

**DRAFT  
CITY OF WASHINGTON  
POLLUTANT REDUCTION PLAN  
FOR THE  
UPPER CHARTIERS CREEK WATERSHED**



**CITY OF WASHINGTON,  
WASHINGTON COUNTY, PENNSYLVANIA  
AUGUST 2017**

**PREPARED BY  
SKELLY AND LOY, INC.  
HARRISBURG, PENNSYLVANIA**

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UPPER CHARTIERS CREEK WATERSHED  
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WASHINGTON COUNTY, PENNSYLVANIA**

**PREPARED FOR**

**CITY OF WASHINGTON  
55 WEST MAIDEN STREET  
WASHINGTON, PENNSYLVANIA 15301**

**PREPARED BY**



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**AUGUST 14, 2017**

## TABLE OF CONTENTS

	PAGE
EXECUTIVE SUMMARY .....	1
PURPOSE.....	1
LOCATION.....	1
MS4 REGULATED AREA.....	1
APPLICABLE SURFACE WATERS AND POLLUTANTS OF CONCERN .....	4
PRP LAYOUT.....	6
Essential Statistics .....	8
I.    INTRODUCTION.....	11
A.    LOCATION .....	11
B.    HYDROLOGY.....	11
B.    TOPOGRAPHY AND GEOLOGY .....	12
C.    SOILS.....	14
D.    LAND USE.....	14
II.   REQUIRED PRP COMPONENTS.....	16
A.    PUBLIC PARTICIPATION.....	16
1.    Advertisement Announcing the City of Washington PRP .....	16
B.    MAP.....	17
1.    Base Map.....	17
2.    Municipal Separate Storm Sewer System.....	18
3.    Outfalls.....	18
4.    Storm Sewersheds .....	19
5.    Planning Areas.....	19
C.    POLLUTANTS OF CONCERN.....	20
1.    MS4 Reduction Goals.....	20
D.    EXISTING LOADING FOR POLLUTANTS OF CONCERN.....	21
1.    Summary.....	21
2.    Calculating MS4 Existing Pollutant Load .....	22
E.    BMPs TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING.....	25
1.    Alternatives Considered .....	30
2.    Summary.....	32
F.    FUNDING MECHANISM(S).....	32
G.    RESPONSIBLE PARTIES FOR OPERATION AND MAINTENANCE OF BMPs.....	34



## LIST OF FIGURES

NO.	DESCRIPTION	PAGE
1	CITY LOCATION MAP .....	2
2	UPPER CHARTIERS CREEK WATERSHED.....	3
3	CITY OF WASHINGTON MS4 REGULATED AND PLANNING AREAS.....	5
4	MS4 SURFACE WATERS.....	7
5	POTENTIAL BMPs.....	27
6	SELECT BMPs.....	28



## LIST OF TABLES

NO.	DESCRIPTION	PAGE
1	POLLUTANT REDUCTION TARGETS FOR SURFACE WATERS IMPAIRED BY SEDIMENT AND/OR NUTRIENTS .....	6
2	HUC 12 WATERSHED AND SURFACE WATERS.....	6
3	OUTFALLS.....	8
4	IMPAIRED SURFACE WATERS' POLLUTANT LOADS BY HUC 12 WATERSHED .....	9
5	PROPOSED BMP PROJECT .....	9
6	WASHINGTON MS4 SURFACE WATERs SUMMARY .....	13
7	LAND USE DISTRIBUTION TABLE .....	15
8	SUMMARY OF OUTFALLS.....	19
9	POLLUTANT REDUCTION TARGETS FOR SURFACE WATERS IMPAIRED BY SEDIMENT AND/OR NUTRIENTS .....	20
10	EXISTING POLLUTANT LOAD BY HUC 12 WATERSHED TOTAL FROM MAPSHED.....	21
11	FINAL ADJUSTED EXISTING POLLUTANT LOAD BY HUC 12 WATERSHED FOR REGULATED WASHINGTON MS4 .....	21
12	CITY OF WASHINGTON ADJUSTED MS4 PLANNING AREA .....	22
13	MAPSHED EXISTING POLLUTANT LOAD BY HUC 12 WATERSHED WITH PARSING ADJUSTMENT .....	24
14	FINAL ADJUSTED EXISTING POLLUTANT LOAD.....	25
15	WASHINGTON MS4 WASHINGTON MS4 SEDIMENT REDUCTION TARGET .....	25
16	PROPOSED BMP PROJECTS AND SEDIMENT REDUCTION.....	29
17	ACHIEVED SEDIMENT REDUCTION BY WATERSHED AND MAJOR BASIN .....	32
18	ESTIMATED PROJECT COSTS .....	33
19	BMP MAINTENANCE INSTRUCTIONS STREAM RESTORATION - PA STORMWATER BMP MANUAL #6.7.4 (FLOODPLAIN RESTORATION).....	35



## LIST OF APPENDICES

APPENDIX A – COPY OF PUBLIC NOTICE AND PROOF OF PUBLICATION

APPENDIX B – MS4 MAP LAYERS AND DATA SOURCES

APPENDIX C – PROPERTIES WITH INDIVIDUAL CHAPTER 102 NPDES PERMITS

APPENDIX D – MAPSHED URBAN AREA TOOL RESULTS

- D1 HUC Watershed Total
- D2 Planning Area Load: Initial Existing Load
- D3 Parsing Adjusted Load (Required for Catfish Creek/Chartiers Run)

APPENDIX E – EXISTING BMPS FOR POLLUTANT LOAD REDUCTION CREDIT

APPENDIX F – BMP COST AND REDUCTION ANALYSIS SPREADSHEETS

- F1 Chesapeake Bay Basin Summary
- F2 Watershed Summary
- F3 Catfish Creek/Chartiers Run Watershed Spreadsheet
- F4 Catfish Creek/Chartiers Run Watershed Spreadsheet
- F5 Catfish Creek/Chartiers Run Watershed Spreadsheet
- F6 PA DEP Effectiveness Values

APPENDIX G – PUBLIC REVIEW COMMENTS AND RESPONSES



## LIST OF ACRONYMS

BMP	Best Management Practices
CAST	Chesapeake Assessment Scenario Tool
CBPRP	Chesapeake Bay Pollutant Reduction Plan
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
GWLF	Generalized Watershed Loading Function
HUC	Hydrologic Unit Codes
IDD&E	Illicit Discharge Detection and Elimination
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PA DEP	Pennsylvania Department of Environmental Protection
PA DCNR	Pennsylvania Department of Conservation and Natural Resources
PCSM	Post-Construction Stormwater Management
PennDOT	Pennsylvania Department of Transportation
PRP	Pollutant Reduction Plan
PTC	Pennsylvania Turnpike Commission
TMDL	Total Maximum Daily Load
U.S. EPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation



## **EXECUTIVE SUMMARY**



## EXECUTIVE SUMMARY

### PURPOSE

The ultimate purpose of the Pollutant Reduction Plan (PRP) is to activate implementation of specific projects to capture and reduce pollutants conveyed by stormwater runoff before they reach streams, rivers, lakes, etc. (a.k.a., surface waters). The PRP provides the background, assumptions, analysis, and methodology to establish a justifiable baseline of current pollutant load generation and then identifies Best Management Practices (BMP) with site locations, planning-level concept designs, costs, and implementation schedules. It also provides a framework for funding installation, operation, and maintenance activities that provides regulators with assurance that the identified projects will materialize within the scheduled timeframe. This City of Washington Upper Chartiers Watershed Pollutant Reduction Plan for the Chesapeake Bay Basin, Catfish Creek, and Chartiers Run is a “Upper Chartiers Watershed PRP.”

### LOCATION

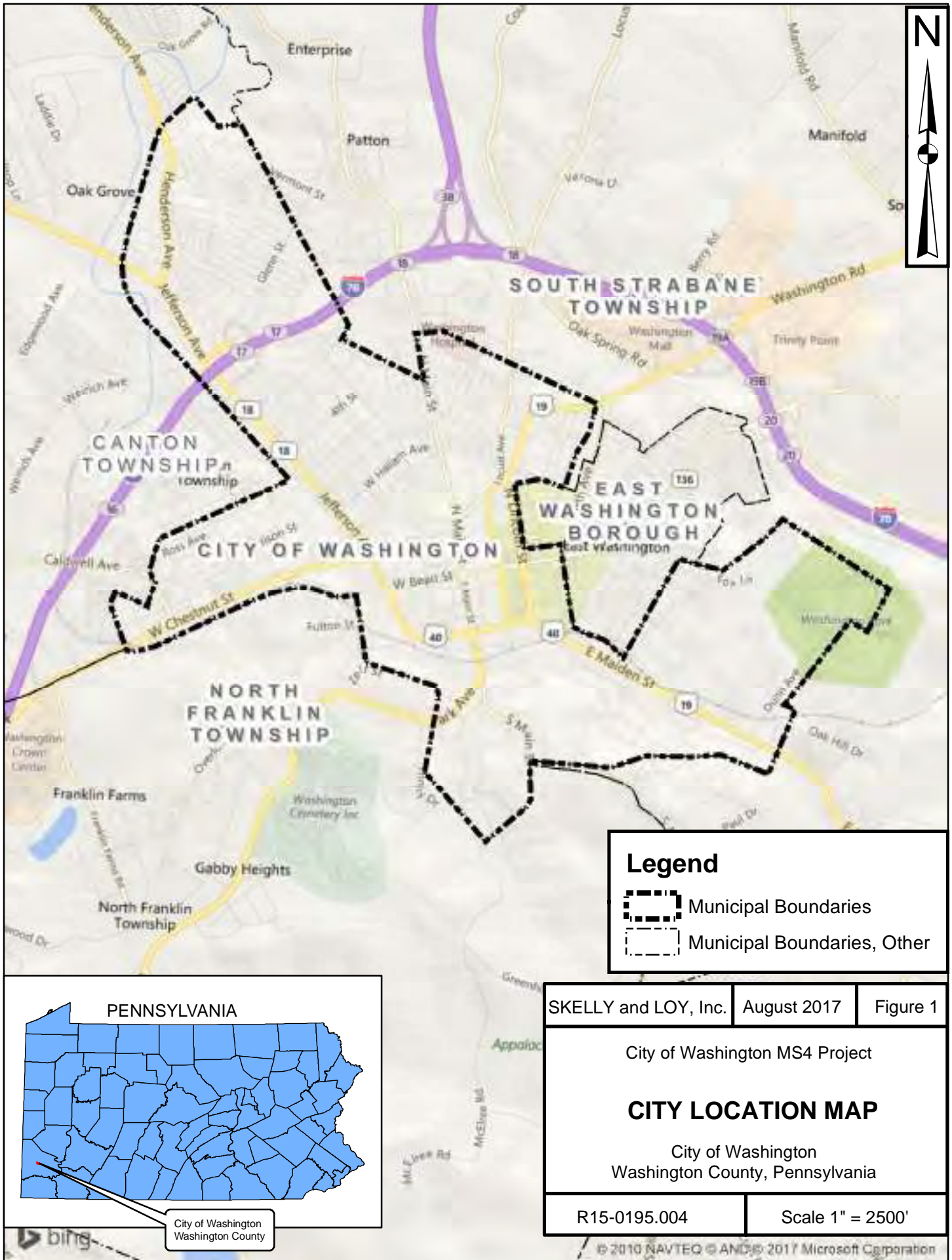
City of Washington is a 2.9-square-mile municipality in Washington County, Pennsylvania. The City is located less than 30 miles southwest of Pittsburgh, Pennsylvania. (The approximate municipality center is Latitude N40° 10' 20", Longitude W80° 14' 51"). Washington, the seat of Washington County, is surrounded on the northeast, east, and southeast by South Strabane Township; on the east by East Washington Borough; on the southwest by North Franklin Township; and on the west-northwest by Canton Township. (See **Figure 1**, Location Map.)

The City is located primarily in the 54.9-square-mile Upper Chartiers Creek Watershed. An insignificant (less than 0.3%) fringe of the City’s wooded land sheet flows to the Little Chartiers and is outside the required study area of this Pollutant Reduction Plan (PRP). (See **Figure 2**, Upper Chartiers Creek Watershed.)



### MS4 REGULATED AREA

The Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit applies only to urban runoff that flows through municipally owned and operated stormwater infrastructure with an identifiable concentrated discharge

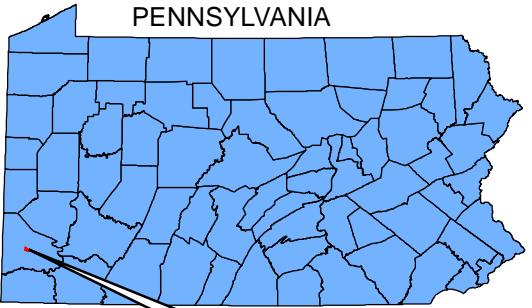




**Legend**

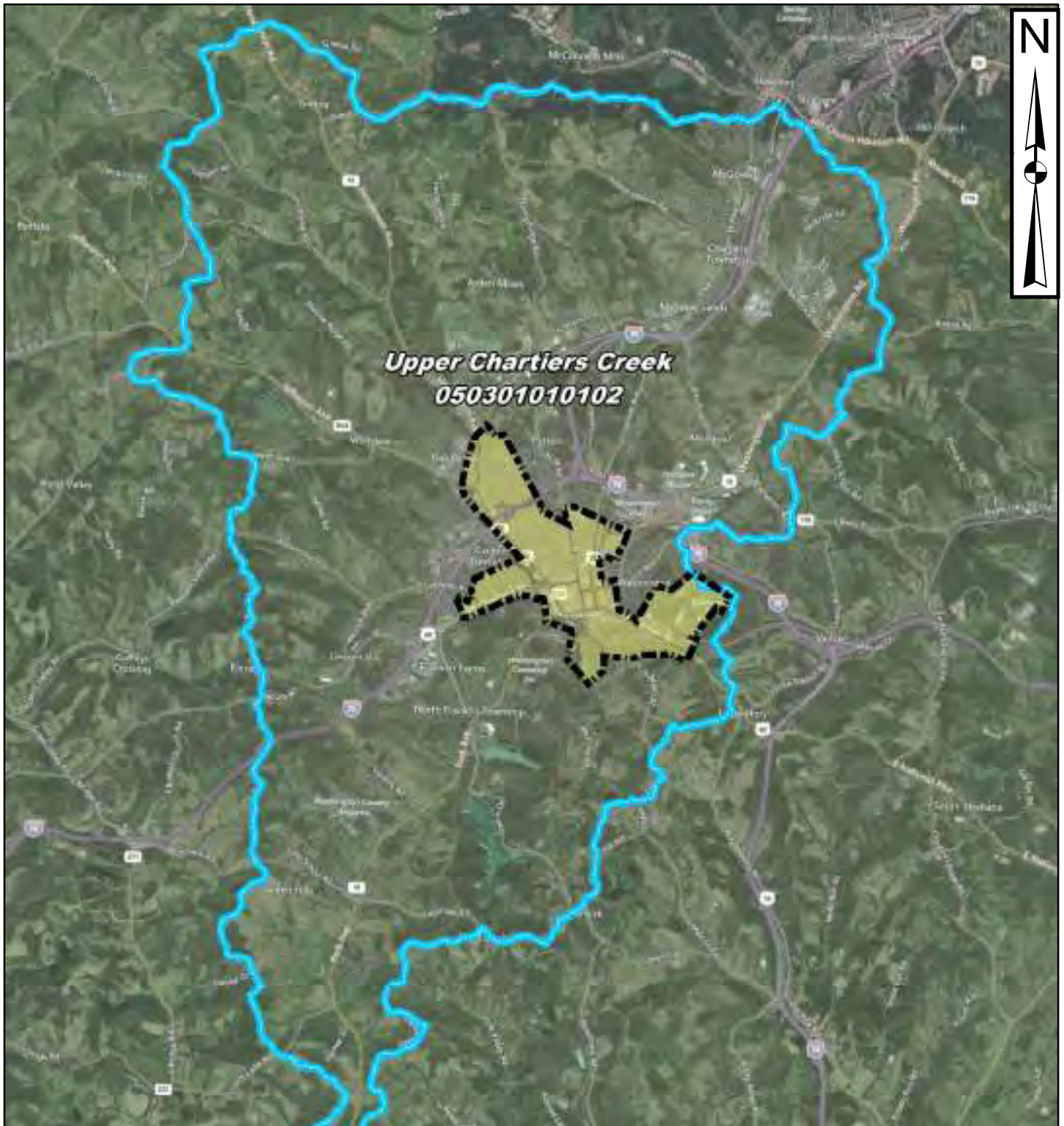
-  Municipal Boundaries
-  Municipal Boundaries, Other

**PENNSYLVANIA**



City of Washington  
Washington County




SKELLY and LOY, Inc.	August 2017	Figure 1
City of Washington MS4 Project		
<b>CITY LOCATION MAP</b>		
City of Washington Washington County, Pennsylvania		
R15-0195.004	Scale 1" = 2500'	



**Upper Chartiers Creek**  
**050301010102**



**Legend**

-  HUC 12 Watershed Boundary
-  City of Washington Municipal Boundary
-  MS4 Planning Area (shaded)

Bing Image

SKELLY and LOY, Inc.	August 2017	Figure 2
City of Washington MS4 Project <b>UPPER CHARTIERS CREEK WATERSHED</b> City of Washington Washington County, Pennsylvania		
R15-0195.004	Scale 1" = 8000'	

(outfall) to a surface water. The urbanized area is the portion of the City that is located within the Urbanized Area boundaries defined by the U.S. Census Bureau in the most recent decennial (2010) census, which includes the entire City. The regulated portion of the City consists of the urbanized area and the contributory region upgradient of the urbanized area flowing to and through the City's storm sewer system. The storm sewer system consists of the municipally owned and operated stormwater conveyance network including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains.

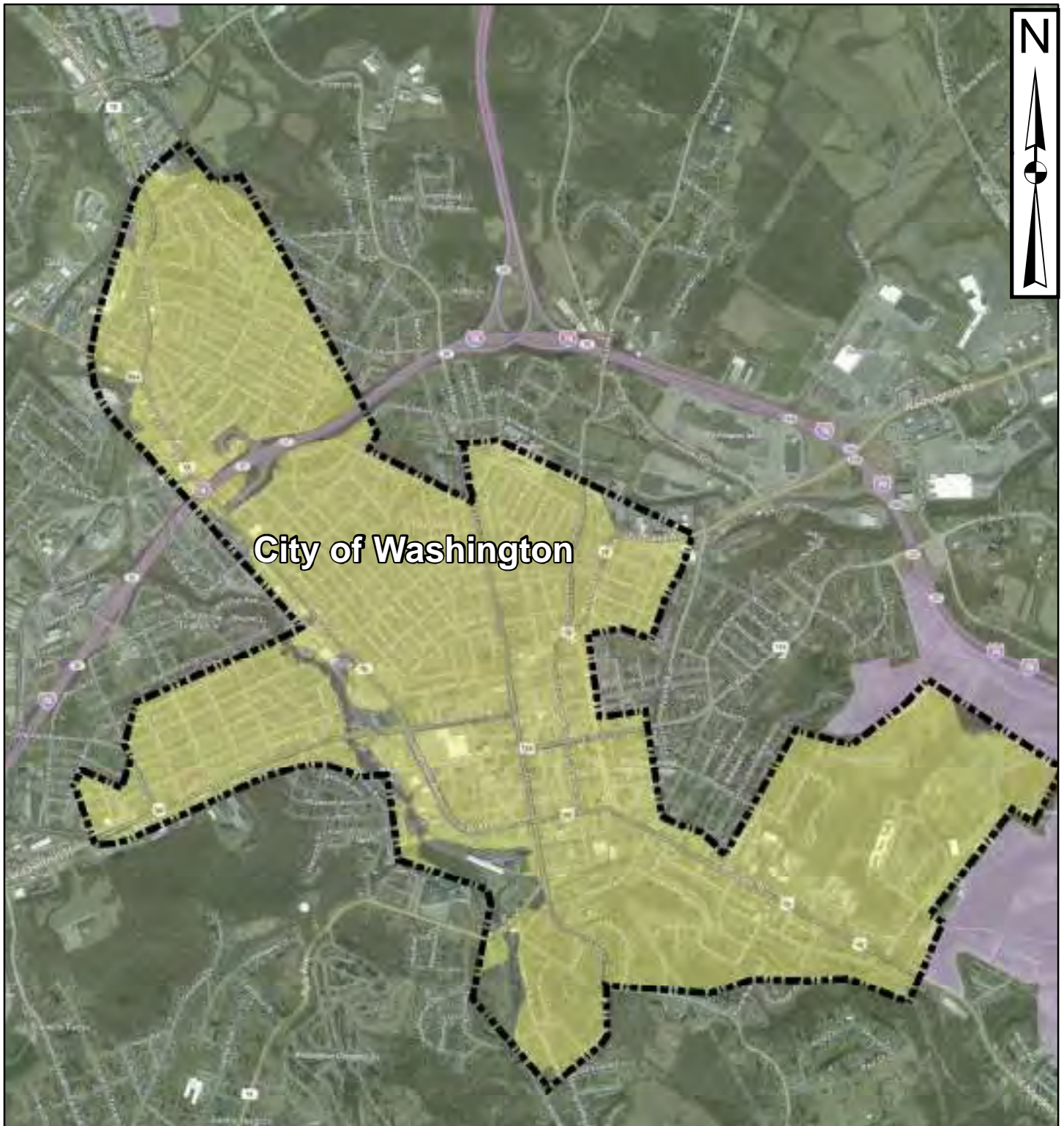
Regulated City of Washington MS4 area includes the entire 2.9 square miles of the municipality since the City is entirely within the urbanized area. (See **Figure 3**, City of Washington MS4 Regulated and Planning Areas.)

### **APPLICABLE SURFACE WATERS AND POLLUTANTS OF CONCERN**

According to the Pennsylvania Department of Environmental Protection (PA DEP) Requirements Table dated August 2, 2017, City of Washington is obligated by the regulation to provide PRPs to address **Appendix E** (Impaired Waters Sediment/Nutrient) because the City's Separate Storm Sewer System discharges to the Chartiers Creek and Catfish Creek, local surface waters listed as having impairment caused by siltation and suspended solids (surrogate names for sediment) and nutrients and organic enrichment/low D.O. (a surrogate name for nutrients). The City of Washington's MS4 also discharges to a tributary of Chartiers Creek and a tributary of Catfish Creek. Both are listed as having impairments caused by siltation and nutrients, and the tributary to Chartiers Creek additionally is listed as impaired by suspended solids and organic enrichment/low D.O.

The pollutants of concern are sediment, phosphorus, and nitrogen. PA DEP has established a uniform pollutant reduction target for MS4s not identified in an existing approved Total Maximum Daily Load (TMDL) plan. Such is the case with City of Washington. The reduction targets are listed in **Table 1**.








City of Washington

Bing Image

**Legend**

-  City of Washington MS4 Regulated Boundary
-  MS4 Planning Area (shaded)
-  Non Urbanized Areas (shaded)

SKELLY and LOY, Inc.	August 2017	Figure 3
City of Washington MS4 Project  <b>CITY OF WASHINGTON MS4 REGULATED AND PLANNING AREAS</b>  City of Washington Washington County, Pennsylvania		
R15-0195.004	Scale 1" = 2200'	

**TABLE 1  
POLLUTANT REDUCTION TARGETS FOR  
SURFACE WATERS IMPAIRED BY SEDIMENT AND/OR NUTRIENTS**

<b>POLLUTANT</b>	<b>REDUCTION TARGET</b>
Sediment (TSS)	10%
Phosphorus (TP)	5%

All surface waters receiving the City of Washington’s MS4 discharges are impaired by the pollutants of concern as shown on **Figure 4**, Watersheds and MS4 Surface Waters (p. 7.)

All the surface waters receiving runoff from the City of Washington MS4 drain to Chartiers Creek which delivers it to the Ohio River northwest of Pittsburgh at McKees Rocks. (For additional information regarding hydrology of the MS4, see Hydrology in Section I, Introduction, p. 11.)

Pollutant load modeling was completed on the HUC 12 Watershed Scale. The Washington MS4 is located entirely within the Upper Chartiers HUC 12 Watershed. The MS4 receiving surface waters of the watershed are listed in **Table 2**.

**TABLE 2  
HUC 12 WATERSHED AND SURFACE WATERS**

<b>HUC 12 CODE</b>	<b>HUC 12 WATERSHED NAME</b>	<b>SUBJECT SURFACE WATERS WITHIN HUC 12 WATERSHED</b>
0503001010102	Upper Chartiers Creek	Chartiers Creek
		1 Unnamed Tributary to Chartiers Creek
		Catfish Creek
		1 Unnamed Tributary to Catfish Creek

**PRP LAYOUT**




The Executive Summary is followed by two sections. Section I, Introduction, describes City of Washington’s characteristics influencing PRP decisions. Topics within Section I include Hydrology, Topography and Geology, Soils, and Land Use.





**City of Washington**

**Legend**

-  City of Washington Municipal Boundary
-  MS4 Planning Area (shaded)
-  Streams, Impaired

Bing Image

SKELLY and LOY, Inc. August 2017 Figure 4

City of Washington MS4 Project

**MS4 SURFACE WATERS**

City of Washington  
Washington County, Pennsylvania

R15-0195.004

Scale 1" = 2200'

Section II, Required PRP Components, provides technical data, analysis and substantiation, and proposed BMP specifics. It is organized and titled according to PA DEP's PRP Instructions. The subsections are:

- A. Public Participation
- B. Map
- C. Pollutants of Concern
- D. Existing Loading for Pollutants of Concern
- E. BMPs to Achieve the Minimum Required Reductions in Pollutant Loading
- F. Funding Mechanism(s)
- G. Responsible Parties for Operation and Maintenance (O&M) of BMPs

City of Washington has opted to use the presumptive approach to report pollutant reduction. Under this approach, it is assumed that if the required sediment reduction is achieved, phosphorus and nitrogen reductions are also reached. Therefore, only sediment load reduction is reported.

### Essential Statistics

Concise at-a-glance summaries of the information gleaned from the research, mapping, analysis, and planning effort are provided below (**Tables 3 through 5**). Please refer to the corresponding narratives in Sections I and II of the PRP for the expanded discussions.

**TABLE 3  
OUTFALLS**

DESCRIPTION	NUMBER
<b>OUTFALLS RECEIVING RUNOFF FROM CITY OF WASHINGTON MS4 LOCATED OUTSIDE CITY OF WASHINGTON</b>	
Number of Outfalls to Attaining Surface Waters	0
Number of Outfalls to Impaired Surface Waters	7
Total Number of Outfalls	7
<b>OUTFALLS UNDER CITY OF WASHINGTON JURISDICTION LOCATED IN CITY OF WASHINGTON</b>	
Number of Outfalls to Attaining Surface Waters	0
Number of Outfalls to Impaired Surface Waters	44
Total Number of Outfalls	44
<b>Total MS4 Outfalls</b>	<b>51</b>





**TABLE 4  
IMPAIRED SURFACE WATERS' POLLUTANT LOADS  
BY HUC 12 WATERSHED**

<b>DESCRIPTION</b>	<b>CHARTIERS CREEK WATERSHED (LBS/YR)</b>
Sediment Adjusted Existing Load	1,813,619
Sediment Load Reduction Target (10%)	181,362
Sediment Reduction Achieved	181,700
Sediment Over Reduction	+338
Phosphorus Adjusted Existing Load	548.2
Phosphorus Load Reduction Target (5%)	27.4
Phosphorus Reduction Achieved	Presumed
Nitrogen Adjusted Existing Load (3%)	8,348.2
Nitrogen Load Reduction Target	250.5
Nitrogen Reduction Achieved	Presumed

**TABLE 5  
PROPOSED BMP PROJECT**

<b>DESCRIPTION</b>	<b>TREATED LINEAR FEET</b>
Chartiers Run HUC 12 Watershed Stream Restoration	1,580

<b>Estimated Cost:</b>	<b>\$1,348,269</b>
------------------------	--------------------



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## **I. INTRODUCTION**

## I. INTRODUCTION

### A. LOCATION

City of Washington is a 2.9-square-mile municipality in Washington County, Pennsylvania. The City is located less than 30 miles southwest of Pittsburgh, Pennsylvania. (The approximate municipality City center is Latitude N40° 10' 20", Longitude W80° 14' 51"). Washington, the seat of Washington County, is surrounded on the northeast, east, and southeast by South Strabane Township; on the east by East Washington Borough; on the southwest by North Franklin Township; on and the west-northwest by Canton Township. (See **Figure 1**, Location Map, p. 2.)

### B. HYDROLOGY

The United States Geological Survey (USGS) developed a hierarchical system to classify hydrology by the region size draining to the watercourse. The Hydrologic Unit Codes (HUC) are comprised of 2 to 12 digits and include regions (2 digits), subregions (4 digits), basins (6 digits), subbasins (8 digits), watershed (10 digits), and subwatershed (12 digits). The PRP has been prepared based on the subwatershed (HUC 12) level. HUC 12s are generally in the 40- to 60-square-mile size (but can be larger or smaller).

The City is located primarily in the 54.9-square-mile Upper Chartiers Creek Watershed. An insignificant (less than 0.3%) fringe of the City's wooded land sheet flows to the Little Chartiers Creek Watershed and is outside the required study area of this Pollutant Reduction Plan (PRP). (See **Figure 2**, Upper Chartiers Creek Watershed, p. 3)

Chartiers Creek, for which the Watershed is named, skirts Washington along the northwest part of the City with only a 1,250-foot segment of the main stem meandering into the City near Woodland and Jefferson Avenues. Chartiers Creek continues north from Washington, flowing through the Middle and Lower Chartiers Creek Watersheds to its confluence with the Ohio River northwest of Pittsburgh at McKees Rocks.

There is an unnamed tributary to Chartiers Creek immediately north of Interstate 70. Except for two short sections (totaling 300 linear feet), this tributary is piped underground.

Catfish Creek drains the bulk of Washington south of Interstate 70. The headwater of the mainstem of Catfish Creek is south of town near South Main Street and Sanitarium Road. An unnamed tributary joins Catfish Creek just north of Park Avenue at the southwest end of a football stadium. The tributary drains an area locally known as Holiday Hills. The receiving



watercourses are highlighted on **Figure 4**, MS4 Surface Waters (p. 7). To facilitate identification of the unnamed tributaries, the final two digits of its 14-digit Reach Code have been included in the surface water names of the figure.

Surface waters of Pennsylvania have been classified into four designated uses (aquatic life, fish consumption, potable water supply, and fish consumption) as found in Pennsylvania Title 25 Environmental Protection, Chapter 93 Water Quality Standards (Chapter 93). Every two years the surface waters are qualitatively evaluated as having water quality supportive of their designated use (attaining) or having water quality deficient for support of the designated use (non-attaining).

All of the watercourses in Washington are non-attaining their designated uses. Chartiers Creek main stem, Chartiers Creek's unnamed tributary (Reach 35), and Catfish Creek main stem are impaired by siltation and suspended solids (surrogate names for sediment), nutrients and organic enrichment (a surrogate name for nutrients), and metals. Chartiers Creek main stem is also impaired for pathogens north of Interstate 70. Catfish Creek's unnamed tributary (Reach 14) is listed as having impairments caused by siltation and nutrients.

**Table 6**, Washington MS4 Surface Water Summary, includes pertinent information for the MS 4 surface waters.

## **B. TOPOGRAPHY AND GEOLOGY**

The City lies in the Waynesburg Hills Section of the Appalachian Plateaus Province, which is characterized as very hilly with narrow hilltops and steep-sloped narrow valleys. The region is marked by a dendritic drainage pattern. The highest point in Washington is located in Washington Park, approximately 1,370 feet above sea level. The lowest point is at the north end of town along the Chartiers Creek, approximately 994 feet above sea level.

The underlying geology of Washington is mostly sandstone with shale and intermittent deposits of limestone and coal. The Washington Formation is dominant and lies beneath the central and southern portions of the City. The north end of town is located over the Conemaugh Group while Washington Park (at the east end of Washington) is underlain by the Green Formation.



**TABLE 6  
WASHINGTON MS4 SURFACE WATERS SUMMARY**

<b>SURFACE WATER NAME</b>	<b>HUC 12 CODE</b>	<b>REACH CODE AT MOST DOWNSTREAM OUTFALL</b>	<b>CHAPTER 93 DESIGNATED USE</b>	<b>STATUS A (ATTAINING) I (IMPAIRED)</b>	<b>IMPAIRMENT CAUSE</b>	<b>TOTAL LENGTH (MILES)</b>	<b>DISTANCE MOST DOWNSTREAM OUTFALL TO MOUTH (MILES)</b>	<b>DOWNSTREAM RECEIVING SURFACE WATER NAME</b>
<b>Chartiers Creek</b>	050301010102	05030101000116	WWF <sup>1</sup>	I	Nutrients, Organic Enrichment/Low D.O., Suspended Solids, Siltation, Pathogens, Metals	49	37.6	Ohio River
Chartiers Creek, Unnamed Tributary (Reach 35)		05030101005035	WWF <sup>1</sup>	I	Nutrients, Organic Enrichment/Low D.O., Suspended Solids, Siltation, Metals	1.8 <sup>2</sup>	0.6	Chartiers Creek
<b>Catfish Creek</b>		05030101001412	WWF <sup>1</sup>	I	Nutrients, Organic Enrichment/Low D.O., Suspended Solids, Siltation, Metals	3.6	0.5	Chartiers Creek
Catfish Creek, Unnamed Tributary (Reach 14)		05030101001414	WWF <sup>1</sup>	I	Nutrients, Siltation	1.6	0.03	Catfish Creek
1. WWF Warm Water Fishes 2. 96% of the Reach within Washington is enclosed in an underground pipe								



## **C. SOILS**

Well-drained soils with moderate permeability are ideal for successful implementation of infiltrative stormwater best management practices. The majority of the soils within Washington are in the Newark-Culleoka-Newark Association. Dormont soils cover almost 50% of Washington and are located on the side slopes of the hills of Washington. Dormont soils are moderately well-drained, with a depth of 24 to 44 inches to the water table, and are classified as Hydrologic Group D. Culleoka and Weikart soils are located on the summits and shoulders of the hills. Culleoka soils (Hydrologic Group B) are moderate to well-drained and are a little deeper than Weikart soils (Hydrologic Group D) which tend to drain rapidly and have shallow depth (<30 inches) to bedrock. Newark Soils (Hydrologic Group B/D) are frequently flooded and are located in the stream valleys.

## **D. LAND USE**

The 270-acre Washington Park at the east end of Washington is predominately forested and naturalized areas with interspersed baseball fields, tennis courts, a swimming pool, playgrounds, and pavilions. The remainder of Washington has urban character. It is fully developed with a mixture of residential, institutional, commercial, and industrial land uses. Remaining unbuilt acreage consists of steep to moderately steep slopes and corridors containing surficial stormwater drainage paths. New construction is generally limited to the redevelopment of existing land uses. The concentration and impervious nature of the urban environment greatly contributes to high velocity runoff that exacerbates erosion and sediment delivery to the region's surface waters.

A number of state roads traverse the City. The significance of the state road system is that the Pennsylvania Department of Transportation (PennDOT) is its own MS4, and the rights-of-way of the state-owned and -operated roads are excluded from the City's planning area. (See Section II.D.a., Planning Area Deductions [Parsing]). State roads crossing Washington include the following:

- Interstate 70: East-west north end of the City
- U.S. Route 40: East-west central and southern City
- U.S. Route 19: North-south eastern City
- S.R. 0018: North-south western City
- S.R. 0136: East from central City



- S.R. 0844: Northwest City split from State Route 18
- Other Segments: S.R. 1009, S.R. 1083, S.R. 2001, S.R. 4022, S.R. 4032, S.R. 4049, S.R. 4051, and S.R. 8014

The Land Uses depicted by the aerial photograph background of the MS4 maps is described below in **Table 7**, Land Use Distribution Table. The land uses were derived from the pollutant load estimating model (MapShed) utilized in preparation of the PRP. Crosswalk names reference to the Chesapeake Assessment Scenario Tool (CAST) program are provided per the PADEP PRP preparation instructions to refer to CAST names and definitions.

**TABLE 7  
LAND USE DISTRIBUTION TABLE**

LAND USE		UPPER CHARTIERS CREEK	
MAPSHED NAME	CAST NAME	WATERSHED	PLANNING AREA
Hay/Pasture	Pasture	6,220	5
Cropland	Hightill with Nutrients	1,695	0
Forest	Forest	12,919	94
Wetland	No Equivalent	0	0
Disturbed	Regulated Construction	94	0
Turfgrass (includes golf courses and large expanses of turf)	Regulated Pervious	306	0
Open Land	Nonregulated Pervious Developed	2,965	109
Bare Rock	Nonregulated Impervious	0	0
Sandy Areas	Nonregulated Extractive	0	0
Unpaved Roads	No Equivalent	0	0
Low-Density (LD) Mixed	Regulated Impervious	791	15
Medium Density (MD) Mixed	Regulated Impervious	1,134	64
High-Density (HD) Mixed	Regulated Impervious	3,205	442
Low-Density (LD) Residential	Regulated Impervious	1,231	0
Medium Density (MD) Residential	Regulated Impervious	4,307	798
High-Density (HD) Residential	Regulated Impervious	146	136
Water	Water	155	0
<b>TOTAL</b>		<b>35,168</b>	<b>1,663</b>

Note: All areas are provided in acres.





## **II. REQUIRED PRP COMPONENTS**

## II. REQUIRED PRP COMPONENTS

### A. PUBLIC PARTICIPATION

The PRP for the Upper Chartiers Watershed was introduced at a public meeting of the City Council on August 7, 2017, at 1:00 P.M. The 30-day review period for the Upper Chartiers Watershed PRP was advertised in the local newspaper, *The Observer-Reporter*, on August 11 and August 14, 2017. The verbiage of the advertisement is provided below. A copy of the advertisement and proof of publishing are provided in **Appendix A**.

#### 1. Advertisement Announcing the City of Washington PRP

A copy of the City of Washington Pollutant Reduction Plan (the "Plan") for the Upper Chartiers Watershed is available for public review and comment at the offices of City of Washington, 55 Est Maiden Street, Washington, PA 15301 beginning August 14, 2017 through and including September 13, 2017 weekdays, during regular business hours of 8:30 a.m. to 5:00 p.m. The Plan is also available for review beginning August 14, 2017 at the Middlesex Township website at <http://www.washingtonpa.us/>. The Plan describes the MS4 regulated City of Washington areas, applicable surface waters and pollutants of concern, existing pollutant loads by HUC 12 watershed, pollutant reduction targets for surface waters impaired by sediment and/or nutrients, and proposed BMP projects. Comments are requested to be placed in writing and submitted to the City of Washington at the office address above no later than September 13, 2017. The proposed adoption of the Plan by the City Council will be considered at a public meeting on September 14, 2017 at 7:00 p.m. during the Council's regularly scheduled meeting, at which time public comment concerning the Plan will also be accepted.

Lynn Galluze, Computer Systems & Web Site Coordinator, City of Washington, PA

Additionally, the Upper Chartiers Watershed PRP was placed on the City's Web page (<http://www.washingtonpa.us/>) for review beginning on August 14, 2017, where it remained for the entirety of the 30-day review period. Interested parties had the option to provide written comments to Ms. Lynn Galluze, Computer Systems & Web Site Coordinator, at City Hall on or before September 13, 2017, or to attend any of the regularly scheduled meetings of the City Council on September 11, 2017, at 6:00 P.M. (Agenda Meeting) or September 14, 2017, at 7:00 P.M. (Council Meeting) to discuss their concerns in the public forum. Comments received and considerations are provided in **Appendix G**.

The finalized Upper Chartiers Watershed PRP was presented and adopted at a regularly scheduled public meeting of the City of Washington City Council on September 14, 2017, at 7:00 P.M.



## B. MAP

The Washington MS4 Map serves the following purposes:

1. Inventory of the City of Washington's existing stormwater network
2. Delineation of the components required by regulation including:
  - a. Land uses and/or impervious and pervious surfaces
  - b. Outfalls
  - c. Storm sewershed boundaries
  - d. Planning areas
  - e. Locations of proposed BMPs
3. Framework for documenting maintenance practices and Illicit Discharge Detection and Elimination (IDD&E) activities
4. Location of proposed pollutant-reducing projects

### MS4 Map Bullets

- **Map Fulfills Multiple Purposes**
  - Inventory
  - Regulated area identification
  - Inspections
  - Future project identification
- **GIS-Based**
- **Base Map**
  - Compiled from publicly available sources
- **Stormwater Sewer Collection System**
  - Digitized from aerial photographs
- **Outfalls and Sewersheds**
  - Produced by professionals
  - Color-coded:
    - Green for Attaining (N/A for the City of Washington)
    - Red for Non-Attaining
- **Planning Areas**
  - Demarcated through GIS Analysis

The map is a Geographic Information System (GIS) product created using ESRI Arc Map.

### 1. Base Map

The base map information was acquired from various publicly available sources including Bing Maps, Washington County GIS, Washington County Tax Maps, PA DEP, Pennsylvania Department of Conservation and Natural Resources (PA DCNR), PennDOT, and the U.S. Census Bureau that are detailed in **Appendix B**, MS4 Map Layers and Data Sources. The information from these sources is shown on the map unedited. Therefore, there are variations in the locations of duplicated information. However, the composite of the information sufficiently provides the required data elements including land uses, impervious/pervious surfaces, locations and names of surface waters that receive discharges from the MS4 outfalls, public and private property lines, municipal boundaries, and the Urbanized Area Boundary according to the

2010 U.S. Census. City of Washington and its consultant, Skelly and Loy, Inc., make no claims as to the accuracy of the data.

## **2. Municipal Separate Storm Sewer System**

The stormwater sewer collection system shown on the MS4 Maps consisting of the surface stormwater conveyances (publicly owned streets, ditches, swales and similar privately owned components that are connected to the system) was digitized based on desktop analysis of aerial photographs and topography.

The remainder of the stormwater sewer system (including inlets, pipes, manholes, intakes, and discharges) will be mapped and field-verified as a separate work effort during the permit term.

## **3. Outfalls**

As part of the previous permit cycle, the City field-located 39 of its outfalls. The end of stormwater pipes, swales, gutter, and ditch connections between municipal streets/properties and surface waters were inventoried by the City's consultant, Skelly and Loy, Inc., on September 2 and September 9, 2016. Twelve (12) additional outfalls were located by plotting the path that storm runoff will follow by gravity between the City of Washington MS4 and the receiving surface water (a.k.a., rain traces). In establishing rain traces, surface topography with enclosed depression characteristics (such as stormwater basins, sinkholes, and ponds) were ignored, in accordance with PA DEP directions, to assume flooded conditions.

**PA DEP 3800-PM-BCW0200A  
dated 1/2017 (page 6, note 2)**

“For discharges to the ground surface rather than directly to surface waters the location where stormwater would likely enter a surface water as a result of a significant storm event is to be identified as the outfall. All stormwater discharges from MS4s are point sources to surface waters unless the stormwater is intentionally directed to the subsurface under a permit.”

The outfall identification numbering follows the recommendation from PA DEP, with the lowest number located at the furthest downstream location and increasing sequentially for upstream locations.



City of Washington has 51 outfalls. All of the City of Washington’s outfalls discharge to surface waters impaired by sediment or nutrients. Outfalls are distributed to the surface waters as shown on Table 8.

**TABLE 8  
SUMMARY OF OUTFALLS**

<b>SURFACE WATER NAME</b>	<b>NUMBER OF OUTFALLS</b>
Chartiers Creek	9
Chartiers Creek Tributary (Reach 35)	3
Catfish Creek	34
Catfish Creek Tributary (Reach 14)	5
<b>Total</b>	<b>51</b>

Of the 51 total outfalls, 44 are located in City of Washington; the remaining 7 outfalls discharge beyond the municipal limits.

#### **4. Storm Sewersheds**

Storm sewersheds were produced by qualified staff using professional judgment to delineate contributory drainage area to each outfall. As part of the analysis, sewersheds were planned to be color-coded to correspond to the impairment/attainment status (as identified in PA DEP’s 2014 Integrated Water Quality Monitoring and Assessment Report) of the receiving surface water at the Washington MS4 outfall location. Sewersheds discharging to surface waters attaining their designated Chapter 93 use, relative to sediment and/or nutrients, were planned to be color-coded “green.” Sewersheds discharging to non-attaining surface waters, impaired by sediment and/or nutrients, were flagged to be color-coded “red.” However, all of Washington’s MS4 sewersheds are color coded “red” because they all discharge to surface waters impaired by sediment and/or nutrients.

#### **5. Planning Areas**

Planning Areas were derived through GIS analysis that merged and clipped the sewershed, the 2010 Urbanized Area, and the upstream contributory area. The Planning Areas can be reduced to exclude parcels where development was authorized by an NPDES permit for



stormwater discharges from construction activity, areas under the jurisdiction of another regulated MS4, and areas that do not contribute drainage to the Municipal Separate Storm Sewer (MS3). The resulting region represents the “service area” (a.k.a., MS4 City of Washington planning area of that is subject to pollutant reduction removal).

**C. POLLUTANTS OF CONCERN**

Pollutants of concern within the overall PRP Planning Area are sediment and total phosphorus. The PA DEP-established pollutant removal targets are listed in **Table 9**.

**TABLE 9  
POLLUTANT REDUCTION TARGETS FOR  
SURFACE WATERS IMPAIRED BY SEDIMENT AND/OR NUTRIENTS**

POLLUTANT	REDUCTION TARGET
Sediment (TSS)	10%
Phosphorus (TP)	5%

**1. MS4 Reduction Goals**

City of Washington has opted to use the presumptive approach. BMP projects to reduce pollutants will report only sediment reduction required to achieve 10% sediment reduction.

**a. Presumptive Approach to Pollutant Reduction**

In accordance with PA DEP’s PRP Instructions (3800-PM-BCW0100k, Re. 3/2017) Section I.B., a presumption of nutrient removal compliance may be assumed if 10% sediment removal is achieved.

**PA DEP’s PRP Instructions  
(3800-PM-BCW0100k, dated 3/2017) Section I.B.  
PRPs**

“PRPs may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish a 5% TP reduction. However, MS4s may not presume that a reduction in nutrients will accomplish a commensurate reduction in sediment.”



**D. EXISTING LOADING FOR POLLUTANTS OF CONCERN**

**1. Summary**

Existing loading totals for sediment, phosphorus, and nitrogen were calculated by HUC 12 watershed using the MapShed model. Analysis at HUC 12 watershed scale is consistent with the requirement to apply the MapShed model to sufficiently sized (>10-square-mile) watersheds. City of Washington is contributory to two HUC 12 watersheds: Upper Chartiers Creek and Little Chartiers Creek. The MS4 planning area is solely located in one of them (Upper Chartiers Creek). **Table 10** lists the total loads for the Upper Chartiers Creek HUC 12 watershed in which the City of Washington MS4 is located. (Also see MapShed Urban Area Tool Results, **Appendix C1**-HUC Watershed Total.)

**TABLE 10  
EXISTING POLLUTANT LOAD BY HUC 12 WATERSHED  
TOTAL FROM MAPSHED**

HUC 12 WATERSHED NAME	HUC 12 CODE	SEDIMENT TSS (LBS/YR)	PHOSPHORUS TP (LBS/YR)	NITROGEN TN (LBS/YR)
Upper Chartiers Creek	050301010102	35,168	9,879	123,642

**Table 11** reports the adjusted existing pollutant load and reduction targets. A detailed discussion of the approach, the computer model, and other supporting calculations are provided below.

**TABLE 11  
FINAL ADJUSTED EXISTING POLLUTANT LOAD BY HUC 12 WATERSHED  
FOR REGULATED WASHINGTON MS4**

WATERSHED NAME (HUC CODE)	SEDIMENT TSS (LBS/YR)		PHOSPHORUS TP (LBS/YR)		NITROGEN TN (LBS/YR)	
	ADJUSTED EX. LOAD	REDUCTION TARGET (10%)	ADJUSTED EX. LOAD	REDUCTION TARGET (5%)	ADJUSTED EX. LOAD	REDUCTION TARGET (3%)
Upper Chartiers Creek (050301010102)	1,813,619.2	181,361.9	548.2	27.4	8,348.2	250.4



## 2. Calculating MS4 Existing Pollutant Load

The calculations to determine the existing pollutant load for City of Washington include 1) reducing the Planning Area through parsing and 2) reducing the modeled Planning Area load by deducting pollutant volume captured by existing BMPs from the modeled load results. Section II.D.2.a., Planning Area Deductions (Parsing), discusses parsing and the modeled pollutant load. Section II.D.2.b., Existing Stormwater Facility Pollutant Load Adjustments, identifies further existing load reduction achieved through existing BMPs.

### a. Planning Area Deductions (Parsing)

As stated in Section II.B, Map, the planning areas were created using GIS analysis to identify the portion of the City within and contributing to the 2010 Urbanized Area that is also served by municipal separate storm sewer system. While it is acceptable to decrease the area from the first analysis by excluding/parsing properties that possess their own NPDES permit with Post-Construction Stormwater Management (PCSM) obligations, no appropriate properties meeting this criteria were identified.

However, some regions within the City were excluded because they are entirely under private ownership that did not contribute runoff to or through the municipal stormwater sewer collection/conveyance system or they were owned and operated by another MS4 permittee. This group included MS4 permittee PennDOT rights-of-way as well as private properties with drainage that discharged directly to surface waters (generally yards directly adjacent to surface waters). The PennDOT rights-of-way and fringe along surface waters encompasses 192 acres.

The adjusted planning area is the regulated Washington MS4, is the region substituted for the Urban Area data layers in the MapShed model, and consists 1,663 acres, as shown in **Table 12.**

**TABLE 12  
CITY OF WASHINGTON ADJUSTED MS4 PLANNING AREA**

TOTAL AREA WASHINGTON (ACRES)	PENNDOT AND REGIONS DISCHARGING DIRECT TO SURFACE WATER (ACRES)	ADJUSTED PLANNING AREA (ACRES)
1,885	192	1,663





i. MapShed Model

MapShed was a natural choice for completion of the PRPs. The model's longevity speaks to its acceptability for regulatory compliance. MapShed is the second generation of the Generalized Watershed Loading Function (GWLF) Model that was used in a majority of the approved Pennsylvania TMDL studies, and it is foundational for the Web-based version, Model My Watershed, currently under development. Since the model enjoys such wide-spread acceptance, data layers (with the program's December 19, 2016, updates) as downloaded from the MapShed website (<http://www.mapshed.psu.edu/>) were utilized to the greatest extent possible to ensure consistency with MapShed data previously accepted by PA DEP and the Chesapeake Bay Program. However, the program's built-in municipal layers did not reflect the planning area required to assess the MS4 reduction responsibility and the HUC 12 watershed was preferred to over the program-provided Small Sheds. Therefore, the following limited adaptations were made.

**Modifications to MapShed**

- **Consultant-created Planning Areas were substituted for the MapShed-provided Urbanized Area data layer.**
- **HUC 12 watersheds from the USGS were substituted for MapShed-provided Small Sheds.**

ii. MapShed Urban Area Tool

MapShed's Urban Area Tool was used to determine the existing pollutant loads generated by the Washington MS4 regulated area (Planning Areas). The Urban Area Tool provides four categories of information:

1. **Watershed Total Pollutant Load** – The annual load of sediment, phosphorus, and nitrogen generated by the entire HUC 12 watershed expressed in pounds/year
2. **MS4 Total Pollutant Load** – The MS4 portion of the watershed's pollutant load
3. **MS4 Regulated Pollutant Load** – Subset of MS4 total load reflecting any additional acreage reductions from the Planning Areas



4. **Unregulated Pollutant Load** – Counterpart to the Regulated Pollutant Load that represents the portion of the pollutant load not conveyed through the subject MS4 stormwater sewer system

The Regulated Pollutant Load portion of the Urban Area Tool allows the user to simulate parsing by inputting an adjusted percentage of land area within land use categories to reflect a smaller regulatory area resulting from exclusions. Since GIS analysis was used to generate a substitute boundary for the Urban Area Data Layer, the parsing was incorporated into the GIS analysis process and was completed in a single step. Adjustments to further adjust the Planning Area size were unnecessary for the Upper Chartiers Creek Watershed. Therefore, only the Total Watershed and Municipality (MS4) Loads features of the Urban Area Tool were utilized.

**Table 13** reports the results from MapShed’s Urban Area Tool. The results tables generated by the model are provided in **Appendix D**.

**TABLE 13  
MAPSHED EXISTING POLLUTANT LOAD  
BY HUC 12 WATERSHED WITH PARSING ADJUSTMENT**

<b>WATERSHED NAME</b>	<b>HUC 12 CODE</b>	<b>SEDIMENT TSS (LBS/YR)</b>	<b>PHOSPHORUS TP (LBS/YR)</b>	<b>NITROGEN TN (LBS/YR)</b>
Chartiers Creek Watershed City of Washington MS4 Loads	050301010102	1,846,226.7	562.3	8,444.2

**b. Existing Stormwater Facility Pollutant Load Adjustments**

In addition to land area excluded from the MS4 regulated area, the pollutant load baseline was further decreased to reflect the treatment provided by the municipality’s existing stormwater management facilities. City of Washington identified the recently restored stormwater management pond located at the Dunn Avenue entrance to Washington Park as its only existing eligible project for reduction of existing pollutant loads. The stormwater facility is a wet pond that was retrofitted with a sediment forebay and a modified outlet structure. The pond was dredged to remove approximately 18,000 cubic yards of accumulated soils and sediment. Privately owned and operated stormwater facilities were not considered for existing baseline load reductions.

The delineated 150-acre contributory area to the pond was verified. The effectiveness rates, according to PA DEP’s NPDES Stormwater Discharges from Small Municipal Separate



Storm Sewer Systems BMP Effectiveness Value (Form Number 3800-PM-BCW0100m dated 5/2016), were applied to the treated acreage. (The BMP effectiveness values are provided in **Appendix D4.**) The facility removal statistics are listed below.

**Existing Washington Park Pond Statistics**

**Ownership and Maintenance:** City of Washington  
**Latitude:** N40° 09' 58"  
**Longitude:** W80° 13' 14"  
**Treated Area:** 150 acres  
**Sediment Removed:** 32,607.5 pounds/year  
**Phosphorus Removed:** 14.1 pounds/year  
**Nitrogen Removed:** 96.0 pounds/year

Based on the Final Adjusted Existing Load reported in **Table 14**, the required sediment reduction target is as shown in **Table 15**.

**TABLE 14  
FINAL ADJUSTED EXISTING POLLUTANT LOAD**

HUC 12 WATERSHED/ BASIN	MAPSHED ADJUSTED PLANNING AREA LOAD (POUNDS/YEAR)			EXISTING STORMWATER FACILITY REDUCTIONS (POUNDS/YEAR)			FINAL ADJUSTED EXISTING LOAD (POUNDS/YEAR)		
	TSS	TP	TN	TSS	TP	TN	TSS	TP	TN
Upper Chartiers Creek (050301010102)	1,846,226.7	562.3	8,444.2	32,607.5	14.1	96.0	1,813,619.2	548.2	8,348

**TABLE 15  
WASHINGTON MS4 WASHINGTON MS4 SEDIMENT REDUCTION TARGET**

HUC 12 WATERSHED/BASIN	FINAL ADJUSTED EXISTING SEDIMENT LOAD	WASHINGTON MS4 SEDIMENT REDUCTION TARGET
Upper Chartiers Creek (050301010102)	1,813,619.2	181,361.9

**E. BMPs TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING**

City of Washington is planning one BMP project to meet the required sediment reduction target. The project is the restoration of a 1,580 linear-foot segment of Catfish Creek Tributary (Reach 14) located on a property owned by the American Legion at 168 Park Avenue.



The analysis supporting this project selection is provided by the table in **Appendix D3**, BMP Cost and Reduction Analysis. The selected BMP (found on the second page of the appendix) is highlighted in yellow. Anticipated pollutant reduction, schedule, and estimated costs for the selected project are tracked at the top of the first page and are likewise highlighted in yellow. The table contains all considered BMP projects including costs, schedule and cross-reference to the MS4 Map (for the selected project), pollutant loads delivered to the BMPs, and reductions achieved by the BMPs. The running tabulation of pollutant reduction and cost of all of the potential projects are tracked at the bottom of the table.

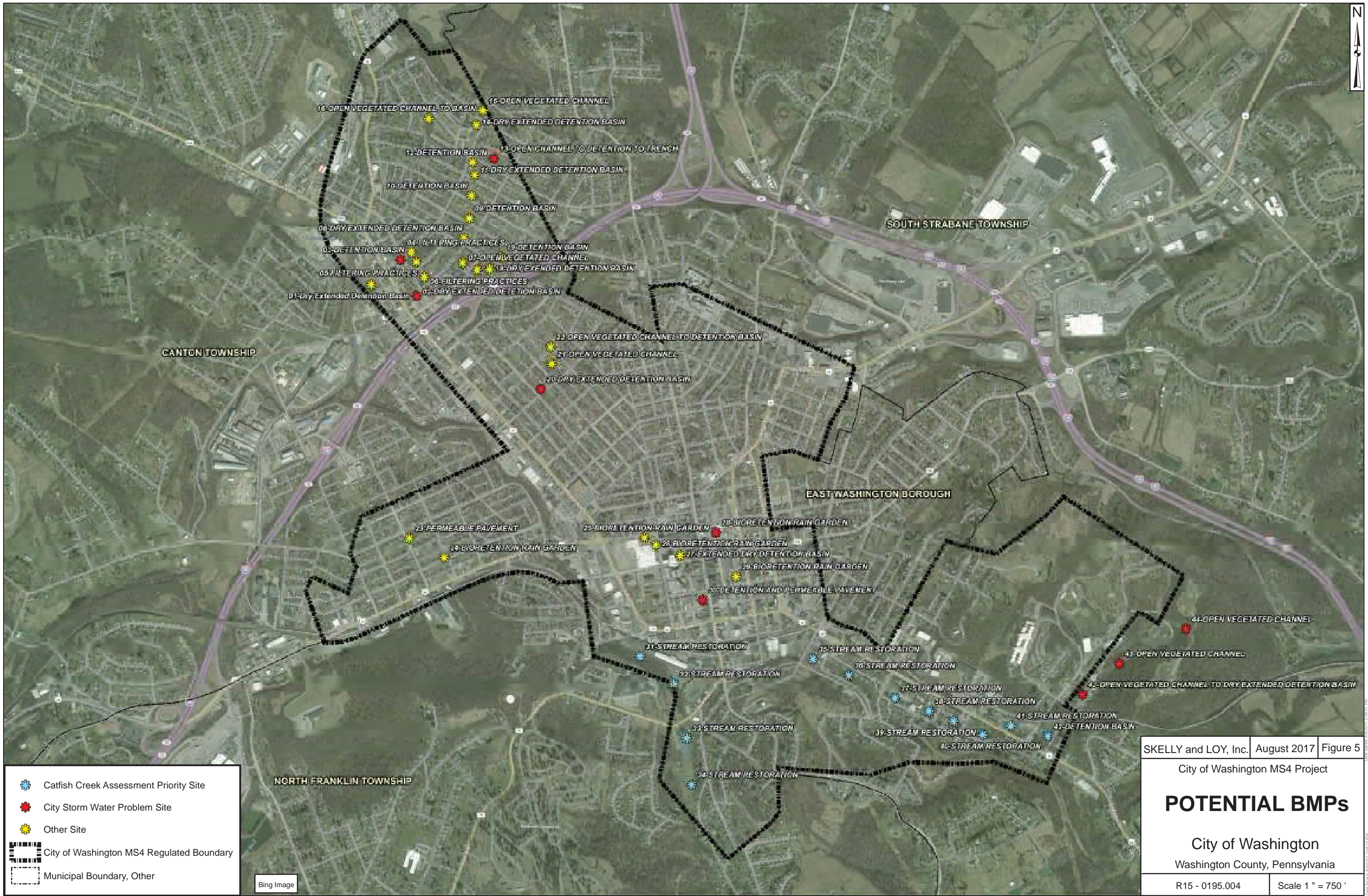
**Figure 5**, Potential BMP Sites and **Figure 6**, Selected BMP Site illustrate all considered site opportunities and the one preferred by City Council, respectively.






Sediment load calculations for the contributing drainage areas to the BMPs identified in the table use the same methodology exercised for calculating the regulated planning area pollutant loads. The spreadsheet produces the pollutant rate using the adjusted MapShed-generated sediment load for the planning area. The consistent use of MapShed-generated loading rates ensures that pollutant load computations for existing condition and treated-acre load results on the spreadsheet remain comparable to the computer model. **Appendix D1 and D2** are summary sheets for the selected project and **Appendix D4** provides the effectiveness values used in the background of the spread sheet to calculate the sediment reduction attained through implementation of the corresponding BMP option.

The most significant contributor of sediment to surface waters is the surface water channel itself. Accelerated runoff velocity and flashy volume surges emanating from impervious development collide with stream embankments eroding the embankment and channel bottom. While source control provided through dispersed BMPs within the contributory area can be effective to slow runoff velocity and decrease runoff volume through infiltration, restoration of the stream itself is the singularly most expedient and effective sediment-reducing BMP.

The *Integrated Stormwater Assessment and Rehabilitation Plan for Catfish Creek* (June 2010, Skelly and Loy, Inc.) evaluated opportunities within the Catfish Creek that could reduce chronic flooding in Washington through construction of stormwater management projects along streams and/or on undeveloped land. The *Assessment* recommended 5 high-priority sites where detention benefits could be achieved and 13 priority sites that would provide less stormwater storage (flood control) but would improve water quality through stabilization. A number of stream segments were identified in the *Assessment* as priority sites for stream restoration including those listed as BMP IDs 31 through 41 on the BMP Cost and Reduction Analysis Table in **Appendix D3**.





-  Catfish Creek Assessment Priority Site
-  City Storm Water Problem Site
-  Other Site
-  City of Washington MS4 Regulated Boundary
-  Municipal Boundary, Other

Bing Image






SKELLY and LOY, Inc. August 2017 Figure 5	
City of Washington MS4 Project	
<b>POTENTIAL BMPs</b>	
City of Washington	
Washington County, Pennsylvania	
R15 - 0195.004	Scale 1" = 750'



*Proposed Stream Restoration  
at American Legion*



**Legend**

-  Potential BMP Sites
-  Proposed Stream Restoration
-  Proposed Dry Extended Basin
-  City of Washington Municipal Boundary
-  parcels

Bing Image

SKELLY and LOY, Inc.

August 2017

Figure 6

City of Washington MS4 Project

**SELECT BMPs**

City of Washington  
Washington County, Pennsylvania

R15-0195.004

Scale 1" = 2200'

The selected stream restoration project features the Catfish Creek tributary segment that was identified as high-priority Site 2. The watercourse at the American Legion property has a degraded and incising channel. An especially attractive characteristic of the site was the expansive lawn that offers abundant opportunity for re-establishing a meaningful floodplain. A number of variations on the concept are detailed the *Integrated Stormwater Assessment and Rehabilitation Plan for Catfish Creek*. They include introduction of a more sinuous channel, excavation to reconnect the floodplain (including appropriately located toe and bank armoring using natural materials), or combining the stream restoration with a more conventional extended dry detention basin to manage flood surges. It is easy to envision the restored stream as a featured site amenity.

Another appealing attribute is that the segment is located on a property with a single owner. If a project site is not located on a municipally owned parcel, singular land ownership is the next best situation since working with one entity instead of numerous owners simplifies coordination and permitting associated with implementing this type of project.

The original stream restoration concept was well-received by residents, and the site location is upstream of a persistent area of flooding near the Tributary's confluence with Catfish Creek is likely to invigorate public enthusiasm for the project. The site's characteristics make it an ideal candidate for stream restoration activity to reduce sediment delivery to Catfish and Chartiers Creeks.

**Table 16** summarizes the pollutant reduction achieved by the proposed BMP.

**TABLE 16  
PROPOSED BMP PROJECTS AND SEDIMENT REDUCTION**

PROJECT NUMBER	PROPOSED BMP	LATITUDE LONGITUDE	LOCATION DESCRIPTION	RATIONALE	EXISTING SEDIMENT LOAD TO BMP (LBS/YR)	BMP SEDIMENT REDUCTION (LBS/YR)
34	Stream Restoration	N40°09'35" W80°14'45"	American Legion	<ul style="list-style-type: none"> <li>Stream Restoration at this site was identified as a high priority project in the Catfish Creek Watershed Assessment</li> <li>Project is located on a property with a single owner that will simplify project coordination</li> <li>Project has multiple benefits including flood reduction, site beautification, habitat enhancement and pollutant reduction</li> <li>Additional stream segments are available on the same property adding flexibility to project refinement</li> </ul>	N/A	181,700



## 1. Alternatives Considered

The City of Washington had an abundance of potential locations from which to select. The potential 45 sites fell into two major categories:

1. Sites previously identified for alleviation chronic flooding  
These projects have been identified under the Comment section In **Appendix D3** using red text and include:
  - a. Locations currently earmarked for stormwater infrastructure enhancement by the City (identified as “City StormH2O Area” of the aforementioned table)
  - b. Places identified by the *Integrated Stormwater Assessment and Rehabilitation Plan for Catfish Creek* to stabilize streams and re-establish meaningful floodplain connections (Identified as “Catfish WA Area” along with its Assessment project number)
2. Locations in strategic proximity to the sites above that could magnify runoff pollutant and flooding reduction

As mentioned above, one of determinative factor in BMP site selection is the simplicity of land ownership. Municipally owned properties are the best sites since the City has complete control to authorize construction and commit to long-term maintenance. Properties under municipal control within the regulated planning consist primarily of road rights-of-way, municipal buildings, parking lots, and parks.

One project located on municipally owned land and considered for construction is BMP ID 43, the new salt shed at the City’s Maintenance Facility. The stormwater management for the site will include Dry Extended Detention Basins and Open Vegetated Channels. However, the extent of earth disturbance during the construction of the salt shed and associated facilities could significantly limit available MS4 sediment reduction credit. If earth disturbance exceeds one acre, an NPDES Permit for construction will be triggered along with the corresponding volume and water quality provisions required by that permit. MS4 sediment reduction credit will be restricted to the load reduction that can be accomplished above the NPDES construction permit’s thresholds.

### BMP Site Selection Criteria

- **Simplicity of ownership**
  - 1<sup>st</sup> Municipally-owned properties
  - 2<sup>nd</sup> Land owned by a singular entity
  - 3<sup>rd</sup> Other land
- **Spatial and physical characteristics to support appropriately responsive BMP**
- **Ease of access**
- **Publicly supported**
- **Popular/uncontroversial**
- **Available**
- **Project achievable within time frame of permit term**





Washington Park, another municipally owned property, contains several potential project opportunity sites in addition to the successful stormwater pond renovation at the Dunn Street park entrance. BMP ID 44 (Lower Log Cabin Road) and BMP ID 45 (Twist Access Road) are potential projects that feature a roadside channels. Runoff along Lower Log Cabin Road will be directed to a new water quality inlet. Depending on channel gradient and other site constraints, these projects have the potential to incorporate pollutant reduction by integrating velocity-reducing components into their design.

The park's roadside channels are among a list of rapid-response stormwater projects to repair/replace failing or absent stormwater collection and conveyance systems. The goal of projects on this list is to reduce localized flooding primarily through use of inlets; pipes; and, where appropriate, swales. Funding for these projects is from a combination of loans and grants (e.g., Dirt, Gravel, and Low Volume Roads Maintenance Program Grant), and there is immediacy to the schedule for implementation.

While the City is committed to implementing improvements in these areas, the approach is to reduce flooding by rapidly evacuated runoff through efficient conveyance. Conversely, the best water quality enhancing BMPs necessary for pollutant removal commonly encourage ponding and slow infiltration of runoff. The infiltrative BMPs of the MS4 program accomplish both flood and pollutant reduction through installation of a network of widely dispersed BMPs near runoff-producing land uses. Most of the City Storm H2O Areas are located within the narrow road rights-of-way insufficient for properly sized stormwater BMPs to successfully manage the pollutant load and runoff volume at the flooding hot spot.

Runoff pollutant reduction projects can more holistically resolve both the water quality and quantity runoff problems but will require master planning and implementation of a stormwater system upgradient of the flooding areas. The spatial requirements of this coordinated system of BMPs will necessarily be located on lots currently in private ownership to produce the desired result. While the City plans to pursue many alternatives in the future, the MS4 permit term might be too abbreviated for a time-intensive endeavor to gain consensus, coordinate numerous private property owners, prepare the design, process permits, and construct the BMPs. The proposed BMPs identified on the BMP Cost and Reduction Analysis Table in **Appendix D3** provides a great starting point for the City to pursue for future MS4 permit terms as a long-term stormwater management solution.



## 2. Summary

Many of the BMPs listed on the BMP Cost and Reduction Analysis Table in **Appendix D3** offer viable alternative projects that can be used as a pool for future work efforts. However the selected stream restoration is a better match for the City’s MS4 program at present. The selected stream restoration project:

- provides superior sediment removal characteristics;
- is located on land with a singular owner;
- possesses ample space for the effective implementation of the BMP;
- delivers multiple benefits including flood reduction, site beautification, habitat enhancement, and pollutant reduction; and
- can meet the Permit’s timeframe.

The selected stream restoration project will slightly exceed the Washington MS4 obligation to reduce sediment by 10% within the Upper Chartiers Creek Watershed. (See **Table 17**.)

**TABLE 17  
ACHIEVED SEDIMENT REDUCTION BY WATERSHED AND MAJOR BASIN**

WATERSHED	MINIMUM REQUIRED SEDIMENT LOADING REDUCTION (LBS/YR)	ESTIMATED SEDIMENT LOADING REDUCTION (LBS/YR)
Upper Chartiers Creek	181,361.9	181,700

### F. FUNDING MECHANISM(S)

The estimated capital costs of the proposed projects are provided in **Table 18**. Capital costs include budget values for design, permitting, and construction and are buffered to allow for potential expenses associated with land access/acquisition. Estimates were derived from the referenced Pennsylvania unit prices in the BayFAST Web-based pollutant reduction model and adjusted to 2017 values using the U.S. Inflation Calculator ([www.usinflationcalculator.com](http://www.usinflationcalculator.com)). BayFAST is one of the U.S. Environmental Protection Agency’s (U.S. EPA) Chesapeake Bay Program approved pollutant removal scenario tools, and the embedded costs that were established through a U.S. EPA grant are acknowledged to be reliable for planning-level use.



**TABLE 18  
ESTIMATED PROJECT COSTS**

PROJECT NUMBER	PROJECT DESCRIPTION	WATERSHED	CAPITAL COST
34	Catfish Creek Tributary (Reach 14) Stream Restoration at the American Legion	Upper Chartiers Creek	\$1,348,269.30

A 30% contingency was added to the cost to approximate the expenses associated with the ever-increasing complexity of the regulatory environment and a lower limit of \$100,000 per project was determined to be reasonable since every project will have certain fixed costs (such as design, permitting, construction oversight and mobilization-demobilization) regardless of the size of the BMP or the number of acres it treats.

Cost estimates for operation and maintenance are provided in **Appendix F**, BMP Cost and Reduction Analysis Spreadsheets. Like capital costs, the basis for operations and maintenance are based on the Pennsylvania unit prices in the BayFAST with an inflation adjustment, contingency, and lower limit per BMP (\$2,500.00/year)

City of Washington is ultimately responsible to pay for implementation of the project and will add the improvements to its capital budget, approximately \$270,000 annually. As a starting point, Washington recently acquired a \$2 million loan for stormwater improvements. Of this \$2 million loan, \$400,000 is earmarked for MS4 stormwater management.

Washington works with a professional grant writer and has been very successful with grant awards. The City will seek to leverage its investment by pursuing grants and looking for potential partners. For example, the stormwater pond restoration at Washington Park received some of its funding through a grant from the U.S. Army Corps of Engineers. Residuals of that grant will be evaluated to determine if transfer to the selected project is possible. The City has also had notable success with creative application of the Dirt, Gravel, and Low Volume Road Maintenance Program and is eligible for certain Department of Community and Economic Development grants due to its proactive effort to reverse the City's stressed financial status. Since Washington County is the home of the Meadows Racetrack and Casino, the City is also eligible for Local Share Account funds.



## **G. RESPONSIBLE PARTIES FOR OPERATION AND MAINTENANCE OF BMPs**

The City of Washington Maintenance Crew will be the party primarily responsible for the operation and maintenance of all BMPs described in the PRP. Maintenance services beyond the expertise of the Maintenance Crew will be performed by contractors/consultants. As listed above, City of Washington will rely on Stream Restoration to meet the sediment load reduction quota. **Table 19** summarizes the maintenance activity and responsible part for the selected BMP proposed in this plan.



**TABLE 19**  
**BMP MAINTENANCE INSTRUCTIONS**  
**STREAM RESTORATION – PA STORMWATER BMP MANUAL #6.7.4**  
**(FLOODPLAIN RESTORATION)**

**Inspection Schedule:** If not specified by state and federal regulators through a permitting process, 1x annually for 2 years then 1x every 5 years and within 1 year following catastrophic storm of 25-year magnitude (5.13 inches/24-hour period per NOAA Atlas 14)

**Inspection Responsible Party:** Maintenance Chief or Consultant

<b>ROUTINE AND PREVENTATIVE MAINTENANCE ACTIVITY</b>	<b>MAINTENANCE SCHEDULE</b>	<b>NOTES</b>	<b>RESPONSIBLE PARTY</b>
Remove litter.	Prior to mowing	Dispose of litter at an approved facility.	Maintenance Crew
Mow.	2x per growing season until tree canopy is established (generally, 3 to 5 years); as needed thereafter	Set mower height at 8 to 12 inches.	Maintenance Crew
Remove exotic/invasive species (aquatic and terrestrial).	2x annually (minimum) Years 1 through 3; as needed thereafter	<ul style="list-style-type: none"> <li>• Minimize landscape disturbance.</li> <li>• Protect healthy native plant communities.</li> <li>• Manually pull or dig invasives that can be entirely extracted safely.</li> <li>• Use herbicides for control of plants that will spread if not entirely removed manually or on plants that pose a health hazard.</li> <li>• Replace invasives with native , non-invasive species.</li> <li>• Properly dispose of invasive plants.</li> </ul>	Maintenance Crew or Contractor
Use weed mats.	1x preventative	<ul style="list-style-type: none"> <li>• Install in conjunction with vegetation planting.</li> <li>• Remove following tree canopy development (generally 3 to 5 years).</li> </ul>	Maintenance Crew
<b>CORRECTIVE MAINTENANCE ACTIVITY<sup>1,2</sup></b>	<b>MAINTENANCE SCHEDULE</b>	<b>NOTES</b>	<b>RESPONSIBLE PARTY</b>
Repair in-channel structures (grade-controls [steps, piles, drops], sills, weirs, vanes, barbs, spurs, bank toe, etc.).	As needed	Repair during low water consistent with permit.	Maintenance Crew or Contractor
Repair bank-armoring structures (revetments, soil-covered riprap, cellular blocks, geogrid, gabions, bulkheads, etc.).		Repair during low water consistent with permit.	Maintenance Crew or Contractor
Repair habitat structures (habitat logs, fish cover structures, pool/riffle rocks and structures).		Repair during low water consistent with permit.	Maintenance Crew or Contractor
Correct irregularities in cross section and longitudinal slope. Reestablish design grades and configuration.	As needed	Reestablish cross section when the channel pattern and dimensions are discernably different from the design.	Maintenance Crew or Contractor
Stabilize eroding and undercut banks.	As needed		Maintenance Crew or Contractor
Maintain 85% vegetative cover.	As needed	If vegetative cover is reduced by 10%, vegetation should be reestablished.	Maintenance Crew
1. Follow protocols for scheduling prompt repair of minor deficiencies upon discovery 2. Establish schedule for significant repairs for publication in Annual Report			



## **APPENDICES**

**APPENDIX A -  
COPY OF PUBLIC NOTICE  
AND PROOF OF PUBLICATION**

## NOTICE

A copy of the City of Washington Pollutant Reduction Plan (the “Plan”) for the Upper Chartiers Watershed is available for public review and comment at the offices of City of Washington, 55 Est Maiden Street, Washington, PA 15301 beginning August 14, 2017 through and including September 13, 2017 weekdays, during regular business hours of 8:30 a.m. to 5:00 p.m. The Plan is also available for review beginning August 14, 2017 at the Middlesex Township website at <http://www.washingtonpa.us/>. The Plan describes the MS4 regulated City of Washington areas, applicable surface waters and pollutants of concern, existing pollutant loads by HUC 12 watershed, pollutant reduction targets for surface waters impaired by sediment and/or nutrients, and proposed BMP projects. Comments are requested to be placed in writing and submitted to the City of Washington at the office address above no later than September 13, 2017. The proposed adoption of the Plan by the City Council will be considered at a public meeting on September 14, 2017 at 7:00 p.m. during the Council’s regularly scheduled meeting, at which time public comment concerning the Plan will also be accepted.

Lynn Galluze, Computer Systems & Web Site Coordinator, City of Washington, PA



**APPENDIX B -  
MS4 MAP LAYERS AND DATA SOURCES**

**CITY OF WASHINGTON, PA**  
MS4 Map Layers and Data Sources

LAYER	SOURCE
2010 Urbanized Area	PA DEP (Referenced to US Census Bureau)
Basemap	Microsoft Bing Aerial photography
BMP -Existing	Skelly and Loy, Inc.
Discharge Point	Skelly and Loy, Inc.
Discharge Point Other	Skelly and Loy, Inc.
Elevation Data (contours)	PA DCNR
Flow Arrows	Skelly and Loy, Inc.
Inlets	<i>(To be provided during permit term)</i>
Inlets - Other	<i>(To be provided during permit term)</i>
Intake Points	<i>(To be provided during permit term)</i>
Intake Points-Other	<i>(To be provided during permit term)</i>
Lakes	Pennsylvania Fish and Boat Commission
Manholes	<i>(To be provided during permit term)</i>
Municipal Boundary	Penn DOT
NWI (Wetlands)	US Fish and Wildlife Service
Observation Points	<i>(To be provided during permit term)</i>
Outfall - Impaired	Skelly and Loy, Inc.
Outfall - Unimpaired	N/A
Parcels	Washington County GIS
Pipes	<i>(To be provided during permit term)</i>
Pipes-Other	<i>(To be provided during permit term)</i>
Planning Area	Skelly and Loy, Inc.
Potential Project Sites	City of Washington Staff and Skelly and Loy, Inc.
Proposed Stream Restoration	Skelly and Loy, Inc.
Rain Traces	Skelly and Loy, Inc.
Storm Sewershed - Impaired	Skelly and Loy, Inc.
Storm Sewershed - Unimpaired	N/A
Stream	PA DEP
Stream Impaired	PA DEP
Surface Water Conveyance	Skelly and Loy, Inc.

- The projection of information shown on the Maps is NAD 1983 State Plane Pennsylvania South US Feet



**APPENDIX C -  
MAPSHED URBAN AREA TOOL RESULTS**

**C1**  
**HUC Watershed Total**

Select input data file: C:\MapShed\Runfiles\2017-08-01\_WASH\_CHAT\_HUC\Output\2017-08-01\_WASH\_CHART\_HUC-998\_ua.csv



Watershed Totals

Municipality Loads

Regulated Loads

Unregulated Loads

**GWLF-E Average Loads by Source for Watershed 998**

Upper Chartiers Creek  
HUC 12 Watershed Total

Source	Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	6220	1322927.90	212.70	4107.28	0.66	1164.77	0.19
Cropland	1695	4463302.59	2633.20	11874.08	7.01	2863.96	1.69
Forest	12919	214752.29	16.60	1068.82	0.08	162.06	0.01
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	94	9568.06	101.80	21.43	0.23	6.88	0.07
Turfgrass	306	17460.61	57.00	200.31	0.65	23.50	0.08
Open Land	2965	827218.50	279.00	3115.93	1.05	523.91	0.18
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	791	7914.60	10.00	205.98	0.26	22.16	0.03
MD Mixed	1134	58995.70	52.00	1447.86	1.28	158.58	0.14
HD Mixed	3205	166691.52	52.00	4091.23	1.28	448.09	0.14
LD Residential	1231	12323.84	10.00	320.55	0.26	34.46	0.03
MD Residential	4307	224011.70	52.00	5498.06	1.28	602.17	0.14
HD Residential	146	7583.90	51.90	186.11	1.27	20.39	0.14
Water	154.589327						
<b>Farm Animals</b>				0.0		0.0	
<b>Tile Drainage</b>		0.0		0.0		0.0	
<b>Stream Bank</b>		18981437.0		9490.9		2837.3	
<b>Groundwater</b>				71847.8		1011.1	
<b>Point Sources</b>				0.0		0.0	
<b>Septic Systems</b>				10165.4		0.0	
<b>Totals</b>	<b>35168</b>	<b>26314188</b>		<b>123642</b>		<b>9879</b>	

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**C2**

**Planning Area Load: Initial Existing Load**

Select input data file: C:\MapShed\Runfiles\2017-08-01\_WASH\_CHAT\_HUC\Output\2017-08-01\_WASH\_CHART\_HUC-998\_ua.csv



Watershed Totals

Municipality Loads

Regulated Loads

Unregulated Loads

View loads for municipality:

Washington City (81328)

Upper Chartiers Creek  
Planning Area Load-Initial

Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	5	1063.50	212.70	3.30	0.66	1.00	0.19
Cropland	0	0.00	0.00	0.00	0.00	0.00	0.00
Forest	94	1560.40	16.60	7.50	0.08	0.90	0.01
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	0	0.00	0.00	0.00	0.00	0.00	0.00
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	109	30411.00	279.00	114.50	1.05	19.60	0.18
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	15	150.00	10.00	3.90	0.26	0.50	0.03
MD Mixed	64	3328.00	52.00	81.90	1.28	9.00	0.14
HD Mixed	442	22984.00	52.00	565.80	1.28	61.90	0.14
LD Residential	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Residential	798	41496.00	52.00	1021.40	1.28	111.70	0.14
HD Residential	136	7058.40	51.90	172.70	1.27	19.00	0.14
Water	0						
<b>Farm Animals</b>				0.0		0.0	0.000
<b>Tile Drainage</b>		0.00		0.0		0.0	0.000
<b>Stream Bank</b>		1738175.44		869.1		259.8	0.158
<b>Groundwater</b>				5604.1		78.9	0.078
<b>Point Sources</b>				0.0		0.0	0.000
<b>Septic Systems</b>				0.0		0.0	0.000
<b>Totals</b>	<b>1663</b>	<b>1846226.7</b>		<b>8444.2</b>		<b>562.3</b>	

Source Weighting

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**APPENDIX D -  
BMP COST AND REDUCTION ANALYSIS  
SPREADSHEETS**



**D1**  
**City of Washington**  
**BMP Cost and Reduction Analysis Summary**



**CITY OF WASHINGTON, PA MS4  
BMP COST AND REDUCTION ANALYSIS SUMMARY**

**BMP Reduction Analysis Table**

Current Condition Baseline		PTC MS4 Area (ac.)	Min. Req'd Loading Reduction (%)	Min. Req'd Loading Reduction (lbs/yr)	Proposed BMP Reductions	
Pollutant	Lbs.				BMP Load Reduction (lbs/yr)	Reduction remaining (-) Over reduction (+)
Sediment	1,813,619.2	1,663	10%	181361.9	181,700.0	+338
Phosphorus	548.2		5%	27.4		
Nitrogen	8,348.2		3%	250.4		

**BMP Cost Analysis Table**

Total Capital Cost	Annual Capital Cost Budget/ Year for 5 years
\$1,348,269.30	\$269,653.86

**Proposed BMPs Table**

BMP Options	Potential Number of Treated Acres/LF	Selected Number of Treated Acres/LF
Dry Detention Basins and Hydrodynamic Structures	69.2	0.0
Dry Extended Detention Basins	39.3	0.0
Filtering Practices	4.5	0.0
Bioretention – Raingarden (C/D soils w/ underdrain)	3.4	0.0
Vegetated Open Channels (C/D Soils)	33.3	0.0
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	0.7	0.0
Stream Restoration (Linear Feet)	7,575.0	1,580.0
Combined:Veg.Channel+Detention Basin	17.3	0.0
Combined:Veg.Chan+Det. Basin+Filter Practice	12.4	0.0
Combined:Detention+PermeablePaving	1.0	0.0



**D2**  
**City of Washington**  
**BMP Cost and Reduction Watershed Summary**



**CITY OF WASHINGTON, PA MS4  
BMP COST AND REDUCTION ANALYSIS WATERSHED SUMMARY**

Watershed	MS4 Area (Acres)	Current Condition Baseline		Minimum Required Loading Reduction (%)	Minimum Required Loading Reduction (lbs/yr)	Proposed BMP Reductions for Selected Projects		Total Capital Cost for Selected Projects
		Pollutant	Lbs.			BMP Load Reduction (lbs/yr)	Reduction remaining (-) Over reduction (+)	
Upper Chartiers Creek	1663	Sediment	1,813,619.2	10%	181,361.92	181,700	+338	\$1,348,269.30
		Phosphorus	548.2	5%	27.41			
		Nitrogen	8,348.2	3%	250.45			
<b>TOTAL</b>	<b>1663</b>	Sediment	<b>1,813,619.2</b>	10%	<b>181,361.9</b>	<b>181,700.00</b>	<b>+338</b>	<b>\$1,348,269.30</b>
		Phosphorus	<b>548.2</b>	5%	<b>27.4</b>			
		Nitrogen	<b>8,348.2</b>	3%	<b>250.4</b>			



**D3**  
**Upper Chartiers Creek**  
**BMP Cost and Reduction Analysis Table**



**BMP COST AND REDUCTION ANALYSIS**  
Upper Chartiers Creek

Watershed HUC Code: 050301010102  
MS4 Area (ac.): 1663

Current Condition Baseline		Min. Req'd Load Reduction (%)	Min. Req'd Load Reduction (lbs/yr)	Loading Rate <sup>1</sup> (lbs/ac/yr)	Proposed BMP Reductions		Total Capital Cost for Selected BMPs	Total Annual O&M Cost
Pollutant	Lbs/yr (Adjusted From MapShed)				BMP Sediment Load Reduction for Selected BMPs (lbs/yr)	Reduction remaining (-) Over reduction (+)		
Sediment	1,813,619.2	10%	181,361.92	1,090.57	181,700.00	+338	\$1,348,269.30	\$31,146.07
Phosphorus	548.2	5%	27.41	0.33				
Nitrogen	8,348.2	3%	250.45	5.02				

BMP ID	BMP Latitude	BMP Longitude	Map Page	Anticipated Construction Year	BMP Options	Quantity	Units	Existing Sediment Load to BMP	Sediment Reduction (lb/year)	Capital Cost	O&M Cost	Selected (X)	Comment
1	N040° 11' 01.26"	W080° 16' 00.70"			Dry Extended Detention Basins	4.3	Treated Acres	4689.45	2,813.67	\$ 100,000.00	\$ 2,500.00		Meadow Ave. vacant field adj. to baseball-Private-In floodplain.
2	N040° 10' 59.50"	W080° 15' 50.24"			Dry Extended Detention Basins	10.3	Treated Acres	11232.88	6,739.73	\$ 100,000.00	\$ 2,500.00		City Storm H2O Area-Allison & Wellington. Private. Req's deep basin to manage upland
3	N040° 11' 05.71"	W080° 15' 54.23"			Dry Detention Basins and Hydrodynamic Structures	3.4	Treated Acres	3707.94	370.79	\$ 100,000.00	\$ 2,500.00		City Storm H2O Area-Allison& Maple-Quasi Pub-Inter Unit 1-Detention, only-Small for Extend.
4	N040° 11' 07.05"	W080° 15' 51.76"			Filtering Practices	2	Treated Acres	2181.14	1,744.91	\$ 100,000.00	\$ 2,500.00		Upland to City Storm H2O Area @Allison- Maple Alley-Invert crown-Infiltration trench/storage
5	N040° 11' 05.44"	W080° 15' 50.56"			Filtering Practices	0.7	Treated Acres	763.40	610.72	\$ 100,000.00	\$ 2,500.00		Upland to City Storm H2O Area @Allison- Maple Alley-Invert crown-Infiltration trench/storage
6	N040° 11' 02.83"	W080° 15' 48.66"			Filtering Practices	1.8	Treated Acres	1963.03	1,570.42	\$ 100,000.00	\$ 2,500.00		Upland to City Storm H2O Area @Allison- Maple Alley-Invert crown-Infiltration trench/storage
7	N040° 11' 05.51"	W080° 15' 40.04"			Vegetated Open Channels (C/D Soils)	9.1	Treated Acres	9924.19	4,962.10	\$ 100,000.00	\$ 3,671.99		Upland to City Storm H2O Area @Allison-N of -70 ramp-Private
8	N040° 11' 09.82"	W080° 15' 39.93"			Dry Extended Detention Basins	5.1	Treated Acres	5561.91	3,337.15	\$ 100,000.00	\$ 2,500.00		Upland to City Storm H2O Area @Glenn & Summerlea-Private- Spacious
9	N040° 11' 13.31"	W080° 15' 38.85"			Dry Detention Basins and Hydrodynamic Structures	8.9	Treated Acres	9706.08	970.61	\$ 121,055.69	\$ 2,500.00		Upland to City Storm H2O Area btwn Arch & Hazel-Private-Small-Detention only
10	N040° 11' 17.25"	W080° 15' 38.49"			Dry Detention Basins and Hydrodynamic Structures	10.4	Treated Acres	11341.94	1,134.19	\$ 141,458.34	\$ 2,500.00		Upland to City Storm H2O Area btwn Bruce and Foster-Private-Small-Detention only
11	N040° 11' 20.88"	W080° 15' 37.87"			Dry Extended Detention Basins	7.2	Treated Acres	7852.11	4,711.27	\$ 100,000.00	\$ 2,500.00		Upland to City Storm H2O Area btwn. Sycamore & Wayne near Maple-Private- Spacious
12	N040° 11' 23.06"	W080° 15' 38.43"			Dry Detention Basins and Hydrodynamic Structures	9.6	Treated Acres	10469.48	1,046.95	\$ 130,576.92	\$ 2,500.00		Upland to City Storm H2O Area @Maple & Michigan Ext-Private- Spacious-Maple Food Mkt.
13	N040° 11' 23.84"	W080° 15' 33.61"			Combined:Veg.Chan+Det. Basin+Filter Practice	1.7	Treated Acres	1853.97	1,687.11	\$ 100,000.00	\$ 2,500.00		City Storm H2O Area-Idaho St-buried Homemade Tank- Channel to basin to trench in alley
14	N040° 11' 29.59"	W080° 15' 37.84"			Dry Extended Detention Basins	2.7	Treated Acres	2944.54	1,766.72	\$ 100,000.00	\$ 2,500.00		Maple & Nevada-Private- Vacant Lot-Discharge to "paper alley"-Spacious
15	N040° 11' 32.13"	W080° 15' 36.43"			Vegetated Open Channels (C/D Soils)	0.6	Treated Acres	654.34	327.17	\$ 100,000.00	\$ 2,500.00		Btwn Nevada & Vermont. Discharge to Maple. Private
16	N040° 11' 30.49"	W080° 15' 48.69"			Combined:Veg.Chan+Det. Basin+Filter Practice	10.7	Treated Acres	11669.11	10,618.89	\$ 339,267.78	\$ 10,799.55		Btwn Maryland & Wilna- Stepped channel and Basin-Private. Tree removal req'd.
17	N040° 11' 04.33"	W080° 15' 36.70"			Dry Extended Detention Basins	0.9	Treated Acres	981.51	588.91	\$ 100,000.00	\$ 2,500.00		Tylerdale Fire Station-Spacious field- potential for diversion of upland runoff for detention
18	N040° 11' 04.53"	W080° 15' 33.91"			Dry Extended Detention Basins	2.9	Treated Acres	3162.66	1,897.59	\$ 100,000.00	\$ 2,500.00		E of Ty. Fire Station-Daylight part of buried stream. Private-Flood attenuation
19	N040° 11' 06.69"	W080° 15' 31.44"			Dry Detention Basins and Hydrodynamic Structures	21.9	Treated Acres	23883.50	2,388.35	\$ 297,878.61	\$ 4,780.66		N of Summerlea-Daylight part of buried stream. Private-Flood attenuation
20	N040° 10' 43.88"	W080° 15' 21.47"			Dry Extended Detention Basins	2.1	Treated Acres	2290.20	1,374.12	\$ 100,000.00	\$ 2,500.00		City Storm H2O Area-Ducan Tunnel-Private-Spacious-Potential flood reduction
21	N040° 10' 48.28"	W080° 15' 19.20"			Vegetated Open Channels (C/D Soils)	6	Treated Acres	6543.42	3,271.71	\$ 100,000.00	\$ 2,500.00		E Donnan & Montgomery. Private but looks like "paper alley"
22	N040° 10' 51.28"	W080° 15' 19.56"			Combined:Veg.Channel+Detention Basin	9.5	Treated Acres	10360.42	5,698.23	\$ 128,065.47	\$ 5,907.20		Fairhall Christian Church- Montgomery-Institutional-Spacious-potential
23	N040° 10' 17.21"	W080° 15' 50.41"			Permeable Pavement w/o Sand or veg. (C/D Soils w/ underdrain)	0.7	Treated Acres	763.40	419.87	\$ 100,000.00	\$ 3,343.22		BB Court- Permeable Pave over infiltration or detention
24	N040° 10' 14.03"	W080° 15' 42.31"			Bioretention - Raingarden (C/D soils w/ underdrain)	0.2	Treated Acres	218.11	119.96	\$ 100,000.00	\$ 2,500.00		Communications Station-Carrell & Fayette. City-owned-Small-Limited
25	N040° 10' 18.47"	W080° 14' 57.03"			Bioretention - Raingarden (C/D soils w/ underdrain)	0.1	Treated Acres	109.06	59.98	\$ 100,000.00	\$ 2,500.00		Omit at this time-West Chestnut-State Rd
26	N040° 10' 17.24"	W080° 14' 54.35"			Bioretention - Raingarden (C/D soils w/ underdrain)	0.1	Treated Acres	109.06	59.98	\$ 100,000.00	\$ 2,500.00		Jefferson Ct. Plaza-N Franklin-Small-Private-Business
27	N040° 10' 15.54"	W080° 14' 48.79"			Dry Extended Detention Basins	3.8	Treated Acres	4144.17	2,486.50	\$ 100,000.00	\$ 2,500.00		Beau & Brownson adj to parking garage-Private-Park opportunity-looks like old p-lot
28	N040° 10' 19.78"	W080° 14' 40.82"			Bioretention - Raingarden (C/D soils w/ underdrain)	2.3	Treated Acres	2508.31	1,379.57	\$ 100,000.00	\$ 2,500.00		City Storm H2O Area-P-lot-Pine, Chestnut & N Main-retrofit ex. Islands-Add new islands
29	N040° 10' 12.14"	W080° 14' 35.96"			Bioretention - Raingarden (C/D soils w/ underdrain)	0.7	Treated Acres	763.40	419.87	\$ 100,000.00	\$ 2,500.00		City Library-revise circulation so drives are in parking-Add islands
30	N040° 10' 07.91"	W080° 14' 43.41"			Combined:Detention+PermeablePaving	1	Treated Acres	1090.57	894.27	\$ 150,855.08	\$ 4,994.33		City Storm H2O Area-Farmers Mkt- Perv. Pave to soak up+trench capture of roof runoff
31	N040° 09' 57.79"	W080° 14' 57.23"			Stream Restoration	935	Linear Feet		107,525.00	\$ 797,868.23	\$ 18,431.37		Catfish WA Area 10B-High priority-west of Chapman





BMP ID	BMP Latitude	BMP Longitude	Map Page	Anticipated Construction Year	BMP Options	Quantity	Units	Existing Sediment Load to BMP	Sediment Reduction (lb/year)	Capital Cost	O&M Cost	Selected (X)	Comment
32	N040° 09' 53.12"	W080° 14' 49.41"			Stream Restoration	1090	Linear Feet		125,350.00	\$ 930,135.15	\$ 21,486.84		Catfish WA Area 10A-High priority-Chapman-Orig. underground vault out due to develop.
33	N040° 09' 43.74"	W080° 14' 46.16"			Stream Restoration	350	Linear Feet		40,250.00	\$ 298,667.25	\$ 6,899.45		Catfish WA Area 1-High priority-AM. Legion-Room for flood storage
34	N040° 09' 35.66"	W080° 14' 44.74"	8	2022	Stream Restoration	1580	Linear Feet		181,700.00	\$ 1,348,269.30	\$ 31,146.07	X	Catfish WA Area 2-High priority-AM. Legion-Room for flood storage
35	N040° 09' 58.15"	W080° 14' 17.98"			Stream Restoration	350	Linear Feet		40,250.00	\$ 298,667.25	\$ 6,899.45		Catfish WA Area 11-Lower priority-Room for grading-grading will be extensive
36	N040° 09' 55.45"	W080° 14' 09.76"			Stream Restoration	1175	Linear Feet		135,125.00	\$ 1,002,668.63	\$ 23,162.42		Catfish WA Area 12(part 1)-Lower priority-Confined flood benches-not floodplain
37	N040° 09' 51.71"	W080° 13' 59.14"			Stream Restoration	450	Linear Feet		51,750.00	\$ 384,000.75	\$ 8,870.72		Catfish WA Area 12(part 2)-Lower priority-Confined flood benches-not floodplain
38	N040° 09' 49.64"	W080° 13' 51.32"			Stream Restoration	350	Linear Feet		40,250.00	\$ 298,667.25	\$ 6,899.45		Catfish WA Area 12(part 3)-Lower priority-Confined flood benches-not floodplain
39	N040° 09' 47.99"	W080° 13' 45.67"			Stream Restoration	465	Linear Feet		53,475.00	\$ 396,800.78	\$ 9,166.41		Catfish WA Area 12(part 4)-Lower priority-Confined flood benches-not floodplain
40	N040° 09' 45.77"	W080° 13' 38.93"			Stream Restoration	660	Linear Feet		75,900.00	\$ 563,201.10	\$ 13,010.38		Catfish WA Area 12(part 5)-Lower priority-Confined flood benches-not floodplain
41	N040° 09' 47.52"	W080° 13' 32.66"			Stream Restoration	170	Linear Feet		19,550.00	\$ 145,066.95	\$ 3,351.16		Catfish WA Area 8B-Lower priority-Hard left bend-nominal flood improvement
42	N040° 09' 45.82"	W080° 13' 24.19"			Dry Detention Basins and Hydrodynamic Structures	15	Treated Acres	16358.56	1,635.86	\$ 204,026.45	\$ 3,274.43		Catfish WA Area 8A-Lower priority-on-stream detention-Steep stream gradient concern.
43	N040° 09' 53.28"	W080° 13' 16.59"			Combined:Veg.Channel+Detention Basin	7.8	Treated Acres	8506.45	4,678.55	\$ 105,148.49	\$ 4,850.12		City Storm H2O Area -Salt Shed- Planned storm H2O management for planned improvements
44	N040° 09' 58.85"	W080° 13' 08.48"			Vegetated Open Channels (C/D Soils)	11.7	Treated Acres	12759.68	6,379.84	\$ 100,000.00	\$ 4,721.13		City Storm H2O Area - Lower Log Cabin- Roadside swale and WQ Inlet
45	N040° 10' 05.19"	W080° 12' 53.56"			Vegetated Open Channels (C/D Soils)	5.9	Treated Acres	6434.37	3,217.18	\$ 100,000.00	\$ 2,500.00		City Storm H2O Area-Twist Access Rd-Roadside swale
<b>TOTALS</b>						<b>7575</b>	<b>(Linear Feet)</b>						
						<b>181.1</b>	<b>(Treated Acres)</b>	<b>197502.37</b>	<b>952,507.75</b>	<b>\$ 10,582,345.46</b>	<b>\$ 258,166.31</b>		

1. Loading Rate = Current Condition Baseline Sediment (Lbs)/MS4 Area(Ac)



**D4**  
**PA DEP Effectiveness Values**



**PA DEP EFFECTIVENESS VALUES**

per  
3800-PM-BCW0100m dated 5/2016

BMP NAME	BMP EFFECTIVENESS VALUES		
	TN	TP	SEDIMENT
Wet Ponds and Wetlands	20%	45%	60%
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%
Dry Extended Detention Basins	20%	20%	60%
Infiltration Practices with Sand, Vegetation	85%	85%	95%
Filtering Practices	40%	60%	80%
Filter Strip Runoff Reduction	20%	54%	56%
Filter Strip Stormwater Treatment	0%	0%	22%
Bioretention – Raingarden (C/D soils with underdrain)	25%	45%	55%
Bioretention/Raingarden (A/B soils with underdrain)	70%	75%	80%
Bioretention/Raingarden (A/B soils without underdrain)	80%	85%	90%
Vegetated Open Channels (C/D Soils)	10%	10%	50%
Vegetated Open Channels (A/B Soils)	45%	45%	70%
Bioswale	70%	75%	80%
Permeable Pavement without Sand or Vegetation (C/D Soils with underdrain)	10%	20%	55%
Permeable Pavement without Sand or Vegetation (A/B Soils with underdrain)	45%	50%	70%
Permeable Pavement without Sand or Vegetation (A/B Soils without underdrain)	75%	80%	85%
Permeable Pavement with Sand or Vegetation (A/B Soils with underdrain)	50%	50%	70%
Permeable Pavement with Sand or Vegetation (A/B Soils without underdrain)	80%	80%	85%
Permeable Pavement with Sand or Vegetation (C/D Soils with underdrain)	20%	20%	55%
Stream Restoration (If using the PA DEP Simplified Method)	0.075 lb/ft/yr	0.068 lb/ft/yr	44.88 lb/ft/yr
Stream Restoration (If modeled at a local watershed scale) <sup>1</sup>			115 lb/ft/yr
Forest Buffers	25%	25%	50%
Tree Planting	10%	15%	20%
Street Sweeping	3%	3%	9%
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1-TN and TP concentrations

1. The proposed stream restoration was modeled at the local watershed scale



**APPENDIX E -  
PUBLIC REVIEW COMMENTS AND RESPONSES**

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Space reserved for public review comments and responses.