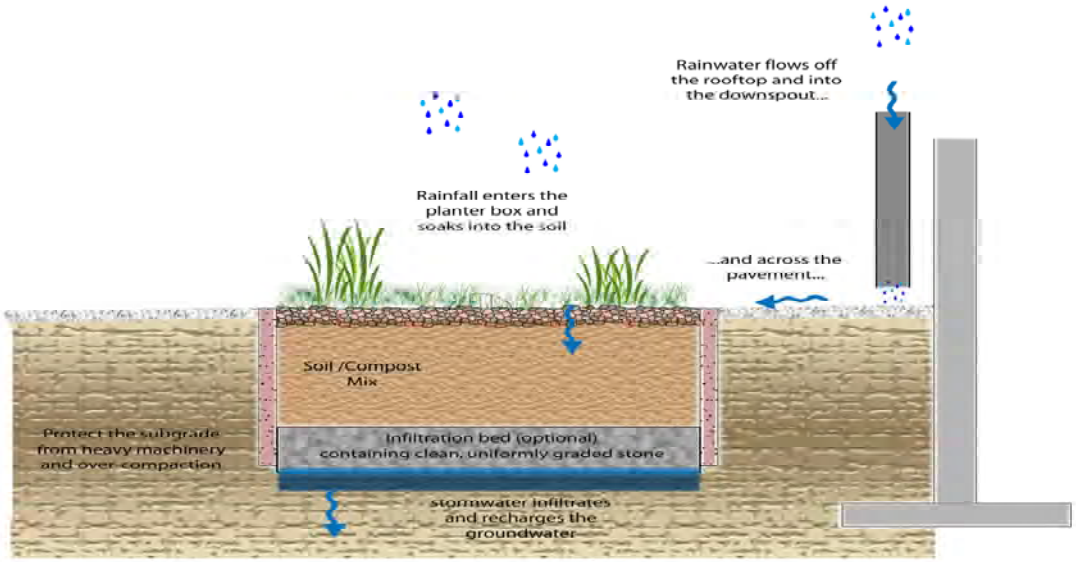


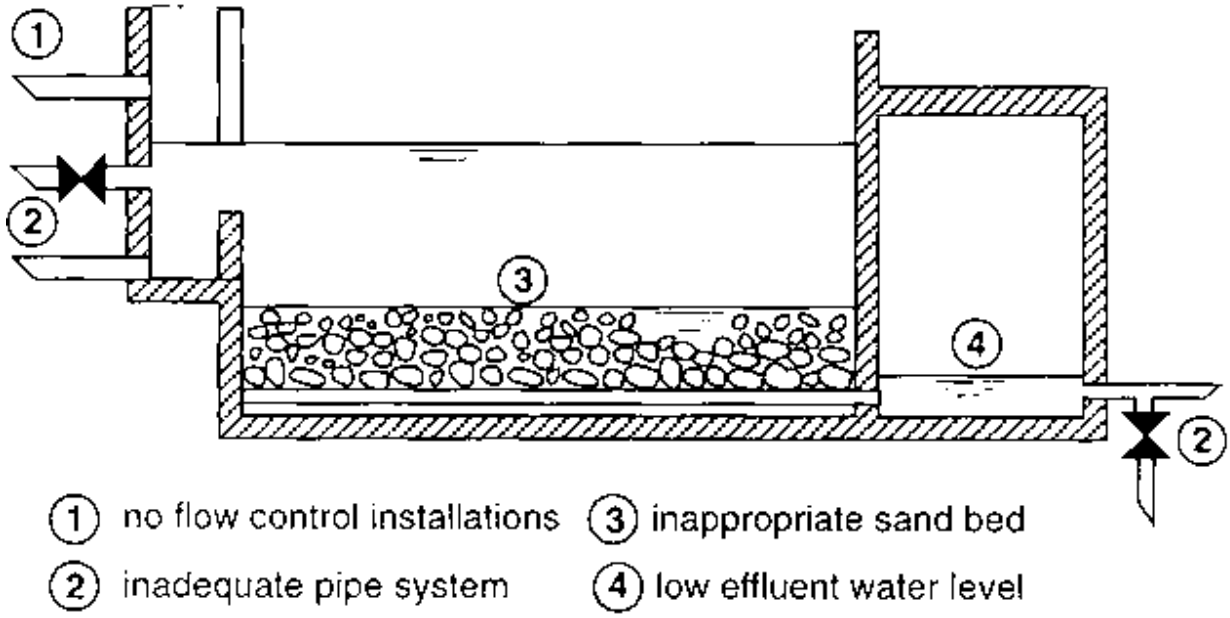
Figure 2-10
Vegetated Filter Strip
(Source: Landmark Design Group)

Green Alley: A green alley is an alley in which water is allowed to infiltrate into the soils through permeable pavement or infiltration basins, instead of being directed into a sewer system.

Planter Box: A planter box is a constructed box with vegetation designed to receive runoff from rooftops and filtrates the stormwater runoff.

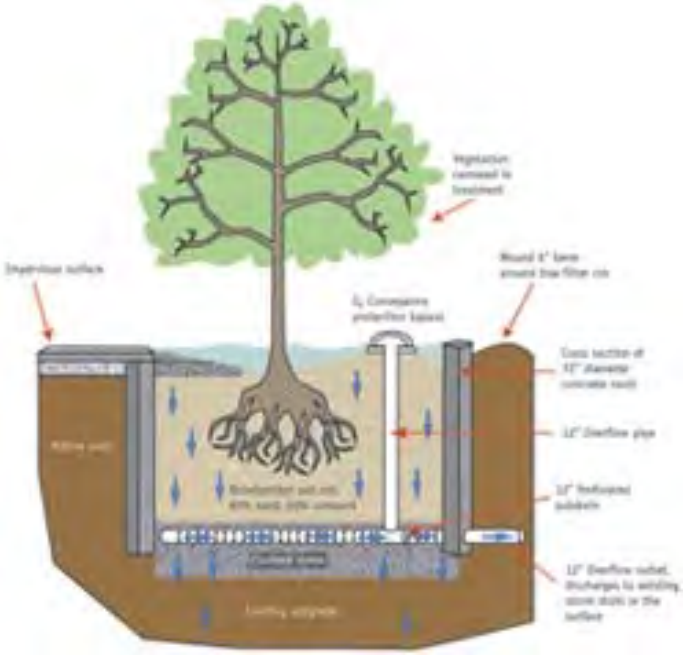


Sand Filter: A sand filter is a device used to filter stormwater through a layer of sand to an underdrain system that conveys the stormwater to a detention facility or discharge point.



SANDFC 25 9 95

Tree Box Filter: A tree box filter is another type of bioretention filter in which stormwater runoff is directed to a box underneath a tree where the water is treated by vegetation and soil before entering an underdrain system.



Vegetated Buffer: Vegetated buffers are areas of natural or established vegetation maintained to protect water quality. Buffer zones slow stormwater runoff, provide an area where runoff can permeate the soil, contribute to ground water recharge, and filter sediment.

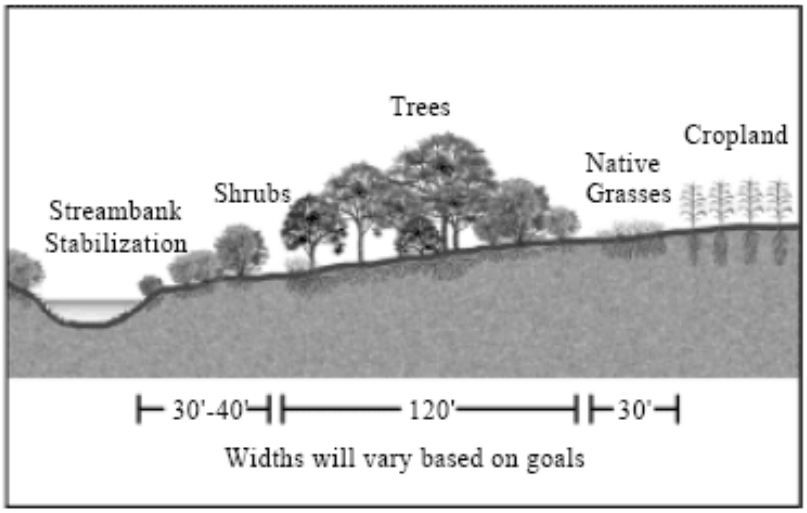
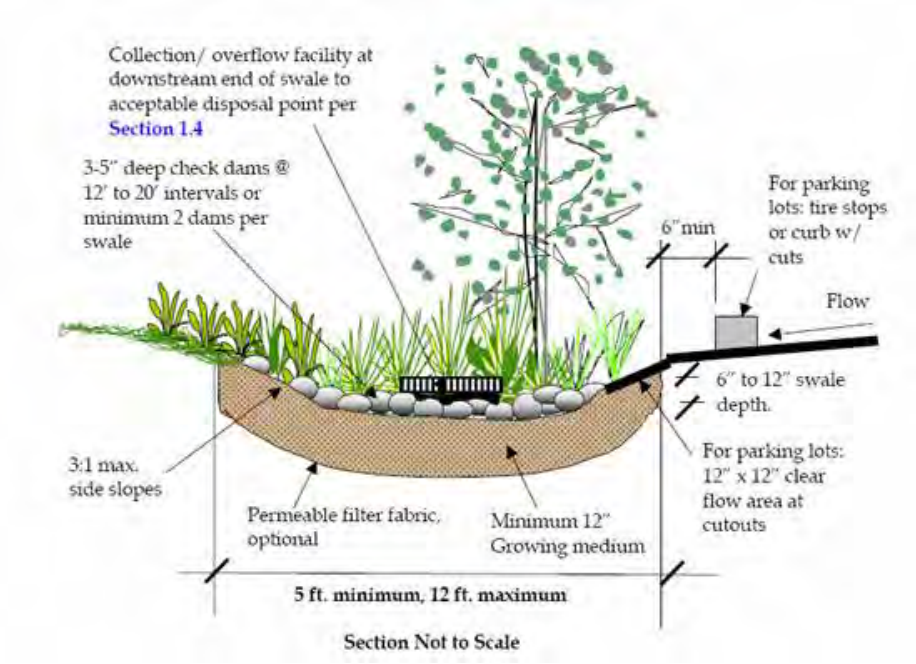


Figure 1. Cross section of an alternative buffer design.

Vegetated Roof: Vegetated (or green) roofs are made up of a layer of vegetation installed on top of a conventional flat or slightly sloped roof that absorbs rainwater in the soil media to be transpired by vegetation or discharged to another BMP or stormwater system.

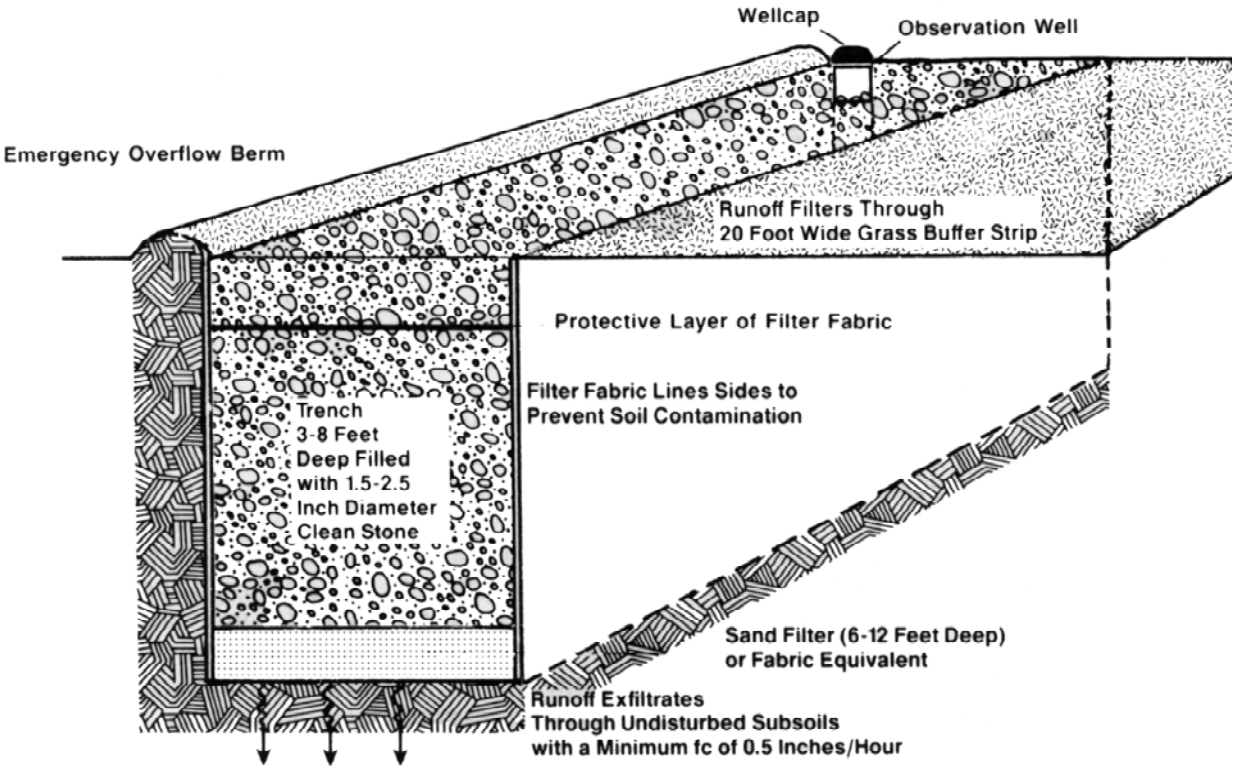
Vegetated Swales: Vegetated swales are gently sloping depressions planted with dense vegetation or grass that treat stormwater runoff from rooftops, streets, and parking lots. As the runoff flows along the length of the swale, the vegetation slows and filters it and allows it to infiltrate into the ground.



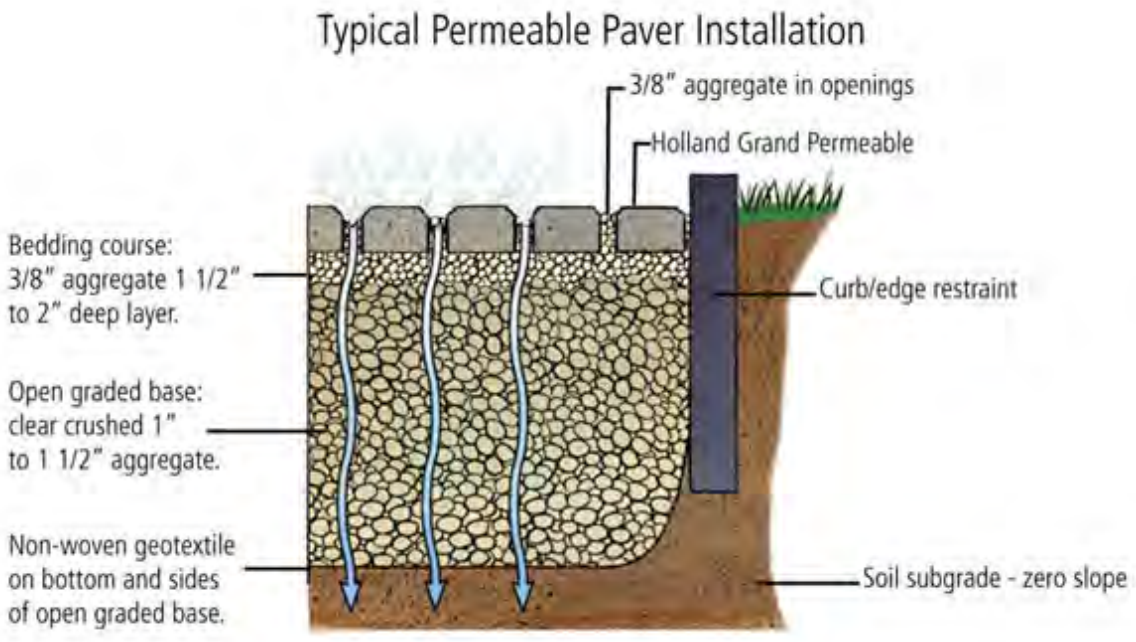
7.2 INFILTRATION:

Infiltration Basin: An infiltration basin is either a natural or constructed shallow surface impoundments that often include a flat, density vegetated floor situated over naturally permeable soils.

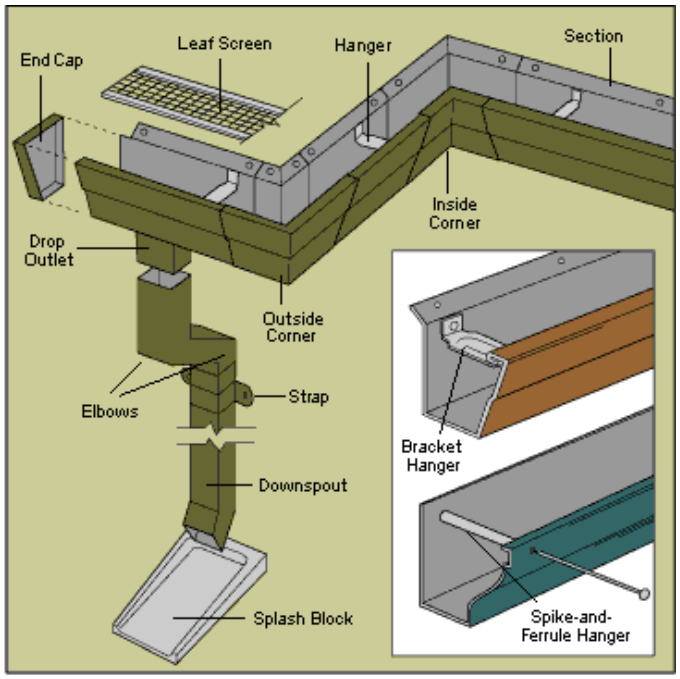
Infiltration Trench: Infiltration trenches are shallow excavations that are lined with filter fabric and filled with stone to create underground reservoirs for stormwater runoff.



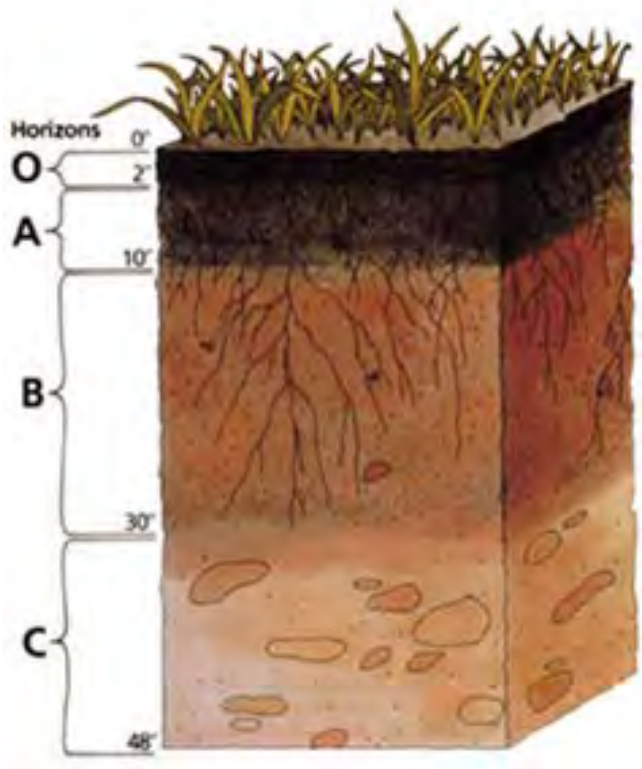
Permeable Pavers: Permeable pavers are similar to conventional pavement, but have pores or voids that allow stormwater runoff to filter through the pavement surface into an underlying stone reservoir.



Roof Downspout System: Downspout dispersion BMPs are splashblocks or gravel-filled trenches that serve to spread roof runoff over vegetated pervious areas.

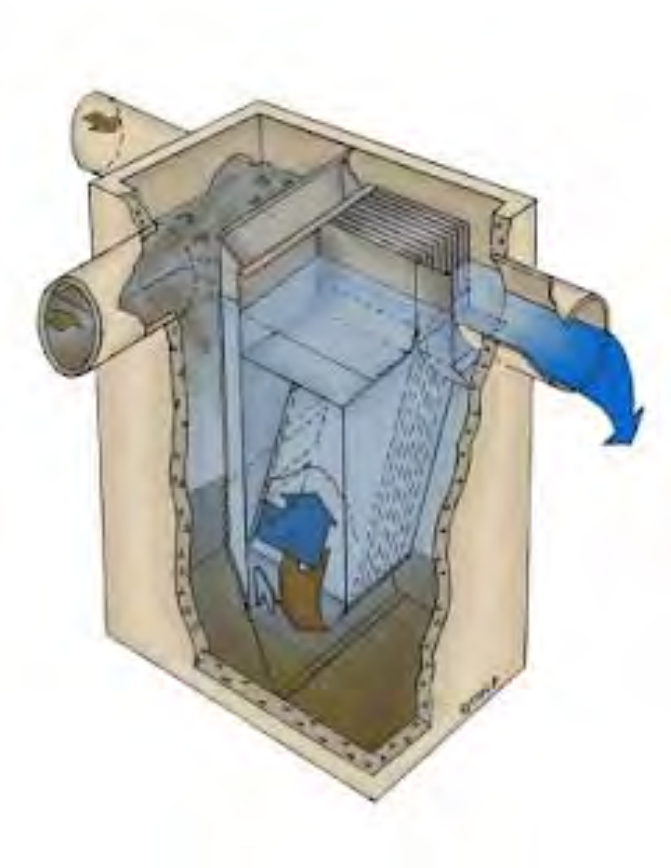


Soil Amendments: A soil amendment is a material added to a soil to improve its water retention, permeability, reduce erosion, and degrade pollutants.

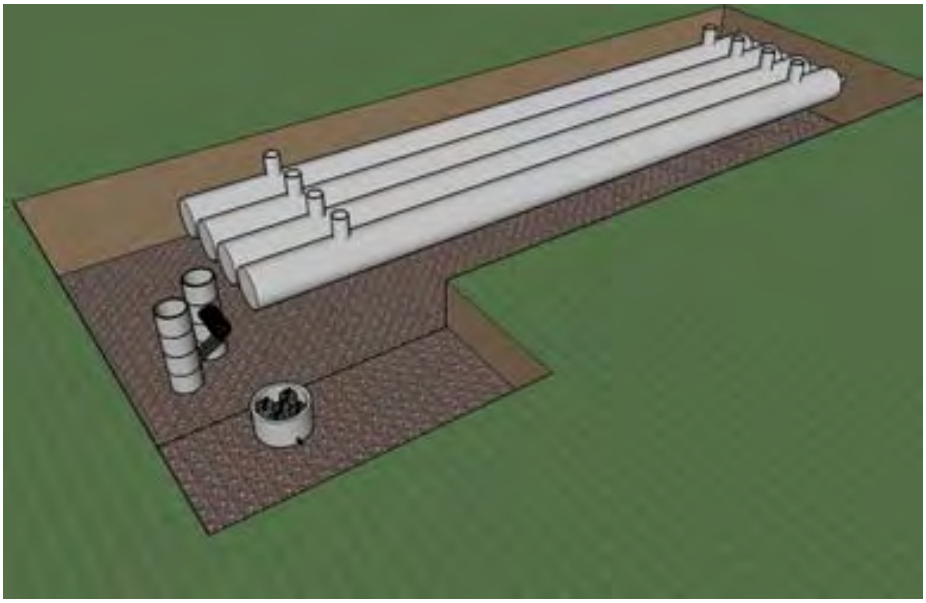


7.3 MANUFACTURED:

Proprietary: Proprietary stormwater BMPS are manufactured systems that use proprietary settling, filtration, absorption/adsorption, vortex principles, vegetation, and other processes to regulate stormwater management.



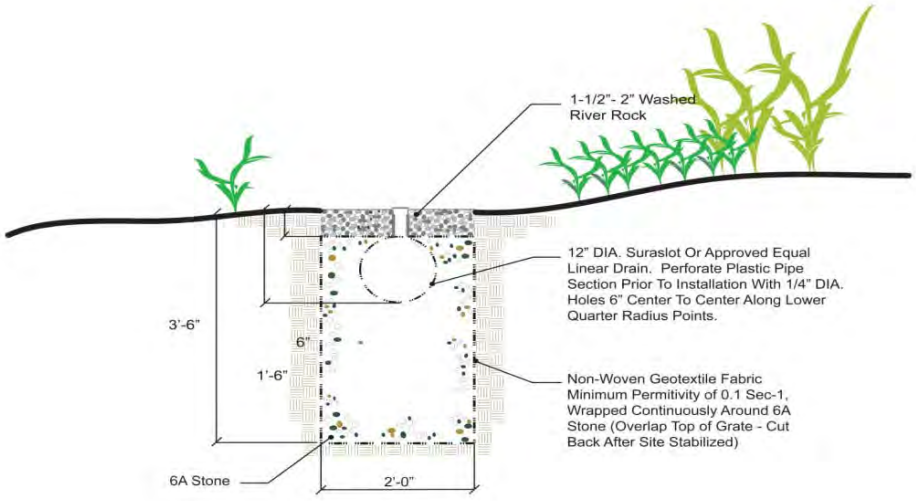
Pipe Detention: Pipe detention systems are underground pipe systems used for storing stormwater runoff.



Parking Lot Storage: A parking lot storage unit is a specialized detention basin used primarily to reduce the peak discharge of stormwater from the surrounding area.

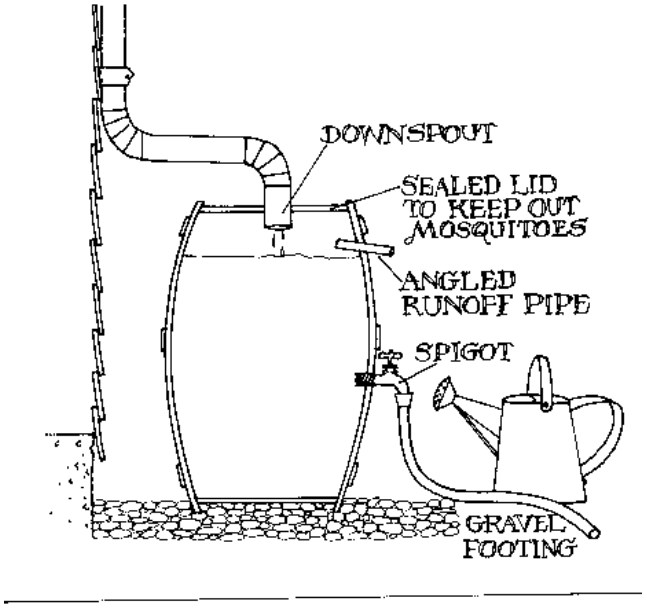
7.4 MISCELLANEOUS:

Level Spreader: A level spreader is an erosion control measure that is designed to mitigate the impact of high-velocity stormwater surface runoff, and can also serve to increase infiltration and reduce water pollution.



Check Dam: Check dams are small, temporary structures built across a swale or a channel with the primary purpose of reducing erosion and sediment level in flowing stormwater.

Stormwater Reuse (Rainbarrel): Stormwater reuse involves the collection and storage of rainwater for future use from rooftops or parking lots.



7.4 BASIN:

Acting as Sediment Basin: A sediment basin is a temporary pond built to capture eroded or disturbed sediment as it is washed away by stormwater.

Dry Basin/Pond: A dry basin is a detention pond used next to rivers, streams, or lakes to prevent from flooding by storing water for a limited period of time. They are called dry ponds because no permanent pool of water exists.

Extended Detention Dry Basin: An extended detention dry basin is a dry basin that is designed to retain excess storm water for an extended period of time.

Wet Basin: A wet basin is a detention pond that is designed as an artificial lake with vegetation around the perimeter that is used for water quality improvement, groundwater recharge, flood protection, or aesthetic improvement.

APPENDIX C

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US Army Garrison- Fort Lee, Virginia

Directorate of Public Works (DPW)

Environmental Management Office (EMO)

Detection and Elimination of Non-Stormwater Discharges to MS4 & Outfall Screening

Standard Operating Procedure (SOP) MCM3-3

Revised: 4-April-2013

1. REFERENCES:

(a) US Army Garrison Fort Lee's Integrated Stormwater Pollution Prevention Plan (SWPPP), October 3, 2008.
(b) Army Regulation 200-1. Environmental Protection and Enhancement, December 13, 2007.
(c) US Army Garrison Fort Lee's Special Environmental Conditions, June 8, 2012.
(d) US Army Garrison Fort Lee's VSMP MS4 General Permit Number VAR040007 dated July 14, 2008.

2. PURPOSE:

This Standard Operating Procedure (SOP) establishes the procedures to conduct surveillance to detect and address non-stormwater discharges, including illegal dumping to all regulated small MS4. The SOP will include the frequency of reconnaissance/inspections, type of the structures screened/monitored, and the actions conducted during and after the inspection/monitoring event.

3. BACKGROUND & SCOPE:

AR 200-1, Chapter 4-2.a(2), Water Resources, mandates the Army comply with all Clean Water Act (CWA) permits, including stormwater permits and to comply with all applicable federal, state and local laws, regulations, executive orders, or overseas final governing standards. Furthermore, Fort Lee's MS4 permit Section II.B.3.d requires that procedures to detect and address nonstormwater discharges, including illegal dumping to the regulated small MS4 be implemented.

Fort Lee's MS4 has multiple associated outfalls. These are identified on the MS4 Storm Sewer Map located at Appendix 1. An outfall is defined as "a point source at the point where a municipal separate storm sewer discharges to surface waters and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels, or other conveyances which connect segments of the same stream or other surface waters and are used to convey surface waters.

4. DUTIES & RESPONSIBILITIES:

(a) Annually, the Stormwater Program Manager, the Compliance Chief, or their designated representative shall visually observe at least 20% of the MS4 outfalls identified in the MS4 Storm Sewer Map during a period of dry weather (defined as at least 48 hours after a rainfall of 0.1in or greater) to screen for illicit discharges. Over the course of five years, all MS4 outfalls will be assessed at least once.

(b) If no flow is observed, it will be assumed that there is no illicit discharge to the outfall being screened. The inspector will note 1) outfall number/location; 2) date/time; and that no illicit discharge was observed.

(c) If flow is observed, the following will be recorded: 1) outfall number/location; 2) date/time; 3) volume of flow (low, medium, high); 4) color; 5) odor; 6) foaming; 7) floating pollutants; 8) visible sheen; 9) staining or other physical evidence of pollutants. Photographs of the discharge will be taken if appropriate. The inspector shall attempt to trace the source of the illicit discharge upstream and take appropriate corrective action (brief the party responsible in proper procedure, submit a work order for repair, etc) if the source can be determined and note this in the report. If no source is discovered this should be noted as well.

(d) The inspection and monitoring of the outfalls described above shall be documented in the online Compliance Tracker system and kept for not less than five years from the date of the inspection. An inspection form is at Appendix A.

5. OTHERS:

All conditions mentioned in Section II.B.3.d of Fort Lee's Municipal Separate Storm Sewer System (MS4) will supersede any other documents listed in Section 1 (REFERENCES) of this SOP.

6. EFFECTIVE DATE:

This SOP is effective as of the revision date.

7. PROPONENT:

The DPW-EMO is the proponent of this SOP. Contacts are Mr. Daniel Ernesto, Stormwater Program Manager at 734-3760, daniel.l.ernesto2.civ@mail.mil or Mr. Craig Norris, Compliance Chief at 734-3772, craig.a.norris10.civ@mail.mil.

Detection of Non-Stormwater Discharges to MS4 & Outfall Dry Weather Screening

SOP MCM3-3

Monitoring Report

Date:	Amount/Date of Last Precipitation:	Observer:
Current Weather Conditions:		

Outfall Name/Location:	Time:
Discharge visible? **NO YES** If yes, explain (note flow rate):	
Note any items in the flow listed below that you observe or **N/A**:	
Color:	Odor:
Foam:	Floating Pollutants:
Sheen:	Staining:
Other:	
Sources of any observed contamination:	

Notes:

US Army Garrison - Fort Lee, Virginia

Directorate of Public Works (DPW)

Environmental Management Office (EMO)

Procedure for Inspection/Enforcement of Erosion and Sediment Control Measures on Construction Sites

Standard Operating Procedure (SOP) MCM4-3

Revised: 19-April-2013

1. REFERENCES:

(a) US Army Garrison Fort Lee's Integrated Stormwater Pollution Prevention Plan (SWPPP), October 3, 2008.
(b) Army Regulation 200-1. Environmental Protection and Enhancement, December 13, 2007.
(c) US Army Garrison Fort Lee's Special Environmental Conditions, June 8, 2012.
(d) US Army Garrison Fort Lee's VSMP MS4 General Permit Number VAR040007 dated July 14, 2008.
(e) Virginia Erosion and Sediment Control Plan Handbook. Third Edition, 1992.
(f) Virginia Stormwater Management Handbook, First Edition, 1999.

2. PURPOSE:

This Standard Operating Procedure (SOP) establishes the formal procedures for inspection and enforcement of sediment and erosion control measures on construction sites.

3. BACKGROUND & SCOPE:

AR 200-1, Chapter 4-2.a(2), Water Resources, requires mandates the Army to comply with all Clean Water Act (CWA) permits, including stormwater permits to comply with applicable federal, state and local laws, regulations, executive orders, or overseas final governing standards. Furthermore, Fort Lee's MS4 permit Section II.B.4.a(5) requires that Fort Lee develop, implement procedures for construction site inspection and enforcement of control measures. Pursuant to this requirement, *Minimum Control Measure 4, BMP 3,* indentified in Fort Lee's MS4 program plan states that Fort Lee will conduct visual inspections of construction sites to determine compliance with Virginia Erosion and Sediment Control Regulation and Virginia Stormwater Management Regulation.

4. DUTIES & RESPONSIBILITIES:

(a) The Stormwater Program Manager, Compliance Manager, or their designated representative will review and approve the Erosion and Sediment Control Plans (ESCs) and Stormwater Pollution Prevention Plans (SWPPPs) for ground disturbing projects in accordance with SOP **MCM4-2/5**-4.

(b) Ground disturbance may begin once a land disturbing project that disturbs more than 10000 square feet (2500 square feet in a Chesapeake Bay Preservation Area) has obtained Virginia Stormwater Management Program (VSMP) permit coverage from the VA DCR, and has an Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan (SWPPP) approved by the DPW-EMO.

(c) At least once during the active ground disturbing phase, the Stormwater Program Manager, Compliance Program Manager, or their designated representative will inspect the project site for compliance with the Virginia Erosion and Sediment Control Regulation and the Stormwater Management Regulation. The inspector will utilize VA DCR Form DCR199-170 to document the inspection. Form included in Appendix A.

(d) The project manager will be presented with the findings of the inspection via e-mail. If any deficiencies were noted, the project manager will be given a timeline to make corrections and a follow up inspection will be scheduled. If the deficiencies are not corrected, the failure to comply with the regulation will be forwarded to the project manager's supervisor and/or the contracting officer, as appropriate.

(e) At project completion, the Stormwater Program Manager and/or Compliance Program Manager will conduct a final inspection of the site. If all Sediment and Erosion Control and Stormwater Management requirements are met, the project manager will be notified that the contractor can submit the Notice of Termination (NOT) for VSMP coverage. The project manager shall retain a copy of this NOT in the project records and shall provide a copy to the Stormwater Program Manager and/or Compliance Program Manager for inclusion in their records. If any deficiencies are noted, the project manager will be given a timeline to make corrections and a follow up inspection will be scheduled. If the deficiencies are not corrected, the failure to comply with the regulation will be forwarded to the project manager's supervisor and/or the contracting officer, as appropriate.

(f) In addition, at project completion, the Real Property Branch can accept the building and reject the grounds/site until corrective actions are completed. This ensures that the contractor is held responsible to make the corrections.

5. EFFECTIVE DATE:

This SOP is effective as of the revision date.

6. PROPONENT:

The DPW-EMO is the proponent of this SOP. Contacts are Mr. Daniel Ernesto, Stormwater Program Manager at 734-3760, daniel.l.ernesto2.civ@mail.mil or Mr. Craig Norris, Compliance Chief at 734-3772, craig.a.norris10.civ@mail.mil.

US Army Garrison - Fort Lee, Virginia

Directorate of Public Works (DPW)

Environmental Management Office (EMO)

Conducting and Documenting Construction Plan Reviews for Proper Erosion and Sediment Control and Post-Construction Stormwater Management.

Standard Operating Procedure (SOP) MCM4-2/5-4

Revised: 19-April-2013

1. REFERENCES:

(a) US Army Garrison Fort Lee's Integrated Stormwater Pollution Prevention Plan (SWPPP), October 3, 2008.
(b) Army Regulation 200-1. Environmental Protection and Enhancement, December 13, 2007.
(c) US Army Garrison Fort Lee's Special Environmental Conditions, June 8, 2012.
(d) US Army Garrison Fort Lee's VSMP MS4 General Permit Number VAR040007 dated July 14, 2008.
(e) Virginia Erosion and Sediment Control Plan Handbook. Third Edition, 1992.
(f) Virginia Stormwater Management Handbook, First Edition, 1999.

2. PURPOSE:

This Standard Operating Procedure (SOP) establishes the formal process for conducting and documenting reviews to ensure proper erosion and sediment controls and post construction stormwater management.

3. BACKGROUND & SCOPE:

AR 200-1, Chapter 4-2.a(2), Water Resources, requires mandates the Army to comply with all Clean Water Act (CWA) permits, including stormwater permits to comply with applicable federal, state and local laws, regulations, executive orders, or overseas final governing standards. Furthermore, Fort Lee's MS4 permit Section II.B.4.a requires that Fort Lee develop, implement, and enforce procedures to reduce pollutants in any stormwater runoff to regulated small MS4 from construction activities. Pursuant to this requirement, Fort Lee's MS4 program plan ***Minimum Control Measure 4, BMP 2***, states that Fort Lee will review and approve Stormwater Pollution Prevention Plans (SWPPPs) and Erosion and Sediment Control Plans (E&SC.). In addition, Minimum Control Measure 5, BMP 4 states that Fort Lee will review and approve designs for post construction stormwater management.

4. DUTIES & RESPONSIBILITIES:

(a) The Stormwater Program Manager, Compliance Program Manager, or their designated representative will review the SWPPPs and ESCs according to Virginia Department of Conservation and Recreation (DCR) plan review checklist included at Appendix A.

(b) All work orders, JOC, and MILCON projects will be submitted to DPW-EMO for review. This review process will be tracked and documented in the EMO NEPA Manager system. Projects involving land disturbance will be routed to the Stormwater Program Manager and the Compliance Program Manager, or their designated representative for review.

(c) Fort Lee Special Environmental Conditions and Fort Lee Policy 09-05 require that land disturbing activities in excess of 10000 square feet (2500 square feet in a Chesapeake Bay Preservation Area) comply with the requirements of the Virginia Erosion and Sediment Control Regulation and the Stormwater Management Regulation, and be reviewed for compliance by DPW EMO.

(d) Project plans that do not meet the standards set forth in the Virginia Erosion and Sediment Control Regulation and the Stormwater Management Regulation will be returned to the project manager for correction.

(e) Once the Stormwater Program Manager and/or Compliance Program Manager are satisfied that the project documents meet the requirements set forth in the Virginia Erosion and Sediment Control Regulation and the Stormwater Management Regulation, the project manager will be notified in writing. The project manager should include a copy of this approval in the project file.

(f) The review and approval process will also be documented in the NEPA Manager system.

(g) Review of post construction stormwater management design and best management practices (BMPs) will simultaneously be conducted as part of the initial SWPPP/ESC plan review. Project managers will submit their post construction management and BMP design for review as part of their site design and demonstrate that requirements in the Stormwater Management Regulations are met. In addition, at project completion, the Real Property Branch can accept the building and reject the grounds/site until any corrective actions are completed. This ensures that the contractor is held responsible to make the corrections.

5. EFFECTIVE DATE:

This SOP is effective as the revision date.

6. PROPONENT:

The DPW-EMO is the proponent of this SOP. Contacts are Mr. Daniel Ernesto, Stormwater Program Manager at 734-3760, daniel.l.ernesto2.civ@mail.mil or Mr. Craig Norris, Compliance Chief at 734-3772, craig.a.norris10.civ@mail.mil.

APPENDIX D

April 30, 2015

Mr. Bradford Hill
Chief, Job Order Contracting
Directorate of Public Works (JOC)
825 19th Street (Bldg. 6005)
Ft. Lee, Virginia 23801

PROJECT NO. Construct BMPs for Hydrologic Areas PE0008-5J, PE0009-5J, PE00010-5J, PE00011-5J, PE00012-5J, PE00013-5J, PE00014-5J & PE00015-5J

Dear Mr. Hill,

Leebcor Services, LLC is pleased to submit our proposal for the referenced project.

Time allowances required for all six (6) AOIs will be approximately 350 calendar days from the NTP date. Our proposal is comprised of approximately 90 days of design.

BASE SIX AOIs	
TOTAL PROPOSAL AOI 15:	**$533,532.00**
TOTAL PROPOSAL AOI 03:	**$749,000.00**
TOTAL PROPOSAL AOI 12:	**$504,132.00**
TOTAL PROPOSAL AOI 10:	**$531,770.00**
TOTAL PROPOSAL AOI 07:	**$335,851.00**
TOTAL PROPOSAL AOI 09:	**$345,224.00**
OPTION AOIs	
TOTAL PROPOSAL AOI 02:	**$567,866.00**
TOTAL PROPOSAL AOI 04:	**$265,521.00**

Please contact me at 757-941-4814 if you have any questions regarding this proposal.

Sincerely,
Leebcor Services, LLC

Billy Kay
Project Manager / Director of Pre-Construction

Enclosures:
1. Design Narrative and Scope of Work dated 4/30/2015

Construct BMPs for Areas of Interest 15, 3, 12, 10, 7, 9, 2 & 4

SCOPE OF WORK

Dated: 4/30/15

SURVEYING, SITE & BMP DESIGN, SWPPP PREPARATION, & VSMP PERMIT:

1) Our services include engineering, design and preparation of all plans, profile, and detail construction drawings to denote the features associated with each of the eight (8) BMP areas as specified by the Statement of Work and the drawings included in the BMP Priority List. Our basis of bid includes a Level One design guidelines as specified in the VA DCR Stormwater Design Specifications.
2) Our proposal is based on all six (6) AOIs (15, 3, 12, 10, 7, & 9) being awarded at the same time. We acknowledge 2 and 4 are options which can be awarded now, at a later date or not at all.
3) We include working on two (2) sites at a time during construction.
4) We include erosion & sediment control measures, phasing, traffic control, clearing, demolition and construction of AOI 15, 3, 12, 10, 7, 9, 2 and 4.
5) We include one (1) TCLP per each bio structure location for testing approval before construction begins (during Design). Upon construction we will cut and haul dirt with no additional testing.
6) Leebcor Services includes preliminary field surveys to include CAD drawings of the topography with one foot contours.
7) Leebcor Services has included performing hydrologic evaluations of each of the AOIs.
8) Leebcor Services has included performing infiltration test at each of the AOIs.
9) Leebcor Services has included gathering background information on soils, utilities and other existing site conditions.
10) Leebcor Services has included proposing alternative units if the Corps' BMPs are shown not to be optimal given existing site conditions.
11) Leebcor Services includes designing the BMPs that are finally agreed upon to include a 30%, 90% and Final Design Package. BMPs include but are not limited to bio-retention ponds, infiltration trenches, pocket sand filters and vegetated open channels.
    a. 30% design package will be an OTS Review
    b. 90% design package will allow for a 14 calendar day review by the Government
    c. 100% Final Design Package will allow for a 7 calendar day review by the Government
12) Preconstruction and construction submittals - - 10 calendar day Government review.
13) Leebcor Services includes preparing specifications for the all materials in project design.
14) Leebcor Services includes design and plantings as required for BMP designs. All vegetation that is part of the BMP's design will be native to Virginia including trees, shrubs and ground cover.
15) Leebcor Services includes fine grade, seed and straw all areas due to disturbed areas from construction.
16) Leebcor Services includes presentations of the designs to the Corps and the Fort Lee DPW JOC Team simultaneously.
17) Leebcor Services includes SWPPP calculations for each AOI. Three (3) copies of SWPPP calculations will be provided for each AOI.
18) Leebcor Services will keep streets, parking lots, and sidewalks operational as much as possible during construction.
19) Leebcor Services will allow for fifteen (15) calendar day notification on any road or parking lot closures.
20) Based on discussions with DPW all stormwater lines shown on AOI exhibits are existing.
21) We have included approximately 50' of connections to existing storms line whenever underdrain needs to be connected to an existing storm.
22) We assume existing storm water system can handle the new water flow from the tie ins associated with our BMP design.
23) We have included a maximum of 500sf of cut and patch of pavement repair per AOI.

24) Leebcor Services includes preparation of as-built drawings.
25) Leebcor Services includes preparation of final reports (including TMDL reports). DEQ Certification is not included.
26) Leebcor Services includes signage for each BMP. Each sign shall have a facility number and follow Fort Lee's IDG. Facility numbers to be determined.
27) Leebcor Services proposal includes instruction and schedules for maintenance of the BMPs at all AOIs.
28) Leebcor Services will provide temporary toilets for construction workers during the project duration.
29) Leebcor Contractors specifically excludes hazardous materials abatement.
30) We exclude any unforeseen surface and subsurface site conditions.
31) We exclude relocation of any utilities.

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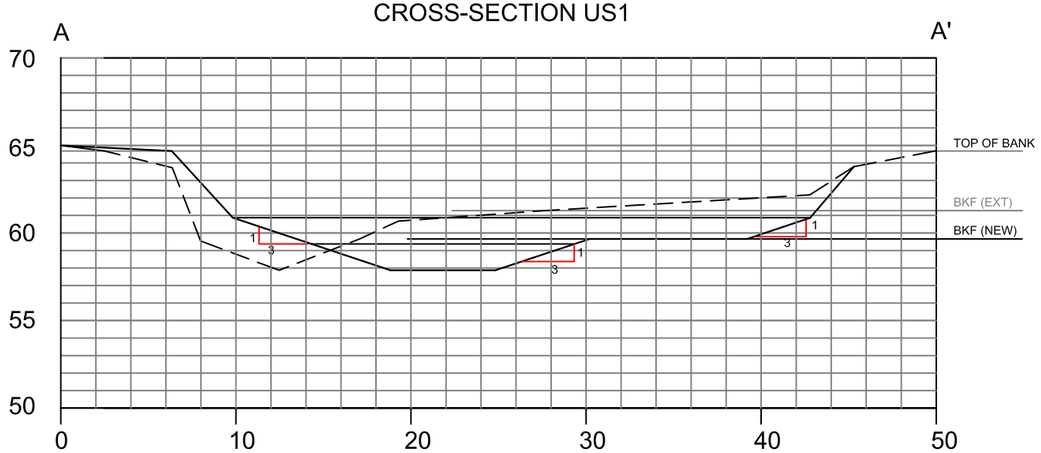
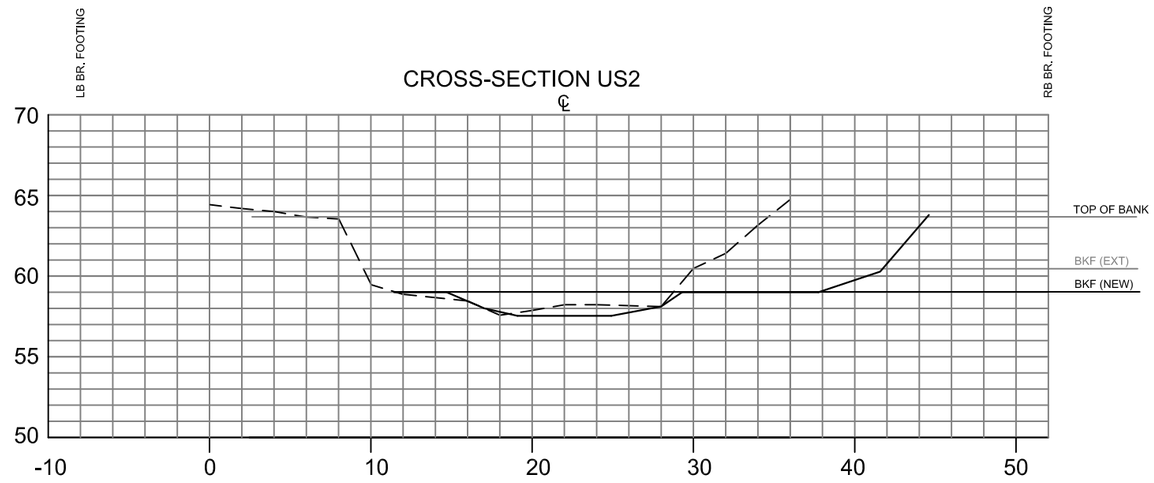
APPENDIX E

CROSS-SECTION US1



Geomorphology				
	Rosgen (C5)	Virginia	Existing	Proposed
Bankfull area (ft²)		20.8	28.3	20.4
Bankfull width (ft)		14.6	20.3	16.8
Bankfull depth (ft)		1.4	3.4	1.5
Bankfull discharge (cfs)		49.5		
Entrench. Ratio	>2.2		2.3	2.0
W/D Ratio	>12		6.0	11.2
Sinuosity	>1.2		1.1	
Slope	<0.2		0.006	

CROSS-SECTION US2



Geomorphology				
	Rosgen (C5)	Virginia	Existing	Proposed
Bankfull area (ft²)		20.8	41.1	16.4
Bankfull width (ft)		14.6	20.4	14.6
Bankfull depth (ft)		1.4	2.8	1.5
Bankfull discharge (cfs)		49.5		
Entrench. Ratio	>2.2		1.3	2.2
W/D Ratio	>12		7.3	9.7
Sinuosity	>1.2		1.1	
Slope	<0.2		0.006	

SCOPE OF WORK

FOR

Earth, Water, Sewer Contracting, LLC

THE WORK WILL INVOLVE STREAMBANK STABILIIZATION AND MINOR RE-ALIGNMENT OF THE CHANNEL TO PUT IT IN CONCERT WITH THE NEW PEDESTRIAN BRIDGE. ANCILLARY ACTIVITIES, INCLUDING EROSION & SEDIMENT CONTROL AND FINAL VEGETATIVE STABILIZATION OF THE STREAM BANKS ALSO WILL BE INCLUDED.

PHASE I: INITIAL SITE STABILIZATION

A. INSTALL (OR MAINTAIN) TURBIDITY CURTAIN ACROSS MAIN CHANNEL OF BAILEY CREEK APPROXIMATELY 120' DOWNSTREAM OF THE PEDESTRIAN BRIDGE.
B. INSTALL "PUMP-AROUND" OF BAILEY CREEK, TO INCLUDE:
    a. Installation of a sandbag dam approximately 130' upstream of the pedestrian bridge
    b. Installation of a sandbag dam approximately 100' downstream of the pedestrian bridge
    c. Installation of a pump sufficient to transfer the flow of Bailey Creek around the area between the two sandbags. It is anticipated that the 'normal' flow of Bailey Creek is approximately 2,000 gal/min.
    d. See Attachment A for additional details.
C. INSTALL (OR MAINTAIN) SILT FENCE AROUND SITE PERIFERY.

PHASE II: STREAM BANK STABILIZATION

A. CONTRACTOR WILL WORK IN THE "DRY" BETWEEN THE TWO SANDBAG DAMS.
B. BRING EXISTING STREAM PLAN AND PROFILE TO THOSE PROPOSED PLAN AND PROFILES SHOWN IN ATTACHMENTS B AND C.
C. CONTRACTOR WILL 'FAIR-IN' STREAMBANKS BETWEEN THE SHOWN CROSS-SECTIONS SO A SMOOTH TRANSITION OCCURS WITHOUT SUDDEN EXPANSIONS OR CONTRACTIONS IN THE STREAM CROSS-SECTION.
D. CONTRACTOR WILL 'FAIR-IN' THE MODIFIED PORTION OF THE STREAM WITH THE EXISTING UPSTREAM AND DOWNSTREAM CROSS-SECTIONS SO NO ABRUPT EXPANSIONS OR CONTRACTIONS INTO OR OUT OF THE MODIFIED PORTION OF THE STREAM EXIST.
E. TO THE EXTENT POSSIBLE, STREAMBANK SOILS CUT FROM THE SOUTHERN BANK DOWNSTREAM OF THE PEDESTRIAN BRIDGE WILL BE USED AS FILL SOILS FOR THE UPSTREAM, NORTHERN STREAMBANK.
F. FILL SOILS ALONG THE NORTHERN BANK WILL BE 'KEYED' INTO THE EXISTING SOILS:
    a. Existing soil will be 'scarred' vertically with bucket teeth (or other acceptable manner).
    b. Fill soils will be placed in lifts no greater than 1' thick and compacted.
G. FINE GRADING WILL BE OVERSEEN BY OWNER'S ENGINEER.

PHASE III: FINAL STABILIZATION

A. CONTRACTOR WILL PLACE TREATMENT 1 SOIL MATTING PER VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK CHAPTER 3.36.
B. CONTRACTOR WILL PLACE PERMANENT VEGETATIVE COVER ON ALL DISTURBED STREAMBANK SOILS ABOVE THE BANKFULL LEVEL.
    a. Permanent vegetation will consist of Tall Fescue applied at a rate of 100 lb/ac (2.3 lbs/1,000 s.f.).
    b. A nurse crop of annual ryegrass will be included in the permanent cover seeding at a rate of 20 lb/ac (0.46 lbs/1,000 s.f.).
    c. Seed will be applied uniformly by broadcasting; seed will be covered with 0.25 inches of soil or less by cultipacking or raking.
C. ADDITIONAL VEGETATION WILL BE INSTALLED AT THE DIRECTION OF OWNER'S ENGINEER, BUT PURCHASE OF THE VEGETATION IS NOT TO BE INCLUDED IN THIS CONTRACT.

ATTACHMENT A – PUMP AROUND SPECIFICATION

MGWC 1.2: PUMP-AROUND PRACTICE

Temporary measure for dewatering in-channel construction sites

DESCRIPTION

The work should consist of installing a temporary pump around and supporting measures to divert flow around in-stream construction sites.

IMPLEMENTATION SEQUENCE

Sediment control measures, pump-around practices, and associated channel and bank construction should be completed in the following sequence (refer to Detail 1.2):

1. Construction activities including the installation of erosion and sediment control measures should not begin until all necessary easements and/or right-of-ways have been acquired. All existing utilities should be marked in the field prior to construction. The contractor is responsible for any damage to existing utilities that may result from construction and should repair the damage at his/her own expense to the county's or utility company's satisfaction.

2. The contractor should notify the Maryland Department of the Environment or WMA sediment control inspector at least 5 days before beginning construction. Additionally, the contractor should inform the local environmental protection and resource management inspection and enforcement division and the provider of local utilities a minimum of 48 hours before starting construction.

3. The contractor should conduct a pre-construction meeting on site with the WMA sediment control inspector, the county project manager, and the engineer to review limits of disturbance, erosion and sediment control requirements, and the sequence of construction. The contractor should stake out all limits of disturbance prior to the pre-construction meeting so they may be reviewed. The participants will also designate the contractor's staging areas and flag all trees within the limit of disturbance which will be removed for construction access. Trees should not be removed within the limit of disturbance without approval from the WMA or local authority.

4. Construction should not begin until all sediment and erosion control measures have been installed and approved by the engineer and the sediment control inspector. The contractor should stay within the limits of the disturbance as shown on the plans and minimize disturbance within the work area whenever possible.

5. Upon installation of all sediment control measures and approval by the sediment control inspector and the local environmental protection and resource management inspection and enforcement division, the contractor should begin work at the upstream section and proceed downstream beginning with the establishment of stabilized construction entrances. In some cases, work may begin downstream if appropriate. The sequence of construction must be followed unless the contractor gets written approval for deviations from the WMA or local authority. The contractor should only begin work in an area which can be completed by the end of the day including grading adjacent to the channel. At the end of each work day, the work area must be stabilized and the pump around removed from the channel. Work should not be conducted in the channel during rain events.

6. Sandbag dikes should be situated at the upstream and downstream ends of the work area as shown on the plans, and stream flow should be pumped around the work area. The pump should discharge onto a stable velocity dissipater made of riprap or sandbags.

MGWC 1.2: PUMP-AROUND PRACTICE

7. Water from the work area should be pumped to a sediment filtering measure such as a dewatering basin, sediment bag, or other approved source. The measure should be located such that the water drains back into the channel below the downstream sandbag dike.

8. Traversing a channel reach with equipment within the work area where no work is proposed should be avoided. If equipment has to traverse such a reach for access to another area, then timber mats or similar measures should be used to minimize disturbance to the channel. Temporary stream crossings should be used only when necessary and only where noted on the plans or specified. (*See Section 4, Stream Crossings, Maryland Guidelines to Waterway Construction*).

9. All stream restoration measures should be installed as indicated by the plans and all banks graded in accordance with the grading plans and typical cross- sections. All grading must be stabilized at the end of each day with seed and mulch or seed and matting as specified on the plans.

10. After an area is completed and stabilized, the clean water dike should be removed. After the first sediment flush, a new clean water dike should be established upstream from the old sediment dike. Finally, upon establishment of a new sediment dike below the old one, the old sediment dike should be removed.

11. A pump around must be installed on any tributary or storm drain outfall which contributes baseflow to the work area. This should be accomplished by locating a sandbag dike at the downstream end of the tributary or storm drain outfall and pumping the stream flow around the work area. This water should discharge onto the same velocity dissipater used for the main stem pump around.

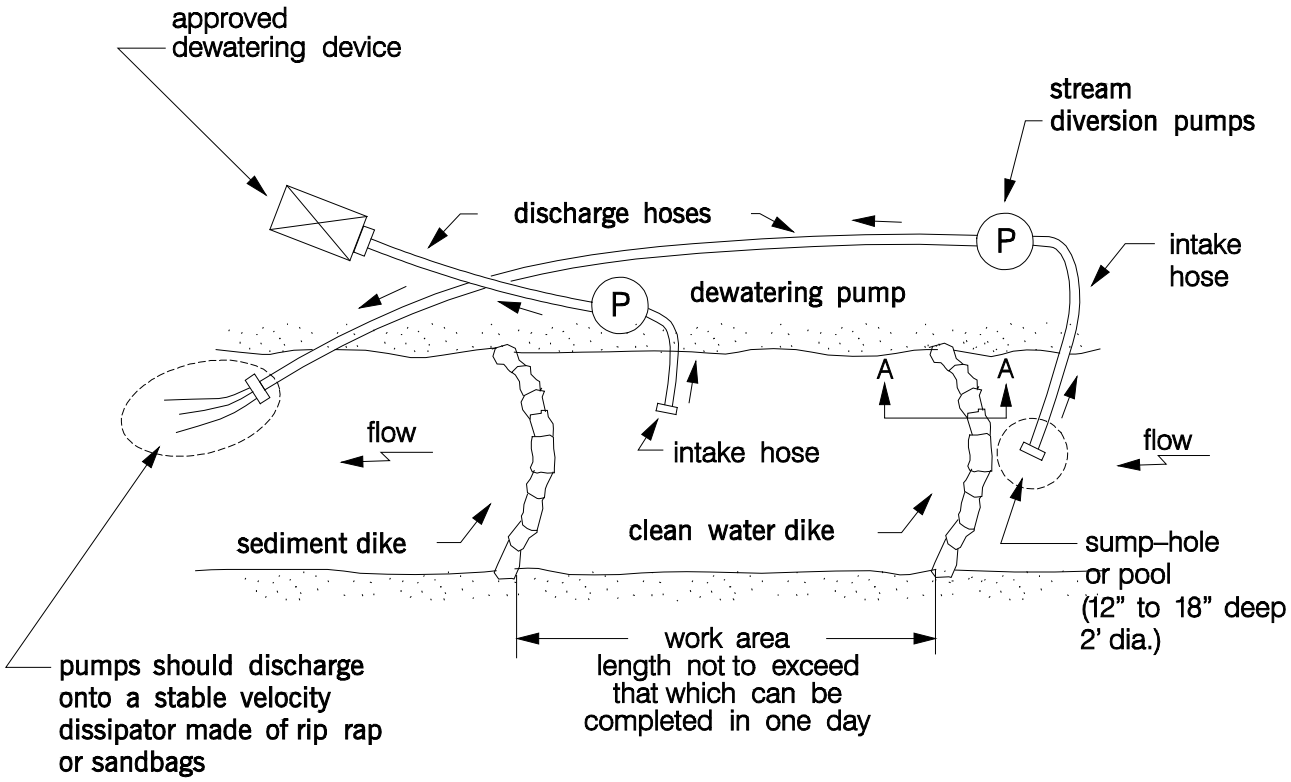
12. If a tributary is to be restored, construction should take place on the tributary before work on the main stem reaches the tributary confluence. Construction in the tributary, including pump around practices, should follow the same sequence as for the main stem of the river or stream. When construction on the tributary is completed, work on the main stem should resume. Water from the tributary should continue to be pumped around the work area in the main stem.

13. The contractor is responsible for providing access to and maintaining all erosion and sediment control devices until the sediment control inspector approves their removal.

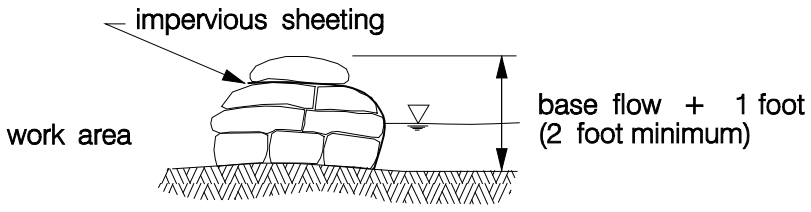
14. After construction, all disturbed areas should be regraded and revegetated as per the planting plan.

Maryland's Guidelines To Waterway Construction
DETAIL 1.2: PUMP–AROUND PRACTICE

PLAN VIEW



SECTION A–A



cross section of sandbag dike

ATTACHMENT B – PROPOSED PLAN VIEW


OLD STREAMLINE
APPROXIMATE LIMITS OF BRIDGE WORK
25’
50’
25’
BRIDGE (TO BE REPLACED)
PROPOSED STREAMLINE
0
10
25
50
APPROXIMATE SCALE IN FEET

ATTACHMENT C – PROPOSED CROSS-SECTION VIEWS

CROSS-SECTIONS

THE FOLLOWING CROSS-SECTIONS ARE SHOWN AS A-A', B-B', C-C', AND D-D' ON THE PLAN VIEW OF THE PROPOSED STREAM ALIGNMENT.

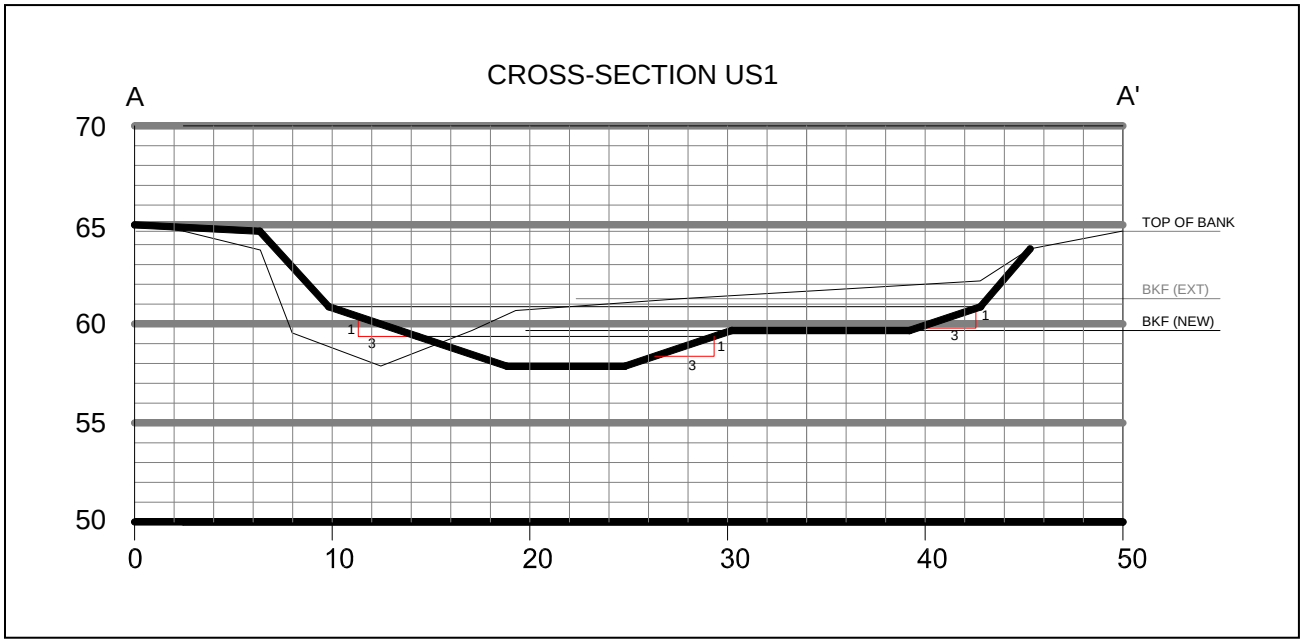


Figure 1. CROSS SECTION 1 UPSTREAM OF BRIDGE (US1).

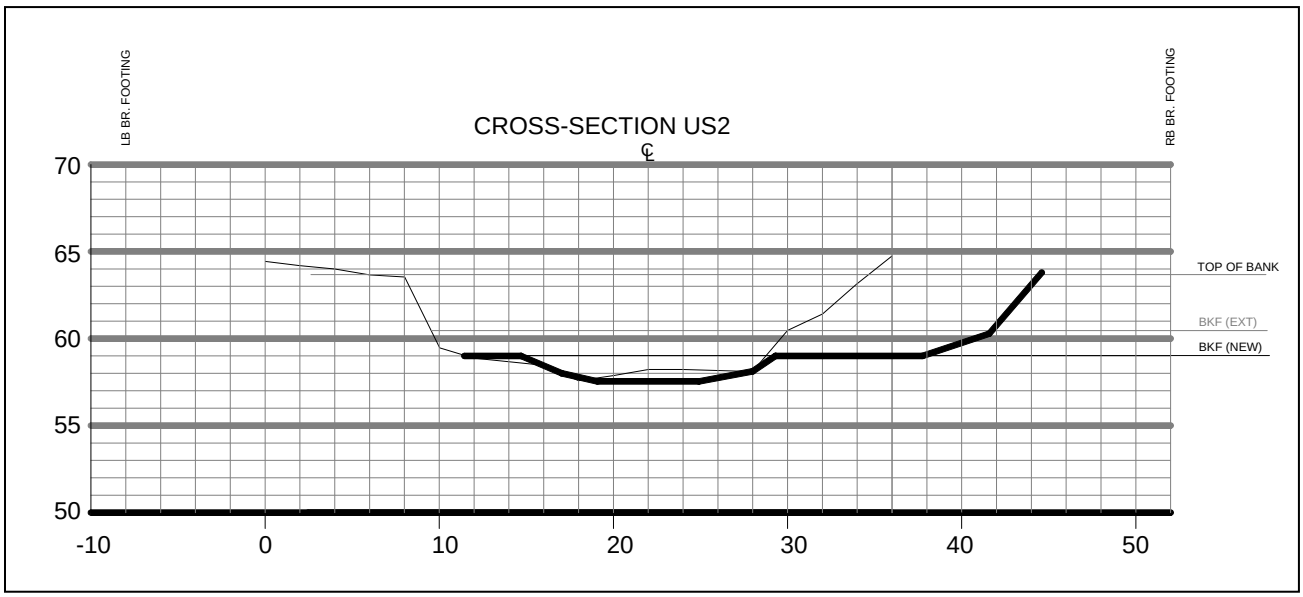


Figure 2. CROSS SECTION 2 UPSTREAM OF BRIDGE (US2) SHOWING BRIDGE CENTERLINE AND FOOTING LOCATIONS. WATER TRAINING AREA IS ON STREAM LEFT.

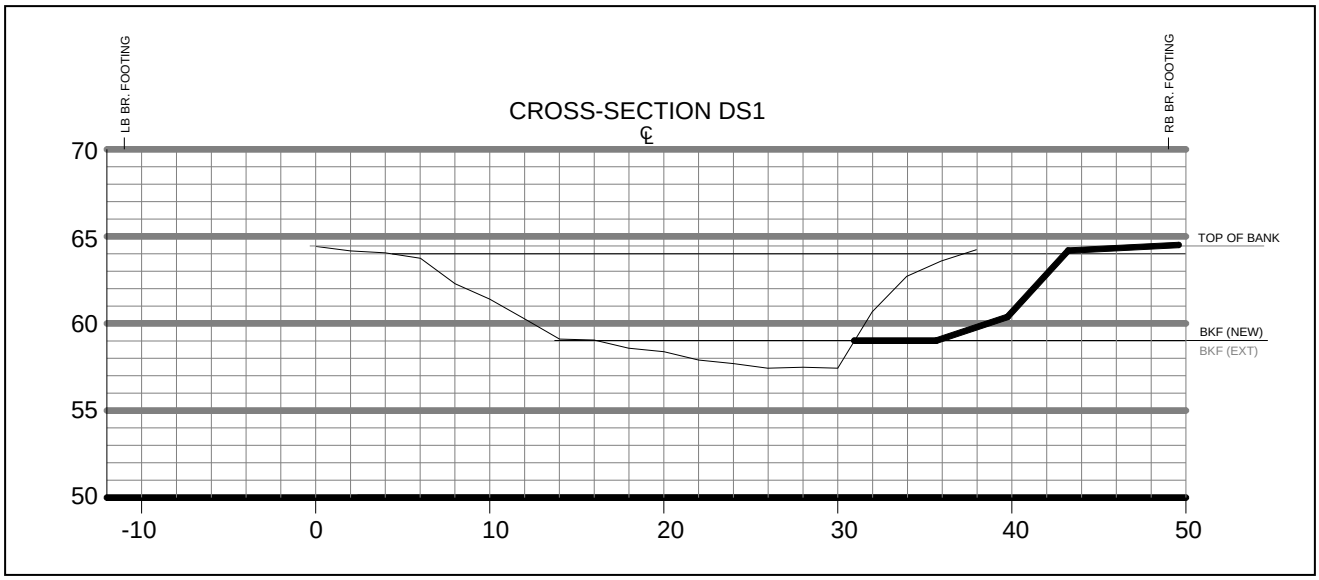


Figure 3. CROSS SECTION 1 DOWNSTREAM OF BRIDGE (DS1) SHOWING BRIDGE CENTERLINE AND FOOTING LOCATIONS. WATER TRAINING AREA IS ON STREAM LEFT.

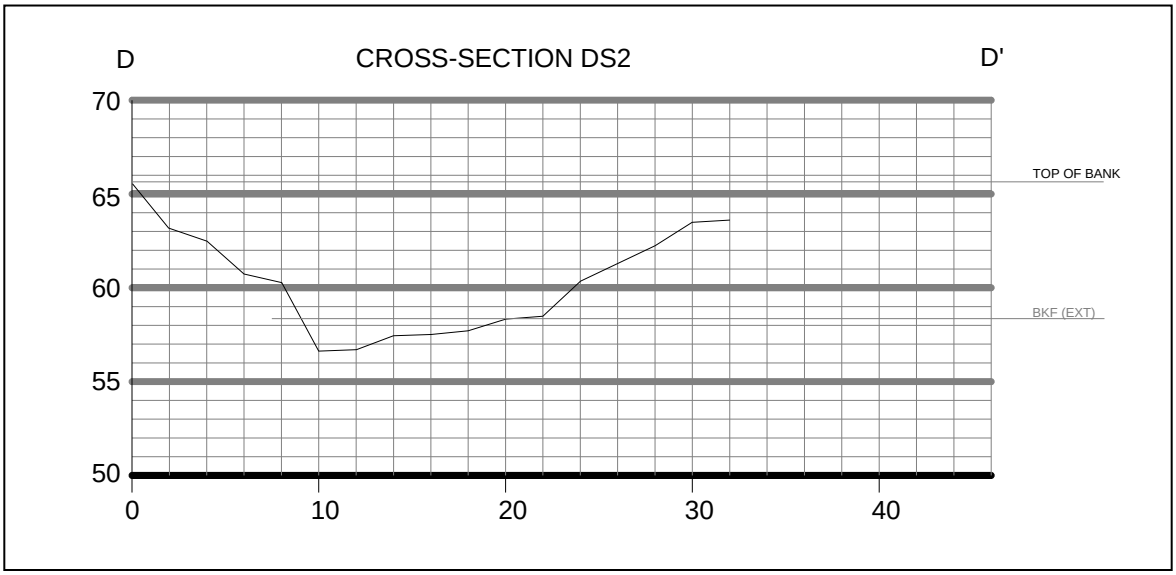
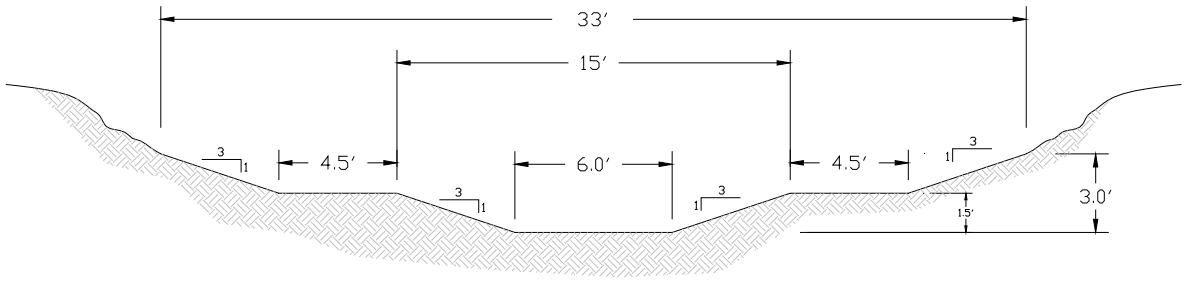


Figure 4. CROSS SECTION 2 DOWNSTREAM OF BRIDGE (DS2). NOTE - NO MODIFICATION IS NEEDED FOR THIS CROSS-SECTION. IT IS INCLUDED TO SHOW THE STREAM CROSS-SECTION INTO WHICH UPSTREAM CROSS-SECTIONS SHOULD BE 'TIED-IN'.



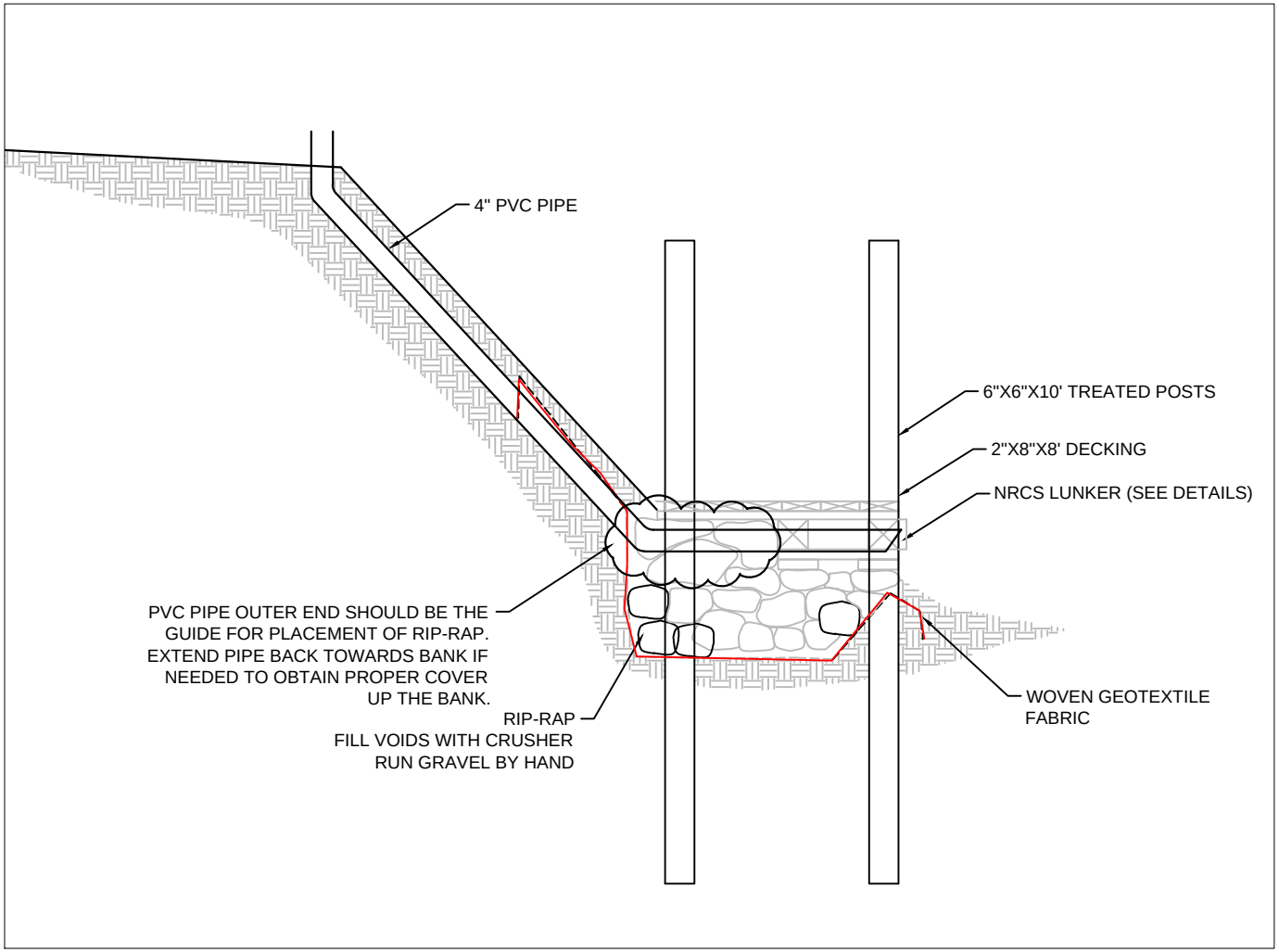
The important features with regard to the cross-section are:

- The width of the stream at an elevation 1.5’ above its deepest point (the thalweg) should be about 15’,
- The width of the stream at an elevation 3.0’ above its deepest point should be at least 33’.

Other considerations are:

- If the stream bed width Is already greater than 6’, then start the bank slopes at its actual width rather than trying to fill the stream.
- The above figure shows a symmetric stream cross-section with slopes from the bed of the stream to the ‘floodplain bench’ and at the outer edges of the floodplain bench being 3. Note that the slope doesn’t have to be 3:1 as long as the widths shown above at the 1.5’ and 3.0’ elevations are met and the bank is otherwise stable.
- The slopes of the banks can be laid back at any angle as long as it is stable for bank elevations above 3.0’ above the thalweg.
- The dimensions shown above do not have to be symmetric about the centerline of the stream. For instance, if the floodplain bench is to be only 2’ on the “right” side of the stream then the floodplain bench could be made to be 7’ wide on the “left” side.

NOTE: The Contractor should provide proof of insurance (e.g., a Certificate of Insurance), and will be expected to provide ATR Associates, Inc., “additional insured” coverage for this project.



SEQUENCE OF OPERATIONS

1. CLEAR STREAM AND BANK OF RUBBLE
2. EXCAVATE 'TRENCH' ALONG LINE OF BANK TOE
   - 2.1. USE ENDS OF PVC PIPE AS GUIDE TO WHERE OUTER LIMIT OF RIP-RAP SHOULD BE PLACED
   - 2.2. EXCAVATE TRENCH THE WIDTH OF LUNKERS - LAYING DOWN THE FABRIC AND HOLDING IT IN PLACE WITH LARGE RIP-RAP STONES
   - 2.3. MAKE SURE THERE IS ENOUGH FABRIC ON THE 'BANKSIDE' OF THE TRENCH TO GO UP THE NEW, STABILIZED BANK WHEN IT IS CONSTRUCTED.
3. INSTALL 6X6 PILINGS
   - 3.1. USE CONSTRUCTED LUNKERS TO JUDGE WHERE TO PLACE THE 6X6 PILINGS. USE 10' PILINGS FOR THOSE NEAR-SHORE, AND CONSIDER USING 12' LENGTHS FOR OUTER PILINGS IF NEEDED FOR STABILITY.
   - 3.2. ALTHOUGH WE ORIGINALLY PLANNED ON 5 LUNKERS UPSTREAM OF THE BRIDGE - USE AS MANY AS NEEDED TO SPAN THE DISTANCE BETWEEN THE PVC DISCHARGE PIPES.
4. ONCE PILINGS ARE IN PLACE, FILL TRENCH WITH SMALLER RIP-RAP
   - 4.1. USE VERY SMALL RIP-RAP OR CRUSHER RUN TO STABILIZE LARGER RIP-RAP STONES
   - 4.2. FORM A RIP-RAP 'DAM', WITH THE TOP WIDTH THE SAME AS THE LUNKER
   - 4.3. BRING RIP-RAP UP TO AN ELEVATION WHERE WHEN THE LUNKER IS PLACED ON TOP OF IT, THE LUNKER IS LEVEL, AND THE WATER LEVEL IS WITHIN THE 8X8 LUNKER 'SPACER' CAVITY
5. PLACE LUNKERS ON RIP-RAP AND TIE THEM TO THE 6X6 PILINGS
6. RE-GRADE EXISTING BANK TO 1:1 SLOPE
7. USE BACKHOE BUCKET TEETH TO SCARIFY RE-GRADED BANK
8. BACKFILL THE SPACE BETWEEN THE RIP-RAP 'DAM' AND THE EXISTING BANK (MAY WANT TO CONSIDER SOME METHOD OF DE-WATERING AT THIS POINT)
9. CONTINUE BACKFILLING UP THE BANK IN 6" - 12" LIFTS, COMPACTING EACH LIFT WITH PLATE COMPACTOR TO FORM A 2:1 (OR THEREABOUTS) FINAL GRADE
10. PLACE SMALLER RIP-RAP UP SLOPE (UNDERLAIN BY FABRIC) TO EXCEED ELEVATION OF SAND BAR ON OPPOSITE SHORE BY 1'
11. INSTALL STEPS
    - 11.1. EXCAVATE 'TRENCHES' DOWN THE SLOPE
    - 11.2. FILL 'TRENCHES' WITH SMALL RIP-RAP UNDERLAIN BY FABRIC
    - 11.3. INSTALL STEPS OVER RIP-RAP
12. INSTALL EROSION CONTROL JUTE MAT AND SEED BANK.

Photo Summary for Water Training Site

Photo 1 - A view of degraded streambank on north side of stream facing downstream. New pedestrian bridge had just been recently installed and this project was to restore the stream bank while at the same time create a working platform for the Water Training Units.

Photo 2 – A view of a portion of the bank being drawn back to a more gentle slope with the foundation of the water training platform being installed. The PVC pipes are being installed to accommodate the discharge hoses from Water Training Units in lieu of leaving the hoses loose on the bank creating erosion down the bank. These PVC pipes extend through the bank to the creek under the platform. Fill material would be brought in at this point to achieve proper bank slope and cover exposed PVC.

Photo 3 - Facing upstream from Photo 2 to the other end of the platform under construction. This view shows the bank having achieved the final slope for this section. Looking further upstream on the other side of the channel you can see a highly eroded bank with trees falling into the creek.

Photo 4 – More heavy equipment work to re-slope the bank. Notice here the better view of the upstream eroded bank on the other side.

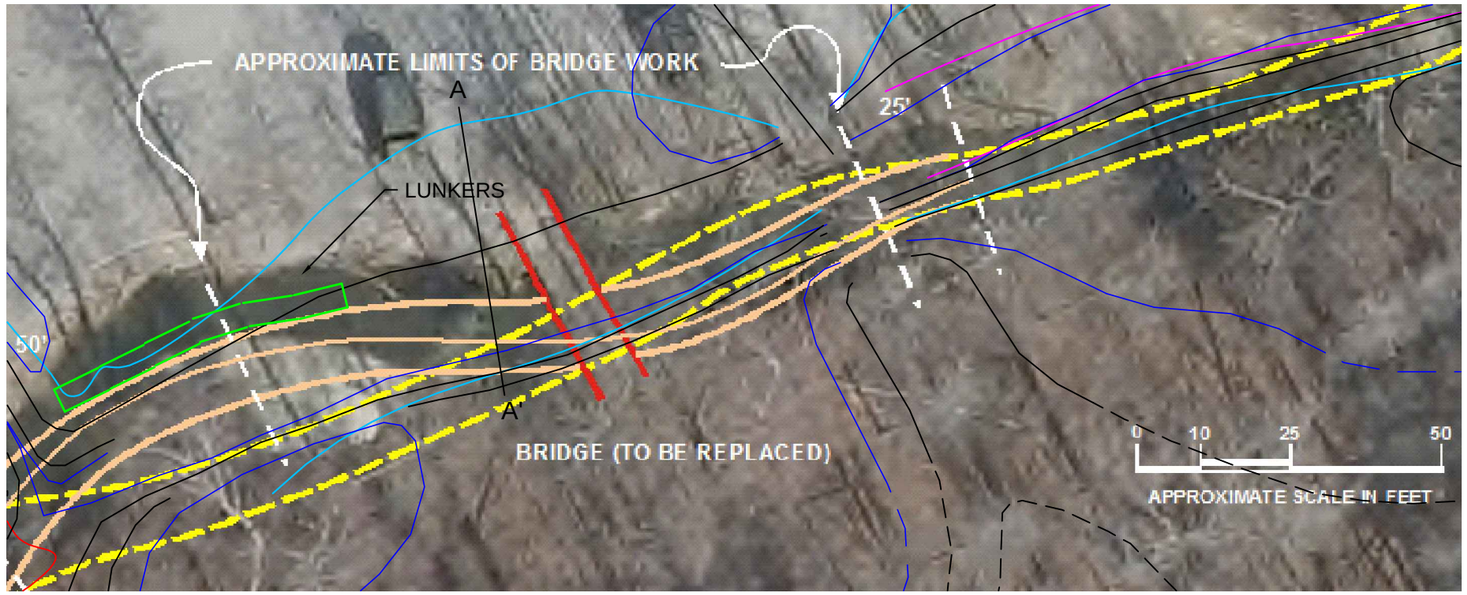
Photo 5 – Platform section of shoreline reaching final phase. Stairs allow Soldiers to access the creek channel safely and use their equipment along the water's edge without being in the creek.

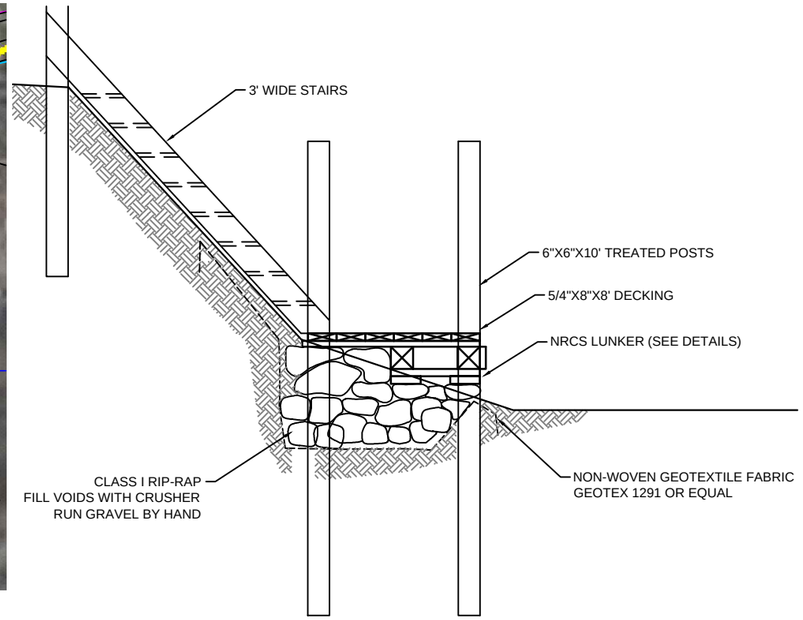
Photo 6 – Work on the upstream shoreline on the south side of the creek. The bank has been denuded to about 10 ft back and is now being drawn back to achieve a more desirable slope. Bank is being prepped for seeding and for riprap along the toe.

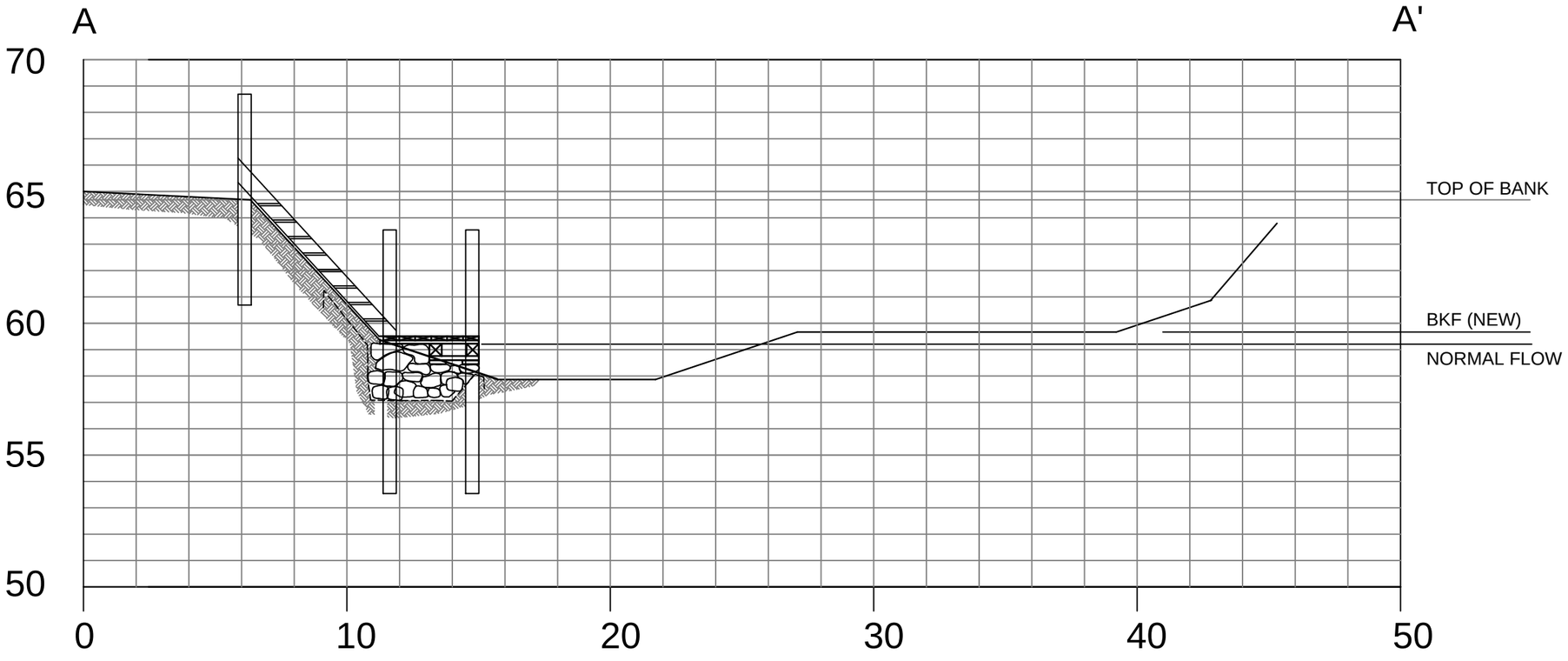
Photo 7 – Completed shoreline on north and south sides. Grass starting to fill in.

Photo 8 – Final view of southern, upstream shoreline. Good grass cover and stable edge.

**This site has held up extremely well and created an award-winning platform for the Petroleum & Water Division's Water Training Unit. We have received lots of thanks from the water training folks for this innovation solution to their training demands, in addition to the rescue of their shoreline. They were losing several feet per year to erosion before we went in and restored the shoreline and created their training platform.







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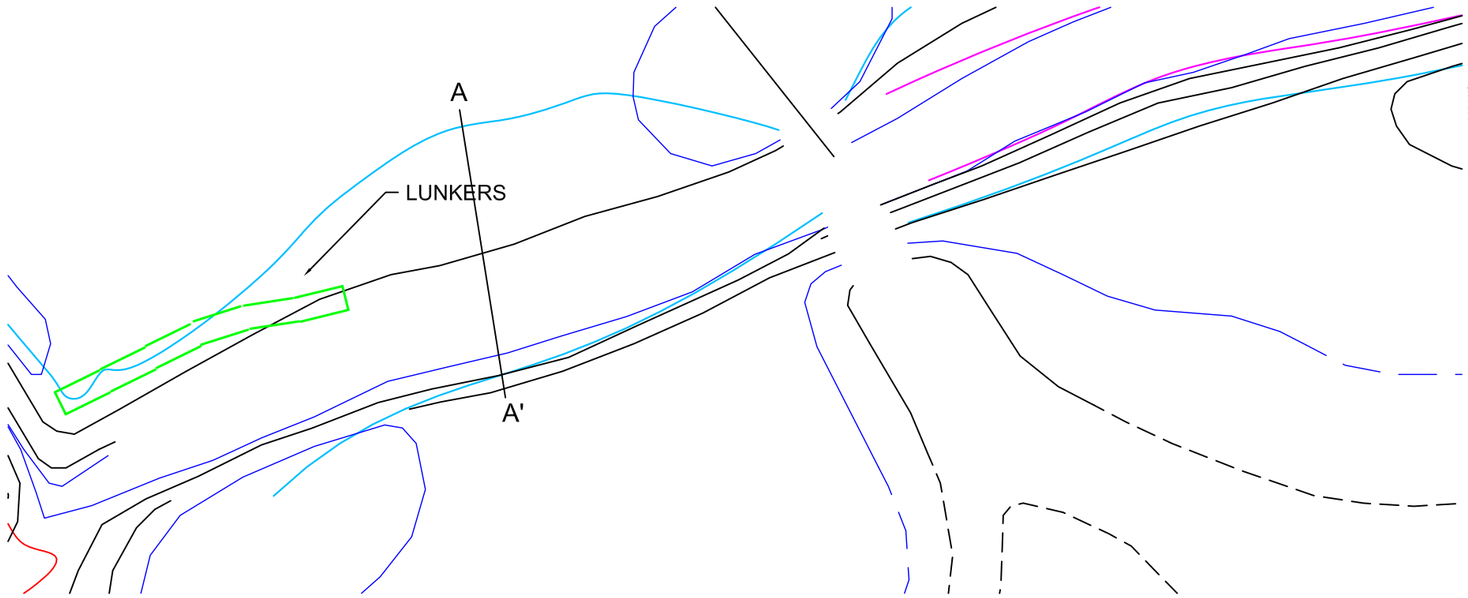
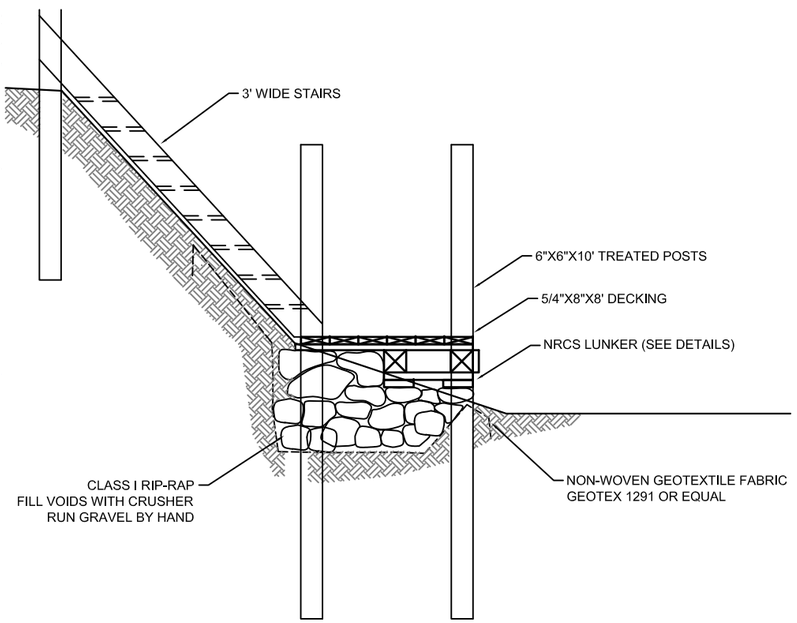
Reviewed by: RLS | Plot date: 3/3/2011

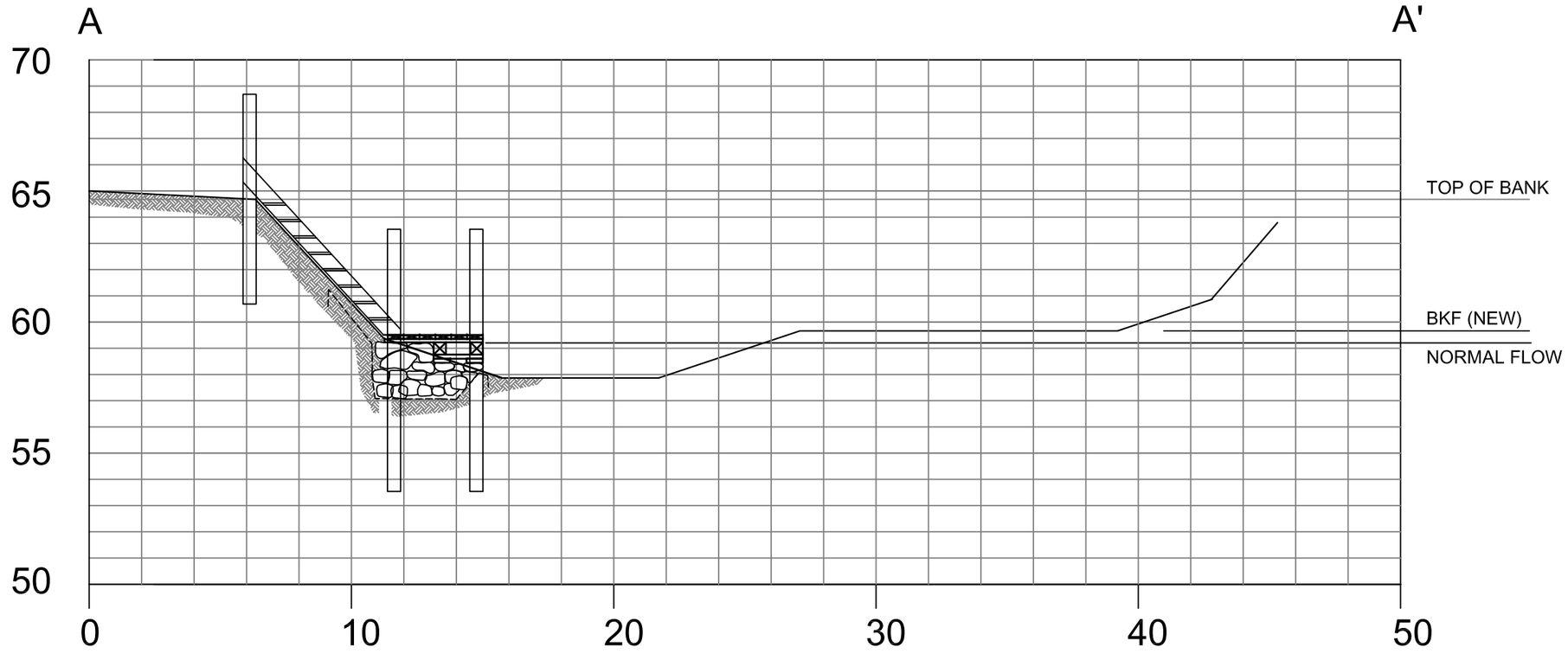
WATER TRAINING AREA
FORT LEE, VIRGINIA

PLAN VIEW AND

Sheet Reference No
C-002
Sheet 2 of 3







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RLS	3/3/2011	As shown

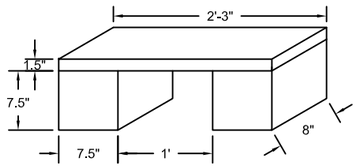
WATER TRAINING AREA
FORT LEE, VIRGINIA

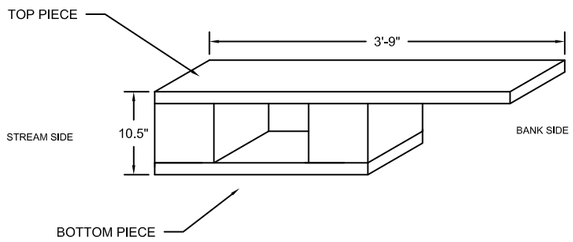
PLAN VIEW AND
CROSS-SECTIONS

Sheet Reference No.

C-002

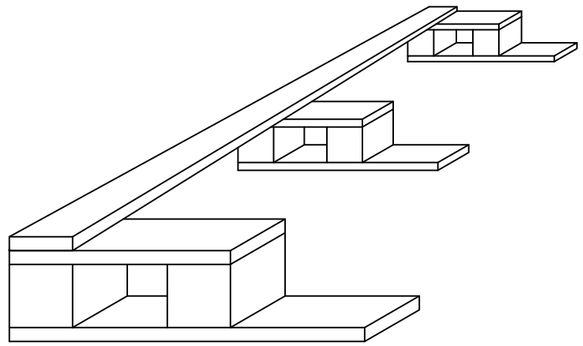
Sheet 2 of 3



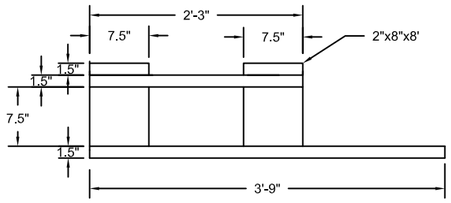


STEP 1: BUILD SPACERS

BUILD 3 EQUAL SPACERS AS SHOWN USING OAK OR OTHER WOOD THAT IS STRONG AND ROT RESISTENT. USE 20 d NAILS MINIMUM.

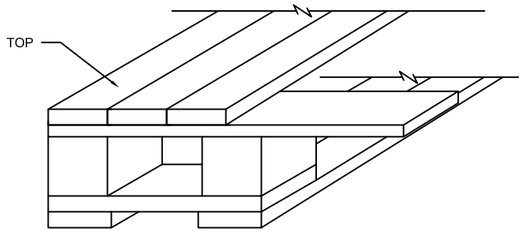


PERSPECTIVE SIDE VIEW (ONE PLANK IN PLACE)

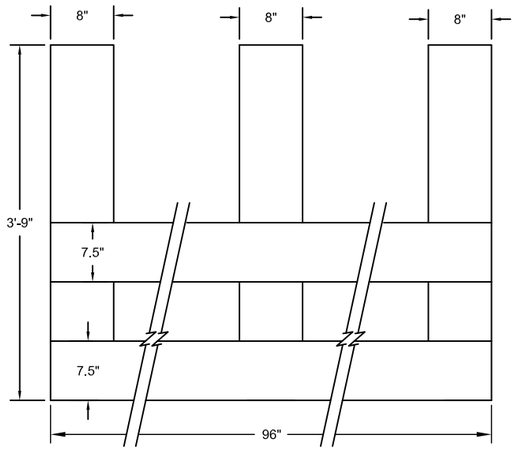


STEP 2: FORM THE LUNKER BOTTOM

BRIDGE THE SPACERS WITH TWO 8-FOOT PLANKS. THE SPACERS SHOULD BE EVENLY SPACED. SECURE EACH PLANK WITH 20 d NAILS.



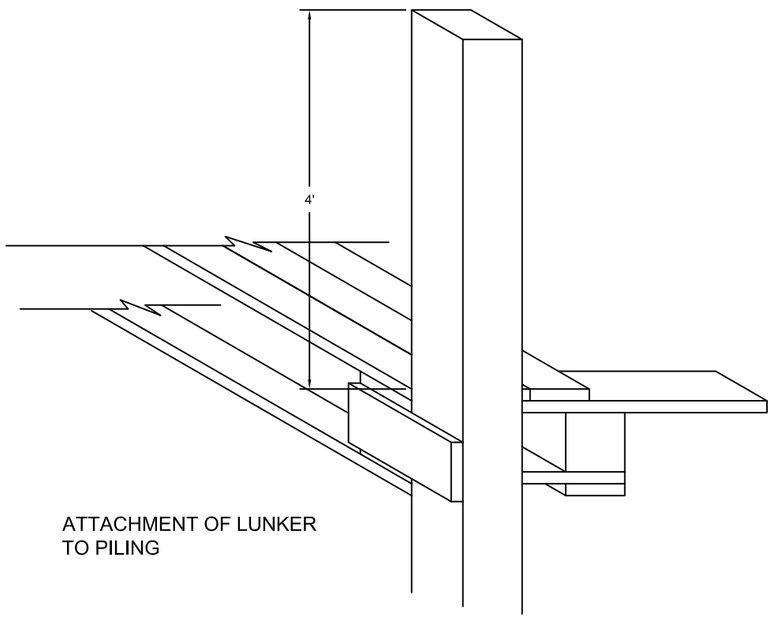
PERSPECTIVE SIDE VIEW (THREE PLANKS IN PLACE)



PLAN VIEW (TWO PLANKS IN PLACE)

STEP 3: FORM THE LUNKER TOP

BRIDGE THE SPACERS WITH THREE 8' PLANKS. SECURE EACH PLANK WITH 20 d NAILS.



ATTACHMENT OF LUNKER TO PILING

NOTES:

1. ALL LUMBER DIMENSIONS ARE SHOWN AS FINISHED S4S. UNFINISHED LUMBER IS ACCEPTABLE.
2. ALL LUMBER SHOULD BE TREATED FOR ROT RESISTANCE.
3. LUNKERS SHOULD BE FASTENED TO PILINGS WITH GALVANIZED THROUGH BOLTS (E.G., CARRIAGE OR HEX BOLTS), NOT LAG BOLTS.

Mark	Description	Date	Appr

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Reviewed by: RLS		Plot date: 3/3/2011	
Submitted by: RLS		Drawing scale: As shown	

WATER TRAINING AREA
FORT LEE, VIRGINIA

LUNKER DETAILS

Sheet Reference No.
C-003
Sheet 3 of 3