pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) INDIVIDUAL PERMIT TO DISCHARGE STORMWATER FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s) APPLICATION

Before completing this form, read the step-by-step instructions provided in this application package.

Related ID#s (If Known)				DEP USE ONLY
Client ID#	72597	APS ID#		Date Received
Site ID#	613842	Auth ID#		
Facility ID#				PA_____ PDG?

GENERAL INFORMATION

Type of Permit: ☐ New Permit ☒ Renewal of Permit Permit No.: PA130029

Is a waiver of coverage being requested and is a waiver application attached to this application? ☐ Yes ☒ No

Is individual permit coverage requested for more than one MS4 applicant? ☐ Yes ☒ No

If Yes, submit this application for each co-applicant and complete the information below (see instructions):

Joint Client Name: _____ Joint Client Phone: _____

Joint Client Address: _____ Joint Client Contact: _____

Joint Client City, State, Zip: _____

MS4 CLIENT/OPERATOR INFORMATION

DEP Client ID#	Client Type/Code		
72597	**MUNI**		
Organization Name or Registered Fictitious Name		Employer ID# (EIN)	Dun & Bradstreet ID#
UPPER SOUTHAMPTON TOWNSHIP			
Mailing Address Line 1	Mailing Address Line 2		
939 STREET ROAD			
Address Last Line – City	State	ZIP+4	Country
SOUTHAMPTON	**PA**	**18966**	**USA**
Client Contact Last Name	First Name	MI	Suffix
GOLDEN	**JOSEPH**		
Client Contact Title	Phone	Ext	
TWP. MANAGER	**(215) 322-9700**		
Email Address	FAX		
jgolden@ustwp.org	**(215) 322-0405**		

MS4 SITE INFORMATION

DEP Site ID#	Site Name				
613842	**UPPER SOUTHAMPTON**				
Urbanized Area (UA) Name(s)		UA Area (specify acres or mi^2)			
UPPER SOUTHAMPTON		**6.6 SQ. MI**			
County Name	Municipality Name	City	Boro	Twp	State
BUCKS	**UPPER SOUTHAMPTON**	☐	☐	☒	
County Name	Municipality Name	City	Boro	Twp	State
		☐	☐	☐	
Site Location Address Line 1	Site Location Address Line 2				
939 STREET ROAD					

Site Location City	State	ZIP+4
SOUTHAMPTON	**PA**	**18966**

Detailed Written Directions to Site

Site Contact Last Name	First Name	MI	Suffix
GOLDEN	**JOSEPH**		

Site Contact Title	Site Contact Firm
TWP MANAGER	

Mailing Address Line 1	Mailing Address Line 2
939 STREET ROAD	

Address Last Line – City	State	ZIP+4
SOUTHAMPTON	**PA**	**18966**

Phone	Ext	FAX	Email Address
(215) 322-9700		**(215) 322-0405**	**jgolden@ustwp.org**

SIC Code(s) (List All That Apply)	NAICS Code(s)

Site-to-Client Relationship
SAME

STORMWATER DISCHARGE INFORMATION

Map(s). Attach a map(s) to the application that identifies all stormwater discharge points (outfalls) from the MS4 to surface waters. For MS4s with existing permit coverage (that did not receive a waiver from DEP during the latest permit term), the map must include all elements required by MCM #3 in the NPDES permit. See instructions.

Surface Water Information. For each surface water body that receives stormwater discharges from the MS4, list the surface water, the furthest downstream outfall ID number, and the surface water's existing use, impairment and TMDL/WLA information in the table below. See instructions. **NOTE** – If the MS4 discharges to any surface water whose existing use is HQ or EV, the MS4 must apply for an individual permit.

Surface Water Name	Outfall No.	Ch. 93 Existing Use	Impaired?	Approved TMDL?	WLA?
MILL CREEK DEP 1091317	001	WWF,MF	Y	NO	NO
SOUTHAMPTON CREEK DEP 1091319	002	WWF, MF	Y	YES	YES
FOR ADDITIONAL OUTFALLS SEE ATTACHED LIST AND MAPS					

Outfall Locations. For each outfall identified in the table above, list the latitude and longitude coordinates. Identify the Horizontal Reference Datum used to determine the coordinates.

Outfall No.	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
001	40	10	2.14	75	00	27.99
002	10	10	8.01	75	03	44.19
FOR ADDITIONAL OUTFALLS SEE ATTACHED LIST AND MAPS						

Horizontal Reference Datum: ☐ NAD of 1927 ☐ NAD of 1983 ☒ WGS of 1984 ☐ Unknown

TMDL Details. For any surface water with an approved TMDL in which a WLA is applicable to the MS4, provide the WLAs below.

Surface Water Name	TMDL Name	Pollutant Name	TMDL WLA (lbs/yr)	Specific or General
SOUTHAMPTON CREEK	SOUTHAMPTON CREEK	NUTRIENTS	2.19	G
SOUTHAMPTON CREEK	SOUTHAMPTON CREEK	ORGANIC/LOW D.O.	---	
SOUTHAMPTON CREEK	SOUTHAMPTON CREEK	SILTATION	288,119	S

MS4 Requirements. Are requirement(s) specified in DEP's MS4 Requirements Table for the MS4? ☒ Yes ☐ No

If Yes, summarize the requirements below by checking all boxes that apply:

☐ Appendix A (AMD Metals and pH)

☐ Appendix B (Pathogens)

☐ Appendix C (Priority Organic Compounds)

☐	Appendix D (Chesapeake Bay Nutrients/Sediment)	☐	Pollutant Reduction Plan attached to application
☒	Appendix E (Impaired Waters Nutrients/Sediment)	☒	Pollutant Reduction Plan attached to application
☒	TMDL Plan	☒	TMDL Plan attached to application

NOTE – Appendices D and E and the TMDL Plan require the applicant to submit documentation of a public involvement and participation process.

STORMWATER MANAGEMENT PROGRAM

☒ Check here if the applicant is relying and will continue to rely on Pennsylvania's Chapter 102 program for erosion and sediment control (E&S) and post-construction stormwater management requirements. (If checked, there is no need to complete the information in the table below for MCM #4, BMPs #4 – #8, and MCM #5, BMPs #4 – #6).

Minimum Control Measure (MCM)	BMP #	BMP Summary	Responsible Party	Contact Name	Contact Phone No.	MOU or Agreement?
#1 – Public Education and Outreach	1	Develop, implement and maintain a written Public Education and Outreach Program.	TWP	J. GOLDEN	(215) 322-9700	☐
	2	Develop and maintain lists of target audience groups that are present within the areas served by the permittee's regulated small MS4.	TWP	J. GOLDEN	(215) 322-9700	☐
	3	The permittee shall annually publish at least one issue of a newsletter, a pamphlet, a flyer, or a website that includes general stormwater educational information, a general description of the permittee's SWMP, and/or information about the permittee's stormwater management activities.	TWP	J. GOLDEN	(215) 322-9700	☐
	4	Distribute stormwater educational materials and/or information to the target audiences using two methods annually.	TWP	J. GOLDEN	(215) 322-9700	☐
#2 – Public Participation and Involvement	1	Develop, implement and maintain a written Public Involvement and Participation Program (PIPP).	TWP	J. GOLDEN	(215) 322-9700	☐
	2	Provide adequate public notice and opportunities for public review, input, and feedback prior to adoption of any ordinance, SOP or plan required by the General Permit.	TWP	J. GOLDEN	(215) 322-9700	☐
	3	Regularly solicit public involvement and participation from the target audience groups using available distribution and outreach methods.	TWP	J. GOLDEN	(215) 322-9700	☐
#3 – Illicit Discharge Detection and Elimination	1	Develop and implement a written program for the detection, elimination, and prevention of illicit discharges into the regulated MS4.	TWP	J. GOLDEN	(215) 322-9700	☐
	2	Develop and maintain a map of the regulated small MS4's outfalls and surface waters.	TWP	J. GOLDEN	(215) 322-9700	☐
	3	In conjunction with the map(s) created under BMP #2 (either on the same map or on a different map), new permittees shall show, and existing permittees shall update, the entire storm sewer collection system, including roads, inlets, piping, swales, catch basins, channels, basins, and any other features of the permittee's storm sewer system including municipal boundaries and/or watershed boundaries.	TWP	J. GOLDEN	(215) 322-9700	☐

Minimum Control Measure (MCM)	BMP #	BMP Summary	Responsible Party	Contact Name	Contact Phone No.	MOU or Agreement?
#3 – Illicit Discharge Detection and Elimination (continued)	4	The permittee shall conduct outfall field screening, identify the source of any illicit discharges, and remove or correct any illicit discharges.	TWP	J. GOLDEN	(215) 322-9700	☐
	5	Enact a Stormwater Management Ordinance (municipal permittees) or SOP (non-municipal permittees) to implement and enforce a stormwater management program that includes prohibition of non-stormwater discharges to the regulated small MS4.	TWP	J. GOLDEN	(215) 322-9700	☐
	6	Provide educational outreach to public employees, business owners and employees, property owners, the general public and elected officials (i.e., target audiences) about the program to detect and eliminate illicit discharges.	TWP	J. GOLDEN	(215) 322-9700	☐
#4 – Construction Site Stormwater Runoff Control	1	If an NPDES permit is required for earth disturbance activities, do not issue a building permit or approval until confirmation that a valid NPDES permit is obtained.	TWP	J. GOLDEN	(215) 322-9700	☐
	2	Notify DEP or CCD within 5 days of the receipt of an application for a permit involving an earth disturbance activity consisting of one acre or more.	TWP	J. GOLDEN	(215) 322-9700	☐
	3	Enact, implement, and enforce an ordinance to require the implementation of erosion and sediment control BMPs, as well as sanctions to ensure compliance.	TWP	J. GOLDEN	(215) 322-9700	☐
	4	Review Erosion and Sediment (E&S) control plans to ensure that such plans adequately consider water quality impacts and meet regulatory requirements.	TWP	J. GOLDEN	(215) 322-9700	☐
	5	Conduct inspections regarding installation and maintenance of E&S control measures during earth disturbance activities. Maintain records of site inspections, including dates and inspection results, in accordance with the record retention requirements in this General Permit.	TWP	J. GOLDEN	(215) 322-9700	☐
	6	Conduct enforcement when installation and maintenance of E&S control measures during earth disturbance activities does not comply with permit and/or regulatory requirements.	TWP	J. GOLDEN	(215) 322-9700	☐
	7	Develop and implement requirements for construction site operators to control waste at construction sites that may cause adverse impacts to water quality. The permittee shall provide education on these requirements to construction site operators.	TWP	J. GOLDEN	(215) 322-9700	☐

Minimum Control Measure (MCM)	BMP #	BMP Summary	Responsible Party	Contact Name	Contact Phone No.	MOU or Agreement?
#4 – Construction Site Stormwater Runoff Control (continued)	8	Develop and implement procedures for the receipt and consideration of public inquiries, concerns, and information submitted by the public to the permittee regarding local construction activities. The permittee shall demonstrate acknowledgement and consideration of the information submitted, whether submitted verbally or in writing.	TWP	J. GOLDEN	(215) 322-9700	☐
#5, Post-Construction Stormwater Management in New Development and Redevelopment	1	Enact, implement, and enforce an ordinance or other regulatory mechanism to address post-construction stormwater runoff from new development and redevelopment projects, as well as sanctions and penalties associated with non-compliance.	TWP	J. GOLDEN	(215) 322-9700	☐
	2	Develop and implement measures to encourage and expand the use of Low Impact Development (LID) in new development and redevelopment.	TWP	J. GOLDEN	(215) 322-9700	☐
	3	Ensure adequate operation and maintenance of all post-construction stormwater management BMPs installed at all development or redevelopment projects that disturb greater than or equal to one acre.	TWP	J. GOLDEN	(215) 322-9700	☐
	4	Review PCSM Plans and require the implementation of structural and/or non-structural BMPs that are appropriate to the local community, that minimize water quality impacts and that are designed to maintain pre-development runoff conditions, and implement a tracking system for qualifying projects and associated PCSM BMPs.	TWP	J. GOLDEN	(215) 322-9700	☐
	5	Inspect all qualifying development or redevelopment projects to ensure proper installation of the approved structural PCSM BMPs.	TWP	J. GOLDEN	(215) 322-9700	☐
	6	Develop a written program that describes how the permittee shall implement and enforce all required components of this MCM.	TWP	J. GOLDEN	(215) 322-9700	☐
#6 – Pollution Prevention / Good Housekeeping	1	Identify and document all operations that are owned or operated by the permittee and have the potential for generating stormwater runoff to the regulated small MS4.	TWP	J. GOLDEN	(215) 322-9700	☐
	2	Develop, implement and maintain a written O&M program for all operations that could contribute to the discharge of pollutants from the regulated small MS4.	TWP	J. GOLDEN	(215) 322-9700	☐
	3	Develop and implement an employee training program that addresses appropriate topics to further the goal of preventing or reducing the discharge of pollutants from operations to the regulated small MS4.	TWP	J. GOLDEN	(215) 322-9700	☐

STORMWATER MANAGEMENT PROGRAM

MOU or Agreement. Attach any Memorandum of Understanding (MOU) or other written agreement that describes the BMP(s) identified above as being the responsibility of another party or a shared responsibility with another party.

Stormwater Management Ordinance. For municipal applicants that are renewing permit coverage, complete the information below and attach the applicant's Stormwater Management Ordinance to the NOI. The box for "Yes" must be checked for one of the three options below. Applicants that lack the authority to enact ordinances and are renewing permit coverage must attach their stormwater management SOP(s).

1.	Has a Stormwater Management Ordinance been enacted that is consistent with either the 2013 or 2022 DEP Model Ordinances?	☒ Yes	Date: **12/17/2013**	☐ No
2.	Has a Stormwater Management Ordinance been enacted that is consistent with an Act 167 Plan approved by DEP in 2005 or later?	☒ Yes	Date: **12/17/2013**	☐ No
3.	Has a Stormwater Management Ordinance been enacted that meets the requirements of the Stormwater Management Ordinance Checklist (for either 2013 or 2022)? If Yes, attach Checklist (3800-PM-BCW0100g).	☒ Yes	Date: **12/17/2013**	☐ No

COMPLIANCE HISTORY

Existing Permits – Identify all existing environmental permits issued by DEP or EPA to the applicant in the past five years.

Type of Permit	Permit No.	Date Issued	Issued By
NPDES	PAG130029	3/2013	PADEP

Was/Is the facility owner or operator in violation of any DEP regulation, permit, order or schedule of compliance at this or any other facility? ☐ Yes ☒ No

If "Yes," list each permit, order or schedule of compliance and provide current compliance status. Use additional sheets to provide information on all permits.

Permit Program: Permit No.:

Brief Description of Non-Compliance:

Steps Taken to Achieve Compliance	Date(s) Compliance Achieved

Current Compliance Status: ☐ In Compliance ☐ In Non-Compliance

CERTIFICATION

I certify under penalty of law and subject to the penalties of 18 Pa. C.S.A. Section 4904 (relating to unsworn falsification to authorities) that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Joseph Golden
Name (type or print legibly)

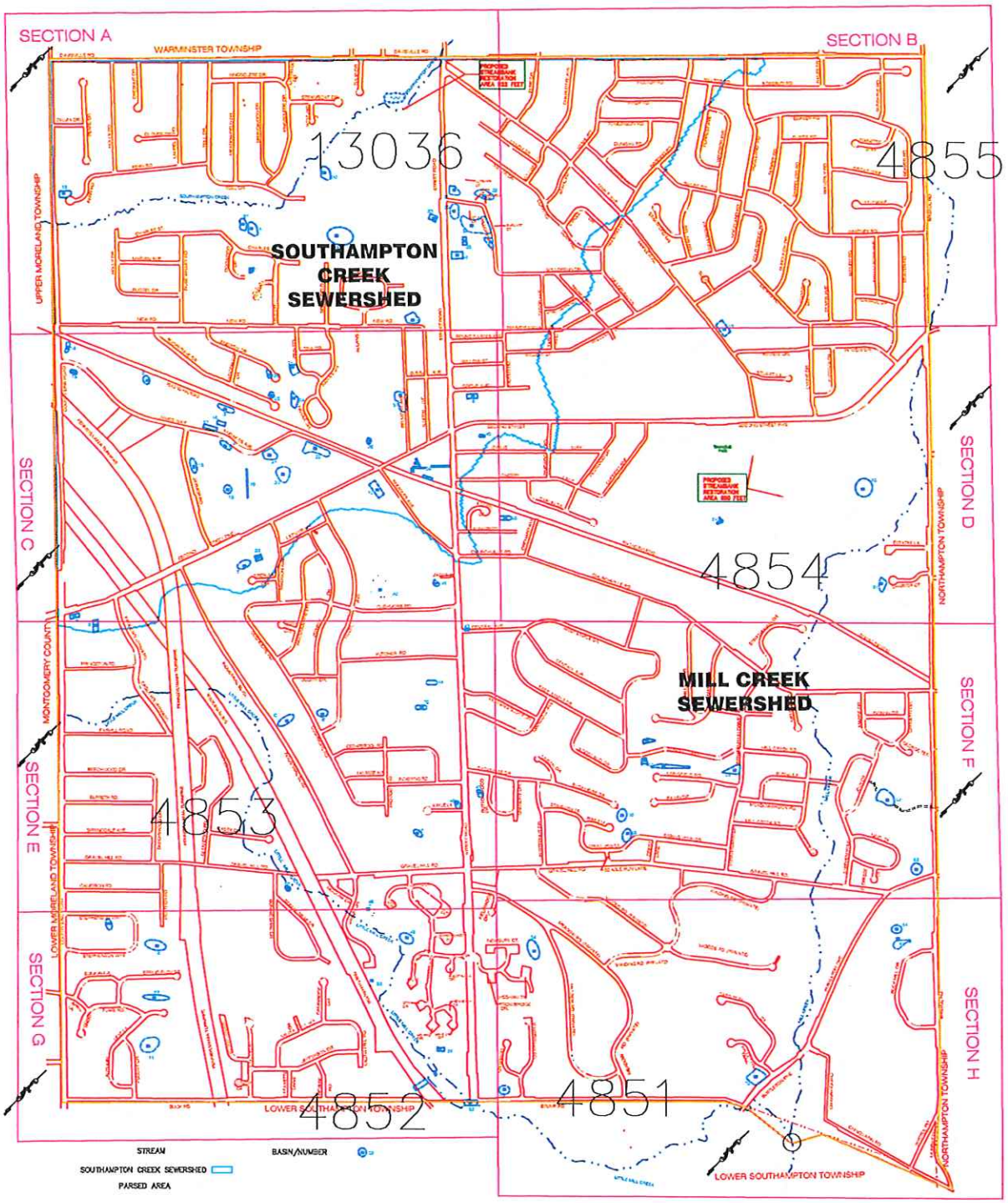
Township Manager
Official Title

Signature

Date Signed

UPPER SOUTHAMPTON TOWNSHIP

BUCKS COUNTY



1"= 400'

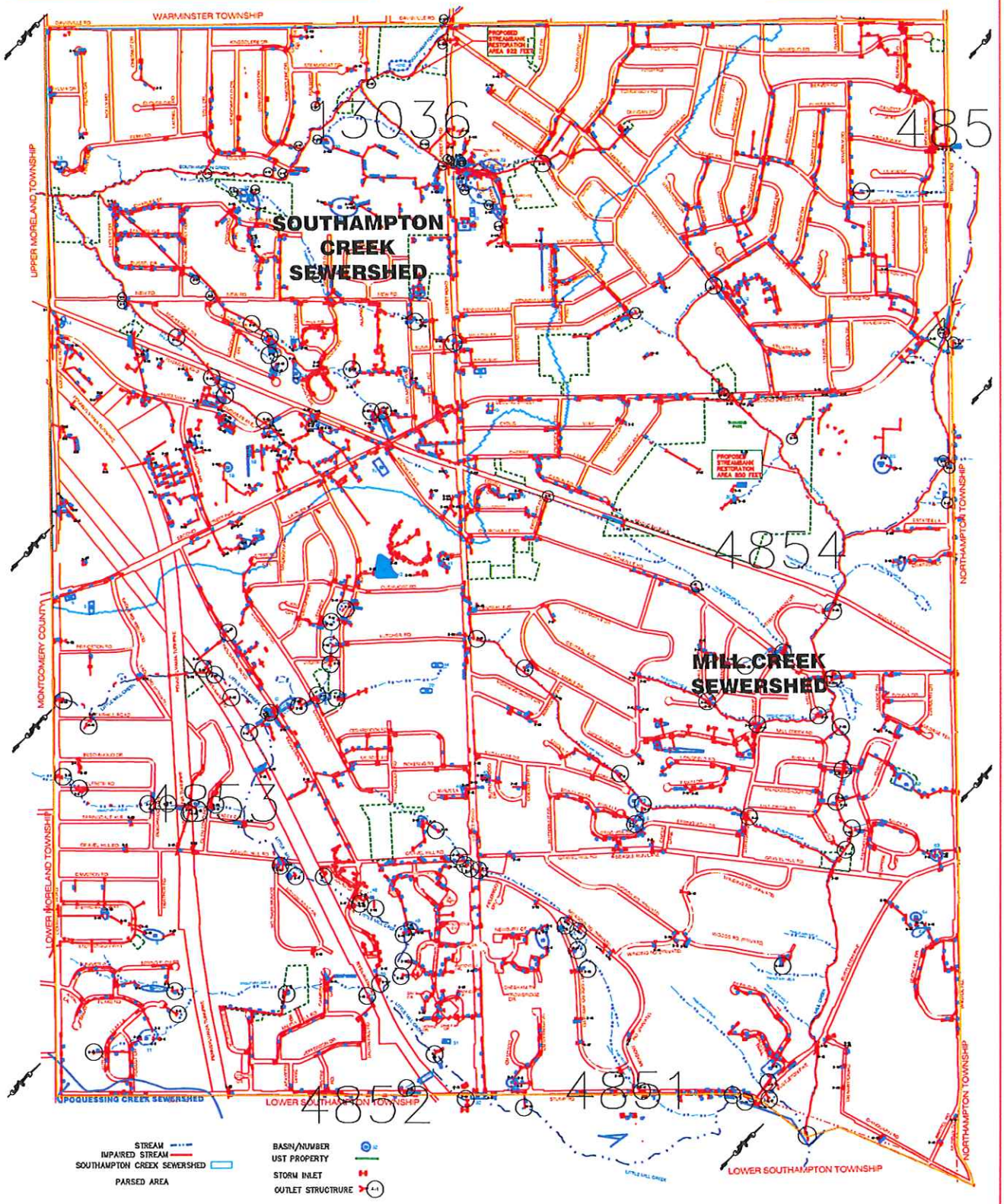
TRI-STATE ENGINEERS & LAND SURVEYORS, INC.

BASIN MAP
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

SHEET 4 of 13

UPPER SOUTHAMPTON TOWNSHIP

BUCKS COUNTY



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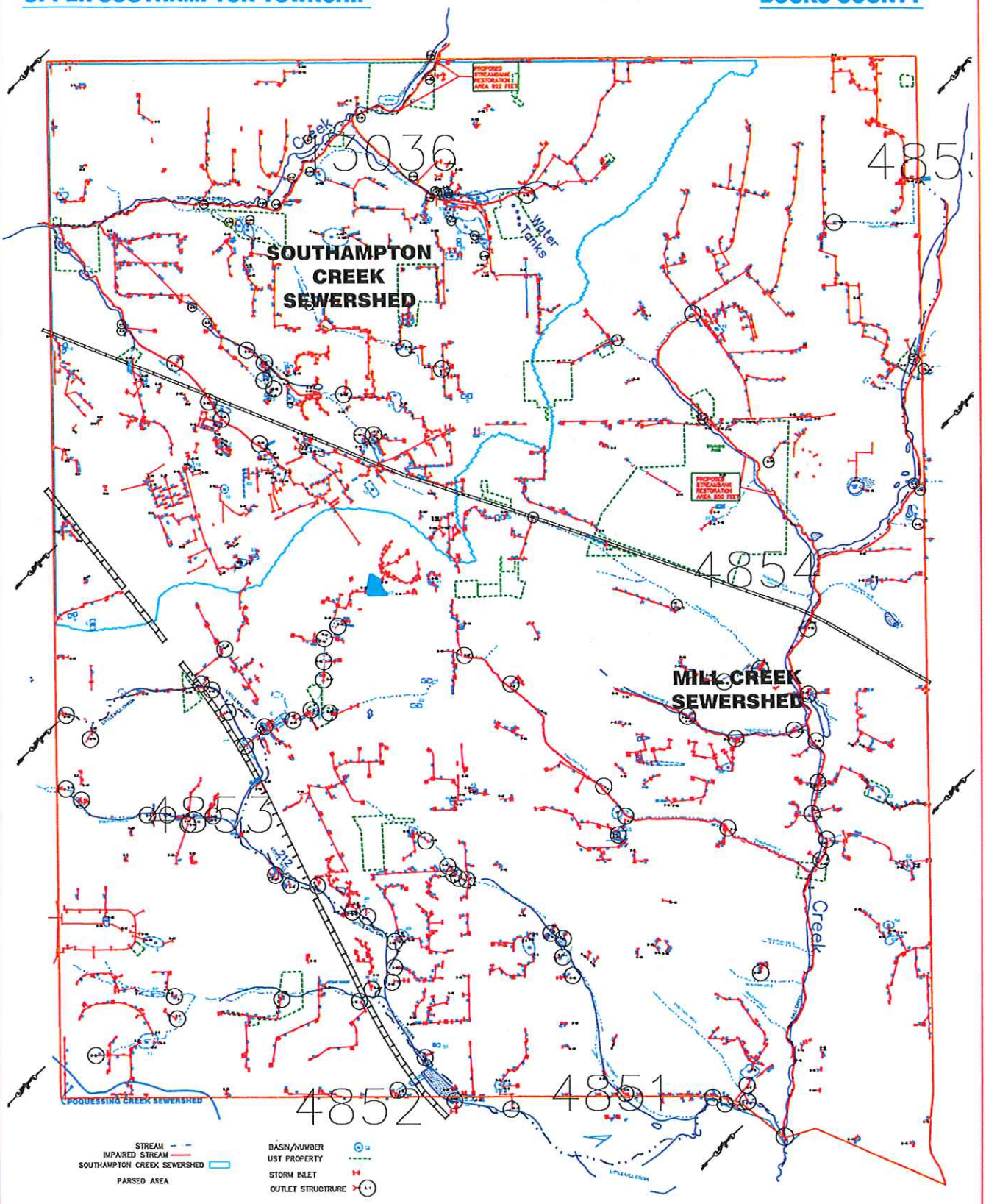
TRI-STATE ENGINEERS & LAND SURVEYORS, INC.

WATERSHEDS
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

SHEET 3 OF 13

UPPER SOUTHAMPTON TOWNSHIP **BUCKS COUNTY**



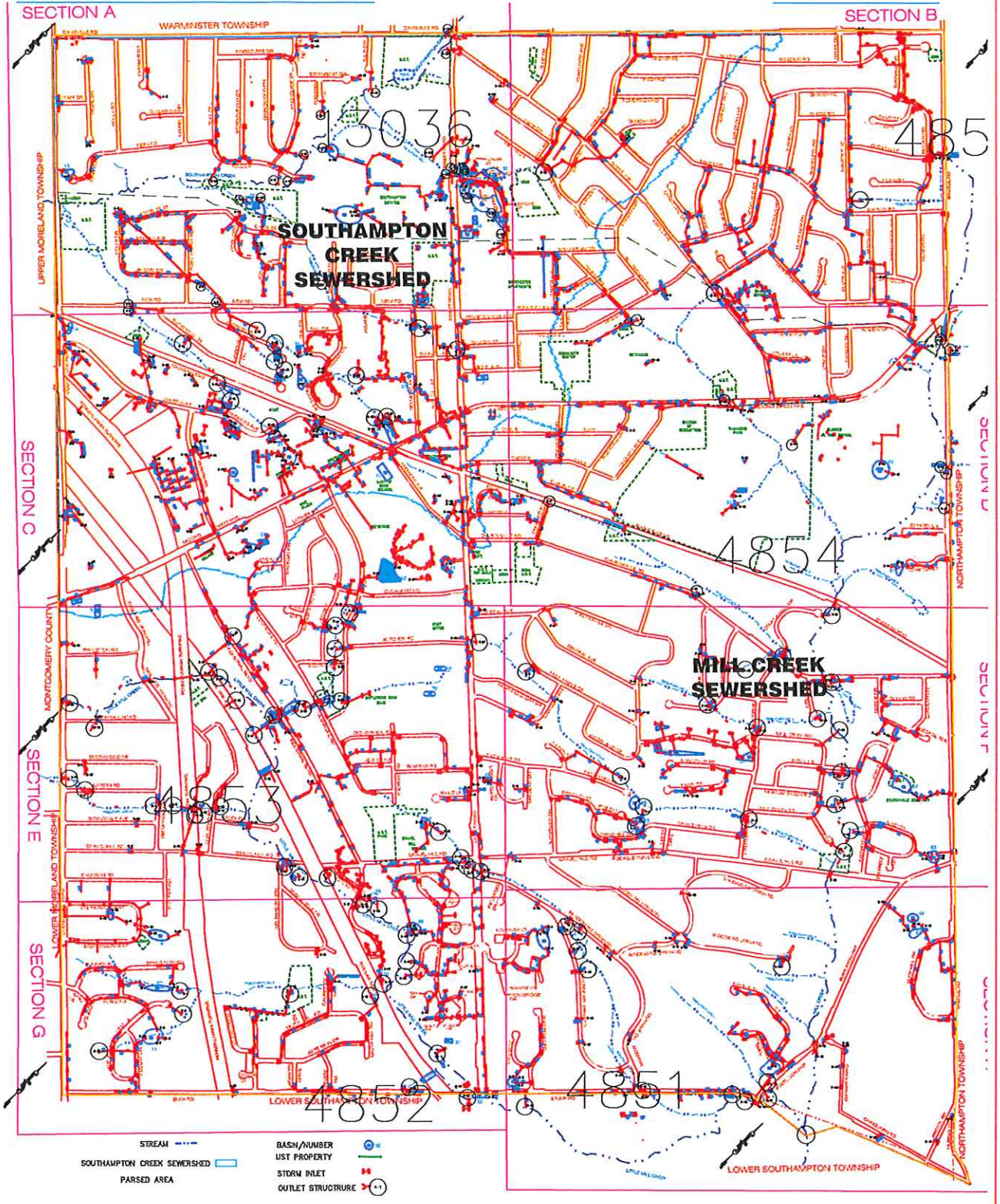
TRI-STATE ENGINEERS & LAND SURVEYORS, INC.

STREM MAP
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

SHEET 2 OF 13

UPPER SOUTHAMPTON TOWNSHIP

BUCKS COUNTY



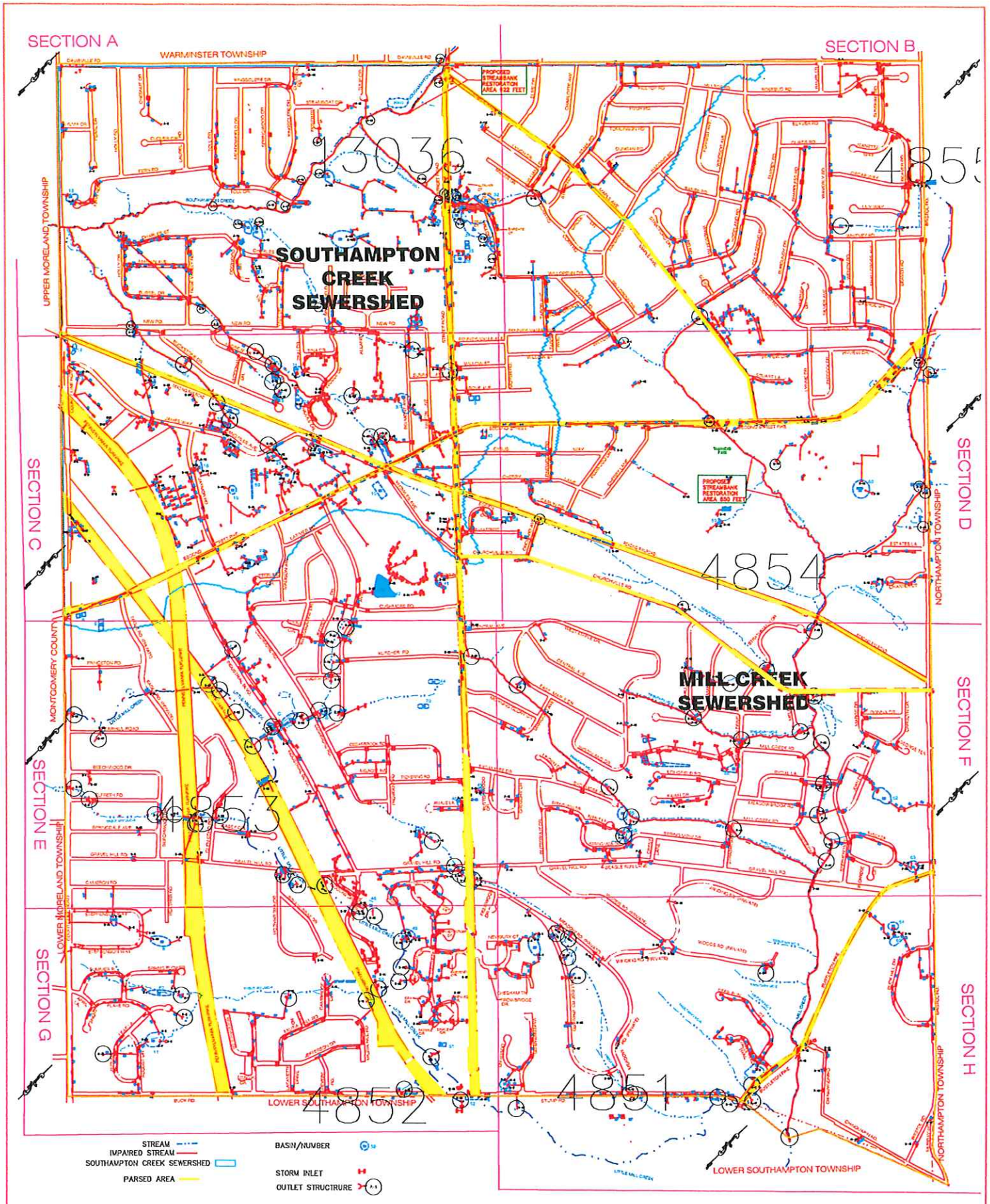
1" = 400'

TRI-STATE ENGINEERS & LAND SURVEYORS, INC.

STORM SYSTEM MAP

MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

SHEET 1 OF 13



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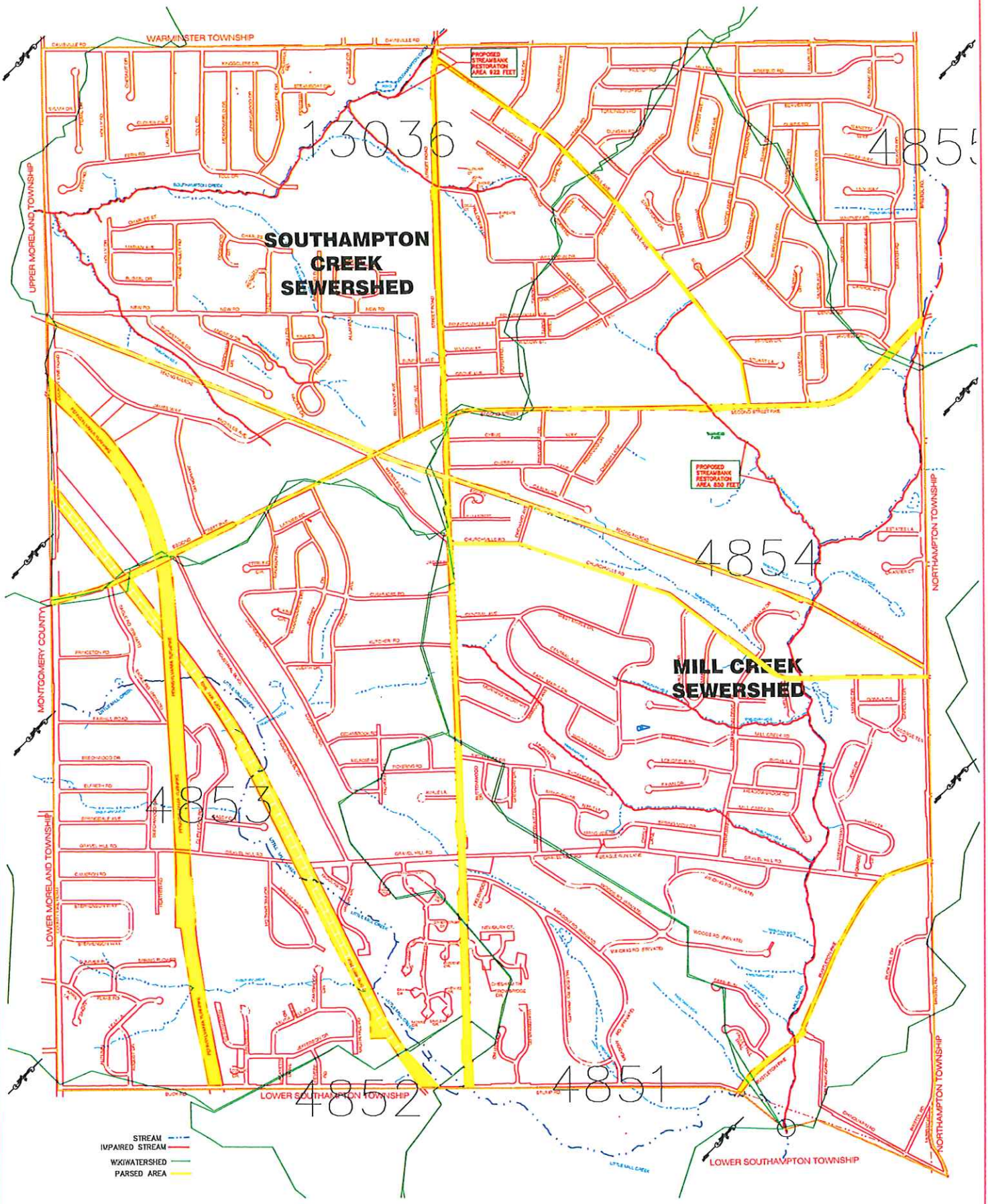
CIVIL ENGINEERS MUNICIPAL ENGINEERS LAND SURVEYORS LAND PLANNERS LANDSCAPE ARCHITECTS
101 WEST STREET ROAD FEASTERVILLE, PENNSYLVANIA 19053
PHONE 215-357-5100 FAX 215-357-2570

OUTFALLS
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

SHEET 1 OF 1



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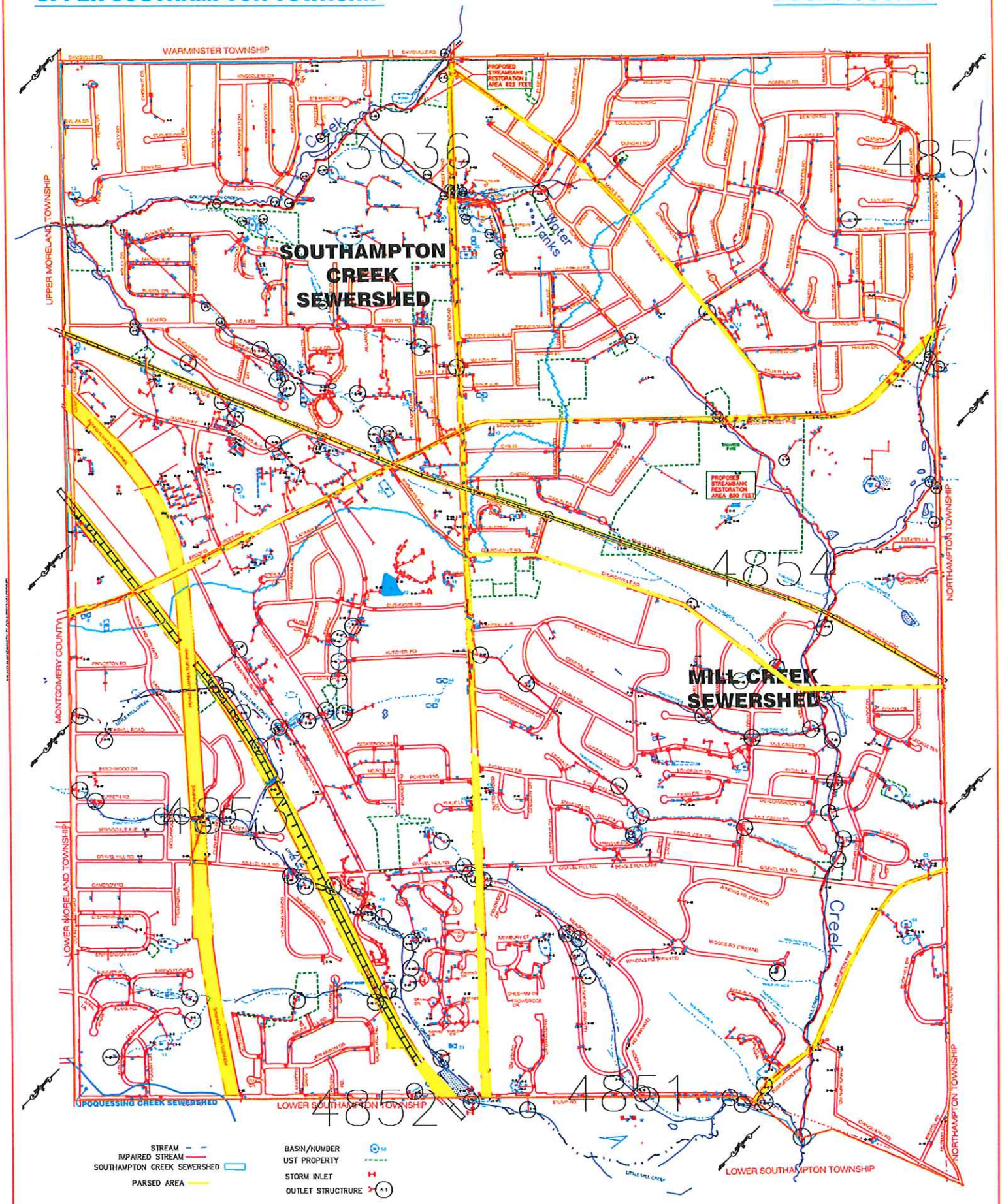
CIVIL ENGINEERS MUNICIPAL ENGINEERS LAND SURVEYORS LAND PLANNERS LANDSCAPE ARCHITECTS
801 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE 215-357-5900 FAX 215-357-2636

PARSED AREAS AND WIKIWATERSHEDS
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

SHEET 1 OF 1

UPPER SOUTHAMPTON TOWNSHIP

BUCKS COUNTY



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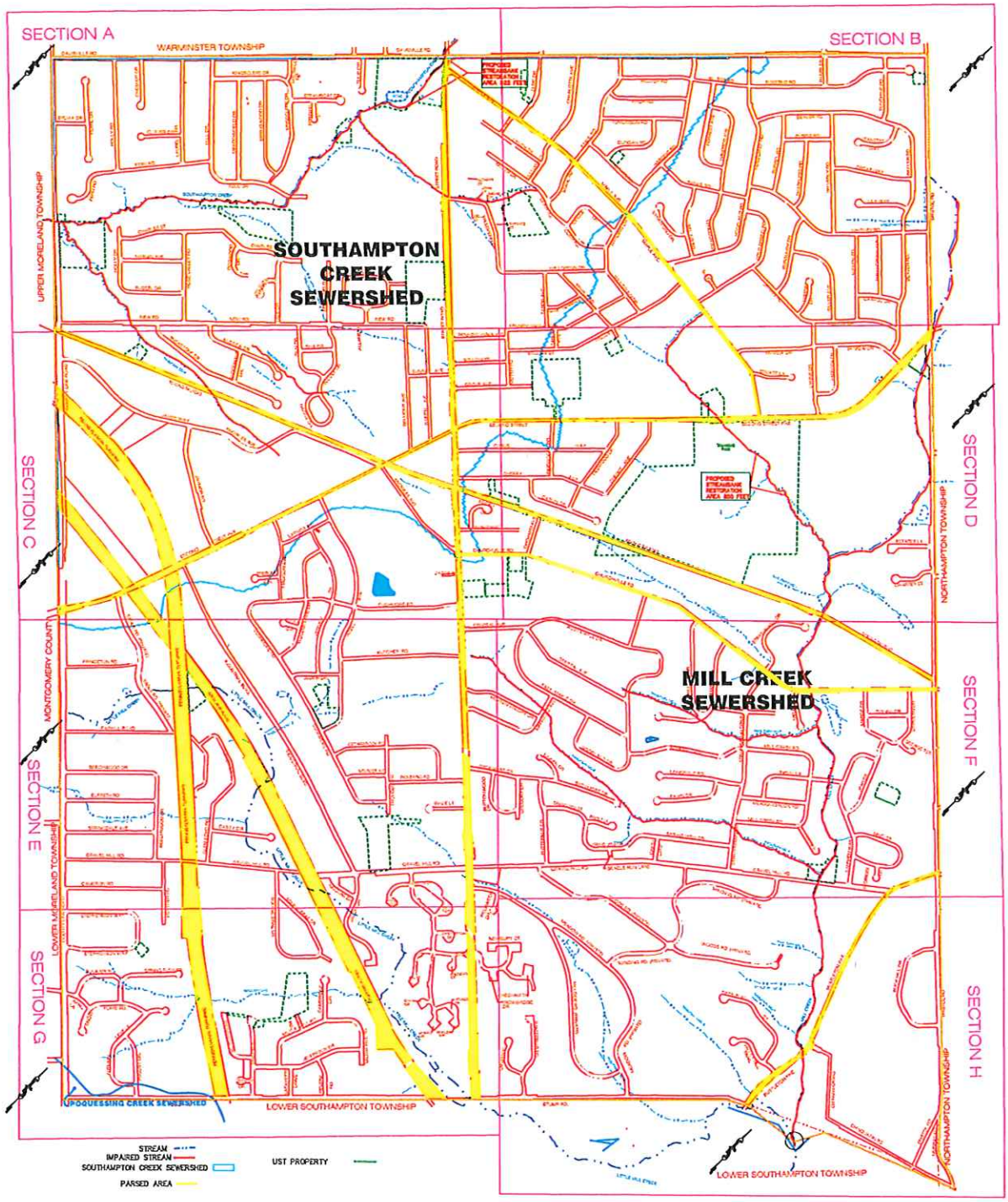
CIVIL ENGINEERS MUNICIPAL ENGINEERS LAND SURVEYORS LAND PLANNERS LANDSCAPE ARCHITECTS
801 WEST STREET ROAD FEASTERVILLE, PENNSYLVANIA 19053
PHONE 215-357-5100 FAX 215-357-2636

PROPOSED BMP AREAS
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

SHEET
1 OF 1

UPPER SOUTHAMPTON TOWNSHIP

BUCKS COUNTY



TRI-STATE ENGINEERS & LAND SURVEYORS, INC.
851 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE 215-357-6050 FAX 215-357-2636

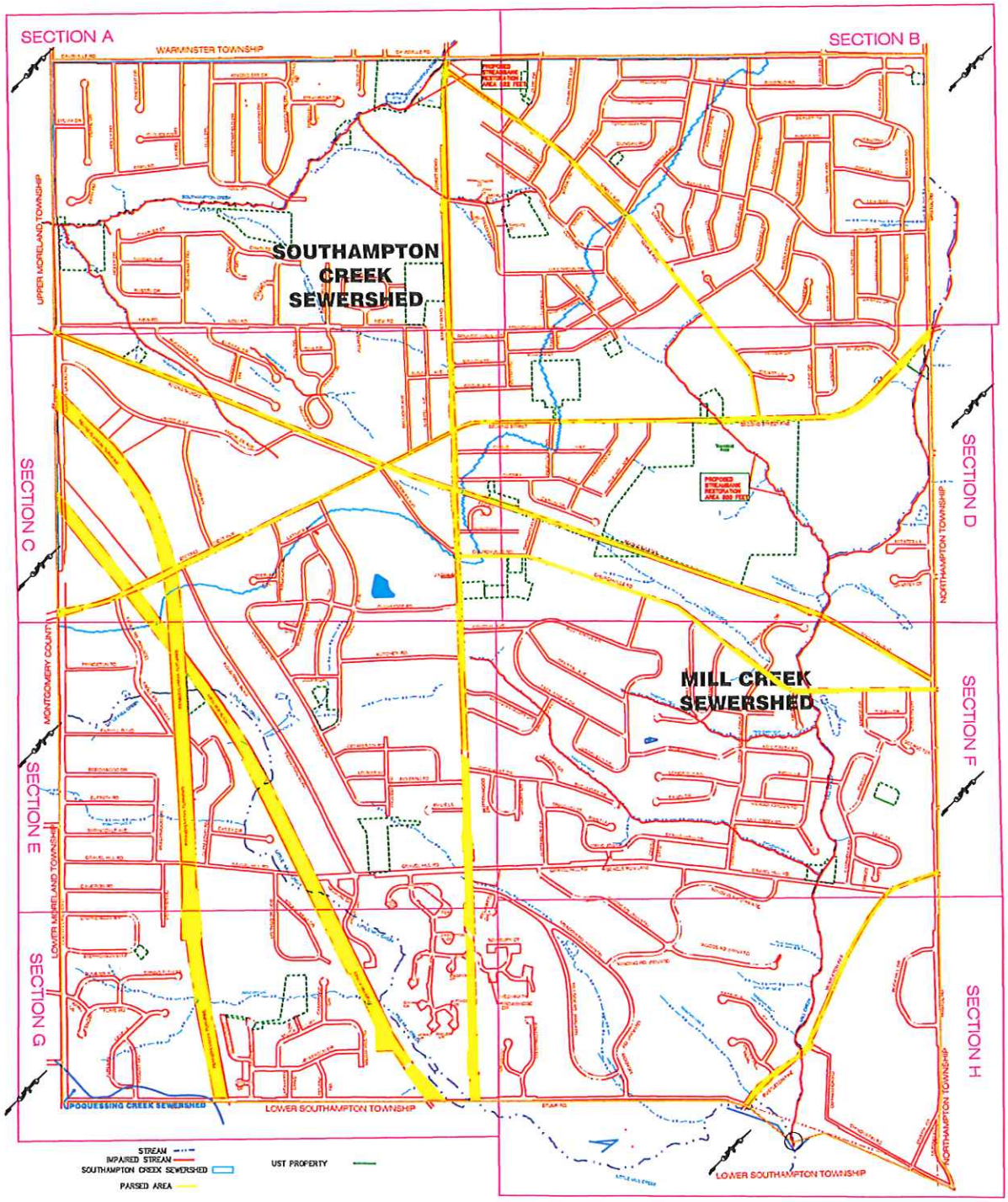
1"= 400'

SECTIONS
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

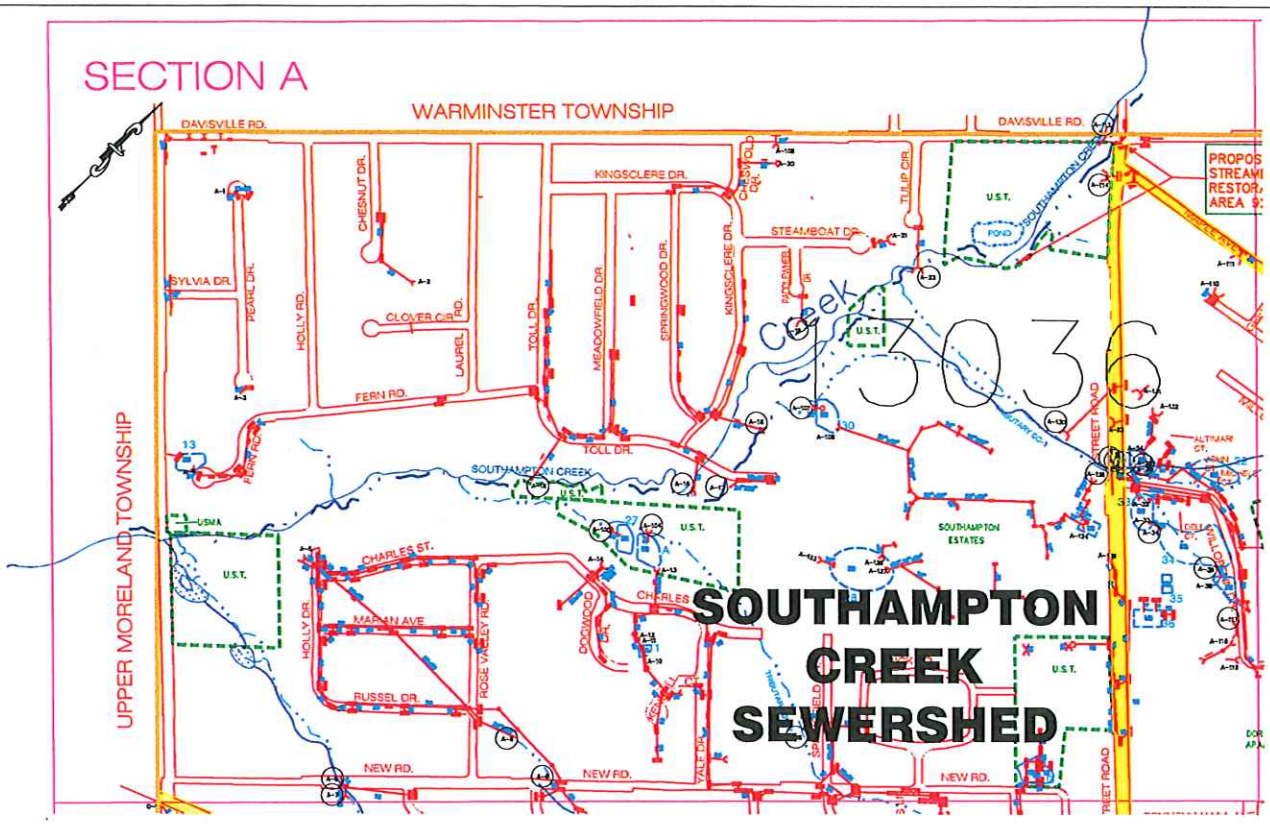
SHEET 5 OF 13

UPPER SOUTHAMPTON TOWNSHIP

BUCKS COUNTY



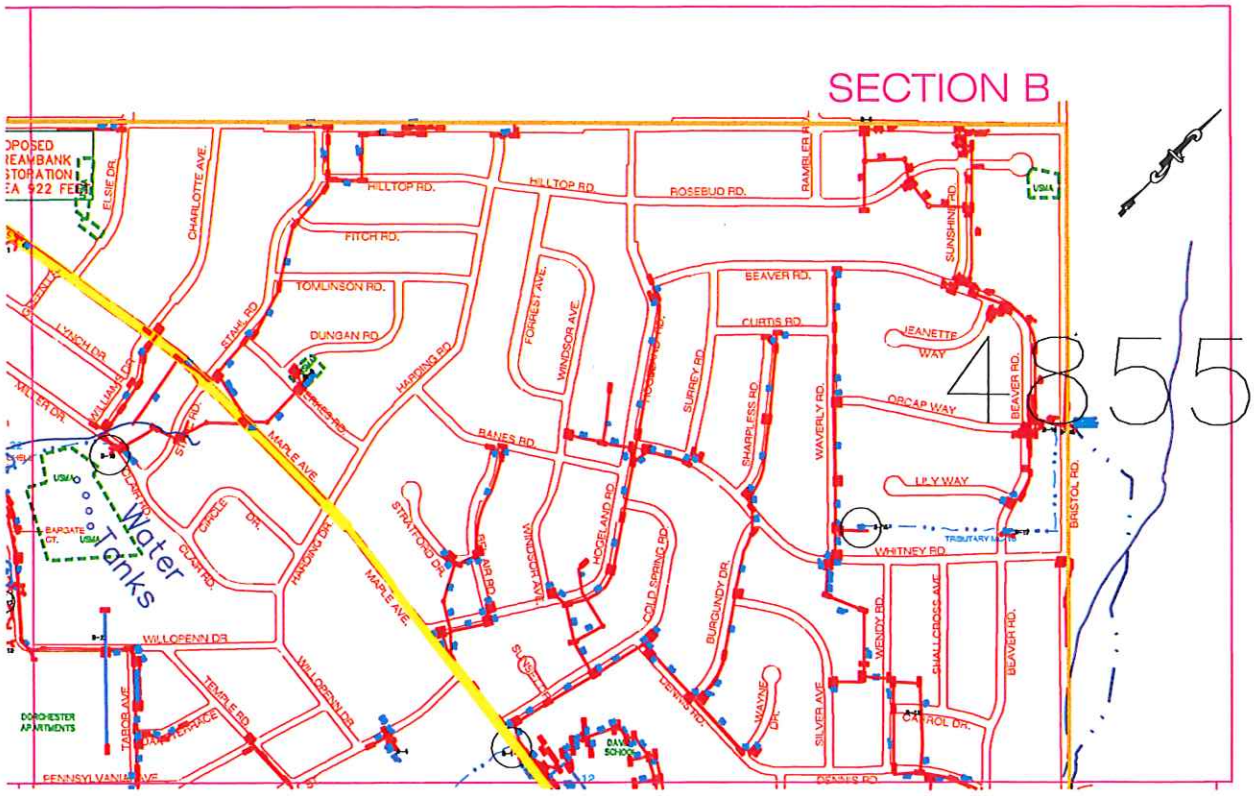
	SCALE IN FEET 1"= 400'		TRI-STATE ENGINEERS & LAND SURVEYORS, INC. CIVIL ENGINEERS · LAND PLANNERS · LANDSCAPE ARCHITECTS 604 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053 PHONE: 215-357-5053 FAX: 215-357-2638		SECTIONS MUNICIPAL SEPARATE STORM SEWER SYSTEMS LOCATED IN UPPER SOUTHAMPTON TOWNSHIP BUCKS COUNTY PENNSYLVANIA	SHEET 5 OF 13



TRI-STATE ENGINEERS & LAND SURVEYORS, INC.

MS4 MAP
SECTION A
FOR
UPPER SOUTHAMPTON TOWNSHIP
PENNSYLVANIA

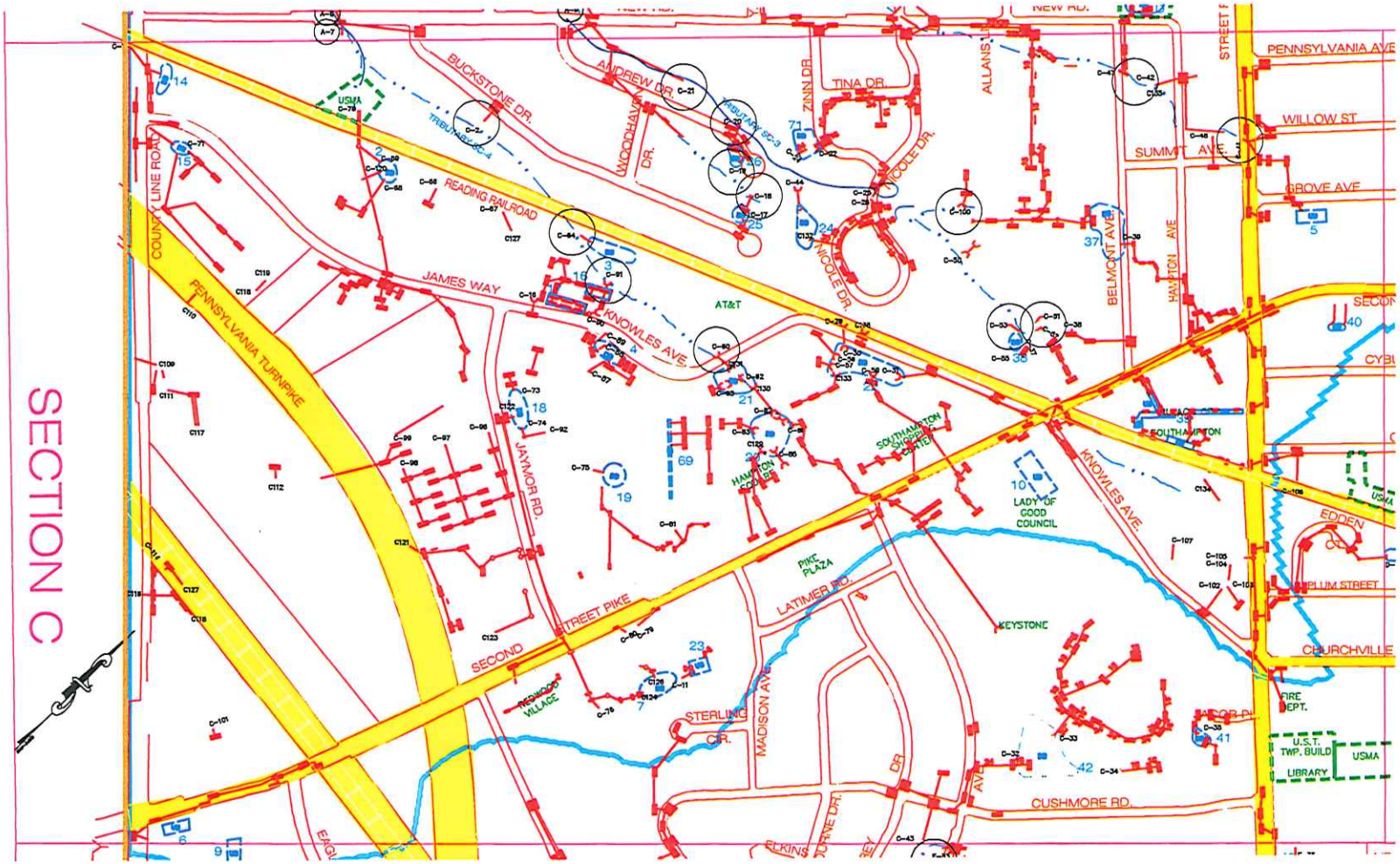
SHEET
6 OF 13



TRI-STATE ENGINEERS & LAND SURVEYORS, INC.

MS4 MAP
SECTION B
FOR
UPPER SOUTHAMPTON TOWNSHIP
PENNSYLVANIA

SHEET 7 OF 13



STREAM
IMPAIRED STREAM
BASIN

STORM PIPE
OUTLET STRUCTURE A–1
STORM INLET
OUTFALL TO STREAM (A–1)

SOUTHAMPTON CK
MILL CK

UST PROPERTY

Pennsylvania One Call System, Inc.
Call Before You Dig
In Pennsylvania
1-800-242-1776
It's the Law Requires
Construction Whose Three working Days Notice
Design Whose Ten working Days Notice
Facility Owners Member of One Call System

Job No.	Date:	Scale:
48-165	6/4/2018	1"=250'
Acreage	No. of Lots	
Designed By: WEP	Drawn By: WEP	Checked By:

REVISION	DESCRIPTION	DATE	DRAWN BY
5.	ADD OUTFALLS AND BASIN DRAINAGE AREAS	1/28/26	WEP
4.	REVISED TOPO AREAS BASINS RENUMBERED	8/7/18	WEP
3.	REVISED FOR WATERSHED REDESIGNATION	8/8/17	WEP
2.	REVISED BASE. UPDATED PER RECENT PROJECTS	3/14/14	JMB
1.	UPDATED FOR 2013	6/5/14	STAFF

SCALE IN FEET
250 125 0 250 500 1000

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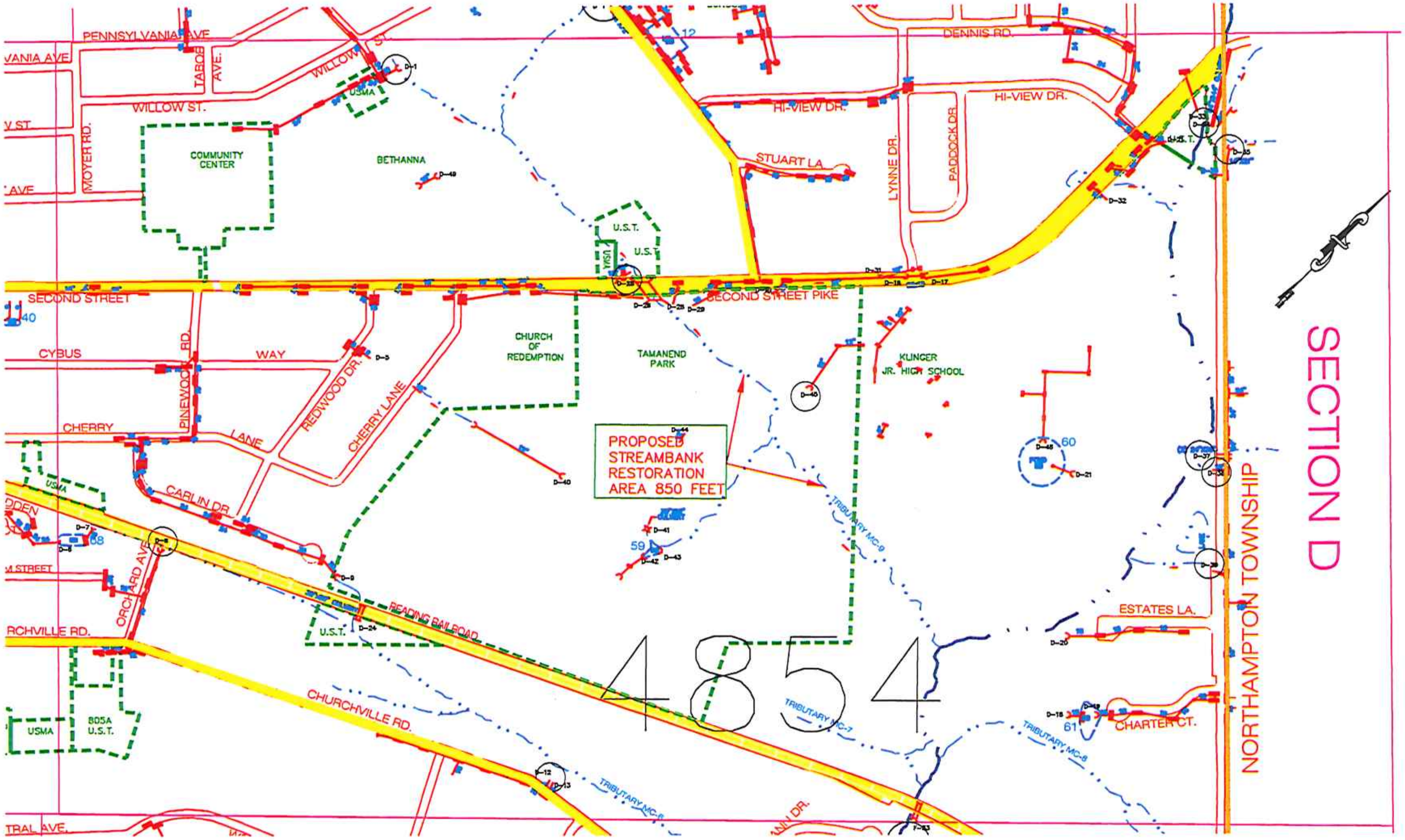
CIVIL ENGINEERS • MUNICIPAL ENGINEERS • LAND SURVEYORS • LAND PLANNERS LANDSCAPE ARCHITECTS
801 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE: 215-357-5950 FAX: 215-357-2836

MS4 MAP
SECTION C
FOR
UPPER SOUTHAMPTON TOWNSHIP
PENNSYLVANIA



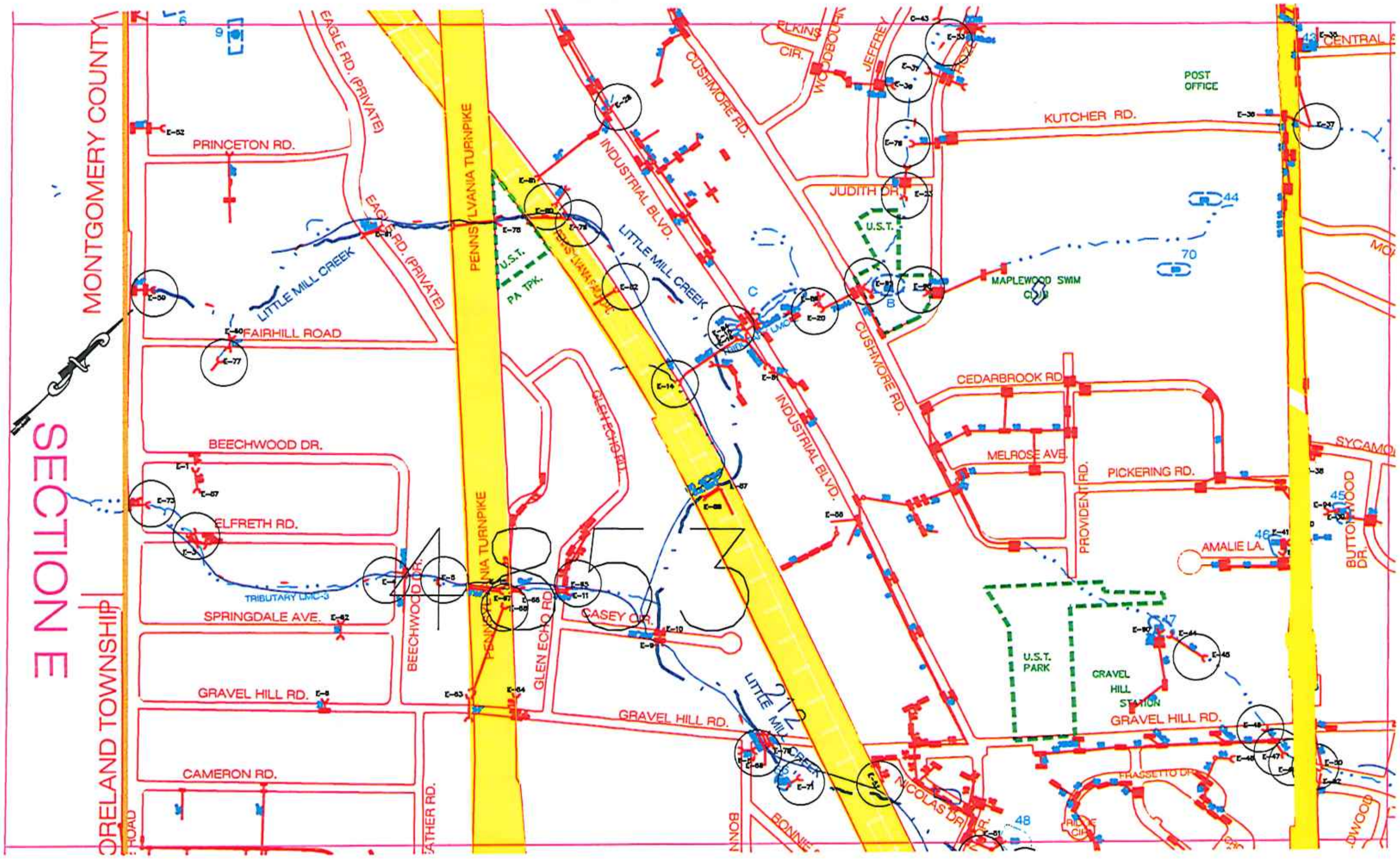
STREAM
IMPAIRED STREAM
BASIN
STORM PIPE
OUTLET STRUCTURE A-1
STORM INLET
OUTFALL TO STREAM (A-1)
SOUTHAMPTON CK
MILL CK
UST PROPERTY

Job No.	Date:	Scale:
48-165	6/4/2018	1"=250'
Acreage	No. of Lots	
Designed By: WEP	Drawn By: WEP	Checked By:

TRI-STATE ENGINEERS & LAND SURVEYORS, INC.
801 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE: 215-357-6950 FAX: 215-357-2836

MS4 MAP
SECTION D
FOR
UPPER SOUTHAMPTON TOWNSHIP
PENNSYLVANIA

SHEET 9 OF 13



STREAM		STORM PIPE		SOUTHAMPTON CK
IMPAIRED STREAM		OUTLET STRUCTURE	A–1	MILL CK
BASIN		STORM INLET		
		OUTFALL TO STREAM	(A–1)	UST PROPERTY

Job No.	Date:	Scale:
48-165	6/4/2018	1"=250'
Acreage	No. of Lots	
Designed By: WJP	Drawn By: WJP	Checked By:

Revision	Description	Date	Drawn By
5.	ADD OUTFALLS AND BASIN DRAINAGE AREAS	1/29/20	WJP
4.	REVISED TOPO ADDED BASINS NUMBERED	8/7/18	WJP
3.	REVISED FOR WATERSHED DESIGNATIONS	8/8/17	WJP
2.	REVISED BASE. UPDATED PER RECENT PROJECTS	3/16/16	JAD
1.	UPDATED FOR 2013	6/5/14	STAFF

SCALE IN FEET: 250 125 0 250 500 1000

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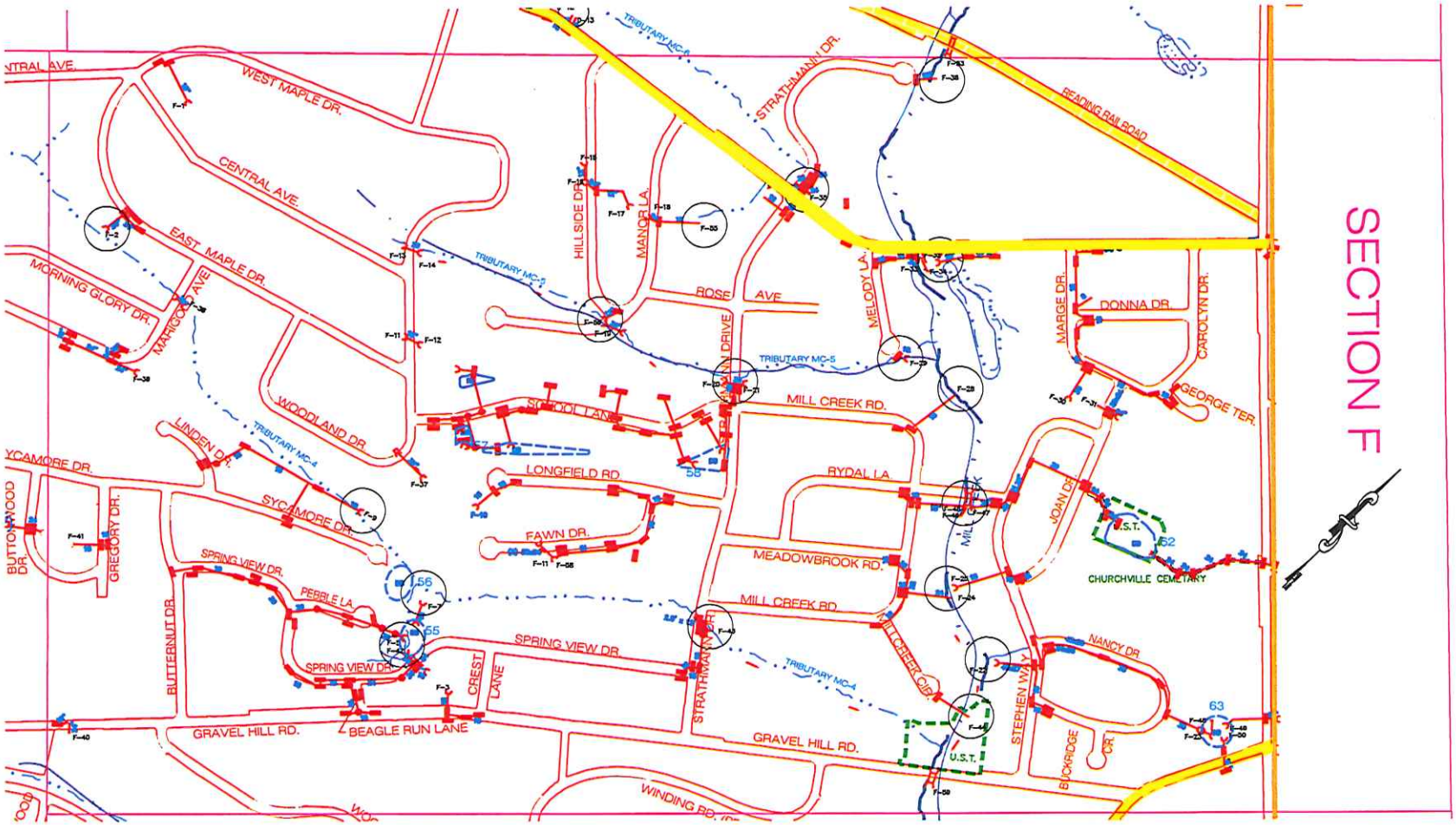
PHONE: 215-357-6950 FAX: 215-357-2836

Pennsylvania One Call System, Inc.

MS4 MAP
SECTION E
FOR
UPPER SOUTHAMPTON TOWNSHIP
PENNSYLVANIA

SHEET 10 OF 13



STREAM
IMPAIRED STREAM
BASIN

STORM PIPE
OUTLET STRUCTURE A–1
STORM INLET
OUTFALL TO STREAM (A–1)

SOUTHAMPTON CK
MILL CK

UST PROPERTY

Job No. 48-165	Date: 6/4/2018	Scale: 1"=250'
Acreage	No. of Lots	
Designed By: WEP	Drawn By: WEP	Checked By:

REVISION	DESCRIPTION	DATE	DRAWN BY
6.	ADD OUTFALLS AND BASIN DRAINAGE AREAS	1/29/20	WEP
4.	REVISED TOPO ADDED BASINS NUMBERED	8/1/19	WEP
3.	REVISED FOR WATERSHED DOMINANCY	8/5/17	WEP
2.	REVISED BASIC, UPDATED PER RESENT PROJECTS	3/15/16	JAS
1.	UPDATED FOR DEQ	5/5/14	STAFF

SCALE IN FEET
250 125 0 250 500 1000

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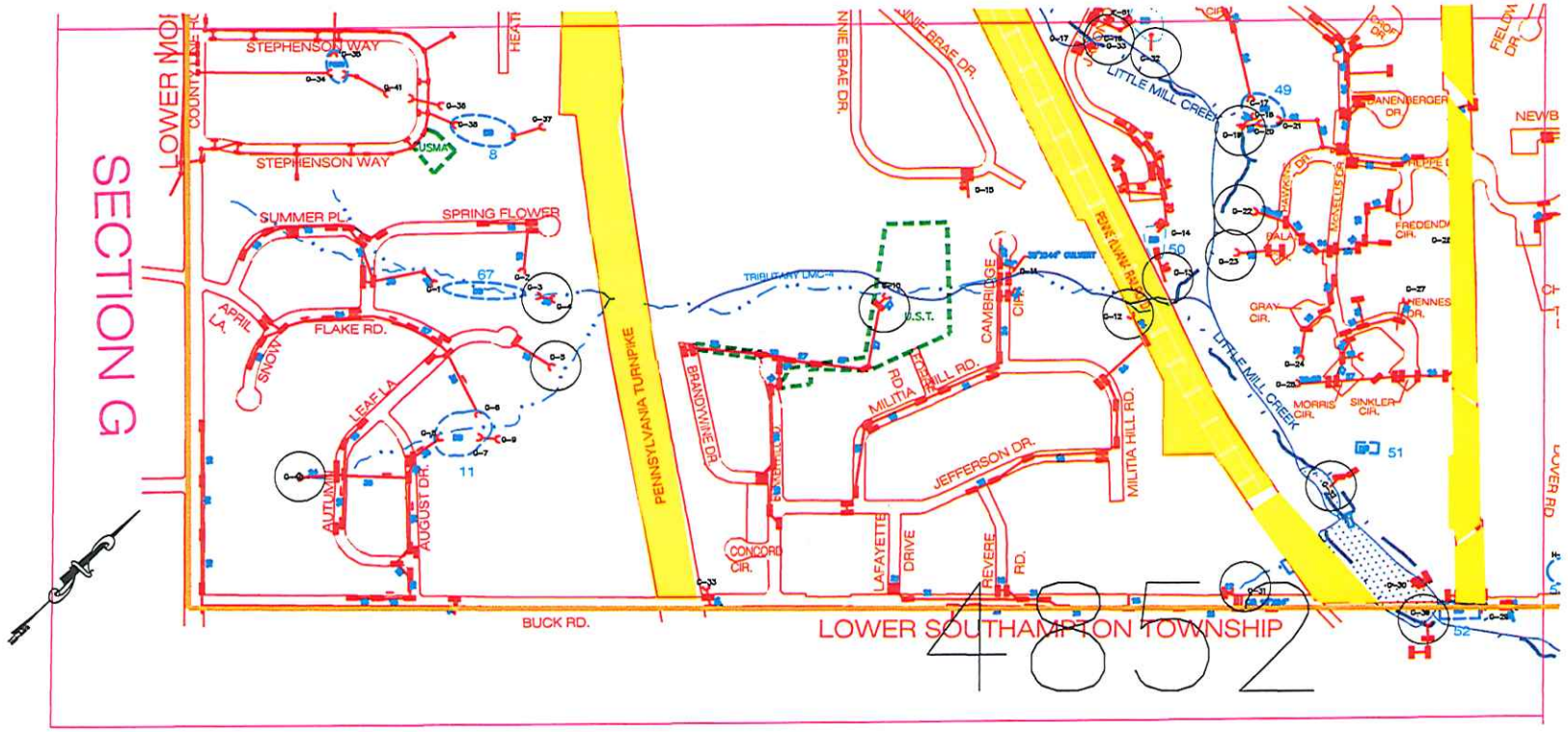
801 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE: 215-357-6950 FAX: 215-357-2836

MS4 MAP
SECTION F
FOR
UPPER SOUTHAMPTON TOWNSHIP
PENNSYLVANIA

SHEET
11 OF 13



STREAM
IMPAIRED STREAM
BASIN

STORM PIPE
OUTLET STRUCTURE A–1
STORM INLET
OUTFALL TO STREAM A–1

SOUTHAMPTON CK
MILL CK

UST PROPERTY

Pennsylvania One Call System, Inc.
Call Before You Dig
In Pennsylvania
1-800-242-1776

Job No.	Date	Scale
48-165	6/4/2018	1"=250'
Acreage	No. of Lots	
Designed By: WCP	Drawn By: WCP	Checked By:

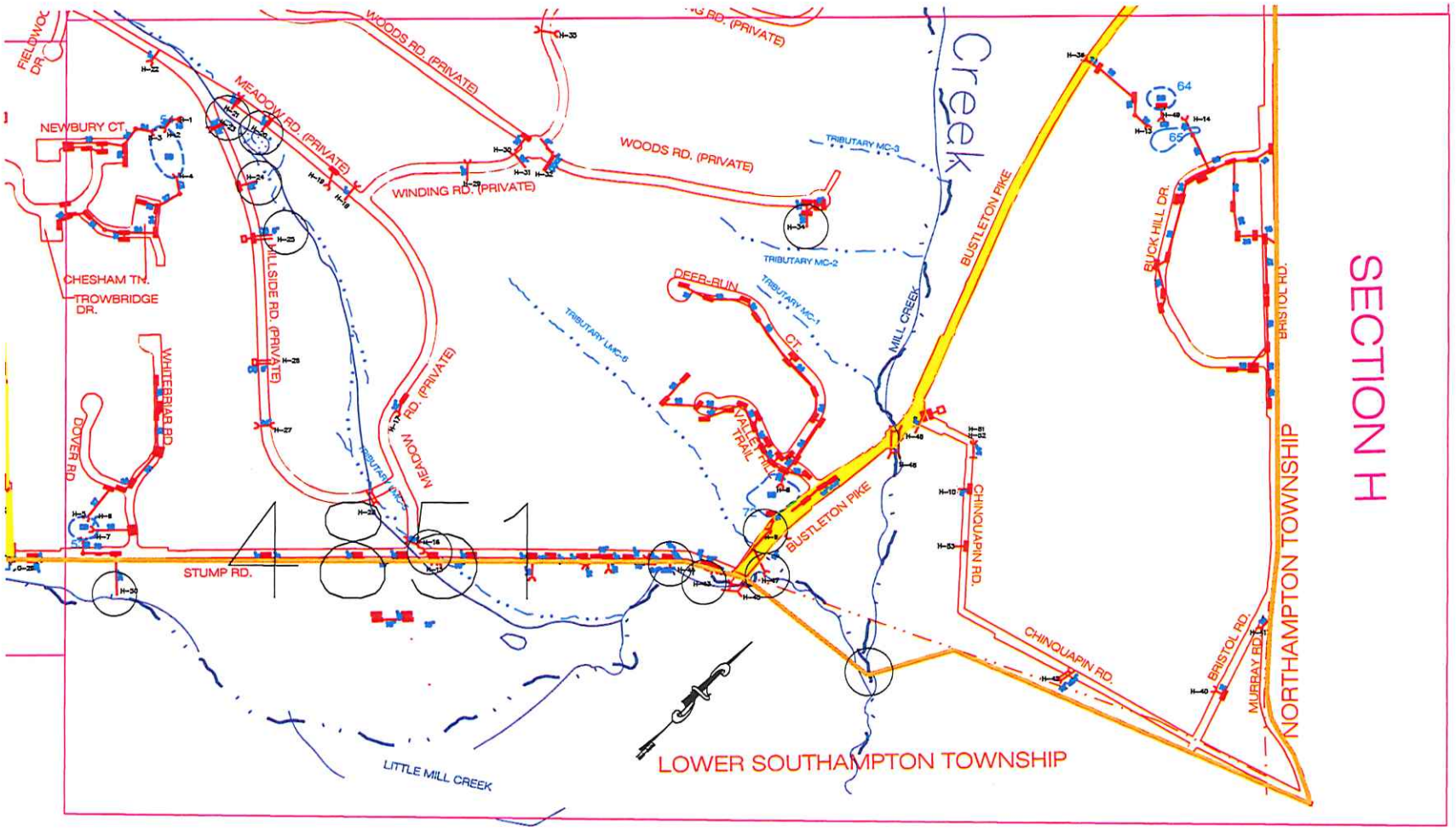
REVISION	DESCRIPTION	DATE	DRAWN BY
4.	ADD OUTFALLS AND BASIN DRAINAGE AREAS	1/29/20	WCP
4.	REVISED TSPD ADDED BASINS NUMBERED	8/2/19	WCP
3.	REVISED FOR MUNICIPAL COMMENTS	8/9/18	WCP
2.	REVISED BASE, UPDATED PER RECENT PROJECTS	3/15/18	JAB
1.	UPDATED FOR SWM	8/8/14	STAFF

SCALE IN FEET
250 125 0 250 500 1000

TRI-STATE ENGINEERS & LAND SURVEYORS, INC.
CIVIL ENGINEERS • MUNICIPAL ENGINEERS • LAND SURVEYORS • LAND PLANNERS LANDSCAPE ARCHITECTS
801 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE: 215-357-5900 FAX: 215-357-2836

MS4 MAP
SECTION G
FOR
UPPER SOUTHAMPTON TOWNSHIP
PENNSYLVANIA

SHEET
12 OF 13



STREAM
IMPAIRED STREAM
BASIN

STORM PIPE
OUTLET STRUCTURE A–1
STORM INLET
OUTFALL TO STREAM (A–1)

SOUTHAMPTON CK
MILL CK

UST PROPERTY

Pennsylvania One Call System, Inc.
Call Before You Dig
1-800-242-1776

Job No.	Date	Scale
48-165	6/4/2018	1"=250'
Acreage		No. of Lots
Designed By: WCP	Drawn By: WCP	Checked By:

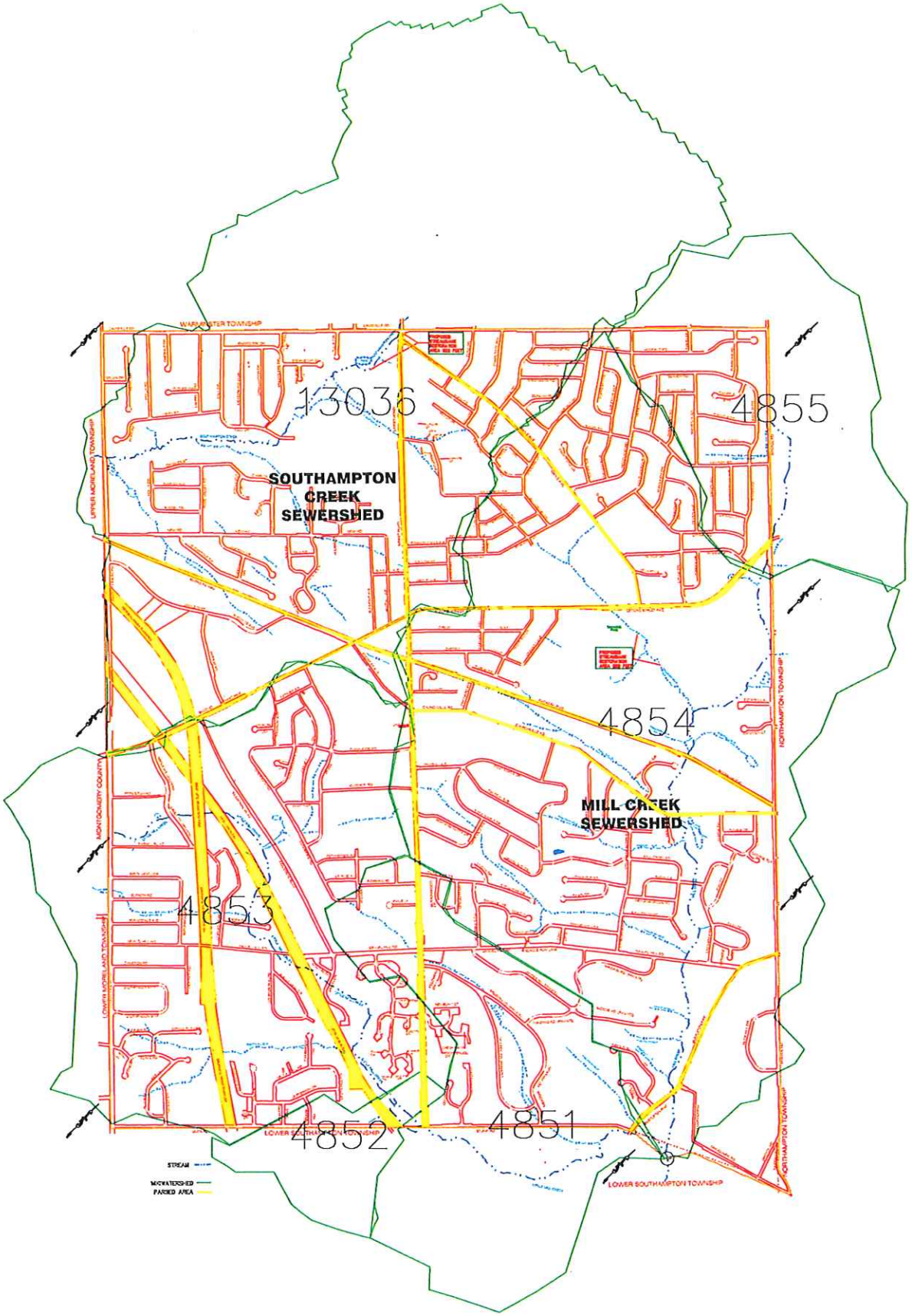
REVISION	DESCRIPTION	DATE	DRAWN BY
4.	ADD OUTFALLS AND BASIN DRAINAGE AREAS	1/28/08	WCP
4.	REVISED TOPO ADDED BASINS NUMBERED	8/1/08	WCP
3.	REVISED FOR WATERSHED NOMENCLATURE	8/9/07	WCP
2.	REVISED BASIC. UPDATED PER RECENT PROJECTS	3/15/16	JAB
1.	UPDATED FOR 2013	5/5/14	STAFF

SCALE IN FEET
250 125 0 250 500 1000

TRI-STATE ENGINEERS & LAND SURVEYORS, INC.
CIVIL ENGINEERS • MUNICIPAL ENGINEERS • LAND SURVEYORS • LAND PLANNERS LANDSCAPE ARCHITECTS
801 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE: 215-357-5950 FAX: 215-357-2836

MS4 MAP
SECTION H
FOR
UPPER SOUTHAMPTON TOWNSHIP
PENNSYLVANIA

SHEET
13 OF 13



1"= 600'

TRI-STATE ENGINEERS & LAND SURVEYORS, INC.
CIVIL ENGINEERS MUNICIPAL ENGINEERS LAND SURVEYORS LAND PLANNERS LANDSCAPE ARCHITECTS
924 WEST STREET ROAD FEASTERVILLE, PENNSYLVANIA 19053
PHONE 215-357-5510 FAX 215-357-0810

WIKI SUB-WATERSHEDS
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

SHEET 1 OF 10

UPPER SOUTHAMPTON - OUTFALLS DIRECTLY TO STREAMS

TOTAL 185

SECTION A		SECTION B		SECTION C		SECTION D	
5	TOLL RD	1	MAPLE AVE	2	BUCKSTONE DR	1	WILLOW ST
6	NEW RD	10	BRISTOL RD	18	BUCKSTONE DR	7	RR/ORCHARD AVE
7	NEW RD	15	WHITNEY RD	20	ANDREW DR	8	RR/ORCHARD AVE
8	ROSE VALLEY RD	19	CHARLES RD	21	ANDREW DR	9	RR/CHURCHVILLE RD
9	NEW RD			24	ZINN DR	12	CHURCHVILLE RD
15	TOLL RD			25	NICOLE DR	13	CHURCHVILLE RD
19	PADDLE WHEEL DR			26	NICOLE DR	18	CHARTER CT
21	STEAM BOAT DR			44	NICOLE DR	20	ESTATES LA
22	TULIP LA			50	BELMONT AVE	21	2ND ST PIKE
26	STREET RD/WILLOWPEN			51	BELMONT AVE	24	RR/CHURCHVILLE RD
27	STREET RD/WILLOWPEN			52	BELMONT AVE	25	2ND ST PIKE
28	STREET RD/WILLOWPEN			53	BELMONT AVE	26	2ND ST PIKE
29	STREET RD/WILLOWPEN			60	KNOWLES AVE	28	2ND ST PIKE
34	STREET RD/WILLOWPEN			70	RR	29	2ND ST PIKE
35	STREET RD/WILLOWPEN			91	KNOWLES AVE	32	2ND ST PIKE
104	CHARLES ST			100	BELMONT AVE	32	2ND ST PIKE
105	CHARLES ST			131	KNOWLES AVE	33	2ND ST PIKE
112	DAVISVILLE RD			134	STREET RD/RR	34	2ND ST PIKE
114	MAPLE AVE					35	2ND ST PIKE
117	STREET RD/WILLOWPEN					37	BRISTOL RD
125	STREET RD					38	BRISTOL RD
128	SPRINGFIELD DR					40	TAMANAND PARK
130	STREET RD					41	TAMANAND PARK
	23		4		18	45	TAMANAND PARK
							24

SECTION E		SECTION F		SECTION G		SECTION H	
3	ELFRETH RD	2	East Maple Dr	1	AUTUMN LEAF LA/FLAKE RD	9	BUSTLETON PIKE
4	BEECHWOOD DR	5	Pebble La/Spring View Dr	2	AUTUMN LEAF LA/FLAKE RD	15	STUMP ROAD
5	BEECHWOOD DR/PA TURNPIKE	7	Pebble La/Spring View Dr	3	AUTUMN LEAF LA/FLAKE RD	16	MEADOW RD
8	BONNIE BRAE DR	9	Sycamore Dr	4	AUTUMN LEAF LA/FLAKE RD	16	STUMP ROAD
9	CASEY CIR	13	Woodland Dr/Central Ave	5	AUTUMN LEAF LA/FLAKE RD	19	MEADOW RD
10	CASEY CIR	14	Woodland Dr/Central Ave	6	AUGUST DR	20	MEADOW RD
11	GLEN ECHO RD	19	Manor La	7	AUGUST DR	21	MEADOW RD
13	PA TURNPIKE/GLEN ECHO RD	20	Strathman Dr	8	AUGUST DR	22	MEADOW RD/HILLSIDE RD
14	RR/GLEN ECHO RD	21	Strathman Dr	9	AUGUST DR	23	HILLSIDE RD
16	INDUSTRIAL BLVD	22	Stephen Way	10	MILITA HILL RD	24	HILLSIDE RD
18	INDUSTRIAL BLVD	28	Mill Creek Rd	11	CAMBRIDGE CIR	25	HILLSIDE RD
20	CUSHMORE RD	29	Melpdy La	12	MILITA HILL RD	28	HILLSIDE RD/MEADOW RD
23	JUDITH DR	32	Churchville Rd/Melody La	13	JASON DR/RR	34	WOODS RD
27	FAIRHILL RD	33	Churchville Rd/Melody La	16	JASON DR	43	STUMP ROAD
28	INDUSTRIAL BLVD	34	Churchville Rd/Melody La	17	JASON DR	44	STUMP ROAD
30	ROZEL AVE	35	Strathman Dr	19	HAWKINS DR	45	STUMP ROAD
31	ROZEL AVE	36	Strathman Dr/RR	22	HAWKINS DR	46	BUSTLETON PIKE
33	ROZEL AVE	38	Marigold Ave	23	HAWKINS DR	47	STUMP ROAD
37	STREET RD/ORCHARD	42	Pebble La/Spring View Dr	24	McNELLIS DR	48	BUSTLETON PIKE
45	GRAVEL HILL STA	43	Strathman Dr	25	MORRIS CIR		
46	GRAVEL HILL RD	44	Mill Creek Cir	32	JASON DR		
47	GRAVEL HILL RD	45	Rydal La	33	JASON DR		
49	STREET RD	46	Rydal La	40	AUTUMN LEAF DR		
50	STREET RD	47	Rydal La				
52	RR/NICHOLAS DR	53	Strathman Dr/RR				
59	COUNTY LINE/FAIRHILLRD	55	Manor la				
60	FAIRHILL RD	56	Manor La				
61	EAGLE RD	59	Gravel Hill Rd				
65	GLEN ECHO RD						
66	PA TURNPIKE/GLEN ECHO RD						
67	PA TURNPIKE/GLEN ECHO RD						
68	PA TURNPIKE/GLEN ECHO RD						
69	BONNIE BRAE DR						
70	BONNIE BRAE DR						
71	RR/BONNIE BRAE DR						
71	BONNIE BRAE DR						
73	COUNTY LINE/ELFRETH RD						
76	KUTCHER RD						
78	RR/INDUSTRIAL BLVD						
79	RR/INDUSTRIAL BLVD						
80	RR/INDUSTRIAL BLVD						
82	RR/INDUSTRIAL BLVD						
84	INDUSTRIAL BLVD						
92	STREET RD						
95	CUSHMORE RD						
96	ROZEL AVE						
	46		28		23		19

UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY, PA

DRAFT POLLUTANT REDUCTION PLAN
FOR COMMENT
SEPTEMBER 2017
(Rev. August 2020)

Prepared by:
Tri-State Engineers and Land Surveyors, Inc.
801 W. Street Road, Feasterville, PA 19053

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) TMDL PLAN / POLLUTANT REDUCTION PLAN

GENERAL INFORMATION

Permittee: Upper Southampton Township, Bucks County, NPDES Permit No.: **PAG 130029**
Effective Date: March 16, 2013
Expiration Date:
Renewal Due Date: November 1, 2018

MS4 Contact Person: Joseph Golden (to 8/30/20), Donald Williams (starting 9/1/20)

Title:	Upper Southampton Township Manager
Mailing Address:	939 Street Road Southampton, PA 18966
Phone:	(215) 322-9700 (office) (215) 322-0405 (fax)
Email:	jgolden@ustwp.org/dwilliams@ustwp.org
Consultant Name:	Tri-State Engineers and Land Surveyors 801 W. Street Road, Feasterville, PA 18966 215 - 357 – 5950 (office) 215 - 357 - 2836 (fax) Wesley Plaisted, wplaisted@tse-ls.com (preparer)

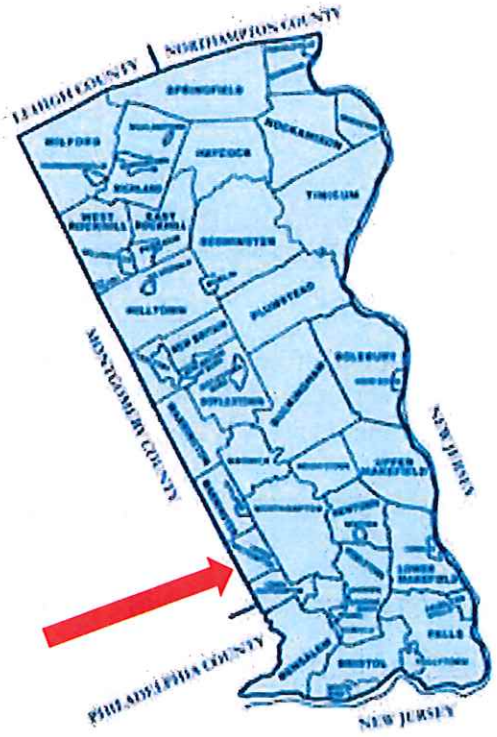
Co-Permittees (if applicable): None

Description of the drainage area of the Township

The discussion includes the MS4 area, the UA that discharges to the various streams. The discussion includes pervious and impervious cover.

Upper Southampton Township, Bucks County, located in southeastern Pennsylvania, is bordered to the east by the Northampton Township, to the north by Warminster, Upper Moreland Township (Montgomery County) to the west and Lower Southampton Township to the south. It covers a total of 6.6 square miles (4,230 acres). (See map, Figure 1). There are two (2) major sewersheds within the Township the largest is the Mill Creek that eventually drains to the Neshaminy Creek. The other is the Southampton Creek that drains to the Pennypack Creek. The two (2) watersheds within the Township, designated as: Mill Creek and the Southampton Creek, see Figure 2. There is a very small portion of the Township (southwest corner) that flows to the Poquessing Creek but is too small to be included in the report.

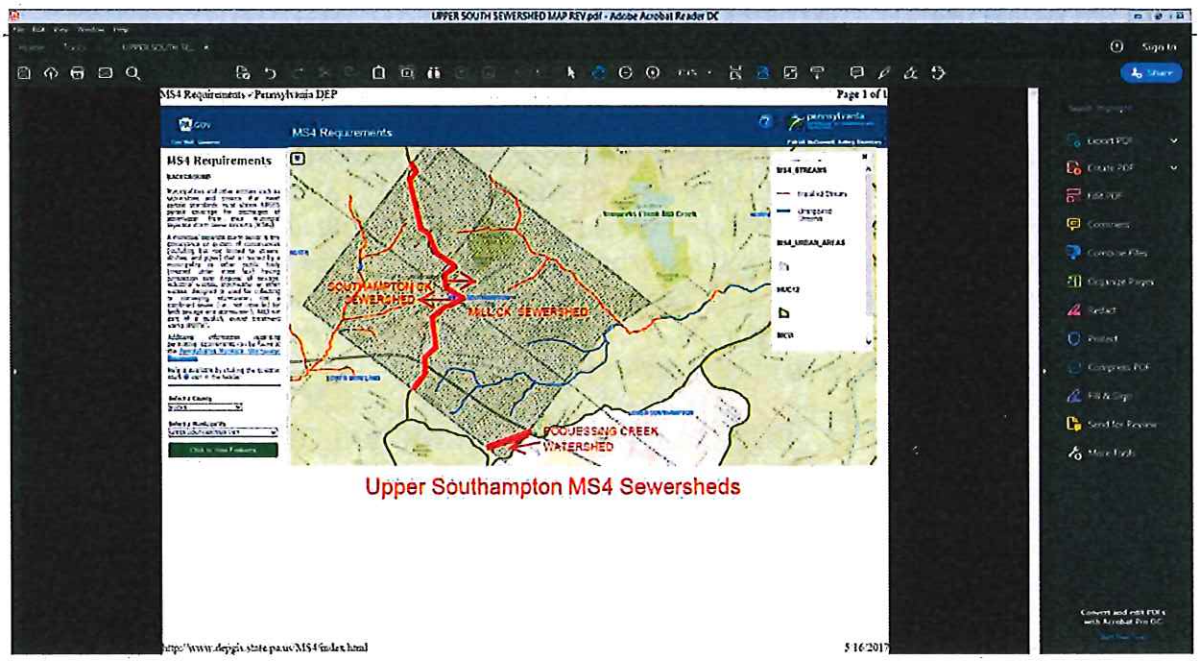
FIGURE 1 – BUCKS COUNTY, PA MUNICIPALITIES
UPPER SOUTHAMPTON TOWNSHIP



The total acreage of the Township, lies within the Urbanized Area (UA) defined in the Pennsylvania Department of Environmental Protection (PADEP) statewide MS4 Land Cover Estimates based on the Urban Areas for 2010 overlain on NLCD 2011 Land Cover (2011 Edition, amended 2014) - National Geospatial Data Asset (NGDA) Land Use/Land Cover data.

FIGURE 2

UPPER SOUTHAMPTON TOWNSHIP SEWER SHEDS



The 2010 Census population was persons 15,152. The Statewide MS4 Land Cover Estimates determined that of the total 4,230 acres 39% (1,650 acres) is impervious with the remaining 61% (2,580 acres) pervious surfaces.

According to the Delaware Valley Planning Commission for Upper Southampton Township, approximately 63% of the Township acreage is residential, 16% Other developed (industrial, commercial, recreational), 3% agricultural and 17% wooded.

The three watersheds in the Township are shown in the map in Appendix A - Maps. The sizes of the watersheds within the Township are given in table A below.

TABLE A – UPPER SOUTHAMPTON WATERSHEDS

	TOTAL	
	SQ. MI.	ACRES
UPPER SOUTHAMPTON	6.6	4,268
SOUTHAMPTON CREEK	1.9	1,228
MILL CREEK	4.7	3,040

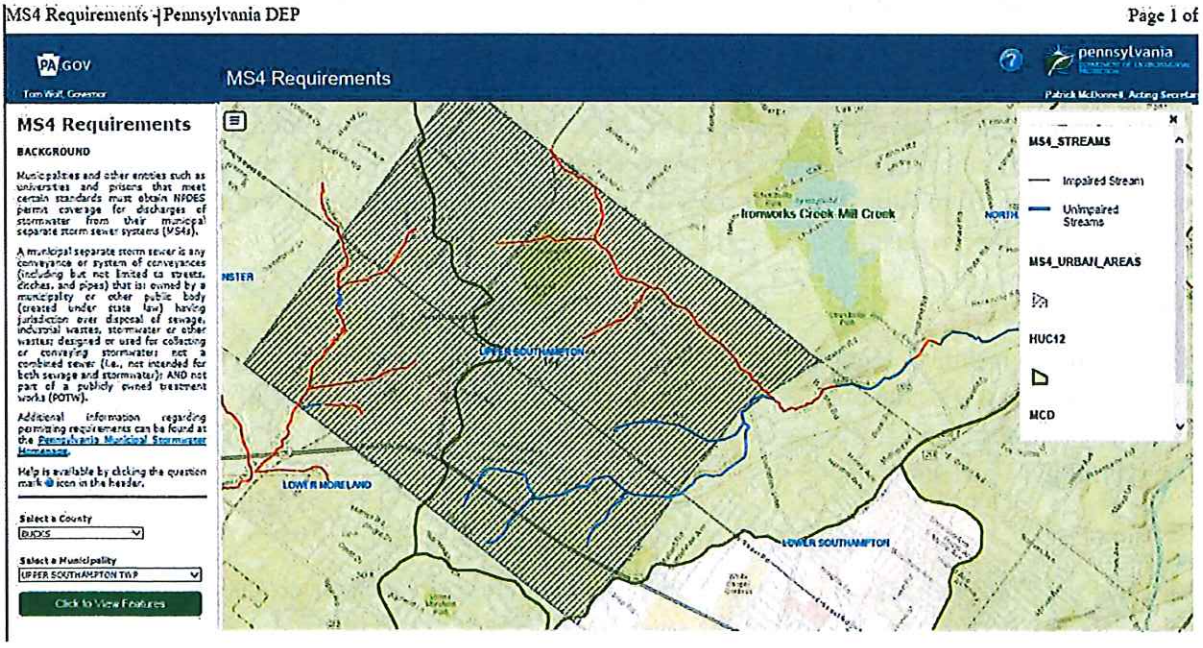
The PADEP estimates that in the UA impervious is 39% of the acreage with 61% pervious. A breakdown of the estimated acreage of pervious and impervious coverages in each watershed are given in Table B.

TABLE B – IMPERVIOUS/PERVIOUS

	INSIDE UA *ACRES)	
	UA IMPERVIOUS	UA PERVIOUS
UPPER SOUTHAMPTON	1,657	2,611
SOUTHAMPTON CREEK	477	751
MILL CREEK	1,180	1,860

From the PADEP MS4 Requirements, the following Figure 3 identifies the impaired streams for Upper Southampton Township. The portions of the Mill Creek and its tributaries (not including the Little Mill Creek) and the Southampton Creek have been identified as impaired. The Little Mill Creek sub-watershed and its tributaries are not determined to be impaired but, will be included in the overall Mill Creek watershed calculations even though it flows to the Mill Creek outside of the Township boundary.

FIGURE 3
IMPAIRED STREAMS IN UPPER SOUTHAMPTON TOWNSHIP



The PADEP MS4 Requirements table identifies the impairments and requirements as given in Table C.

TABLE C – MS4 REQUIREMENTS FOR MIDDLETOWN TOWNSHIP

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Bucks County						
UPPER SOUTHAMPTON TWP	PAG13003	Yes	TMDL Plan	Southampton Creek TMDL	TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				Unnamed Tributaries to Neshaminy Creek		Water Flow Variability (4c)
				Unnamed Tributaries to Southampton Creek	Appendix B-Pathogens (4a)	
				Southampton Creek		Flow Alterations, Other Habitat Alterations, Water Flow Variability (4c)
				Mill Creek	Appendix E-Siltation (4a)	Other Habitat Alterations, Water Flow Variability (4c)
				Pennypack Creek	Appendix E-Siltation (5)	Cause Unknown (5)
				Neshaminy Creek	Appendix E-Siltation (4a), Appendix B-Pathogens (5), Appendix E-Nutrients, Organic Enrichment/Low D.O. (5)	

The Southampton Creek has a draft TMDL Plan with a WLA that address the issues and potential mitigation for the segment located in the Township and is attached to the permit application. **No TMDL has been established for the Mill Creek watershed.**

The 2008 EPA TMDL Report does list pathogens as a pollutant as a requirement to be addressed. However, the 2008 report lists unnamed tributary (UNT) 02453 as the only having pathogens as a pollutant, in Table 1. Figures 1 and 2 indicate that this segment is located in Lower Moreland Township. UNT Segment 02454, which the flow from Bucks County (Upper Southampton Township), is not shown as having pathogen impairment. As such we do not believe that pathogens are an issue with the Southampton Creek within Upper Southampton Township. There are pathogens listed as impairments to the Neshaminy Creek. However, the Neshaminy Creek does not flow through Upper Southampton and therefore will not be addressed. The Stormwater Ordinance was last amended in 2013. It includes prohibition of Pet Waste in **§ 120-4 Nuisances**, defined and prohibited, In addition, while there are few on-lot systems within the Township, **Ordinance 319 – Section 142-14** address on-lot septic systems. This requires certified inspection of the system every two years and required a copy of the inspection report be submitted to the Township within 30-days of the inspection. Copies of the ordinances are available from the Township

LAND USE

The Township is almost completely built out with essentially a homogenous distribution of the various land uses. For the purpose of this report, the land use percentages derived from the WikiWatershed model. A Zoning map is included in the Appendix as an indication of the land use within the Township.

SOILS

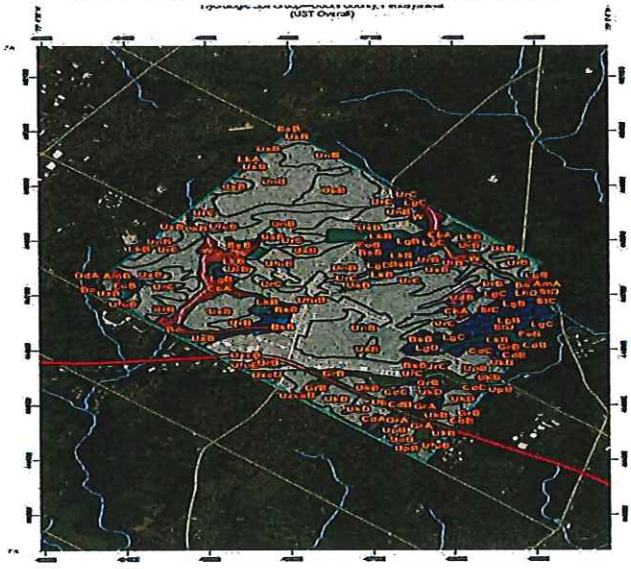
Much of the Township was constructed in the 1970's and no stormwater provisions were required. In addition, the majority of the streambanks are private property. A Soils maps and unit descriptions are given in Figure 4 below Table D shows the soils in each watershed as given by the WikiWatershed model. In general, the Township soils are 73% Urban Land, predominately in Group C with respect ot infiltration capabilities, Type A has a high infiltration

characteristic (low runoff), Type B has a moderate infiltration characteristic (moderate runoff), Type C has a slow infiltration characteristic (high runoff) and Type D a Very slow filtration characteristic (very high runoff). Urban soils are not rated for infiltration. Urban land soils tend to have very high runoff.

Within the Urban Land, the highest percentage is UnB (Urban land – Duffield complex with 0 – 8% slopes). This soil, based on the USDA Web Soil Survey, is considered to have low runoff and is well drained. The other largest Urban Land soils (UsB) are both considered to have high runoff and are well to moderately well drained.

Soils, therefore, in the Township have relatively high runoff potential and are not favorable for large infiltration basin infiltration.

FIGURE 4
UPPER SOUTHAMPTON SOILS MAP



SOIL MAP LEGEND

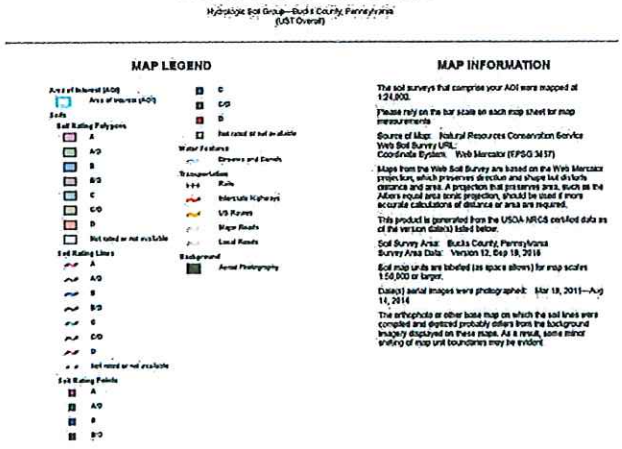


TABLE D

WIKIWATERSHED MODEL SOILS

SOUTHAMPTON CREEK SOILS		
Type	Area (km^2)	Coverage (%)
A - High Infiltration	0.53	7
A/D - High/Very Slow Infiltration	0	0
B - Moderate Infiltration	0.3	3.9
B/D - Medium/Very Slow Infiltration	0	0
C - Slow Infiltration	6.19	81
C/D - Medium/Very Slow Infiltration	0.02	0.3
D - Very Slow Infiltration	0.6	7.8

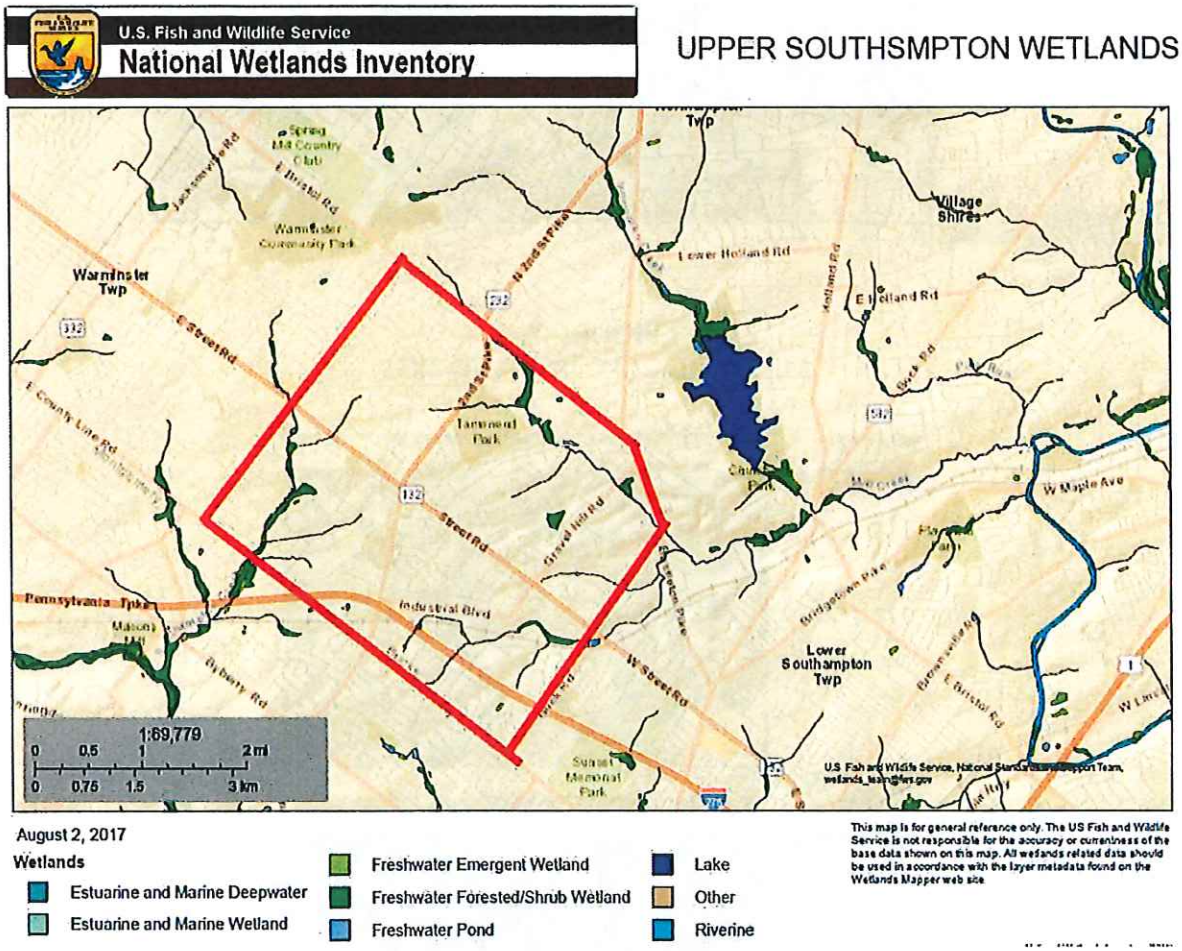
MILL CREEK SOILS

Type	Area (km^2)	Coverage (%)
A - High Infiltration	0.11	0.7
A/D - High/Very Slow Infiltration	0	0
B - Moderate Infiltration	2.11	12.6
B/D - Medium/Very Slow Infiltration	0	0
C - Slow Infiltration	12.85	77
C/D - Medium/Very Slow Infiltration	1.08	6.5
D - Very Slow Infiltration	0.54	3.2

WETLANDS

Wetlands (Figure 5) in the Township are concentrated along the Southampton Creek, Mill Creek and Little Mill Creek channels. As these currently capture stormwater runoff and the Southampton and Mill Creeks are listed as impaired, the benefits of redirection of stormwater into the wetlands may not be useful. However, a field investigation will be made to see if any direct stream discharge can be re-directed.

FIGURE 5
UPPER SOUTHAMPTON WETLANDS



Using WikiWatershed modeling, all of the Southampton Creek is essentially included in I.D. 13036 as is shown in Figure 6 below. The Mill Creek Watershed include various portion of five (5) WikiWatershed sub-watershed, shown in Figure 7-9 below as ID's. 4851, 4852, 4853, 4854,4855.

FIGURE 6
SOUTHAMPTON CREEK SUB-WATERSHED I.D. 13036

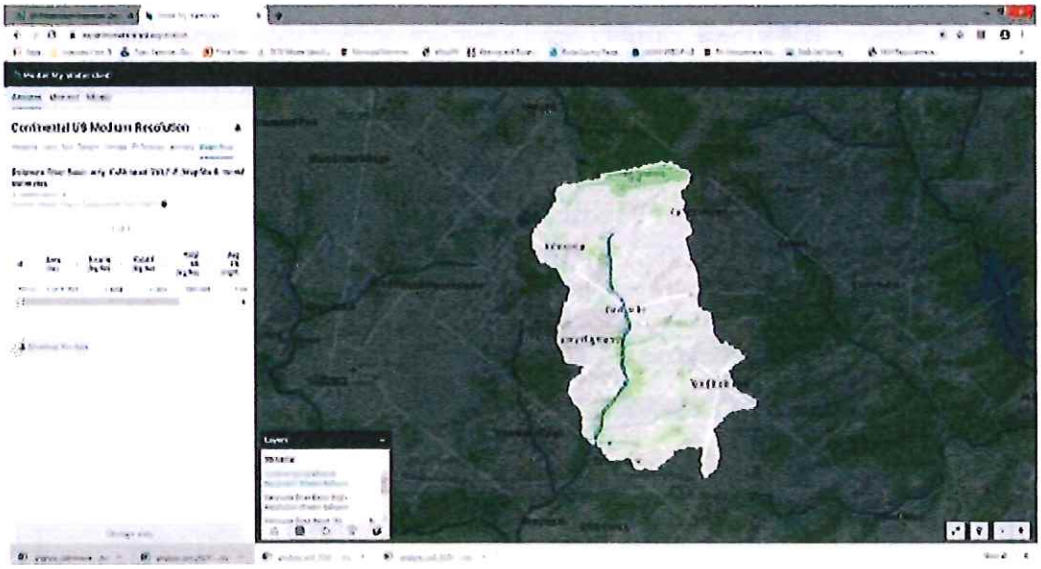


FIGURE 7
MILL CREK I.D. 4851 AND 4853

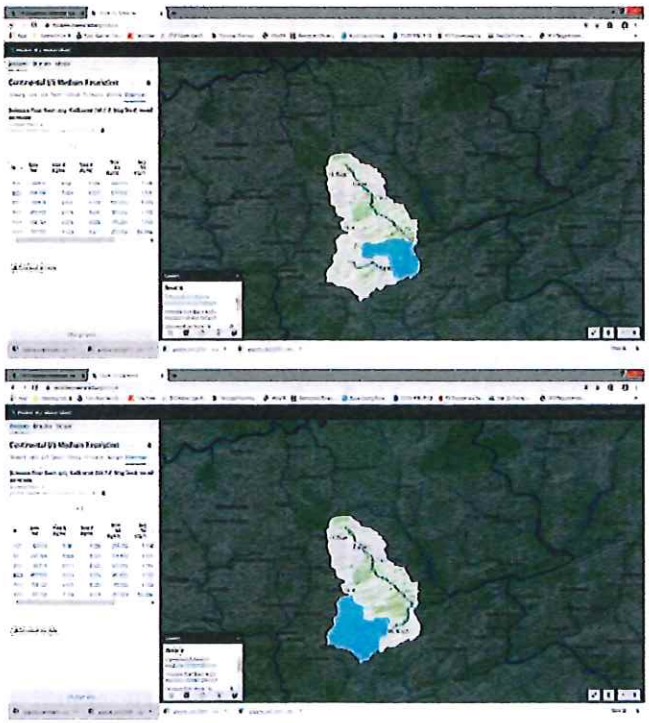


FIGURE 8
MILL CREK I.D. 4852 AND 4854

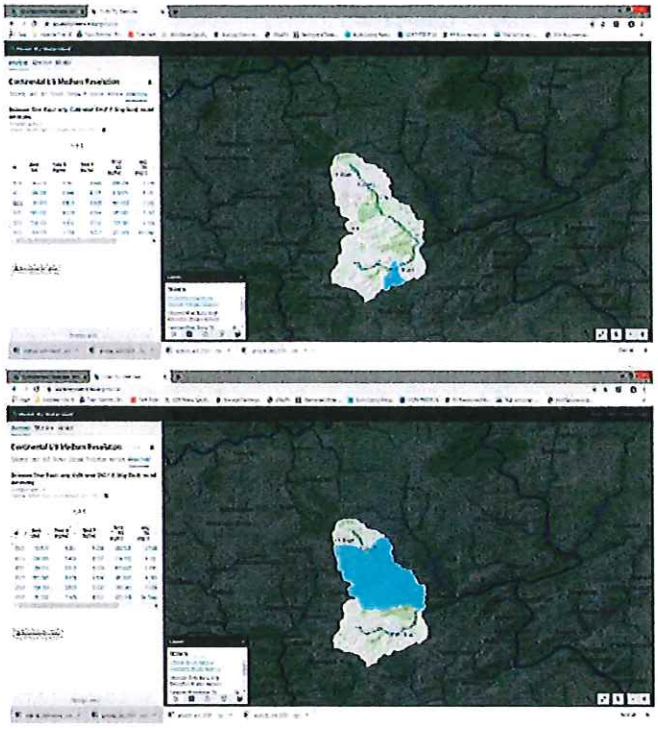
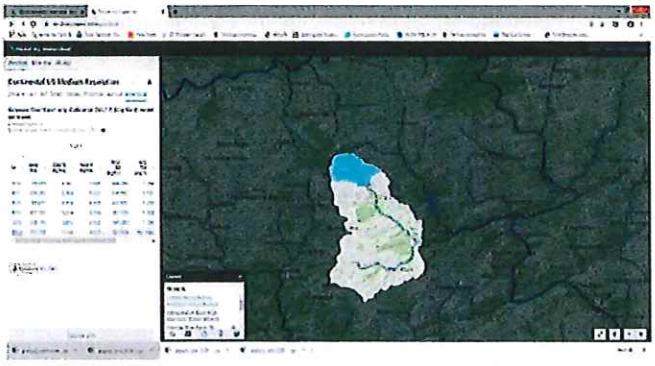
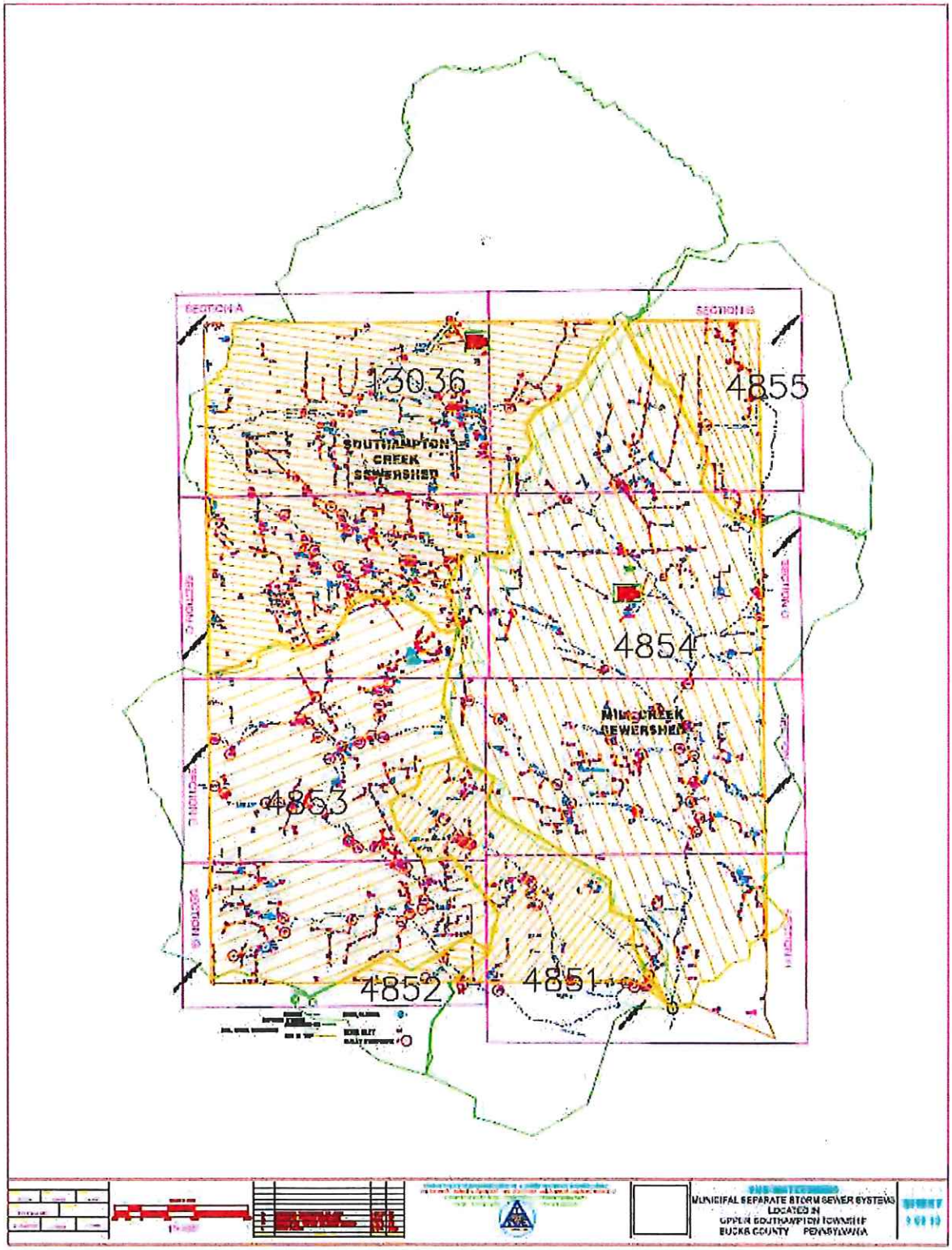


FIGURE 9
MILL CREK I.D. 4855



Overall, the individual sub-watersheds are shown superimposed on the Township map in Figure 10 below. As is seen, the sub-watersheds extend beyond the Township boundaries.

FIGURE 1O
UPPER SOUTHAMPTON WIKIWATERSHED I.D.'S



Sedimentation (TSS) loadings are estimated for each sub-watershed in Table E and Land Use in Table F. These are taken directly from the WikiWatershed model. In addition, since WikiWatershed modeling was used, the TSS removal per foot of streambank restoration value of 115 pounds/foot was used to estimate the required restoration need to achieve the 10% reduction. Also, based on PADEP and Chesapeake Bay documents, achieving the 10% reduction in TSS it is assumed that this will also achieve the required reduction in Total Phosphorus (TP) and Total Nitrogen (TN). These incorporate the land use estimates from the model, which are shown in Table E below which show that streambank restoration of approximately 1,166 feet will achieve the desired reductions.

TABLE E
ESTIMATES OF SUB-WATERSHED AREAS WITHIN THE TOWNSHIP
AND ASSOCIATED POLLUTANT LOADINGS

	WIKIWATERSHED AREAS								
	A	B	C	D	E	F	G	H	
	ID	ha	ACRES	S.F. IN TWP	ACRES IN TWP	% IN TWP	PARSED ACRES	NET ACRES	
	CALCS		B*2.47	From Mapping	D/43560	E/C	From Mapping	E-G	
	MILL CREEK WATERSHED								
	4851	245	605	13,755,203	316	52%	7.09	309	
	4852	54	132	1,408,043	32	24%	4.33	28	
	4853	422	1,042	39,746,126	912	88%	79.99	832	
	4854	754	1,862	69,794,326	1,602	86%	31.54	1,571	
	4855	198	489	7,750,517	178	36%	1.77	176	
	TOTALS		4,131	132,454,215	3,041	74%	124.72	2,916	
	SOUTHAMPTON CREEK WATERSHED								
	13036	1,020	2,519	53,476,620	1,228	49%	62	1,166	

	POLLUTANT LOADING CALCULATIONS								
	I	J	K	L	M	N	O	P	Q
ID	Total N (kg/ha)	Total N (lbs/ac)	Total P (kg/ha)	Total P (lbs/ac)	Total SS (kg/ha)	Total SS (lbs/ac)	TOTAL N (LBS)	TOTAL P (LBS)	TOTAL SS (LBS)
CALCS	Wikiwatershed	I*2.20432/2.47	Wikiwatershed	K*2.20432/2.47	Wikiwatershed	M*2.40462/2.47	J*H	L*H	N*H
	MILL CREEK WATERSHED								
4851	5.46	4.87	0.26	0.23	317	283	1,504	72	87,340
4852	6.91	6.17	0.33	0.29	548	489	173	8	13,693
4853	6.62	5.91	0.34	0.30	487	435	4,919	253	361,849
4854	5.82	5.19	0.25	0.22	199	178	8,159	350	278,990
4855	7.11	6.35	0.31	0.28	252	225	1,118	49	39,622
						TOTAL	15,873	732	781,493
						10% REMOVAL			78,149
	SOUTHAMPTON CREEK WATERSHED								
13036	7.03	6.28	1.30	1.16	503	449	7,318	1,356	523,834
					WLA (2008 REPORT)				288,119
					10% REMOVAL OF TOTAL LOAD				52,383

	STREAMBANK RESTORATION LENGTHS				
	MILL CREEK				680
	SOUTHMAPTON CREEK				456
	WIKIWATERSHED REMOVAL VALUE @	115	LBS/FT		
	UNIT CONVERSIONS				
	1 ha = 2.47 ac				
	1 kg = 2.20462 lbs				

TABLE F

LAND USE FROM WIKIWATERSHED MODEL

MILL CREEK WATERSHED LAND USE (FROM WIKIWATERSHED)		
	FOR ENTIRE WATERSHED	
Type	Area (km^2)	Coverage (%)
Open Water	0.01	0
Perennial Ice/Snow	0	0
Developed, Open Space	7.74	46.4
Developed, Low Intensity	3.95	23.7
Developed, Medium Intensity	0.76	4.5
Developed, High Intensity	0.2	1.2
Barren Land (Rock/Sand/Clay)	0	0
Deciduous Forest	3.31	19.8
Evergreen Forest	0.06	0.3
Mixed Forest	0.14	0.8
Shrub/Scrub	0.11	0.7
Grassland/Herbaceous	0.01	0.1
Pasture/Hay	0.13	0.8
Cultivated Crops	0.07	0.4
Woody Wetlands	0.21	1.3
Emergent Herbaceous Wetlands	0	0
	16.7	
247.105 ACRES/KM^2 GIVES	4,127	ACRES
	4,137	PER WIKIWATERSHED
	0.25%	DIFFERENCE
WATERSHED WITHIN THE MUNICIPAL LIMITS OF THE TOWNSHIP		
	2659	ACRES
% IN TOWNSHIP	36%	

SOUTHAMPTON CREEK WATERSHED LAND USE (FROM WIKIWATERSHED)		
	FOR ENTIRE WATERSHED	
Type	Area (km^2)	Coverage (%)
Open Water	0	0
Perennial Ice/Snow	0	0
Developed, Open Space	3.4	44.5
Developed, Low Intensity	2.42	31.6
Developed, Medium Intensity	0.8	10.4
Developed, High Intensity	0.23	2.9
Barren Land (Rock/Sand/Clay)	0	0
Deciduous Forest	0.54	7.1
Evergreen Forest	0.01	0.2
Mixed Forest	0.03	0.5
Shrub/Scrub	0.03	0.4
Grassland/Herbaceous	0.02	0.2
Pasture/Hay	0.01	0.1
Cultivated Crops	0	0
Woody Wetlands	0.16	2.1
Emergent Herbaceous Wetlands	0	0
	7.65	
247.105 ACRES/KM^2 GIVES	1,890	ACRES
	1,895	PER WIKIWATERSHED
	0.25%	DIFFERENCE
WATERSHED WITHIN THE MUNICIPAL LIMITS OF THE TOWNSHIP		
	1221	ACRES
% IN TOWNSHIP	36%	

The Township is investigating various options for the installation of BMP's to achieve the required reduction, both nutrient (TP) and siltation (TSS) are listed as pollutants. The Southampton Creek TMDL Plan included in Appendix E identified streambank restoration as the primary BMP to achieve the reduction goal in the Southampton Creek watershed. As soils are not conducive to infiltration throughout the Township, the retrofit of basins to the most efficient infiltration type would not achieve the desired reduction. Thus, they have chosen streambank restoration as the primary BMP for both the Southampton Creek and Mill Creek basins.

However, a retrofit from the relatively inefficient dry basin (10%) to the more efficient extended basin (60%) could also provide a significant opportunity for the Township. In addition to streambank restoration and basin retrofits, the Township is investigating both vegetative planting along stream corridors as part of the streambank restoration work and encouragement/assistance for private homeowner/business rain gardens. Table G shows the efficiencies of various BMP's.

TABLE G
SEDIMENT BMP EFFICIENCIES

BMP	PER PADEP 3800-PM-BCW0100m (5/20/16)	PER CHESAPEAKE BAY PROGRAM (CBP,2011)
Wet Ponds and Wetlands	60%	---
Dry Detention Basins	10%	10%
Dry Extended Detention Basins	60%	60%
Infiltration Practices w/ Sand, Vegetation	95%	95%
Filtering Practices	80%	80%
Filter Strip Runoff Reduction	56%	---
Filter Strip Stormwater Treatment	22%	---
Bioretention/Raingardens (C/D Soils w/ underdrain)	55%	55%
Bioretention/raingarden (A/B soils) w/underdrain	80%	80%
Bioretention/Raingarden A/B soils, no underdrain)	90%	90%
Vegetative Open Channels (C/D soils)	50%	---
Vegetative Open Channels (A/B soils)	70%	---
Bioswale	80%	80%
Permeable Pavement w/o Sand or Veg. (C/D soil w/ underdrain)	55%	55%
Permeable Pavement w/o Sand or Veg. (A/B soil w/ underdrain)	70%	70%
Permeable Pavement w/o Sand or Veg. (C/D soil w/o underdrain)	85%	---
Permeable Pavement w/ Sand or Veg. (A/B soil underdrain)	70%	70%
Permeable Pavement w/ Sand or Veg. (A/B soil w/o underdrain)	85%	85%
Permeable Pavement w/o Sand or Veg. (C/D soil underdrain)	55%	55%
Stream Restoration	44.88 lbs/ft/yr.	44.88 lbs/ft/yr. (2013)
Forest Buffers	50%	50%
Tree Planting	20%	Credit as land use change
Street Sweeping (25 times annually)	9%	9%
Storm Drain Cleaning (based on weight)	50% Max 80% for sediment	---
Illicit discharges – correction of cross-connections/sewer repair	---	100%
Pet Waste program	---	Calculate load reduction

As reported values between the two lists are in general agreement, where BMP's not included in both will assumed to be the same percentage given. Permitting allows for the use of either, provided all calculations are consistent. However, by using the WikiWatershed analysis, 115 lbs removal/ft restoration can be used.

Due to the poor soils, the rain garden efficiency is assumed to be at the lower end of 55%. The necessary proportions of the BMP's to achieve removal of the 10% requirement are given in Table F.

A majority of the land up to the streambanks is privately owned making access for construction problematic. Table H presents the estimated costs for the several alternative to achieve the reduction goal.

TABLE H
ESTIMATED COSTS FOR 10% REDUCTION IN TSS

COST ESTIMATES FOR STREAMBANK RESTORATION					
	$/FOOT				
STREAMBANK RESTORATION	LOW	HIGH	FEET	LOW	HIGH
LAND STUDIES (2018)	$500	$700	1,136	$568,000	$795,200
CHESAPEAKE BAY (2015)	$150	$400	1,136	$170,400	$454,400
WATERSHED BREAKDOWN FOR STREAM RESTORATION USING LAND STUDIES COSTS					
SOUTHAMPTON CREEK	$500	$700	456	$228,000	$319,200
MILL CREEK	$500	$700	680	$340,000	$476,000

Since a majority of the basin are privately owned, it would be difficult for the Township to require basin retrofits. For the Mill Creek, the retro fit of all eight (8) basins will not accomplish the goal. The Township does own a significant amount of streambank property and will opt for restoration of streambanks as the option to meet the removal goals. As an estimate, Land Studies, Inc. has determined that stream / floodplain restoration projects can cost between $500 and $700 per Linear Foot (lf) studies to complete (including design, permitting, and construction) versus $150 - $400 per foot from the Chesapeake Bay studies. For the Southampton Creek watershed, the costs range between $228,000 to $319,200 and for the Mill Creek $340,000 to $476,200 for total removal of the 10% goal by streambank restoration. For complete removal by streambank restoration, the cost range between $628,000 to $795,200. The economics indicate that the basin retrofit in the Mill Creek watershed contributes only a small amount and the cost for including basin retrofits is not recommended. The alternative plantings, streambank restoration and/or rain gardens, however, depends on participation and cooperation of existing property owners. In the Mill Creek watershed, the Township owns/controls approximately 2,800 feet of stream corridor on the Mill Creek and its impaired tributaries. The largest portion being Tamanend Park (2,300 feet). Therefore, streambank restoration along the impaired Mill Creek tributary is a logical choice for a majority of the reduction work. Figure 11 Shows the proposed area within the impaired stream in Tamanend Park, approximately 850 feet. Final determination of the 680 feet is under study. In the Southampton Creek watershed, the Township owns a significant portion in several areas. The primary focus would be where the creek enters the Township at Davisville Road. Figure 12 shows the proposed area for streambank restoration, approximately 625 feet. Final determination of the 303 feet is under study. Photographs of the areas are included in Appendix B for Tamanend Park and Appendix C for Davisville Road Area. Appendix D shows some typical restoration methods under evaluation.

FIGURE 11
PROPOSED STREAMBANK RESTORATION AREA IN TAMANEND PARK

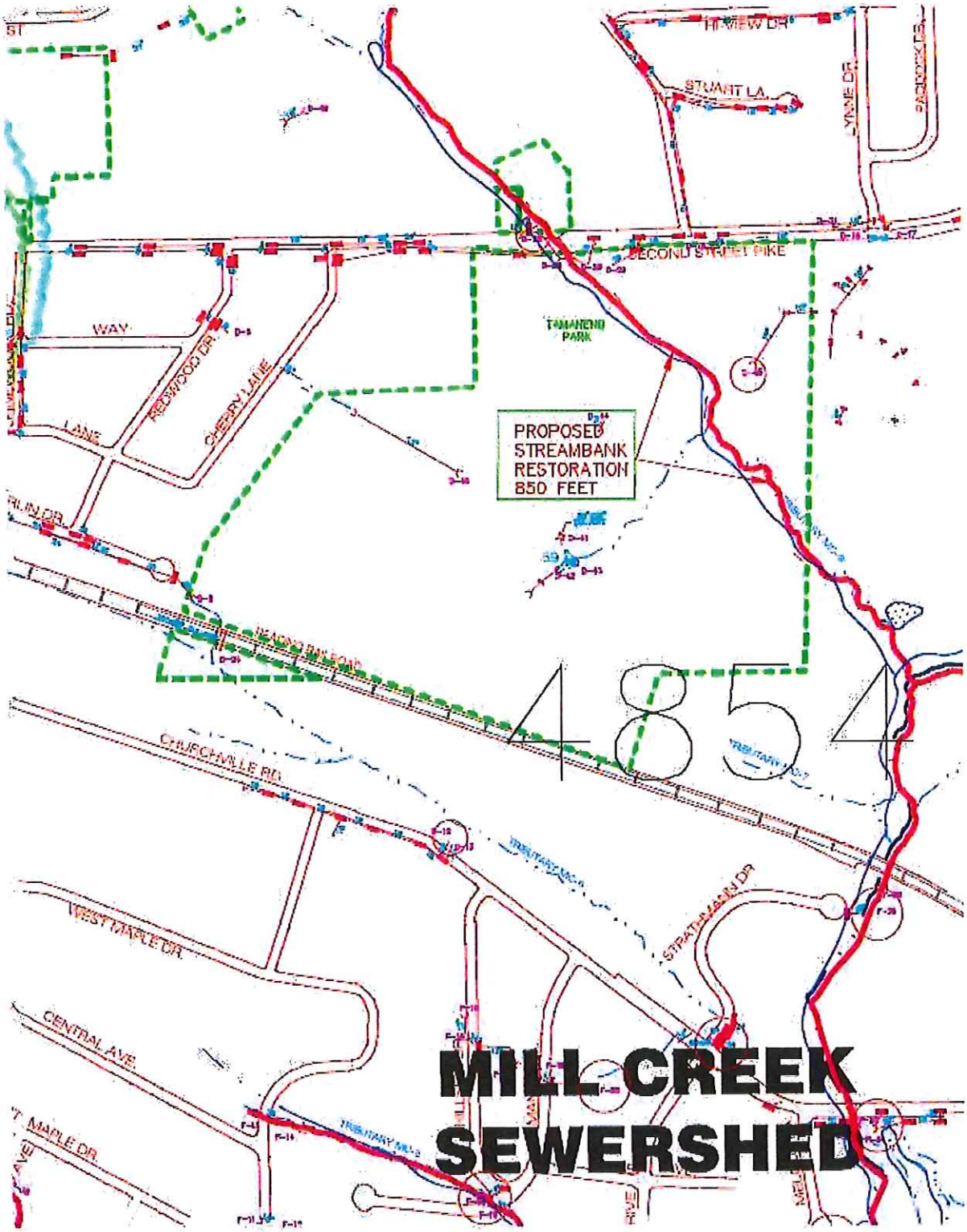
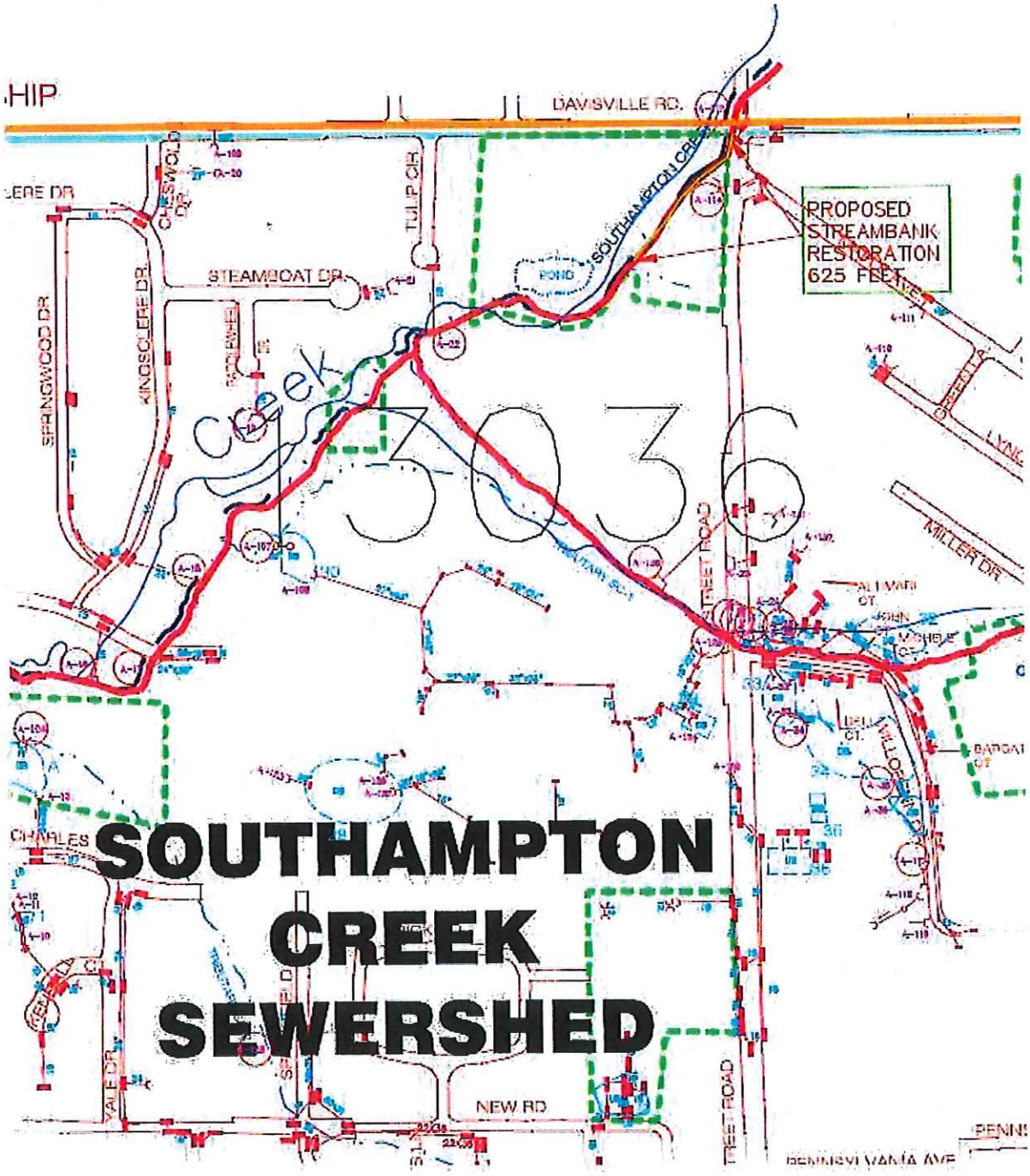


FIGURE 12
PROPOSED STREAMBANK RESTORATION AREA AT DAVISVILLE ROAD



CONCLUSIONS

The 10% reduction goals can be met by BMP construction as follows:

Southampton Creek Watershed

- The goal can be achieved by singly or combinations of
  - 456 feet of Streambank restoration at Davisville Road
  - Vegetative plantings along stream corridors included in the restoration

  Other options and future work may include:
  - Basin retrofits
  - Private homeowner/business rain gardens

Mill Creek Watershed

- The goal can be achieved by singly or combinations of
  - 680 feet of Streambank restoration in Tamanend Park

  Other options and future work may include:
  - Basin retrofits
  - Private homeowner/business participation in stream corridor vegetative strip planting and/construction of rain gardens will be needed. rain gardens

Private Property Enhancements

- Moving forward, private basins and streambank buffers may be needed to achieve the desired removal goals, the Township has no direct control over them. For any retrofitting of private basins or alterations to streambank for vegetative strips along private property, the Township must enter into an agreement with the property owner for their cooperation to do any work. In addition, there must be an agreement that states that the private owner will be responsible for all maintenance of stormwater improvements on their property.
- The Township will endeavor to include in attempt to include work done on private property in any state or federal grants received when allowed by the grant agency.

Funding

- The costs are greater than the Township budgets for this type of project, therefore the Township must receive state/federal grants to complete the work.
- No work will be done on any private property until grants are received for the entire part of the project involving all work on private property.

APPENDICES

A. MAPS

B. PHOTOS AND MAP OF TAMANEND PARK

C. PHOTOS AND MAP OF DAVISVILLE RD

D. TYPICAL STREAMBNAK ERSTORATION METHODS

E. SOUTHAMPTON CREEK TMDL PLAN (EPA 2008)

WIKIWATERSHED AREAS

A	B	C	D	E	F	G	H
ID	ha	ACRES	S.F. IN TWP	ACRES IN TWP	% IN TWP	PARSED ACRES	NET ACRES
CALCS		B*2.47	From Mapping	D/43560	E/C	From Mapping	E-G
MILL CREEK WATERSHED							
4851	245	605	13,755,203	316	52%	7.09	309
4852	54	132	1,408,043	32	24%	4.33	28
4853	422	1,042	39,746,126	912	88%	79.99	832
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TOTALS		4,131	132,454,215	3,041	74%	124.72	2,916
SOUTHAMPTON CREEK WATERSHED							
13036	1,020	2,519	53,476,620	1,228	49%	62	1,166

POLLUTANT LOADING CALCULATIONS

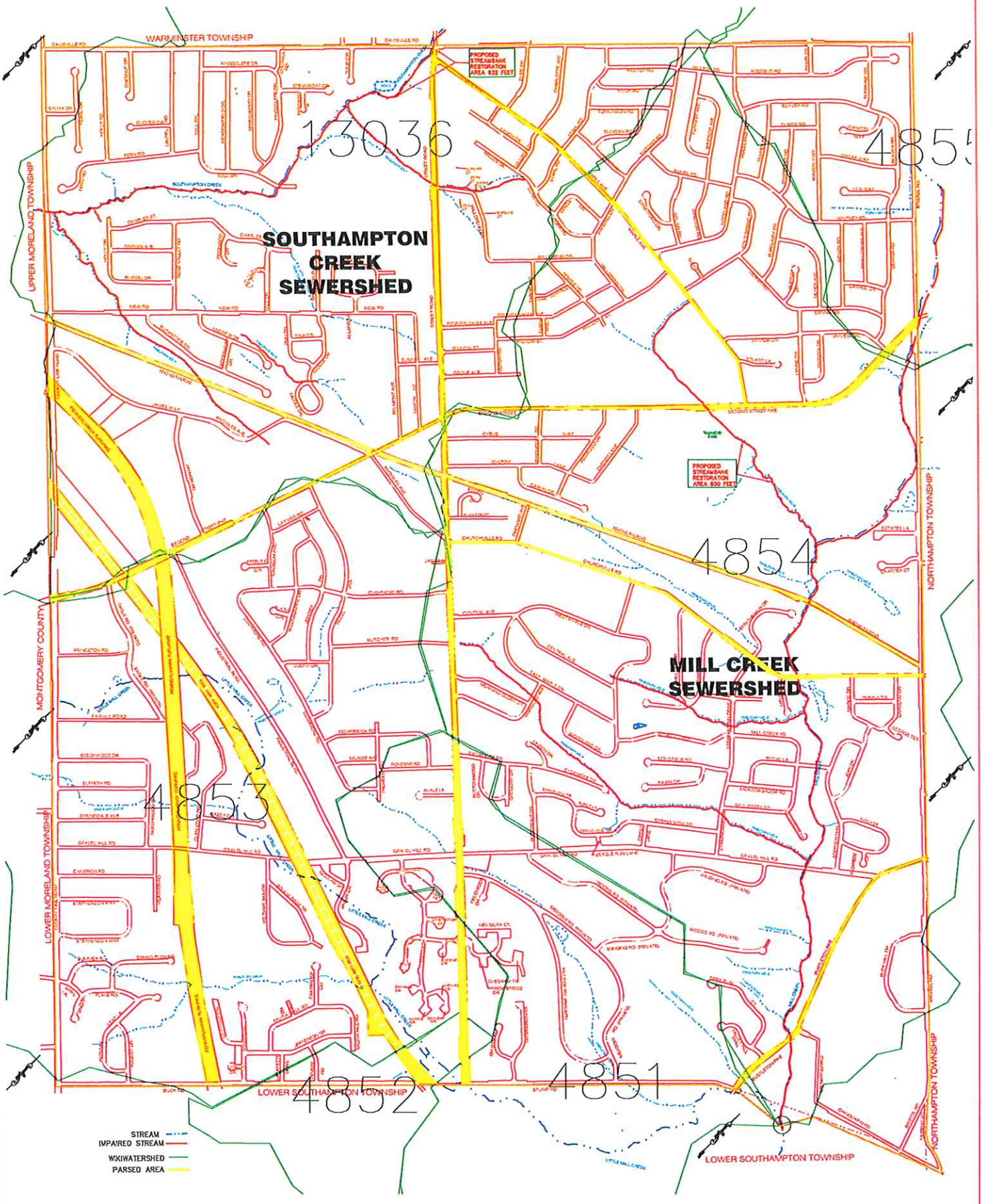
ID	I Total N (kg/ha)	J Total N (lbs/ac)	K Total P (kg/ha)	L Total P (lbs/ac)	M Total SS (kg/ha)	N Total SS (lbs/ac)	O TOTAL N (LBS)	P TOTAL P (LBS)	Q TOTAL SS (LBS)
CALCS	Wikiwatershed	I*2.20432/2.47	Wikiwatershed	K*2.20432/2.47	Wikiwatershed	M*2.40462/2.47	J*H	L*H	N*H
MILL CREEK WATERSHED									
4851	5.46	**4.87**	**0.26**	**0.23**	**317**	**283**	**1,504**	**72**	87,340
4852	6.91	**6.17**	0.33	**0.29**	548	**489**	**173**	**8**	13,693
4853	6.62	**5.91**	0.34	**0.30**	487	**435**	**4,919**	**253**	361,849
4854	5.82	**5.19**	0.25	**0.22**	199	**178**	**8,159**	**350**	278,990
4855	7.11	**6.35**	0.31	**0.28**	252	**225**	**1,118**	**49**	39,622
						TOTAL	**15,873**	**732**	**781,493**
						10% REMOVAL			78,149
SOUTHAMPTON CREEK WATERSHED									
13036	7.03	**6.28**	1.30	**1.16**	503	**449**	**7,318**	**1,356**	523,834
					WLA (2008 REPORT)				**288,119**
					10% REMOVAL OF TOTAL LOAD				**52,383**

STREAMBANK RESTORATION LENGTHS

MILL CREEK	**680**
SOUTHMAPTON CREEK	**456**

WIKIWATERSHED REMOVAL VALUE @ 115 LBS/FT

UNIT CONVERSIONS
1 ha = 2.47 ac
1 kg = 2.20462 lbs



1"= 400'

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851 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE 215-357-5900 FAX 215-357-2636

PARSED AREAS AND WIKIWATERSHEDS
MUNICIPAL SEPARATE STORM SEWER SYSTEMS
LOCATED IN
UPPER SOUTHAMPTON TOWNSHIP
BUCKS COUNTY PENNSYLVANIA

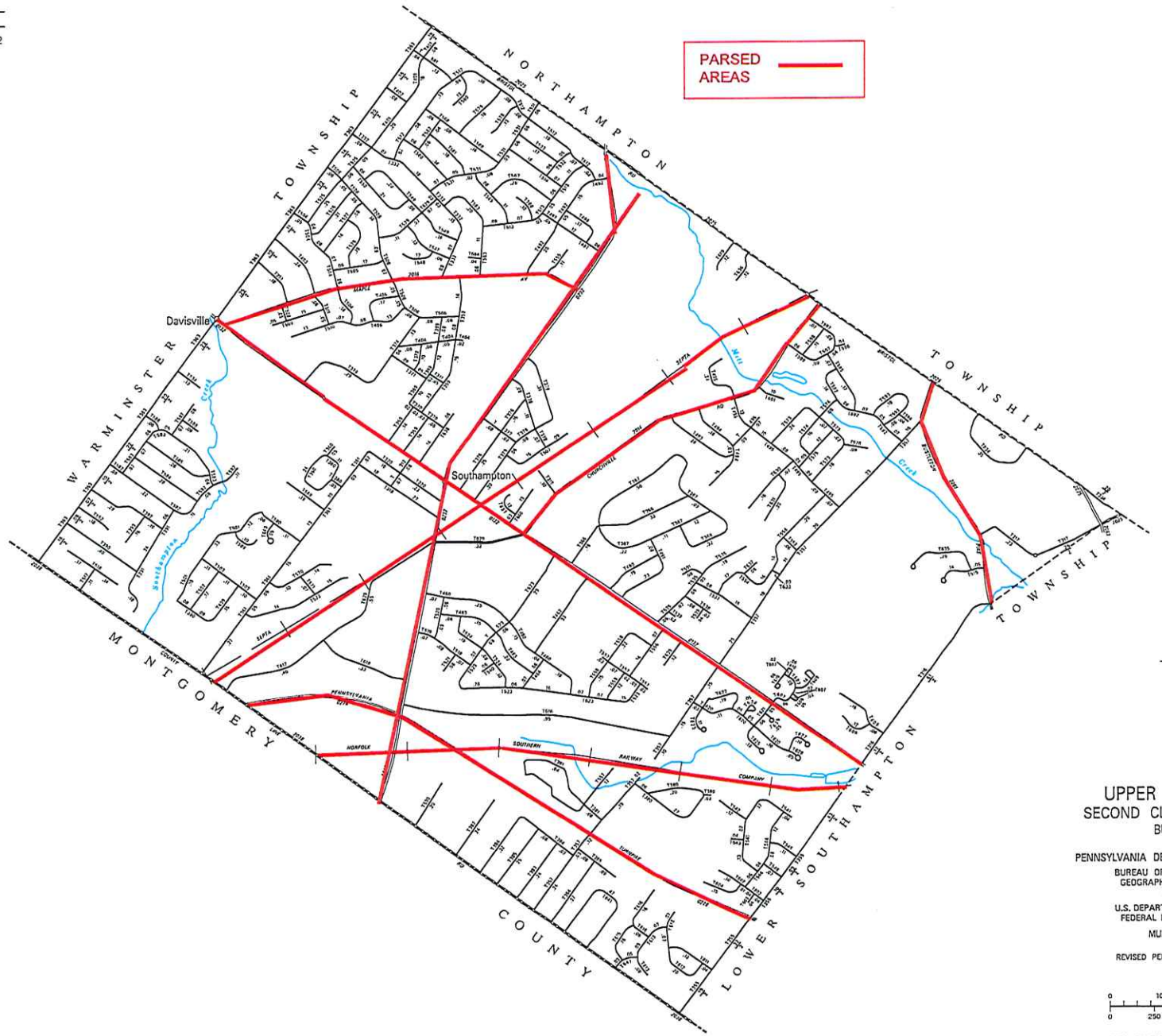
SHEET 1 OF 10

TOTAL MILES

Township Road System	55.23*
State Highway System	12.50
Total	67.73

* Includes ACT 32 Turnback Mileage of .32

512	SUMMIT AV	570	ANDREW DR
515	ORCHARD AV	571	WOODHAVEN DR
516	STUMP RD	572	RUCKSTONE DR
517	CHINQUAPIN RD	573	MILL CREEK RD
518	BELMONT AV	574	RYDAL LA
520	HAMPTON AV	575	MEADOWBROOK RD
532	HOGELAND RD	576	MILL CREEK CIR
534	MURRAY RD	578	LILT WAY
551	ELSIE DR	579	ORCAP WAY
555	BUCK RD	580	JEANETTE WAY
557	GRAVEL HILL RD	581	SUNSHINE RD
559	WILLOW ST	582	TOLL DR
560	RICK RD	583	KINGSCLERE RD
561	NEW RD	584	MEADOWFIELD RD
563	DAVISVILLE RD	585	SPRINGWOOD RD
564	CAMERON RD	586	CHOSWOLD RD
565	HEATHER RD	587	STRAWBOAT DR
566	CENTRAL AV	588	PADDLEWHEEL DR
567	MAPLE DR	589	DOGWOOD DR
568	WOODLAND DR	590	YALE DR
569	PENNSYLVANIA AV	591	LINDEN DR
570	WATER DR	592	STEPHEN WAY
571	TABOR AV	593	NANCY DR
572	OAK TER	594	BUCKRIDGE CIR
574	WILLOWDALE DR	595	JOAN DR
576	CYRUS WAY	596	GEORGE TER
577	PINEWOOD RD	597	CAROLYN DR
578	REDWOOD DR	598	DONNA DR
579	CHERRY LA	599	MARGE DR
580	BONNIE BRAE DR	600	PLUM ST
581	GLEN ECHO RD	601	WELDOT LA
582	FAIRHILL RD	602	BUNKER HILL RD
583	SPRINGDALE RD	603	CONCORD CIR
584	BEECHWOOD RD	604	BRANDYWINE DR
585	ELFRETH RD	605	WHITEBRIAR RD
590	HOLLY RD	606	DOVER RD
591	FERN RD	607	TROWBRIDGE DR
592	LAUREL RD	608	GRANTHAM CT
593	CLOVER CIR	609	CHESHAM TU
601	ROSEBUD RD	610	NEWBURY CT
602	HAMBLER RD	611	AUGUST DR
603	CHARLOTTE AV	612	AUTUMN LEAF LA
604	TEMPLE RD	613	SNOW FLAKE RD
605	CIRCLE DR	614	APRIL LA
606	CLAIR RD	615	SUMMER PL
660	ROZEL AV	616	SPRING FLOWER CT
662	KUTCHER RD	617	JAMES WAY
663	JEFFROY DR	618	JATHOR RD
664	JUDITH DR	619	ESTATES LA
690	MORNING GLORY LA	620	MC NELIS DR
691	MARIGOLD AV	621	HEPPS DR
692	HIVISH DR	622	CROFT DR
693	HILLSIDE DR	623	FRASSOTTO DR
694	MANOR LA	624	DANDENBERGER DR
695	STRATHAM DR	625	HARKINS DR
696	ROSS AV	626	FRADENDALL CIR
697	LYNNE DR	627	NEWBOSSY DR
698	PADDOCK DR	628	MORRIS CIR
699	RUSSELL DR	629	ENDELOS AV
501	CHARLES ST	630	LONGFIELD RD
502	MARIAN ST	631	FARR DR
503	ROSEVALLEY RD	632	PEBBLE LA
504	STAHL RD	633	BEAGLE RUN LA
505	YERKES RD	634	BUCK HILL DR
506	HARDING RD	635	DEER RUN CT
507	CARLIN DR	636	CHARTUM CT
508	GROEN LA	637	CODON CT
509	LYNCH DR	638	CROWD AV
510	WILLOW DR	639	AMILIO LA
511	WILLIAMS DR	640	KENDALL CT
512	BEAVER RD	641	STEPHENSON WAY
513	DENNIS RD		
514	WENDY RD		
515	VALLEY HILL TRL		
516	INDUSTRIAL HWY		
517	SYLVIA DR		
518	PEARL DR		
519	MADISON AV		
520	LATIMER RD		
521	STERLING CIR		
523	CUSHMORE RD		
524	HOUGHDURNE RD		
525	HILLTOP RD		
526	FITCH RD		
527	TOMLINSON RD		
528	DUNCAN RD		
529	RANDS RD		
530	PRINCETON RD		
531	WHITNEY RD		
532	CARROL DR		
533	SHALLCROSS AV		
534	TULIP CIR		
535	SYCAMORE DR		
537	BUTTERNUT DR		
538	GREGORY DR		
539	DUTTONWOOD DR		
540	ELKINS CIR		
541	WILITIA HILL RD		
542	CAMBRIDGE CIR		
543	FORGE RD		
544	JEFFERSON DR		
545	HEYDRE RD		
546	LAFAYETTE DR		
547	DEL AIR RD		
548	STRATFORD DR		
549	KINDSON AV		
550	FORREST AV		
551	CASEY CIR		
552	CHESTNUT RD		
553	CREST LA		
554	SPRING VIEW DR		
555	STUART LA		
556	PICKERING RD		
557	PROVIDENT RD		
558	CEDARBROOK RD		
559	WELROSE AV		
560	SURREY RD		
561	SHARPLESS RD		
562	CURTIS RD		
563	COLD SPRING RD		
564	SUNSET DR		
565	BURGUNDY DR		
566	RAYNO DR		
567	SILVER AV		
568	RAYERLY RD		
569	SPRINGFIELD DR		



LEGEND

- LIMITED ACCESS HIGHWAY
- STATE ROUTE AND NUMBER
- STATE MAINTAINED BRIDGE ON TOWNSHIP ROAD
- TOWNSHIP ROAD, NUMBER AND SEGMENT LENGTH IN MILES
- IMPASSABLE TOWNSHIP ROAD
- TURNBACK TOWNSHIP ROAD
- OTHER ROAD
- RAILROAD (IN SERVICE)
- RAILROAD ABANDONED (TRACK RETAINED)
- STATE BOUNDARY
- COUNTY BOUNDARY
- TOWNSHIP BOUNDARY
- CITY OR BOROUGH BOUNDARY
- MUNICIPAL BUILDING
- SPLIT MILEAGE BETWEEN MUNICIPALITIES

UPPER SOUTHAMPTON
SECOND CLASS TOWNSHIP MAP
BUCKS COUNTY

PREPARED BY THE

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION
BUREAU OF PLANNING AND RESEARCH
GEOGRAPHIC INFORMATION DIVISION

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

MUNICIPAL CODE 09 225

REVISED PER FORM 990 DATED 3-16-17

SCALE

0 1000 2000 3000 FEET
0 250 500 750 1000 METERS

TYPE 5 MAP UPPER SOUTHAMPTON TOWNSHIP BUCKS COUNTY PENNSYLVANIA

(RECREATED BY RPL 6-26-00) (REVISED: 4-20-17)

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS
BMP EFFECTIVENESS VALUES

This table of BMP effectiveness values (i.e., pollutant removal efficiencies) is intended for use by MS4s that are developing and implementing Pollutant Reduction Plans and TMDL Plans to comply with NPDES permit requirements. The values used in this table generally consider pollutant reductions from both overland flow and reduced downstream erosion, and are based primarily on average values within the Chesapeake Assessment Scenario Tool (CAST) (www.casttool.org). Design considerations, operation and maintenance, and construction sequences should be as outlined in the Pennsylvania Stormwater BMP Manual, Chesapeake Bay Program guidance, or other technical sources. The Department of Environmental Protection (DEP) will update the information contained in this table as new information becomes available. Interested parties may submit information to DEP for consideration in updating this table to DEP's MS4 resource account, RA-EPPAMS4@pa.gov. Where an MS4 proposes a BMP not identified in this document or in Chesapeake Bay Program expert panel reports, other technical resources may be consulted for BMP effectiveness values. Note – TN = Total Nitrogen and TP = Total Phosphorus.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Wet Ponds and Wetlands	20%	45%	60%	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
Dry Extended Detention Basins	20%	20%	60%	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Infiltration Practices w/ Sand, Veg.	85%	85%	95%	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil, they are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approval to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.
Filtering Practices	40%	60%	80%	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
Filter Strip Runoff Reduction	20%	54%	56%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips.
Filter Strip Stormwater Treatment	0%	0%	22%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips.
Bioretention – Raingarden (C/D soils w/ underdrain)	25%	45%	55%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.
Bioretention / Raingarden (A/B soils w/ underdrain)	70%	75%	80%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Bioretention / Raingarden (A/B soils w/o underdrain)	80%	85%	90%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.
Vegetated Open Channels (C/D Soils)	10%	10%	50%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.
Vegetated Open Channels (A/B Soils)	45%	45%	70%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.
Bioswale	70%	75%	80%	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	10%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/ underdrain)	45%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/o underdrain)	75%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (A/B Soils w/ underdrain)	50%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Permeable Pavement w/ Sand or Veg. (A/B Soils w/o underdrain)	80%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (C/D Soils w/ underdrain)	20%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.
Stream Restoration	0.075 lbs/ft/yr	0.068 lbs/ft/yr	44.88 lbs/ft/yr	An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol.
Forest Buffers	25%	50%	50%	An area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. Effectiveness credit for TN is for 4 upslope acres for each acre of buffer (4:1), and 2 upslope acres for TP and sediment (2:1). Additional credit is gained by converting land use from current use to forest. (Note – the values represent pollutant load reductions from stormwater draining through buffers).
Tree Planting	10%	15%	20%	The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given.
Street Sweeping	3%	3%	9%	Street sweeping must be conducted 25 times annually. Only count those streets that have been swept at least 25 times in a year. The acres associated with all streets that have been swept at least 25 times in a year would be eligible for pollutant reductions consistent with the given BMP effectiveness values.

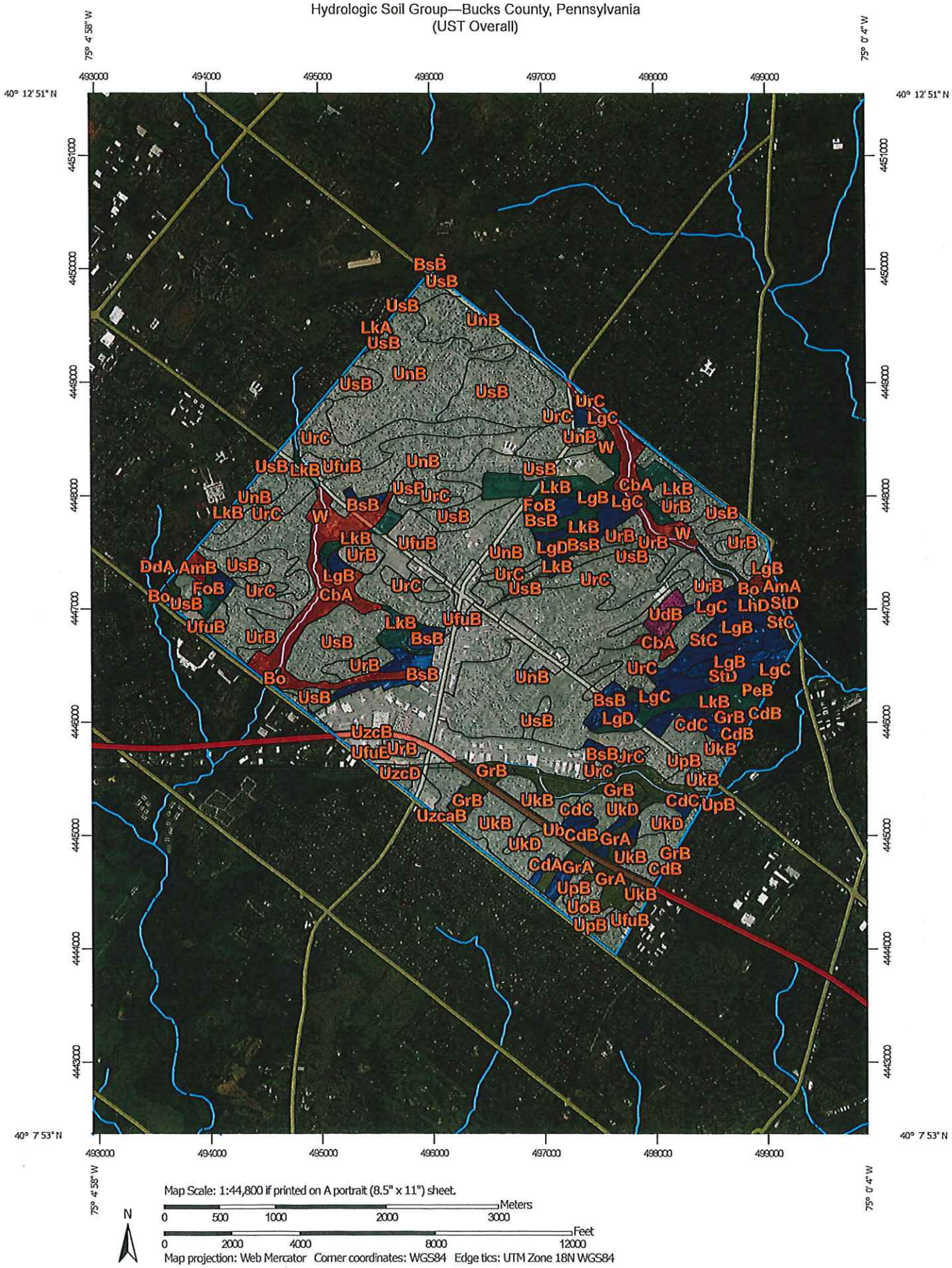
BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1 – TN and TP concentrations	This BMP (also referred to as "Storm Drain Cleaning") involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. To determine pollutant reductions for this BMP, these steps must be taken: 1) Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected. 2) Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter). 3) Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the sediment removal efficiency specified by the manufacturer may be assumed, but no higher than 80%.

BMP EFFECTIVENESS TABLE FOR SEDIMENT (TSS)

BMP	PER PADEP 3800-PM-BCW0100m (5/20/16)	PER CHESAPEAKE BAY PROGRAM (CBP,2011)
Wet Ponds and Wetlands	60%	---
Dry Detention Basins	10%	10%
Dry Extended Detention Basins	60%	60%
Infiltration Practices w/ Sand, Vegetation	95%	95%
Filtering Practices	80%	80%
Filter Strip Runoff Reduction	56%	---
Filter Strip Stormwater Treatment	22%	---
Bioretention/Raingardens (C/D Soils w/ underdrain)	55%	55%
Bioretention/raingarden (A/B soils) w/underdrain	80%	80%
Bioretention/Raingarden A/B soils, no underdrain)	90%	90%
Vegetative Open Channels (C/D soils)	50%	---
Vegetative Open Channels (A/B soils)	70%	---
Bioswale	80%	80%
Permeable Pavement w/o Sand or Veg. (C/D soil w/ underdrain)	55%	55%
Permeable Pavement w/o Sand or Veg. (A/B soil w/ underdrain)	70%	70%
Permeable Pavement w/o Sand or Veg. (C/D soil w/o underdrain)	85%	---
Permeable Pavement w/ Sand or Veg. (A/B soil underdrain)	70%	70%
Permeable Pavement w/ Sand or Veg. (A/B soil w/o underdrain)	85%	85%
Permeable Pavement w/o Sand or Veg. (C/D soil underdrain)	55%	55%
Stream Restoration	44.88 lbs/ft/yr.	44.88 lbs/ft/yr. (2013)
Forest Buffers	50%	50%
Tree Planting	20%	Credit as land use change
Street Sweeping (25 times annually)	9%	9%
Storm Drain Cleaning (based on weight)	50% Max 80% for sediment	---
Illicit discharges – correction of cross-connections/sewer repair	---	100%
Pet Waste program	---	Calculate load reduction

As reported values between the two lists are in general agreement, where BMP's not included in both will assumed to be the same percentage given. Permitting allows for the use of either, provided all calculations are consistent.

Hydrologic Soil Group—Bucks County, Pennsylvania
(UST Overall)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bucks County, Pennsylvania
Survey Area Data: Version 12, Sep 19, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 19, 2011—Aug 14, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Bucks County, Pennsylvania (PA017)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AmA	Amwell silt loam, 0 to 3 percent slopes	D	6.3	0.1%
AmB	Amwell silt loam, 3 to 8 percent slopes	D	11.4	0.3%
Bo	Bowmansville-Knauers silt loams	C/D	29.5	0.7%
BsB	Brownsburg silt loam, 3 to 8 percent slopes	B	99.9	2.2%
CbA	Chalfont silt loam, 0 to 3 percent slopes	D	222.5	5.0%
CdA	Chester silt loam, 0 to 3 percent slopes	B	6.5	0.1%
CdB	Chester silt loam, 3 to 8 percent slopes	B	45.7	1.0%
CdC	Chester silt loam, 8 to 15 percent slopes	B	38.0	0.8%
DdA	Doylestown silt loam, 0 to 3 percent slopes	C/D	6.8	0.2%
FoB	Fountainville silt loam, 3 to 8 percent slopes	C	20.3	0.5%
GrA	Glenville silt loam, 0 to 3 percent slopes	C/D	120.1	2.7%
GrB	Glenville silt loam, 3 to 8 percent slopes	C/D	52.8	1.2%
LgB	Lansdale loam, 3 to 8 percent slopes	B	87.1	1.9%
LgC	Lansdale loam, 8 to 15 percent slopes	B	48.2	1.1%
LgD	Lansdale loam, 15 to 25 percent slopes	B	9.9	0.2%
LhD	Lansdale loam, 8 to 25 percent slopes, extremely stony	B	34.0	0.8%
LkA	Lawrenceville silt loam, 0 to 3 percent slopes	C	1.3	0.0%
LkB	Lawrenceville silt loam, 3 to 8 percent slopes	C	232.5	5.2%
PeB	Penn channery silt loam, 3 to 8 percent slopes	B	2.8	0.1%
StC	Steinsburg gravelly loam, 8 to 15 percent slopes	B	51.3	1.1%

Hydrologic Soil Group— Summary by Map Unit — Bucks County, Pennsylvania (PA017)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
StD	Steinsburg gravelly loam, 15 to 25 percent slopes	B	40.6	0.9%
Ub	Udorthents, loamy	A/D	36.3	0.8%
UdB	Udorthents, shale and sandstone	A	19.5	0.4%
UfuB	Urban land, 0 to 8 percent slopes		395.4	8.8%
UkB	Urban land-Chester complex, 0 to 8 percent slopes		200.5	4.5%
UkD	Urban land-Chester complex, 8 to 25 percent slopes		72.9	1.6%
UnB	Urban land-Duffield complex, 0 to 8 percent slopes		1,045.0	23.3%
UoB	Urban land-Gladstone complex, 0 to 8 percent slopes		44.5	1.0%
UpB	Urban land-Glenville complex, 0 to 8 percent slopes		25.8	0.6%
UrB	Urban land-Lansdale complex, 0 to 8 percent slopes		281.3	6.3%
UrC	Urban land-Lansdale complex, 8 to 15 percent slopes		465.9	10.4%
UsB	Urban land-Lawrenceville complex, 0 to 8 percent slopes		660.3	14.7%
UzcaB	Urban land-Udorthents, schist and gneiss complex, 0 to 8 percent slopes		25.5	0.6%
UzcB	Urban land-Udorthents, shale and sandstone complex, 0 to 8 percent slopes		22.1	0.5%
UzcD	Urban land-Udorthents, shale and sandstone complex, 8 to 25 percent slopes		13.0	0.3%
W	Water		3.1	0.1%
Totals for Area of Interest			4,478.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

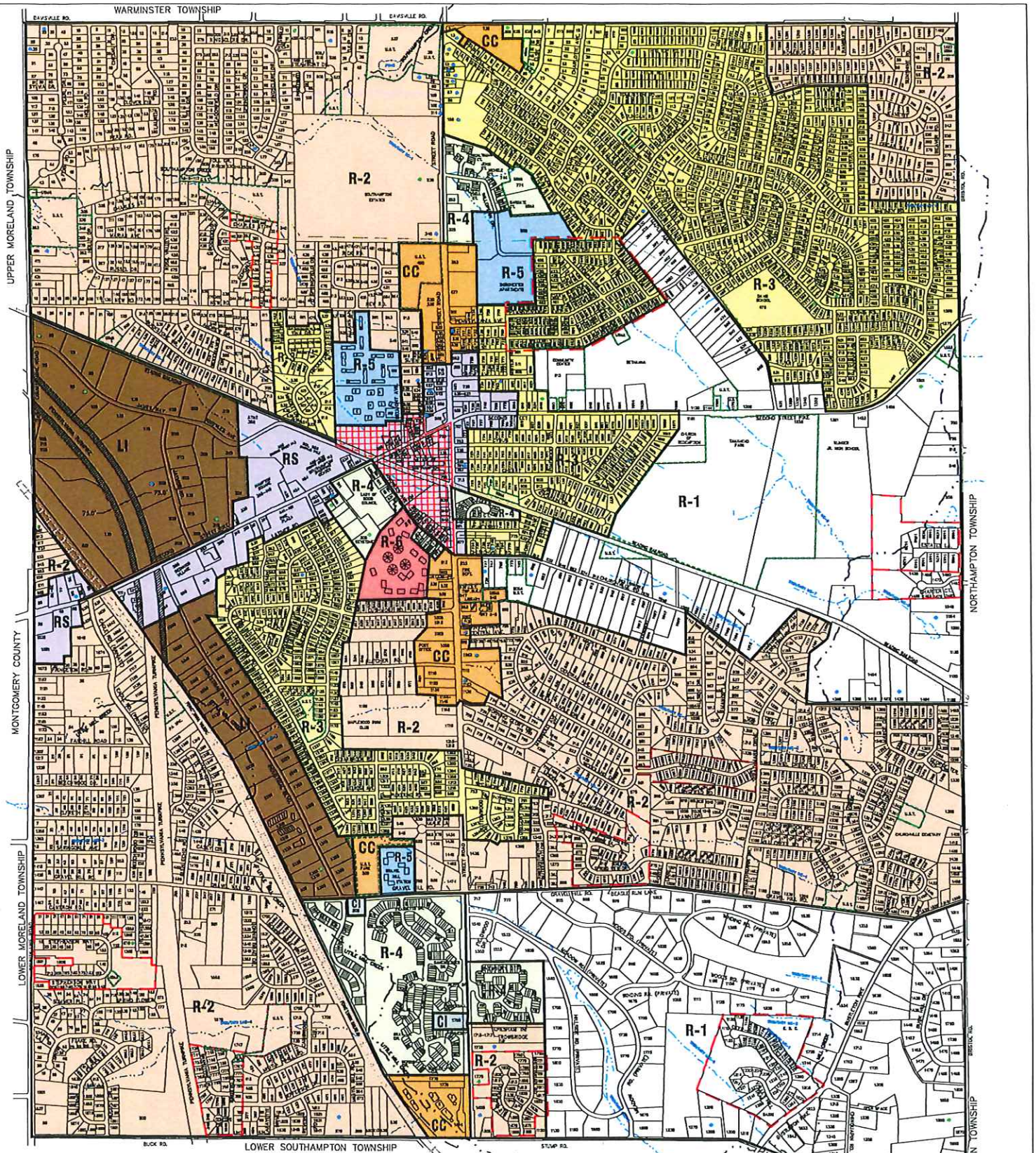
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



ZONING DISTRICTS:

R-1	RESIDENTIAL CONSERVATION DISTRICT	
R-2	LOW DENSITY RESIDENTIAL DISTRICT	
R-3	MODERATE DENSITY RESIDENTIAL DISTRICT	
R-4	MODERATELY HIGH DENSITY RESIDENTIAL DISTRICT	
R-5	HIGH DENSITY RESIDENTIAL DISTRICT	
R-6	HIGHEST DENSITY RESIDENTIAL DISTRICT	
CC	CONTROLLED COMMERCIAL DISTRICT	
RS	RETAIL SERVICE DISTRICT	
CI	CAMPUS INDUSTRIAL DISTRICT	
LI	LIMITED INDUSTRIAL DISTRICT	
OPAS	OFF-PREMISES ADVERTISING SIGN DISTRICT (OVERLAY ZONING DISTRICT, ORD. #351)	
TCAA	TOWN CENTER ACTIVE ADULT DISTRICT (OVERLAY ZONING DISTRICT, ORD. #416)	

STATE ROADS

BUSTLETON PIKE
COUNTY LINE ROAD
EAGLE AVENUE
SECOND STREET PIKE
BRISTOL ROAD
DAVISVILLE ROAD
STREET ROAD
PA TURNPIKE

TOWNSHIP IS 8.3 SQUARE MILES

ZONING MAP OF UPPER SOUTHAMPTON TOWNSHIP BUCKS COUNTY, PA.

LEGEND

- ZONING DISTRICT BOUNDARY LINE
- ZONING DISTRICT LABEL — R-2
- SUN OIL PIPELINE
- NON-CONFORMITIES
- USE VARIANCES OR CONDITIONAL USES
- UPPER SOUTHAMPTON MUNICIPAL AUTHORITY
- CLUSTER DEVELOPMENT

PREPARED BY:
TRI-STATE ENGINEERS & LAND SURVEYORS, INC.
CIVIL ENGINEERS • LAND SURVEYORS • LAND PLANNERS • MUNICIPAL ENGINEERS • LANDSCAPE ARCHITECTS
801 WEST STREET ROAD, FEASTERVILLE, PENNSYLVANIA 19053
PHONE (215)357-5950 FAX (215)357-2836

SCALE IN FEET

NO.	DATE	DESCRIPTION	BY
	11/2018	REVISED COLOR	WCP
	7/9/2018	REVISED BASE	WCP
	11/2017	REVISED BASE	WCP
	03/2016	REVISED BASE	JAS
	01/2015	REVISED BASE, ADDED TCAA	WC

MILL CREEK WATERSHED LAND USE (FROM WIKIWATERSHED)

FOR ENTIRE WATERSHED

Type	Area (km^2)	Coverage (%)
Open Water	0.01	0
Perennial Ice/Snow	0	0
Developed, Open Space	7.74	46.4
Developed, Low Intensity	3.95	23.7
Developed, Medium Intensity	0.76	4.5
Developed, High Intensity	0.2	1.2
Barren Land (Rock/Sand/Clay)	0	0
Deciduous Forest	3.31	19.8
Evergreen Forest	0.06	0.3
Mixed Forest	0.14	0.8
Shrub/Scrub	0.11	0.7
Grassland/Herbaceous	0.01	0.1
Pasture/Hay	0.13	0.8
Cultivated Crops	0.07	0.4
Woody Wetlands	0.21	1.3
Emergent Herbaceous Wetlands	0	0
	16.7	
247.105 ACRES/KM^2 GIVES	4,127	ACRES
	4,137	PER WIKIWATERSHED
	0.25%	DIFFERENCE

WATERSHED WITHIN THE MUNICIPAL LIMITS OF THE TOWNSHIP

	2659	ACRES
% IN TOWNSHIP	36%	

SOUTHAMPTON CREEK WATERSHED LAND USE (FROM WIKIWATERSHED)

FOR ENTIRE WATERSHED

Type	Area (km^2)	Coverage (%)
Open Water	0	0
Perennial Ice/Snow	0	0
Developed, Open Space	3.4	44.5
Developed, Low Intensity	2.42	31.6
Developed, Medium Intensity	0.8	10.4
Developed, High Intensity	0.23	2.9
Barren Land (Rock/Sand/Clay)	0	0
Deciduous Forest	0.54	7.1
Evergreen Forest	0.01	0.2
Mixed Forest	0.03	0.5
Shrub/Scrub	0.03	0.4
Grassland/Herbaceous	0.02	0.2
Pasture/Hay	0.01	0.1
Cultivated Crops	0	0
Woody Wetlands	0.16	2.1
Emergent Herbaceous Wetlands	0	0
	7.65	
247.105 ACRES/KM^2 GIVES	1,890	ACRES
	1,895	PER WIKIWATERSHED
	0.25%	DIFFERENCE

WATERSHED WITHIN THE MUNICIPAL LIMITS OF THE TOWNSHIP

	1221	ACRES
% IN TOWNSHIP	36%	

A Homeowner's Guide to Stormwater Management

You can make a difference!

Learn what you can do on your property and in your community to improve the health of your watershed.

Prepared by: Office of Watersheds
Philadelphia Water Department
Volume 1 • January 2006

The Office of Watersheds would like to thank the following organizations and partners for their assistance and for the use of their materials in this guide:

Center for Watershed Protection

Fairmount Park Commission

Montgomery County Conservation District

NAM Planning & Design, LLC

National Oceanic & Atmospheric Administration (NOAA)

Pennsylvania Department of Environmental Protection (DEP)

Pennsylvania Horticultural Society

Philadelphia Department of Streets

South River Federation

TreeVitalize

University of Wisconsin — Extension

Washington State Puget Sound Action Team

Wisconsin Department of Natural Resources

Wissahickon Valley Watershed Association

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If you plan to install any of the following structural projects on your property in the City, please notify PWD via its e-mail address (WaterShedsPWD@phila.gov): Rain Barrels, Rain Gardens, or Dry Wells. PWD would like to register your project with the City's Department of Licenses & Inspections (L&I). Also, PWD encourages you to take photographs of your project and to send them to PWD via the above e-mail address

If you experience problems with any water or sewer piping on your property, you should contact a registered plumber.

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A Homeowner's Guide to Stormwater Management

Table of Contents

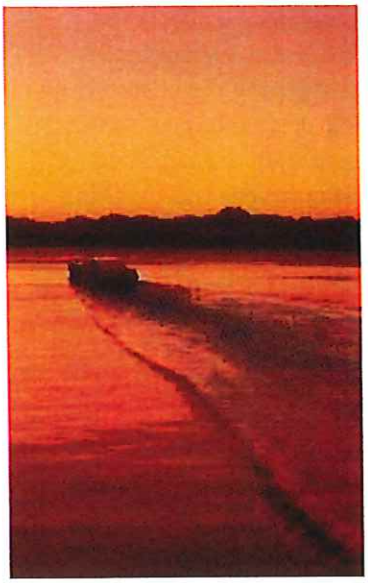
Introduction

The Office of Watersheds of the Philadelphia Water Department has a vision for Philadelphia—"Clean Water—Green City." We want to unite the City with its water environment, creating a green legacy for future generations while incorporating a balance between ecology, economics and equity.

In order to achieve the goal of "Clean Water-Green City," we must work together with our partners, local residents, homeowner associations and municipalities on managing stormwater in a manner that will restore our watersheds. We can all play a part in taking an active role in converting our streams, creeks and surrounding green spaces into healthy systems that local residents, along with native fish and wildlife, can use as amenities, sanctuaries and habitats. As a homeowner, your part can be as simple as maintaining your car properly or building a rain garden on your lawn. This guide provides you with the steps and actions you can take to improve stormwater management on your property or in your community. These stormwater management projects will not only help protect our invaluable drinking water sources, but they will help green the city, restore our waterways and improve quality of life for all residents.

For more information, please visit www.PhillyRiverInfo.org or e-mail WaterShedsPWD@phila.gov.

Vehicle Maintenance

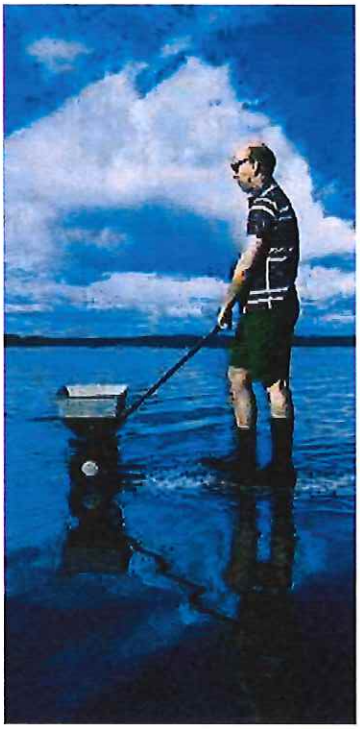


By maintaining your car properly you can prevent oil leaks, heavy metals and toxic materials from traveling from your car onto the street. Rain washes oil and other hazardous chemicals from the street into the nearest storm drain, ultimately draining into the Delaware and Schuylkill Rivers, the source of drinking water for many. Just imagine the number of cars in our region and the amount of oil that finds its way into our local waterways! It has been estimated that each year over 180 million gallons of used oil is disposed of improperly (Alameda CCWP, 1992), and that a single quart of oil can pollute 250,000 gallons of drinking water (NDRC, 1994). Please follow proper automotive maintenance.

Maintaining your Vehicle

- Maintain your car and always recycle used motor oil.
- Check your car or truck for drips and oil leaks regularly and fix them promptly. Keep your vehicle tuned to reduce oil use.
- Use ground cloths or drip pans under your vehicle if you have leaks or if you are doing engine work. Clean up spills immediately and properly dispose of clean up materials.
- Collect all used oil in containers with tight-fitting lids. Old plastic jugs are excellent for this purpose.
- Recycle used motor oil. Many auto supply stores, car care centers, and gas stations will accept used oil. Do not pour liquid waste down floor drains, sinks or storm drains.
- Do not mix waste oil with gasoline, solvents, or other engine fluids. This contaminates the oil which may be reused, increases the volume of the waste, and may form a more hazardous chemical.
- Never dump motor oil, antifreeze, transmission fluid or other engine fluids into road gutters, down the storm drain or catch basin, onto the ground, or into a ditch.
- Many communities have hazardous waste collection days where used oil can be brought in for proper disposal. Find out about your program. Recycling just one gallon of used oil can generate enough electricity to run the average household for almost 24 hours.
- Try to use drain mats to cover drains in case of a spill.
- Store cracked batteries in leak proof secondary containers.

Lawn & Garden Care



When fertilizing lawns and using other common chemicals, such as pesticides and herbicides, remember you're not just spraying the lawn. When it rains, the rain washes the fertilizers, pesticides and herbicides along the curb and into storm drains, which ultimately carry runoff into the Schuylkill and Delaware Rivers, our drinking water source. In addition to degrading the water quality of our streams and rivers, pesticides can kill critters in the stream and fertilizers can cause algal blooms, which rob our waterways of oxygen that fish need to survive. If you have to use fertilizers, pesticides, and herbicides, carefully read all labels and apply these products sparingly.

Many homeowners are unaware of the actual nutrient needs of their lawns. According to surveys conducted by the Center for Watershed Protection, over 50% of lawn owners fertilize their lawns, yet only 10 to 20% of lawn owners take the trouble to perform soil tests to determine whether fertilization is even needed (CWP, 1999). *Organic lawn care practices (no chemical pesticides and fertilizers) can also be a wise environmental choice and will save you money.* Conduct a soil test on your lawn and follow the below practices to reduce the need to fertilize on your lawn and garden.

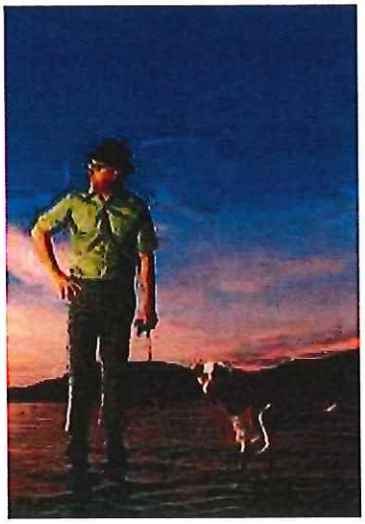
Caring for your Lawn and Garden

- Use fertilizers sparingly. Lawns and many plants do not need as much fertilizer or need it as often as you might think. Test your soil to be sure!
- Consider using organic fertilizers; they release nutrients more slowly.
- Never fertilize before a rain storm (the pollutants are picked up by stormwater during rain events).
- Keep fertilizer off of paved surfaces—off of sidewalks, driveways, etc. If granular fertilizer gets onto paved surfaces, collect it for later use or sweep it onto the lawn.
- Use commercially available compost or make your own using garden waste. Mixing compost with your soil means your plants will need less chemical fertilizer and puts your waste to good use. Another alternative is to use commercial compost, called Earthmate, which is available for free through PWD. Call 215-685-4065 or visit the website to learn more about Earthmate: www.phila.gov/water/brc/brchow2get.html
- Let your grass clippings lay! Don't bag the grass. Use a mulching lawn mower to cut one-third of the blade length each week and naturally fertilize your lawn in the process.

Lawn & Garden Care

- Wash your spreader equipment on a pervious (penetrable) vegetated area, like the lawn, to allow for the natural absorption of excess fertilizer.
- Never apply fertilizer to frozen ground or dormant lawns.
- Maintain a buffer strip of unmowed natural vegetation bordering waterways and ponds to trap excess fertilizers and sediment from lawns/gardens.
- Grow an organic garden (no pesticides or fertilizers). Call the Organic Landscape Alliance at 1-866-820-0279 or visit www.organiclandscape.org.

Pet Waste

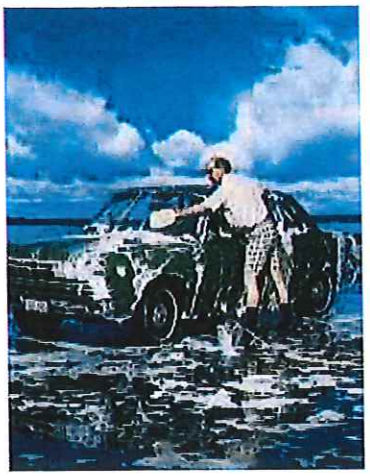


When animal waste is left on the ground, rainwater or melting snow washes the pet waste into our storm drains or directly into our local creeks. The disease-causing bacteria found in pet waste eventually flows from our local waterways into the Delaware and Schuylkill Rivers, our drinking water source. In addition to contaminating waterways with disease-carrying bacteria, animal waste acts like a fertilizer in the water, just as it does on land. This promotes excessive aquatic plant growth that can choke waterways and promote algae blooms, robbing the water of vital oxygen.

Scooping Up the Poop

- Bag it! When going for dog walks, take a shopping bag or sandwich bag. When doggy makes a deposit, turn the baggie inside out over your hand and use it as a glove to pick up the waste.
- Flush the pet waste down the toilet because then it is treated at a sewage treatment plant.
- If flushing down the toilet is not a viable option, put the pet waste in the trash, but never put waste into storm drains.
- Encourage your neighbors to provide pet waste stations for collection and disposal of waste. Check to see if the parks in your neighborhood have them.
- Dig a small trench in your yard where your pets tend to defecate and toss the waste in the trench, cover with a layer of leaves, grass clippings, and dirt.
- Dispose waste in disposal units called Doggy Loos where they are installed into the ground. Decomposition occurs within the unit.
- At the park, set up a pooch patch which has a pole surrounded by a light scattering of sand around it. Dog owners can introduce their dog to the pole upon entry to the park. Dogs will then return to the patch to defecate and then you can place the pet waste in special bins for disposal.

Vehicle Washing



Car washing is a common routine for residents and a popular way for organizations, such as scout troops, schools, and sports teams to raise funds. However, most of the time, cars are washed in driveways and parking lots which allow wash water (dirty water) to finds its way to the nearest storm drain, ultimately draining into our drinking water sources, the Delaware and Schuylkill Rivers. The wash water often contains pollutants, such as oils and grease, phosphates (from the soap), and heavy metals—all of which are unhealthy for people and fish.

Washing Your Car Properly

- The best action is to take your vehicle to a commercial car wash, especially if you plan to clean the engine or the bottom of the car. Most car washes reuse water several times before sending it for treatment at a sewage treatment plant.

If you still want to wash your car at home...

- Wash your car on gravel, grass or another permeable surface, so the ground can filter the water naturally.
- Use soap sparingly. Try to use non-phosphate detergents. Phosphates are nutrients that can cause problems for nearby waterways.
- Use a hose that is high pressure, low volume. Use a hose with a nozzle that automatically turns off when left unattended or one that has a pistol grip or trigger nozzle to save water. Wash one section of the car at a time and rinse it quickly.
- When you're done, empty your bucket of soapy water down the sink, not the street.
- Block off the storm drain during charity car wash events or use an insert with a vacuum pump to catch wash water and empty it into the sink, not the street.

Tree Planting

If you have any tree planting questions and need to ask an expert, go to www.pennsylvaniahorticulturalsociety.org/garden/ask_gardener

Trees are not only a beautiful addition to the landscape, but they also provide invaluable benefits to cities. They reduce heat by cooling and shading homes during the hot summer months, decreasing the amount of energy required to cool a home and its related electric bills. Mature trees can actually cut summer cooling costs by 40% and tree-lined blocks can even decrease local temperatures. Trees naturally clean the air of pollutants and create a neighborhood noise buffer. Trees also improve stormwater management, reducing the amount of polluted stormwater that normally would go directly into storm drains. Tree roots also allow rainwater to filter back into the soil, recharging the often thirsty water table. A 2005 study by the University of Pennsylvania found that trees can increase property values. Planting a tree within 50 feet of a house can increase its sale price by 10 to 15%. Some studies even indicate that the mere presence of trees can create stronger neighborhood ties and reduce crime.

Planting a Tree

Before getting started, you may be interested in participating in the TreeVitalize rebate program where you may be eligible to receive up to a $25 rebate on the purchase of a tree. Whether you are planting a tree in your yard or hiring a contractor to plant a street tree, you may qualify. For more information, visit www.treevitalize.net and www.pennsylvaniahorticulturalsociety.org/phlgreen/tree-pledge.html.

Also, the Pennsylvania Horticultural Society's Tree Tenders Program offers a basic training course designed to teach general tree-care skills to organized community groups and individuals in Philadelphia. If you are interested in the course or a free copy of the *Tree Tenders Handbook* or *Mini-Guide to Tree Planting,* visit www.pennsylvaniahorticulturalsociety.org/phlgreen/treetenders.

1. Now, if you are ready to get started with your tree planting, select a site appropriate for your tree.
2. Dig the hole at least 1½ to 2 times the width of the root ball (container) to be installed, and no deeper than the height of the root ball so that the root flare (the top of the root mass) is flush with the existing ground. The planting pit should be dug so the walls of the pit are angled like a bowl or sloping outward in heavy soils.
3. Break up the walls of the pit after digging, so that fine roots can penetrate the soil. The soil that you dig out of the hole is what you will use to backfill around the root ball. Soil amendments are not recommended when planting a tree; therefore, no compost, moss, or shredded pine bark should be added to the backfill.

Tree Planting

You can also volunteer to plant trees elsewhere in the city—along creeks and streams in Fairmount Park and at local schools. The more trees in Philadelphia, the healthier we will be! Contact Fairmount Park, Greater Philadelphia Cares and UC Green to learn how you can volunteer to plant trees.

4. Remove all debris from the pit and gently tightly pack the loose soil in the bottom of the pit by hand.
5. Cut and remove the rope and burlap from around the trunk and check for root flare. Remove all nails. Drop the burlap down to the bottom of the hole.
6. Do not handle the plant by the branches, leaves or stem. Place the plant straight in the center of the planting pit, carrying the plant by the root ball. Never carry a plant by the trunk or branches.
7. After the tree is in the pit, carefully cut and remove the top third of the wire basket and as much burlap as possible using the least amount of disturbance.
8. Backfill planting pit with existing soil and pack it in there tightly to fill all voids and air pockets. Do not over compact soil. Make sure plant remains straight during backfilling/ packing procedure.
9. The top of the root mass (root flare) of the tree should be flush with the final grade. Do not cover stem with soil. If your tree has soil over the trunk flare (where the trunk cures outward into the root system), it is essential to plant the trunk flare above soil. Remove the soil from the root ball if the flare is buried by it.
10. Water plant thoroughly and slowly, immediately after planting to saturate backfill. For the first year after planting, water the tree with 15 gallons per week. Use your index finger to check the soil moisture under the mulch. If the soil is cool to the touch, do not water. If it is warm and dry, then water. A layer of mulch (i.e. shredded bark, compost) should be placed around the tree, at a depth between 3 to 4 inches and with a radius of approximately 2 to 4 inches from the tree stem. Do not rest the mulch directly against the tree stem. The mulch makes it easier to water the tree and reduces weed competition.
11. Remove all tags, labels, strings and wire form the plant material.

Many homeowners ask how a newly planted tree can affect the sewer, water lines, sidewalk and/or building's foundation? If you choose the correct tree, site, and planting conditions, your tree shouldn't interfere with your sewer, waterline, etc. Most tree roots grow in the soil's top 12 inches and spread well beyond the tree's canopy in search of water and nutrients. They don't "attack" underground mains, unless these are already damaged, providing entrances for developing roots. An adequate and generous tree pit, or long, narrow continuous "tree lawn" will provide the best conditions for establishing and maintaining a "well behaved" tree with the environment needed to survive in the city.

Tree Planting

Street Trees

If you do not have a yard, but you would like to have a tree in front of your property —on your sidewalk—you have several options in Philadelphia.

You can get a tree for free and installed at no cost by **Fairmount Park**, however, this may involve being placed on a waiting list

You or a group from your neighborhood can sign up for a **Tree Tenders program** through the Pennsylvania Horticultural Society, where you can get trained to care for your tree, learn how to organize a tree planting project and receive free tree care tools in exchange for your participation.

Lastly, you can **hire a contractor** approved by Fairmount Park to plant a tree in front of your house. However, the contractor you hire must apply for a Street Tree Permit from Fairmount Park before any work can be done. The private planting could cost you up to $500 (not including the price of the tree).

Talk to your neighbors and find out if there is a neighborhood organization or Tree Tenders group organizing a street tree planting project. Some local groups that do tree plantings, include The South of South Neighborhood Organization, UC Green and Citizens Alliance.

Recommended Street Tree List for Philadelphia

The Fairmount Park Commission recommends the below list of approved trees which will thrive in an urban setting, have a good track record, and won't interfere with overhead wires in Philadelphia.

Small Trees—Under 30 feet

Acer buergeranum—Trident Maple

Acer campestre—Hedge Maple

Acer ginnala—Amur Maple

Acer tataricum—Tartarian Maple

Crataegus crus-galli 'Inermis'—Thornless Hawthorn, tree form

Crataegus laevigata 'Superba'—Crimson Cloud Hawthorn tree form

Crataegus phaenopyrum—Washington Hawthorn, tree form

Crataegus viridis—Winter King Hawthorne

Prunus triloba—Flowering Plum

Malus (selected varieties)—Crabapple

Syringa reticulata—Japanese Tree Lilac

Medium Trees 30–46 feet

Aesculus x carnea 'Briotii'—Ruby Red Horsechestnut

Cercidiphyllum japonica—Katsura tree

Cladrastis lutea—Yellowwood

Crataegus lavallei—Lavalle Hawthorn

Koelreuteria paniculata—Golden Rain Tree

Malus (selected varieties)—Crabapple

Ostrya virginiana—Hop Hornbeam

Phellodendron amurense—Amur Cork Tree

Prunus x yedoensis—Yoshino Cherry

Ulmus parvifolia—Chinese Elm

Quercus acutissima—Sawtooth Oak

Large Trees Over 47 feet

Acer rubrum (selected cultivars)—Red Maple

Celtis occidentalis—Hackberry

Corylus colurna—Turkish Filbert

Fraxinus pennsylvanica 'Patmore'—Patmore Green Ash

Gleditsia triacanthos (selected cultivars)—Honey Locust, a) Halka, b) Moraine, c) Shademaster

Ginkgo biloba (male selections only)—Ginkgo

Liquidambar styraciflua—Sweetgum

Quercus rubra—Red Oak

Quercus macrocarpa—Bur Oak

Quercus palustris—Pin Oak

Sophora japonica—Japanese Pagoda Tree

Tilia cordata—Little Leaf Linden

Zelkova serrata (selected cultivars)—Japanese Zelkova—a) Green Vase, b) Village Green

Columnar Trees for Narrow Streets

Acer rubrum 'Armstrong'—Armstrong Columnar Red Maple

Carpinus betulus fastigiata—Pyramidal European Hornbeam

Ginkgo biloba 'Princeton Sentry'—Princeton Sentry Ginkgo Grafted Male Variety

Prunus sargentii 'Columnaris'—Columnar Sargent Cherry

Quercus robur 'Rose Hill'—Rose Hill English Oak

Backyard Stream

Establish a streamside (riparian) buffer—a vegetated area along the edge of the stream that protects it from pollution and erosion. This buffer zone absorbs pollutants and nutrients that would otherwise end up running directly into the stream. Plant material slows runoff and filters out pollutants and sediments. Well-planted streamside buffers are also a great low-cost way to control erosion. While plants slow runoff, filter pollutants, and help control erosion, trees cast shade on the stream, cooling the water, reducing algae growth and improving fish habitat. A buffer with trees and shrubs also becomes a home to birds, butterflies and other creatures. Trees and plants that grow in the buffer play a critical role in keeping streams healthy.

Caring for Your Stream

- Begin with a "no mow" or "no graze" zone along your stream banks. Make your buffer as wide as possible.
- Plant trees and shrubs in your buffer zone. They provide many long-lasting benefits and can be quite inexpensive to establish and maintain.
- Using shrubs will give your buffer a quick start; many reach full size in just a few years.
- Set your mower blades at least three inches high. Taller grass slows runoff, resists drought and needs less fertilizer
- Use hay bales or a special silt fence to prevent soil from washing off your site and into the stream while establishing your stream buffer.
- Cover piles of soil with tarps to protect them from rain.
- Use good farm practices by not cultivating the soil and planting winter cover crops to conserve soil.
- Contact your local DEP office or county conservation district if you see soil runoff in the stream from a nearby construction site.
- Limit your overall use of pesticides and herbicides, and use extreme caution when using them near streams.
- Keep grazing and other farm animals out of and away from the stream. Contact your county conservation district or the U.S. Fish and Wildlife Service to find out about farm fencing programs.
- Compost yard waste. Don't bag lawn trimmings or throw them into the stream; leave them in place for effective recycling of nutrients.
- Store firewood, trash and other materials well away from streams.

Winter De-icing

As snow piles up in the winter, we oftentimes turn to salt to melt snow and ice. Salt, however, causes adverse environmental impacts, especially on our streams and rivers, our drinking water source in Philadelphia. Excess salt can saturate and destroy a soil's natural structure and result in more erosion to our waterways. High concentrations of salt can damage and kill vegetation. Salt poses the greatest danger to fresh water ecosystems and fish. Studies in New York have shown that as salt concentrations increase in a stream, bio-diversity decreases. Excess salt can seep into groundwater and stormwater runoff. Effective ice control can help prevent excess salt runoff to our waterways.

De-icing in the Winter

There are many alternatives to salt including potassium chloride, calcium chloride and magnesium chloride, corn processing byproducts, and calcium magnesium acetate (CMA). Most can be found in your local hardware stores under various trade names, so check the labels for chemical content. While these alternatives can be spread in a dry form or sprayed as a liquid, their best use occurs when they are used with salt. They tend to increase the efficiency of salt thereby reducing the amount that needs to be applied. When over-applied, all chloride compounds can be harmful to the environment. Non-chloride corn byproducts recycled from mills and breweries have been shown to be effective de-icers as well. While they are often advertised as organic or natural, they can have extremely high phosphorus content, a major water pollutant. Numerous studies have shown calcium magnesium acetate (CMA) to be the most environmentally benign de-icer. Many northern states use CMA on roads in sensitive areas (wetlands, endangered species' habitat, drinking water supply, etc.). A couple of disadvantages with CMA however, is that it does not work well below 25° Fahrenheit and it is the most expensive de-icer. Because all de-icers can be harmful to the environment when applied in excess, the best strategy is to reduce the use of these chemicals as much as possible.

- The first line of defense should simply be to shovel sidewalks and pathways to keep them clear and to prevent ice from forming. Also, consider that salt and de-icers are not effective when more than 3 inches of snow have accumulated.
- Consider the temperature. Salt and calcium magnesium acetate (CMA) have a much slower effect on melting snow and ice at temperatures below 25° Fahrenheit.

Winter De-icing

- Track winter weather and only use salt and de-icers when a storm is about to come through. If a winter storm does not occur, sweep up any unused material, store, and reuse for the next big storm.
- Apply de-icing products discriminately, focusing on high-use areas and slopes where traction is critical. Apply the least amount necessary to get the job done. This will save money in product costs and will also help minimize property damage to paved surfaces, vehicles, and vegetation.
- Reduce salt and other chemicals by adding sand for traction.
- Become familiar with various de-icing products and wetting agents such as magnesium chloride and calcium chloride, which can improve the effectiveness of salt and reduce the amount needed.
- If you observe ongoing issues of ineffective ice management or examples of poor application, such as excess piles of road salt left to disperse, share your concerns with the property manager of your residence or business, or with the City of Philadelphia Streets Department. The Streets Department Hotline is 215-686-5560 and their website is www.phila.gov/streets.
- Plant native vegetation that is salt tolerant in stormwater drainage swales and ponds that may receive salt-laden runoff. Not only will these native species have a greater chance for survival, but they will continue to act as an effective buffer for our local waterways.
- Store salt and other products on an impervious (impenetrable) surface, such as a basement floor, to prevent ground contamination. Also store products in a dry, covered area to prevent stormwater runoff.

Planters (Container Gardens)

*These are just a few of the websites PWD came across during our research. These particular companies are not endorsed by PWD, nor can PWD verify any information on these companies.

Planters reduce impervious cover (impenetrable surfaces, such as concrete sidewalks, parking lots, etc.) by retaining stormwater runoff rather than allowing it to directly drain into nearby sewers and creeks. Planters offer "green space" in tightly confined urban areas by providing a soil/plant mixture suitable for stormwater capture and treatment. They can be used on sidewalks, parking areas, back yards, rooftops and other impervious areas.

Contained Planters

Contained planters are used for planting trees, shrubs, and ground cover. The planter is either prefabricated or permanently constructed and has a variety of shapes and sizes. Planters may range from large concrete planters to potted plants arranged on an impervious surface like the roof garden shown in the bottom photos to left. Planters can be placed on impervious surfaces like sidewalks, back yards, rooftops, or along the perimeter of a building in order to catch stormwater runoff from the roof. Contained planters may drain onto impervious surfaces through holes in their base or by an overflow structure so the plants do not drown during larger rain events.

Plants should be hardy and self-sustaining native species with little need for fertilizers or pesticides. Planters can be made of stone, concrete, brick, wood, or any other suitable material. However, treated wood should be avoided if it leaches any toxic chemicals.

Planters can be permanently fixed in place or easily moved around to enable you to change the look of the planter garden that you have created. Numerous manufactured pots and planters are available at your local hardware or landscaping store. You can create a "do-it-yourself" planter or use recycled items to create planters. Homemade planters may be constructed by stacking and fastening wood beams or laying and mortaring stones. There are many websites with detailed instructions to help with this type of project, such as www.taunton.com, www.hgtv.com, www.diynetwork.com.*

Creating a Contained Planter

- Purchase planters at the local hardware or landscaping store, if you are not building your own planter box.
- Drill holes in the bottom of the planter if they are not already there.
- Fill the planter with soil and leave a 12 inch area from the soil to the top of the planter.
- Choose native drought and saturation tolerant plants and trees to plant in the planter.
- Occasionally turn or till the soil to improve infiltration.

Rain Barrels

Please read the Disclaimer on the inside cover, if you are interested in installing this project.

A rain barrel collects and stores stormwater runoff from rooftops. By detaining (temporarily holding) the stormwater runoff during a rain event, you can help add capacity to the city's sewer system and reduce sewer overflows to our creeks and rivers, our drinking water source. Also, the collected rain water can be reused for irrigation to water lawns, gardens, window boxes or street trees.

Rain barrels can be purchased on-line or they can be built. If you would like to purchase a rain barrel on-line, view the list of retailers we came across in our research.*

Whether you buy or build a rain barrel, the most important thing to remember is that they are only effective at stormwater management when the stored water is emptied in between storms, making room in the barrel for the next storm.

Building a Rain Barrel

- Rain barrels help lower water costs when the stored water is recycled for lawn irrigation, for example.
- Rain barrels help reduce water pollution by reducing stormwater runoff, which oftentimes picks up pollutants in its path, such as oil, grease and animal waste, and transports these pollutants to the nearest creek, river or stormdrain.
- Storing rainwater for garden and lawn use helps recharge groundwater naturally.

Materials Needed for Building a Rain Barrel

- One 55 gallon drum
- One 5 foot section vinyl garden hose
- One 4 foot diameter atrium grate (basket used in garden ponds and pool skimmers)
- One ½ inch PVC male adapter
- One ¾ inch x ½ inch PVC male adapter
- One 5 foot section of drain hose, drain line, or sump pump line (1¼ inch)
- One 1¼ inch female barbed fitting and
- One 1¼ inch male threaded coupling
- One vinyl gutter elbow
- Drill (or a hole saw)
- Router, jig saw or coping saw
- Measuring tape

Optional:

- Waterproof sealant (silicone caulk, PVC glue)
- Teflon tape
- Fiberglass window screen material or mosquito netting
- Cinder blocks or wooden crate

Rain Barrels

*Rain Barrel Distributors

Clean Air Gardening
Composters.com
Day's Garden
ENVIRO ENERGY International Inc.
Gardener's Supply Company
GARDENWARe
Green Culture
Green Venture
Jerry Baker
Lee Valley Tools
Midwest Internet Sales
New England Rain Barrel and Composter Company
RainCatcher 4000
Plow&Hearth
Rain King
Rainsaver USA
Real Goods
Riversides
The Rain King
Spruce Creek Rainsaver
The Rain Pail
Urban Garden Center

This is not a comprehensive list of rain barrel distributors or suppliers. This is a list of rain barrel distributors that PWD came across during our rain barrel research. The particular companies are not endorsed by PWD, nor can PWD verify any information on these companies.

Instructions for Building a Rain Barrel

Step 1. Cut Holes in Rain Barrel:

- Cut lower drain hole: Measure about 1 inch above the bottom of the barrel (55 gallon drum) where the barrel side begins to rise toward the top. Using a ¾ inch bit (or hole saw), drill a hole through the barrel.
- Cut upper drain hole: Mark the upper drain hole according to where you want the overflow to be in the upper region of the barrel and in relationship to the lower drain. Use a 1⅝ inch hole saw to cut out the overflow hole.
- Cut top hole for atrium grate (filter): Using the atrium grate as a template for size, mark a circle at the center of the top of the drum (locating the rainwater inlet in the center of the barrel lets you pivot the barrel without moving the downspout). Drill a ½ inch hole inside of the marked circle. Use a router, jigsaw or coping saw to cut until the hole is large enough to accommodate the atrium grate, which filters out large debris. Don't make the hole too big—you want the rim of the atrium grate to fit securely on the top of the barrel without falling in.
- Cut notch to hold hose: Using a ½ inch bit or hole saw, cut out a notch at the top of the barrel rim (aligned so that it is above the lower drain hole). The notch should be large enough so that the end of the hose with the adapter will firmly snap into place.

Step 2. Set Up Barrel and Modify Downspout:

- Set up barrel: Since water will only flow from the garden hose when the hose is below the barrel, place the barrel on high ground or up on cinder blocks or a sturdy wooden crate underneath your downspout, making sure the barrel is level.
- Modify your downspout: Cut your existing downspout using a saw so that the downspout's end can be placed over the top of your rain barrel. Use a vinyl downspout elbow that fits the size of your downspout (usually 3 inch or 4 inch) to aim the stormwater into the rain barrel or just simply place the barrel right under the downspout.

Step 3. Assemble Parts:

- Attach garden hose to lower drain hole: Screw in the ½ inch PVC male adapter to the lower drain hole. The hard PVC threads cut matching grooves into the soft plastic of the barrel. Unscrew the ½ inch PVC male adapter from the hole. Wrap threads tightly with teflon tape (optional). Coat the threads of the coupler with waterproof sealant (optional). Screw the coated adapter back into the hole and let it sit and dry for 24 hours (optional). Attach 5 foot garden hose to the PVC male adapter. Attach the ¾ inch x ½ inch PVC

Rain Barrels

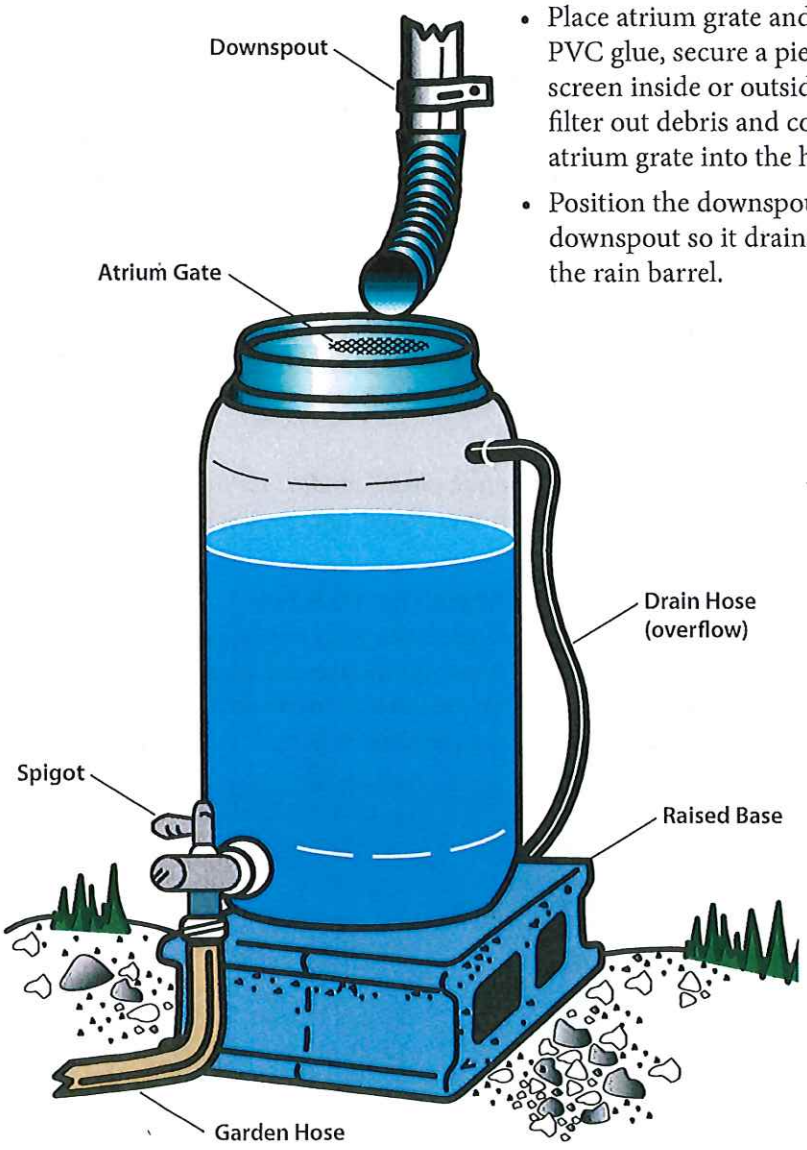
Don't forget to empty your rain barrel after the storm!

male adapter to the other end of the hose (this can be readily adapted to fit a standard garden hose).

- Attach drain hose (overflow hose) to upper drain hole: Put the 1¼ inch male threaded coupling inside the barrel with the threads through the hole. From the outside, screw the 1¼ inch female barbed fitting onto the threaded coupling. Use silicone on the threads (optional). Attach 5 foot section of drain hose to upper fitting and connect it to where the original downspout was connected (sewer riser) in order to transport the overflow into the sewer.

  The overflow must be conveyed safely away from your property and your neighbor's property. If your downspout was not originally connected to the sewer, place a splash pad on the ground under the overflow hose to direct the flow away from the foundation of your home.

- Place atrium grate and screen in top hole: Using PVC glue, secure a piece of fine mesh window screen inside or outside of the atrium grate to filter out debris and control mosquitoes. Place the atrium grate into the hole (basket down).
- Position the downspout: Position the end of your downspout so it drains onto the atrium grate on the rain barrel.



Rain Gardens

Please read the Disclaimer on the inside cover, if you are interested in installing this project.

A rain garden uses native plants and landscaping to soak up rain water (stormwater) that flows from downspouts or simply flows over land during a rain event. The center of the rain garden holds several inches of water, allowing the stormwater to slowly seep into the ground instead of flow directly from your roof, yard or driveway into the nearest storm drain, creek or river.

Creating a Rain Garden

- A rain garden allows 30% more water to seep into the ground than a conventional lawn (South River Federation & Center for Watershed Protection, 2002). This increase helps replenish the groundwater supply (important during a drought!), and also helps hold back stormwater from contributing to the storm-water and sewage overflows into nearby creeks and rivers.
- A rain garden reduces the amount of water pollution that would otherwise eventually reach the streams and rivers through stormwater runoff. Scientific studies have demonstrated that the first inch of rainfall is responsible for the bulk of the pollutants in stormwater runoff. A rain garden is designed to temporarily hold this one-inch of rainfall and slowly filter out many of the common pollutants in the water, such as oil, grease, and animal waste, that would otherwise flow into the waterways via the nearest stormdrain or stormwater runoff.
- The native plants used in rain gardens require less water and less fertilizer than conventional lawns. They also require less maintenance and provide habitat for birds and other wildlife.

Materials

- Plants for the garden (see plant list)
- Hose, rope or string
- Level
- Shovel or spade
- Measuring tape
- Humus or other soil amendments (optional)
- Downspout extension (also optional).

Instructions

Before starting this project, please conduct an Infiltration Test (pages 26–27) to determine if your soil conditions are adequate for a rain garden.

Step 1. Size and Locate your Rain Garden:

- First, measure the footprint of your house by getting the area (length x width) of your house and then determine how much of your rooftop area drains to the downspout you are disconnecting to your garden (for gutters with a downspout at

Sizing Example

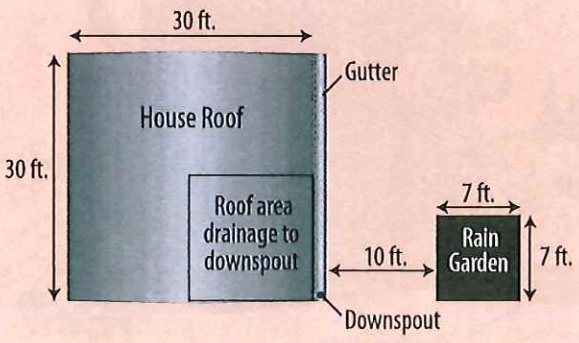
If the area of the house is 30 ft. x 30 ft. and ¼ of this area drains to one downspout:

15 ft. x 15 ft. = 225 ft.²

20% of 225 ft.² = 45 ft.²

30% of 225 ft.² = 67.5 ft.²

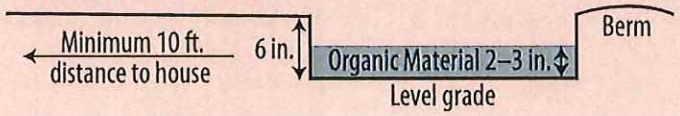
The rain garden area should be between 45 and 67.5 square feet, depending on soil type (use 20% for sandier soils).



each end, assume that half the water goes to each downspout). Refer to the sizing example for guidance. Be sure you measure the house footprint only, but include the area of any driveway or patio areas that will drain to the rain garden (do not take the roof slope into account). The surface area of your rain garden should be between 20% and 30% of the roof area that will drain into the rain garden.

- Locate the garden at least 10 feet away from your house and your neighbor's house (to prevent water leakage), and create the garden in the lowest point of this section of your lawn, maintaining a minimum 1% slope from the house down to the rain garden. If your yard drain is also located in this section of the lawn, you can build the rain garden around the drain. The bottom of the rain garden would be a few inches lower than the drain and the overflow would actually be in the middle of the rain garden.
- If you build the rain garden around your yard drain, when it fills up with water, the water that overflows from the garden will be conveyed safely to the yard drain. If you are not building around the yard drain, it is imperative that the overflow is safely conveyed to a drain nearby to prevent it from flowing into your neighbor's property.
  Make sure the drain is in a suitable location in relation to the rain garden in order to effectively manage the garden's overflow.

Garden Cross Section



- When finding the right spot for your rain garden, keep in mind that you will want to create a shallow ditch or swale that carries the stormwater runoff from the disconnected downspout to the rain garden. The swale will help slow the runoff before it reaches the rain garden.
- Finally, lay out the boundary of the garden with a rope.

Step 2. Dig the Rain Garden:

- To enable the rain garden to hold several inches of water during a storm, you'll have to dig a hole 3 to 4 inches deep across the entire surface of the rain garden. If the soil lacks organic material, you can improve it by digging the hole 5 to 6 inches deep, and adding 2 to 3 inches of humus or other organic material. Make sure the bottom is level, but gently slopes from the bottom to the ground level around the edges. If the drop at the edge is too steep, you might get some erosion around the edges.

Rain Gardens

- Next, test how the garden will hold water during a storm by letting water flow into the rain garden from a hose placed at the downspout. Based on this test, make any necessary adjustments (e.g., create a berm on the lower side of the garden using the diggings—the soil that was excavated).

Step 3. Add Plants to the Rain Garden:

- Choose native plants that won't require much watering, but make sure they can withstand wet soils for up to 24 hours. (Refer to the list of native plants below.)
- Also, take into account how much sun your garden receives. It's often helpful to draw out a planting plan before you start, and mark planting areas within the garden with string. After planting, weeding may be required until the plants become established. You may also need to periodically prune some of the plants to let others grow. In the winter, leave dead or dormant plants standing and cut back in the spring.
- Your garden may need a bit more maintenance than a lawn in the beginning, but in the long run it will be easier to care for and provide many added benefits!

Native Plants Recommended by Fairmount Park for Rain Gardens

Perennials

Bee-balm—*Monarda didyma*
Black-eyed Susan—*Rudbeckia hirta*
Blazing star—*Liatris spicata*
Blue flag iris—*Iris versicolor*
Boneset—*Eupatorium perfoliatum*
Butterfly weed—*Asclepias tuberosa*
Cardinal flower—*Lobelia cardinalis*
Early goldenrod—*Solidago bicolor*
Golden alexander—*Zizia aurea*
Joe-pye weed—*Eupatorium purpureum*
New England aster—*Aster novae-angliae*
New York ironweed—*Veronia novaborescensis*
Obedient plant—*Physostegia virginiana*
Ox-eye—Heliopsis helianthoides
Solomon's seal—*Polygonatum biflorum*
White snakeroot—*Eupatorium rugosum*

Grasses and Grass-like plants

Big bluestem—*Andropogon gerardii*
Bottle brush grass—*Elymus hystrix*
Canada wild rye—*Elymus canadensis*
Path rush—*Juncus tenuis*
Purple-top—*Tridens flavus*
Soft rush—*Juncus effusus*
Switch-grass—*Panicum virgatum*
Virginia wild rye—*Elymus virginicus*

Ferns

Christmas fern—*Polystichum acrostichoides*
Hay-scented fern—*Dennstaedtia punctilobula*
Rattlesnake fern—*Botrychium virginianum*
Sensitive fern—*Onoclea sensibilis*

Shrubs

Gray dogwood—*Cornus racemosa*
Highbush blueberry—*Vaccinium corymbosm*
Mountain laurel—*Kalmia latifolia**
Ninebark—*Physocarpus opulifolius*
Pasture rose—*Rosa carolina*
Red osier dogwood—*Cornus sericea*
Spicebush—*Lindera benzoin*
Sweet pepperbush—*Clethra alnifolia*

*Pennsylvania's state flower

When purchasing plants, pay close attention to the scientific names to ensure the correct species are selected.

Wildflower Meadow

Wildflower meadows present excellent opportunities for stormwater management, promoting groundwater infiltration, water quality treatment, and even flood control. Also, when using native plants in a meadow you are not only providing an aesthetically pleasing landscape, but preserving native species and biodiversity, and creating habitat for wildlife. Meadows allow you to spend less time mowing, less time applying fertilizers and lawn chemicals, and less time watering in the summer months. This low maintenance structure helps protect our nearby local streams from pollutants and other chemicals, in addition to flooding conditions, thereby helping to protect the Delaware and Schuylkill Rivers, the source of our drinking water in Philadelphia.

Creating a Wildflower Meadow

Step 1. Site Selection: First, you need to choose a suitable location, preferably an open sunny site that gets at least six hours of sun every day. It should have good air movement. This helps keep diseases down, and the movement caused by wind will make plants sturdier, and stems stronger. The site should have few weeds. An already cultivated site such as a field or garden plot is ideal. A lawn can work too. The hardest is an overgrown garden bed, or old field full of aggressive weeds and grasses. A site next to such an area to transform is also difficult, due to weed seeds blowing in. A site next to a formal landscape may also be a hard sell. In such formal areas, an informal transition area may be necessary.

Step 2. Plant Selection: Plant selection is important for long bloom, as noted already, but more importantly for species that will last under your conditions. Soil type is not as important as whether the site is dry or moist. A dry site is best. The key is to have a diversity of species, as found in nature, with a mix of graminoides (grasses and grass-like plants) and forbs (flowering meadow wildflowers). If you don't create your own mixture, buy a good quality seed mix from a reputable supplier. When it comes to these seeds, you truly get what you pay for. Inexpensive mixes often contain mainly annuals which are gone after the first year, contain non-native species, seeds that have poor germination, potential weedy species, or just a lot of seed debris. Another consideration under species selection, whether you buy a mix or make your own mixture, is whether you want a short term (1 to 5 years) or longer term meadow. In the former you may have more annuals for color up front, but keep in mind that they may be out competed with weeds after a few years. A long term meadow may have mainly perennials which may take several years to begin a good display, but will last and out compete many weeds.

Wildflower Meadow

The number of plants of any one type will depend on how you will be viewing the meadow. If seeing it from a distance, you'll want to use larger numbers of each plant type, and place them in sweeping masses. If creating a small area, or one viewed at close range, you may have few of any one type plant, and have them all mixed.

Step 3. Site Preparation: This is the step often overlooked, yet the key to success or failure. Since these wildflowers are usually less competitive than weeds, the site should contain no weeds or weed seeds. Unless the site has been cultivated already, with few to no weeds, there are several methods you may use.

You may smother vegetation with black plastic for a whole growing season. You may also smother existing growth with thick layers of leaves, grass clippings, or newspapers. Another method is to plant a summer buckwheat crop, cut and tilled in before going to seed, followed by fall planting of winter wheat, cut and tilled in late winter. You may need to repeat this a second season. Or you may repeat deep soil tillage every three weeks for a full growing season. If it's a lawn with no weeds, remove the sod using a sod-cutter that can be rented from equipment rental firms. Many use a systemic herbicide, but avoid those that are residual (last in the soil).

Step 4. Sowing or Planting: You may sow in spring or early summer, which favors grasses over the forbs. Keep the spring-sown meadow watered as you would a newly seeded lawn, often for a month or two. Sowing in early fall favors the forbs, as some grass seeds rot then. Since many seeds will either not germinate until the following spring, or germinate and not grow until then, you should also use annual rye as a winter cover crop with fall sowings. Avoid sowing in mid to late summer when there may be droughts or seeds drying out before germinating. For sowing, aim for about 80 seeds per square foot. In several years this will result in one or two plants in this space. Of this number per square foot, for spring sowing use about 60 forb and 20 grass seeds. This is about 9 lbs. and 3 lbs. per acre. For fall sowing, use a higher proportion of grass seeds.

For small areas (for instance under 1000 square feet), consider using already-germinated small plants you can buy in trays as "plugs." These are more costly than seeds, but will establish more quickly. You can find these at specialty suppliers, either local, mail-order, or online.

Step 5. Post-planting management: In the first two years, seeds of annual and biennial weeds still in the soil or blown in will grow faster than your perennial wildflowers. Don't allow such weeds the first year to get above one foot tall before cutting back to four to six inches high. The wildflowers will, for the most part, remain short and below this height. The second year, cut back to about one foot high since plants will be larger. A weed or string trimmer works well for this. Don't pull weeds, as this may also disturb wildflower seedlings. Don't use herbicides as these may drift, killing large patches of both weeds and wildflowers!

In the third and future years, mow it close to the ground. This should be done in late fall or early spring, removing the debris from mowing. This exposes the soil to the rapid warmth from the sun in spring, encouraging your wildflowers over cool-season weeds. Learn your wildflowers, and over the years you can selectively weed out any weeds or woody plant seedlings.

Dry Well

Please read the Disclaimer on the inside cover, if you are interested in installing this project.

Materials

- Measuring tape
- Shovel
- Saw
- Wheelbarrow
- Vinyl downspout elbow to fit your downspout (typically 3 in. or 4 in.)
- Landscape non-woven geotextile fabric
  - Make sure the fabric is porous enough to allow water to pass through it.
- Crushed stone
  - Use stone that is approximately 1–1½ in. diameter.
  - Wash the stone to make sure that it is clean. You can use a sieve to remove fine material if the stone seems to have a lot of small particles.
  - It is important that the stone is washed (no dust or particles) and that the stone is uniformly the same size.
  - The stone does not have to be very large; it just has to be roughly of a similar size to get the maximum amount of void space in the stone while maintaining the structure of the well.

Dry wells are small, excavated pits, filled with stone or gravel that temporarily stores stormwater runoff until it infiltrates (soaks) into the surrounding soil. The stormwater can come straight off of the roof of your house via a downspout that either indirectly or directly connects to the dry well. It can travel indirectly to the dry well through a grassy swale or it can travel directly into the well through a pipe. This design guide describes how you can disconnect your downspout to a swale and dry well that is sized based on the included sizing table (noted below). Dry wells help protect our rivers and streams in combined and separate sewered areas. They help add capacity to Philadelphia's sewer system during heavy rainfalls by helping prevent the stormwater runoff from reaching the system and instead allowing the runoff to soak into the surrounding soil. In separate sewered areas, the impact of stormwater runoff on neighborhood streams, is reduced. By infiltrating the stormwater runoff on land, the combined (sewage and stormwater) sewer overflows into the Delaware and Schuylkill Rivers are reduced, thereby decreasing pollution in our streams, lessening flooding impacts and improving water quality in our rivers, our drinking water source. Dry wells also recharge groundwater through infiltration, which leads to more flow in streams during dry weather (when it is not raining) and less streambank erosion during wet weather (when it is raining).

Building a Dry Well

Site Preparation

- Conduct an Infiltration Test (see pages 24–25) to determine if your soil conditions are suitable for a dry well.
- Make sure buried electrical, telephone, and TV cables and gas piping are not going to be a problem in the area that you will be digging your dry well. If you don't know where they are located, call PA One Call at 1-800-242-1776 at least three days before you dig.
- Install leaf guards to prevent leaves and other plant material from entering the downspout and clogging the dry well.
- Determine the size of the well. Read through the Dry Well Sizing section of this fact sheet.
- Determine the volume of crushed stone you will need.
  Volume of Stone = Dry Well Area x 1½ feet
  For example: 33 square feet x 1½ feet = 49.5 cubic feet of stone.

Dry Well

Dry Well Sizing

- Refer to the sizing table. Decide what size storm you would like to store and infiltrate in your dry well. Find the closest number in Column A. About one-third of storms in the Philadelphia area are 0.25 inches or less, 60% are 0.5 inches or less, and 85% are 1.0 inch or less.
- Estimate the roof area draining to the dry well (length [ft.] x width [ft.] = area in square feet). Find the closest value in Column B for the storm depth you have chosen. At this point, you have narrowed your choice down to just one line of the table.
- Find the area required for your dry well in Column D. When you multiply your dry well length and width, the resulting number (area) needs to be at least as great as the number in Column D. Columns E and F show examples of lengths and widths that will work.
- Determine whether your yard and budget will allow you to build a dry well of this size with a safe overflow. If not, choose a smaller storm and repeat the steps. Storing a larger storm provides a greater benefit, but also requires more space and costs more. Storing even the smallest storm in the table will provide benefits.
- **The dry well should have a safe overflow**, such as an overflow to your yard drain. In larger storms, your dry well will fill up, and you need to make sure that the overflow doesn't damage your property or your neighbors' properties. Keep in mind that the yard drain has to be slightly downhill from the dry well.
- **The dry well should be at least 10 feet from your house** and any other buildings that are level with yours. It should be at least 25 feet from buildings that are downhill from the dry well.

Example

Storm Depth =
0.5 inches (Lines 4-6, Column A)

Roof Area =
250 square feet (Line 5, Column B)

Dry Well Area =
19 square feet (Line 5, Column D)

Possible Dimensions:
7 feet long by 3 feet wide =
21 square feet
(Line 5, Columns E and F)

4 feet long by 5 feet wide =
20 square feet

6 feet long by 3.5 feet wide =
21 square feet

	A Storm Depth (in.)	B Roof Area Draining to Dry Well (sq. ft.)	Dry Well Dimensions			
			C Depth (ft.)	D Area (sq. ft.)	E Example Length (ft.)	F Example Width (ft.)
1	0.25	100	1.5	3.8	2	3
2	0.25	250	1.5	9.4	4	3
3	0.25	500	1.5	19	7	3
4	0.5	100	1.5	7.5	3	3
5	0.5	250	1.5	19	7	3
6	0.5	500	1.5	38	13	3
7	1.0	100	1.5	15.1	6	3
8	1.0	250	1.5	38	13	3
9	1.0	500	1.5	75	26	3

Dry Well

Step 1. Modify your downspout. Cut your existing downspout close to the ground using a saw so that a vinyl downspout elbow can fit over the disconnected downspout (usually 3 or 4 inches). The elbow should aim the stormwater runoff into the swale

Step 2. Dig a swale—a small channel or ditch starting from the point below the disconnected downspout to the dry well location. The swale should be just a few inches deep and wide. The swale should slope downward from the downspout to the dry well. The runoff draining from the disconnected downspout through the swale should drain readily toward the dry well.

Step 3. After preparing the site and determining the size of your well, shape the well, using the Dry Well Sizing Table.

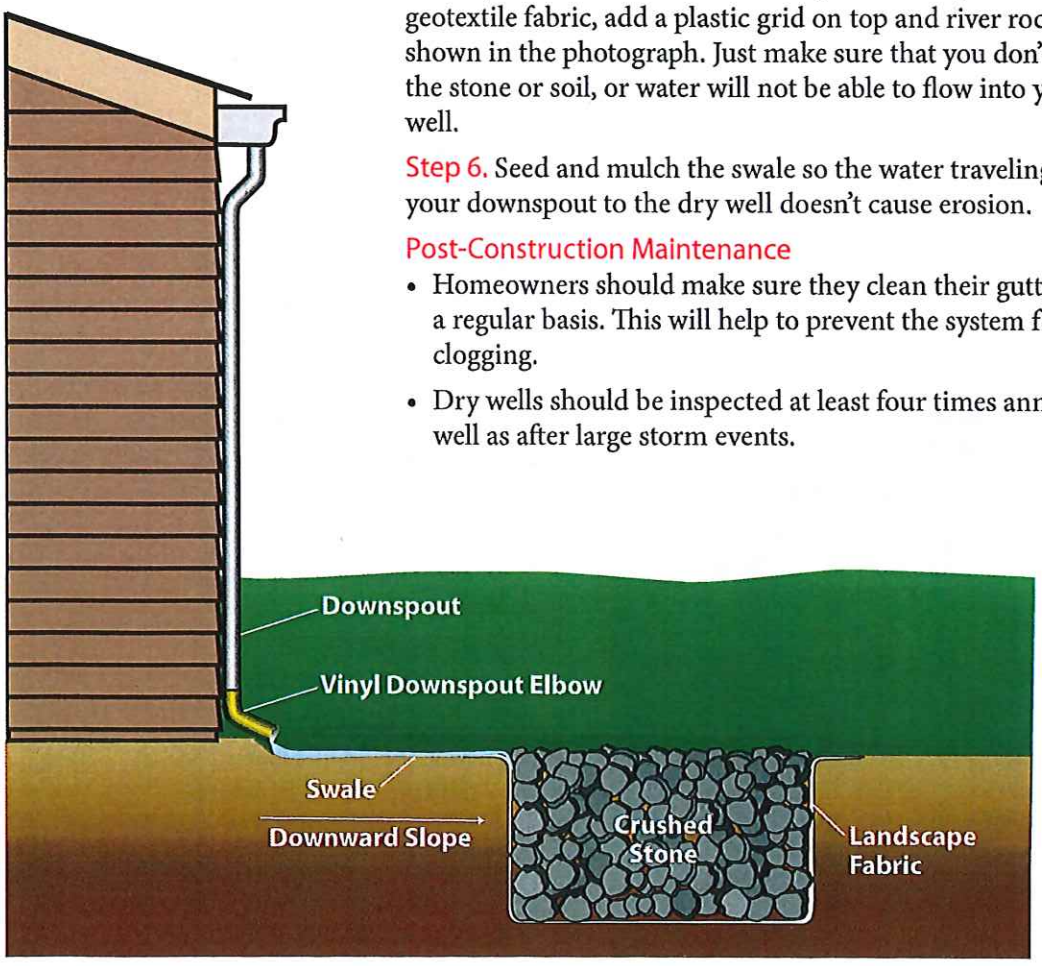
Step 4. Line the well with landscape fabric (non-woven geotextile fabric or filter cloth). Make sure it is porous enough to allow water to pass through it. Also, excess fabric should be folded over the edges of the well. The fabric prevents surrounding soil from getting into the system and clogging it up.

Step 5. Fill the well with the crushed stone. You can either a) fill the well with stones all of the way to the top until flush with the surrounding soil, b) fill the well with stones just a few inches from the top of the well, add a layer of geotextile fabric and backfill over the well with soil to plant in it (make sure the layer of fabric is between the stone and soil), or c) fill the well with stones just a few inches from the top of the well, add a layer of geotextile fabric, add a plastic grid on top and river rocks, as shown in the photograph. Just make sure that you don't mound the stone or soil, or water will not be able to flow into your dry well.

Step 6. Seed and mulch the swale so the water traveling from your downspout to the dry well doesn't cause erosion.

Post-Construction Maintenance

- Homeowners should make sure they clean their gutters on a regular basis. This will help to prevent the system from clogging.
- Dry wells should be inspected at least four times annually as well as after large storm events.



Infiltration Test

It is important that water infiltrate well even during saturated conditions. Conduct your infiltration test after a rain storm.

An infiltration test will help you determine if the soil on your property is suitable for certain types of stormwater management measures, such as a dry well or rain garden. An infiltration test measures how quickly water can soak in and flow through the soil. It is important to know how your soil infiltrates water before building a dry well, rain garden or any other stormwater management structure.

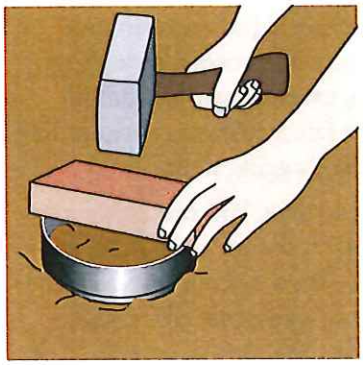
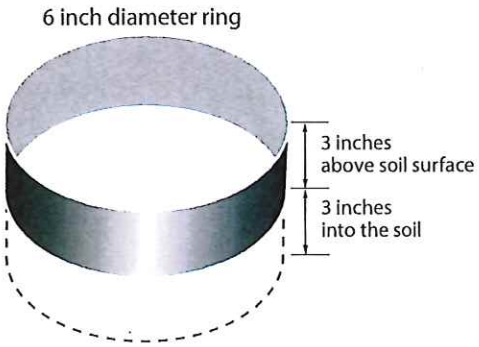


Figure 1
Using the hand sledge and block of wood, drive the 6 inch diameter ring, beveled edge down, to a depth of three inches.

Materials

- 6 inch diameter ring
- Hand sledge and wood block
- Plastic wrap
- 500 mL plastic bottle or graduated cylinder
- Water
- Stopwatch or timer
- Pen and paper



Step 1. Drive Ring into Soil:

- Clear the sampling area of surface residue, etc. If the site is covered with vegetation, trim it as close to the soil surface as possible.
- Using the hand sledge and block of wood, drive the 6 inch diameter ring, beveled edge down, to a depth of three inches (see Figure 1).
- If the soil contains rock fragments, and the ring cannot be inserted to the depth, gently push the ring into the soil until it hits a rock fragment.

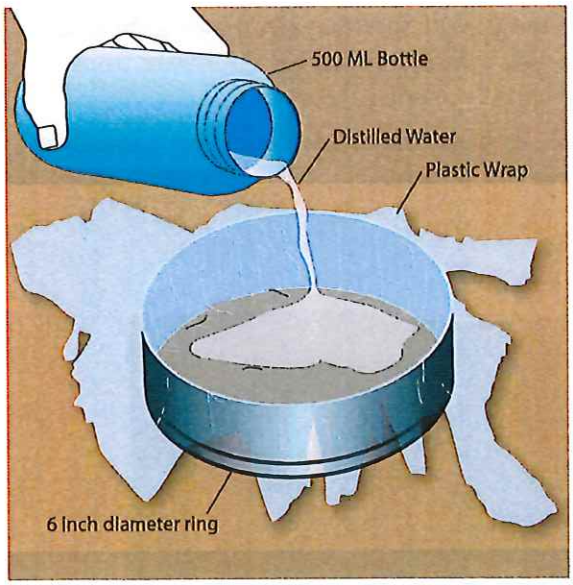


Figure 2
Pour the 444 mL of water (1 inch of water) into the ring lined with plastic wrap.

Step 2. Firm Soil:

- With the 6 inch diameter ring in place, use your finger to gently firm the soil surface only around the inside edges of the ring to prevent extra seepage. Minimize disturbance to the rest of the soil surface inside the ring.

Step 3. Line Ring with Plastic Wrap:

- Line the soil surface inside the ring with a sheet of plastic wrap to completely cover the soil and ring as shown in Figure 2. This procedure prevents disturbance to the soil surface when adding water.

Infiltration Test

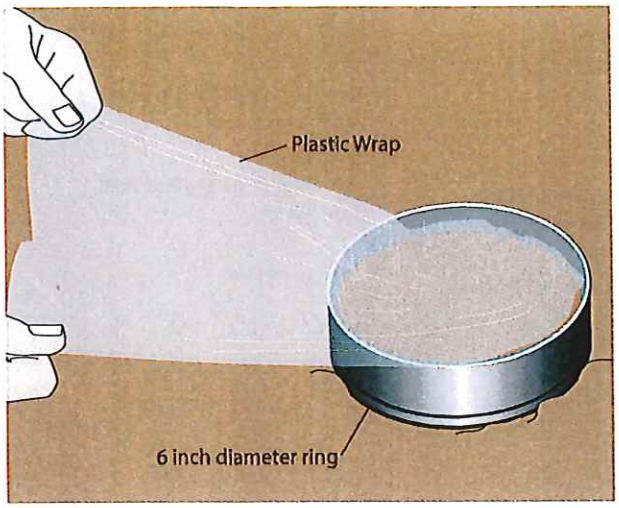


Figure 3
Remove the plastic wrap by gently pulling it out, leaving the water in the ring.

Step 4. Add Water:

- Fill the plastic bottle or graduated cylinder to the 444 mL (1 inch) mark with water. Pour the 444 mL of water (1 inch of water) into the ring lined with plastic wrap as shown in Figure 2.

Step 5. Remove Wrap and Record Time:

- Remove the plastic wrap by gently pulling it out, leaving the water in the ring (Figure 3). Note the time. Record the amount of time (in minutes) it takes for the 1 inch of water to infiltrate the soil. Stop timing when the surface is just glistening. If the soil surface is uneven inside the ring, count the time until half of the surface is exposed and just glistening. Record the time.

Step 6. Repeat Infiltration Test:

- In the same ring, perform Steps 3, 4, & 5 with a second inch of water. Record the number of minutes elapsed for the second infiltration measurement. Repeat the test (Steps 3, 4, & 5) a few more times. All of the tests should be conducted consecutively. If the test continues to yield the same results, you will have a good idea of the saturated infiltration rate. If the soil infiltrates the water under 1 hour, your soil is ready for a dry well, rain garden or any of the other structural projects in this manual.

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Washington State Puget Sound Action Team

Lawn & Garden Care
Washington State Puget Sound Action Team

Pet Waste
Washington State Puget Sound Action Team

Vehicle Washing
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Tree Planting
page 8 – TreeVitalize

Backyard Stream
NAM Planning & Design

Winter De-Icing
Chuck Leonard

Planter Boxes
Multiple planters – Miriam Manon
Single planter – Clint Bautz

Rain Barrels
page 15 – Three Rivers Wet Weather Demonstration Program
page 16 – Michael Pickel

Rain Gardens
page 19-20 – Roger Bannerman, Wisconsin Department of Natural Resources

Creating a Wildflower Meadow
Robin Sasek, CDM

Dry Wells
Wissahickon Valley Watershed Association

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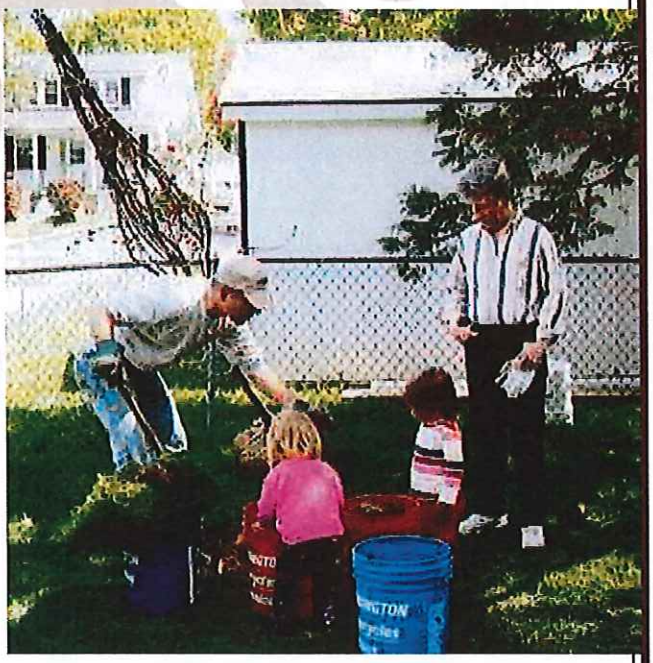
TreeVitalize

A partnership to restore tree cover in Southeast PA



To stop your rain from going down the drain, plant more trees. Trees catch rainfall on leaves, branches and trunks. A single London Plane tree will intercept over 130 gallons during a minor (1/4 inch) rainstorm.

Plus, trees help conserve water.

For more info on TreeVitalize planting projects, Tree Tender education classes and homeowner rebates go to **www.treevitalize.net.**

TreeVitalize Partners

TreeVitalize
A partnership to restore tree cover in Southeast PA

The Pennsylvania Horticultural Society
Philadelphia Green

AQUA Pennsylvania

DCNR

DEP

Eagles

Fairmount Park
Philadelphia's Park System

Morris Arboretum of the University of Pennsylvania

PECO

PLNA
Pennsylvania Landscape & Nursery Association

Penn State
College of Agricultural Sciences

Forest Service
U.S. Department of Agriculture

William Penn Foundation

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After the Storm

A Citizen's Guide to Understanding Stormwater

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

EPA 833-B-03-002
January 2003

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

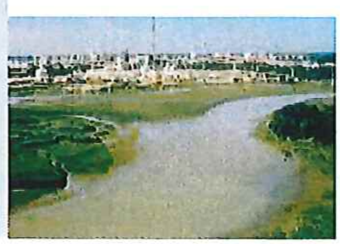
Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.

- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.



- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential

Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

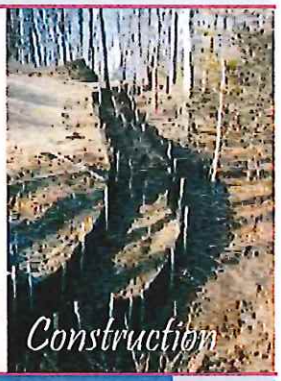
Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.

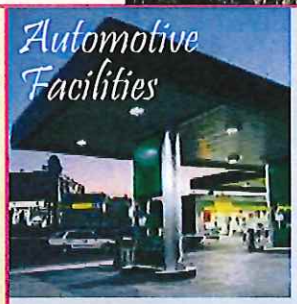


Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

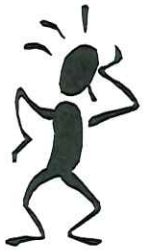
- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

What is HHW?

HHW--household hazardous wastes--are hazardous in nature.

But because these wastes are produced in limited quantities by households*, they are not regulated as hazardous under federal and state laws.

Each person in Pennsylvania generates an average of four pounds of HHW each year. HHW includes old paint and paint-related products, pesticides, pool chemicals, drain cleaners, degreasers, car care products and other common household products.



If carelessly managed, HHW can create environmental and public health hazards.

*Households include multiple residences, hotels, motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds and day-use recreation areas.

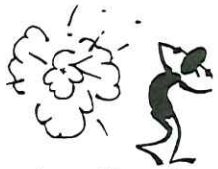
How can I identify HHW?

Generally, HHW materials belong to one of the following hazardous waste categories:

CORROSIVES. Examples are drain cleaners, rust removers and oven cleaners. Corrosives have an extremely low or high pH and can burn skin and mucous membranes. Labels usually state, *"CORROSIVE—AVOID CONTACT WITH SKIN OR EYES."*

FLAMMABLES. Examples include gasoline, kerosene, fuel oil, butane, oil-based paints and paint thinners. Labels usually say, *"EXTREMELY FLAMMABLE—KEEP AWAY FROM ANY SOURCE OF IGNITION"* and *"HIGHLY FLAMMABLE—KEEP AWAY FROM FLAMES."*

TOXIC MATERIALS. Examples are benzene, cyanide compounds (found in rat fumigants), thallium sulfate (ant traps) and carbon tetrachloride (old fire extinguishers). Materials may be carcinogenic. Labels often contain the skull and crossbones and usually state, *"DANGER/POISON"* or *"WARNING—KEEP OUT OF REACH OF CHILDREN."*



OXIDIZERS. These chemicals react strongly with other compounds and may cause fires or explosions. Examples include chlorinated pool chemicals, sodium hypochlorite and various peroxides. Labels usually say, *"WARNING—STRONG OXIDIZER."*

AIR QUALITY HAZARDS could cause excessive emissions or toxic ash problems at resource recovery facilities or incinerators. Examples include thermostats, paints that contain more than one percent by weight of heavy metals, products that contain significant amounts of volatile organic compounds (VOCs), and batteries—nickel, cadmium, lithium and lead acid.

WILDLIFE HAZARDS. Examples include old chlorinated pesticides such as DDT, chlordane, dieldrin, heptachlor, etc. Labels usually indicate the material presents a hazard to fish or wildlife. The material may be immediately toxic or accumulate in various tissues of the fish or animals. Of particular concern are those materials that are slow to degrade and tend to bio-accumulate.

UNKNOWNS. Unidentified materials—such as those that contain no label or ingredient information—should be treated as though they belong to one of the above categories until proven otherwise.

What can YOU do about HHW?

1. The best way to manage HHW is to **avoid creating it.** Select the least toxic product to do the job. Buy only as much as you need.

2. Is the product still usable? **Give it away.** A friend, neighbor, or community group such as Little League or Habitat for Humanity may be able to use it.

3. If the product isn't usable, or you can't give it away, take it to your community's **HHW collection program.**

4. Do you have used motor oil or used oil filters? Take them to a **used oil collection site.**

5. **Take spent lead acid batteries back to the place where you bought them.** State law requires dealers to accept old batteries when you buy new ones.

6. If your community doesn't have an HHW collection program, or if you must throw the material away before the next collection, you may put it in your regular trash, **PROVIDED:**

   a. You have complied with any disposal instructions on the label.

   b. There are no free-standing liquids. If water-based, allow the liquid to evaporate. If not water-based, absorb the liquid into vermiculite, cat litter, saw dust or other absorbent material.

   c. You have carefully packaged any residue to prevent leakage while the material is being transported to a disposal facility.

   d. You have only a small quantity. Divide larger quantities and dispose of them over several collection periods.

Commonwealth of Pennsylvania
Dept. of Environmental Protection

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www.state.pa.us or directly at
www.dep.state.pa.us

Tom Ridge, Governor James M. Seif, Secretary

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HOUSEHOLD HAZARDOUS WASTE (HHW)

What can YOU do about it?

As stormwater flows over driveways, lawns, and sidewalks, it picks up debris, chemicals, dirt, and other pollutants. Stormwater can flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water. Polluted runoff is the nation's greatest threat to clean water.

By practicing healthy household habits, homeowners can keep common pollutants like pesticides, pet waste, grass clippings, and automotive fluids off the ground and out of stormwater. Adopt these healthy household habits and help protect lakes, streams, rivers, wetlands, and coastal waters. Remember to share the habits with your neighbors!

Healthy Household Habits for Clean Water

Vehicle and Garage

- Use a commercial car wash or wash your car on a lawn or other unpaved surface to minimize the amount of dirty, soapy water flowing into the storm drain and eventually into your local waterbody.

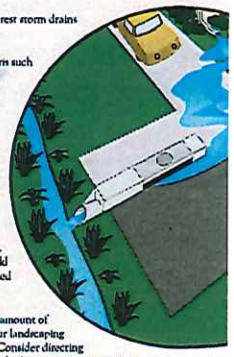
- Check your car, boat, motorcycle, and other machinery and equipment for leaks and spills. Make repairs as soon as possible. Clean up spilled fluids with an absorbent material like kitty litter or sand, and don't rinse the spills into a nearby storm drain. Remember to properly dispose of the absorbent material.
- Recycle used oil and other automotive fluids at participating service stations. Don't dump these chemicals down the storm drain or dispose of them in your trash.

Lawn and Garden

- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Avoid application if the forecast calls for rain; otherwise, chemicals will be washed into your local stream.
- Select native plants and grasses that are drought- and pest-resistant. Native plants require less water, fertilizer, and pesticides.
- Sweep up yard debris, rather than hosing down areas. Compost or recycle yard waste when possible.
- Don't overwater your lawn. Water during the cool times of the day, and don't let water run off into the storm drain.
- Cover piles of dirt and mulch being used in landscaping projects to prevent these pollutants from blowing or washing off your yard and into local waterbodies. Vegetate bare spots in your yard to prevent soil erosion.

Home Repair and Improvement

- Before beginning an outdoor project, locate the nearest storm drains and protect them from debris and other materials.
- Sweep up and properly dispose of construction debris such as concrete and mortar.
- Use hazardous substances like paints, solvents, and cleaners in the smallest amounts possible, and follow the directions on the label. Clean up spills immediately, and dispose of the waste safely. Store substances properly to avoid leaks and spills.
- Purchase and use nontoxic, biodegradable, recycled, and recyclable products whenever possible.
- Clean paint brushes in a sink, not outdoors. Filter and reuse paint thinner when using oil-based paints. Properly dispose of excess paints through a household hazardous waste collection program, or donate unused paint to local organizations.
- Reduce the amount of paved area and increase the amount of vegetated area in your yard. Use native plants in your landscaping to reduce the need for watering during dry periods. Consider directing downspouts away from paved surfaces onto lawns and other measures to increase infiltration and reduce polluted runoff.



Pet Care

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Swimming Pool and Spa

- Drain your swimming pool only when a test kit does not detect chlorine levels.
- Whenever possible, drain your pool or spa into the sanitary sewer system.
- Properly store pool and spa chemicals to prevent leaks and spills, preferably in a covered area to avoid exposure to stormwater.

Septic System Use and Maintenance

- Have your septic system inspected by a professional at least every 3 years, and have the septic tank pumped as necessary (usually every 3 to 5 years).
- Care for the septic system drainfield by not driving or parking vehicles on it. Plant only grass over and near the drainfield to avoid damage from roots.
- Flush responsibly. Flushing household chemicals like paint, pesticides, oil, and antifreeze can destroy the biological treatment taking place in the system. Other items, such as diapers, paper towels, and cat litter, can clog the septic system and potentially damage components.

Storm drains connect to waterbodies!

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Remember: Only rain down the drain!

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Make your home

The

SOLUTION TO STORMWATER POLLUTION!

A homeowner's guide to healthy habits for clean water

EPA United States Environmental Protection Agency

Why use rain barrels?

They irrigate your lawn and garden

During the summer months it is estimated that nearly 40 percent of household water is used for lawn and garden maintenance. A rain barrel collects water and stores it for those times that you need it most — during the dry summer months. Using rain barrels potentially helps homeowners lower water bills, while also improving the vitality of plants, flowers, trees, and lawns.

Rain is naturally soft and devoid of minerals, chlorine, fluoride, and other harmful chemicals. The chemicals and hard water from many of our municipal water systems can add to chemical imbalances in soil and damage sensitive plants. Water collected from the roofs of houses picks up very little contamination, and is very healthy for plant life.

Conserve water with rain barrels

What is a rain barrel?

A rain barrel is a container that collects and stores rainwater from downspouts and rooftops for future use watering lawns and gardens. Generally a rain barrel is made using a 55-gallon drum, a vinyl garden hose, PVC couplings, a screen grate to remove debris and keep insects out, and other materials found at most hardware stores.

Rain barrels can be constructed in a number of ways, but they all serve the same purpose — to collect rainwater and decrease the amount of stormwater runoff that leaves your property. Using rain barrels is one way to decrease your household's impact on local waterways and to become a good steward of the local watershed.

For more information, visit
www.marc.org/Environment/Water

Use native plants to increase water infiltration and decrease time consuming maintenance

A wonderful way to complement your rain barrel and increase your property's ability to absorb runoff is through a rain garden. Rain gardens can be a fun and easy way to learn about beautiful native plants and also help to improve water quality and reduce flooding. Rain gardens typically absorb 30 percent more water than the same size area of lawn, they are drought resistant, and are less prone to destructive insects and diseases. Rain gardens create a preferred habitat for birds, butterflies and dragonflies. These specialty gardens are versatile — they can be any size or shape, but to maximize their benefit, they should be built in an existing low spot or near the drainage area of a rain barrel. Please refer to the "How to Build Your Own Rain Garden" brochure for more information at www.marc.org/Environment/Water.

www.marc.org/Environment/Water

MARC

Mid-America Regional Council

Why use rain barrels?

They redirect water from your roof to your lawn or garden

The average rainfall of one inch within a 24-hour period can produce more than 700 gallons of water that runs off the roof of a typical house. Much of this water runs from gutters onto surfaces that do not allow water to soak into the ground. These are called ***impervious surfaces*** and include concrete, asphalt, and compacted soil. Even commonly used sod has a very low infiltration rate and can be a major cause of increased runoff.

As it flows, runoff collects and transports soil, pet waste, salt, pesticides, fertilizer, oil and grease, litter and other pollutants. This water drains directly into nearby creeks, streams and rivers, without receiving treatment at sewage plants.

Polluted stormwater contaminates local waterways. It can harm plants, fish and wildlife, while degrading the quality of water.

Build your own Rain Barrel

Tools

- 7/8" spade drill bit
- Electric jigsaw
- Electric drill
- Utility knife
- Marker

Cutting the top hole

Supplies

1 - 55-gallon plastic barrel
2 - ¾" plastic faucets
1 - ¾" female coupling
1 - Skimmer basket like those found in garden ponds and pools
1 - Roll of teflon tape
1 - All purpose caulk or plumbing sealant
1 - 5-ft. section of garden hose
4 - Hose couplers
1 - 12" x 12" piece of fiberglass window screen

Hose and Coupler

Skimmer Basket

55-Gallon Barrel

Top hole

- Use basket to trace template on barrel
- Pre-drill small hole using 1" spade bit
- Make sure to drill inside the line
- Use a jigsaw to cut out hole using the inside line as a guide

Trace a hole for the basket

Basket

- Cut fiberglass window screen to fit basket
- Affix screen to lip of basket using caulk/plumbing sealant
- Allow several hours to dry and place in top hole

Cover basket with screen

Lower drain

- Mark holes at least two inches from bottom of barrel
- Use 1" drill bit to drill hole
- Screw plastic faucet into hole
- Use utility knife, as needed, to increase hole size
- Remove faucet, wrap threads in tape, caulk threads, replace faucet
- Caulk area where faucet and barrel meet to ensure no leakage

Lower Drain

Upper drain

- Mark holes at least two inches from top of barrel
- Use 1" drill bit to drill hole
- Screw plastic faucet into hole
- Use utility knife as needed to alter hole
- Wrap ¾" coupling threads in Teflon tape and caulk and screw onto faucet inside the barrel

Upper Drain/Overflow Valve

Hoses

- Cut 2' section of hose
- Push each end of hose into a hose coupler and tighten screws
- Screw 3' section onto top outflow faucet and 2" section to bottom faucet

Final Steps

- Build a base to elevate the rain barrel
- Adjust downspout to flow into rain barrel
- Always keep overflow valve open

Finished rain barrel at work

Tips for using your rain barrel

- Cover the top basket with screen, and make sure that all other openings are secured to ***prevent mosquitoes and other disease-carrying insects from entering the barrel***
- Elevate your rain barrel with cinder blocks, railroad ties or decorative stones to increase pressure and flow
- Make sure your barrel is clean and free of chemicals before using
- Disconnect the barrel from downspout during winter months to avoid the formation of damaging ice
- Paint or decorate your rain barrel to make it a distinct part of your yard or garden
- During severe storms it may be necessary to open both valves to prevent overflow.

Finding a 55-barrel

For help locating a 55-gallon barrel for constructing a rain barrel, e-mail **rainbarrels@marc.org**, call MARC Water Resources at 816/474-4240, or visit **www.marc.org/Environment/Water.**

Prefabricated rain barrels can be found at some local lawn and garden stores, and on the Internet.

MARC
Mid-America Regional Council

For more information, please visit www.marc.org/Environment/Water, or call 816/474-4240.

Forming a Resident Action Group

In RainReady℠ communities, better water management means that homes, schools, and businesses are prepared for rain—whether too much or too little. RainReady programs keep residences secure and dry, services running, and rivers and lakes clean.

When faced with wet basements, cracking building foundations, or polluted beaches, residents often find themselves alone, not realizing that these problems may impact many members of their community. If you're in this situation, you may want to set up a Resident Action Group composed of local residents interested in addressing these issues.

NEED HELP SETTING UP A RESIDENT ACTION GROUP?

RAINREADY CAN PROVIDE ADVICE
INFO@RAINREADY.ORG

By enabling residents to document and vocalize problems, discuss causes and solutions, and engage with government and nonprofit entities, Resident Action Groups are an essential tool for helping communities become RainReady.

START BY HOSTING A MEETING

Resident Action Groups consist of local residents who seek solutions to their shared problems at a community level. While all members of the wider community should be encouraged to contribute ideas and materials to the campaign, it's helpful to maintain a small group of core members. Reach out to neighbors and acquaintances and invite them to your house, or another informal space, to discuss the issues and see who might contribute their time.

DEVELOP A MISSION

Resident Action Groups should articulate a clear set of initial goals, whether reducing basement flooding, preventing sewer overflows, or minimizing water wastage in the community. These goals can change over time as necessary, but having a clear mission helps the group communicate clearly with other organizations and agencies. Your group may want to choose a memorable name for itself, as this will help publicize its efforts more effectively. Clarity and tactful humor often work well when selecting names.

AGREE ON A STRUCTURE

Members should agree on an organizational structure (or lack thereof) that helps it best accomplish its mission. There are many potential roles. A chairperson could lead meetings and act as an ambassador for the group. A publicity expert might manage the group's social media page(s) or spearhead efforts to contact local politicians. "Watchers" can be tasked with documenting problems in the community and reporting them back to the group. Residents with strong computer skills may be useful for helping record and map these problems.

HOLD MEETINGS

Informal spaces, such as centrally located homes or garages, work well as meeting places. These sessions can take many forms, but they might be used to discuss options for addressing water problems, brainstorm ways to reach out to politicians and government agencies, or delegate related tasks.

CREATE A VISUAL PORTFOLIO

Photos, videos, maps, and incident records are useful ways of communicating with agencies and politicians. Photos and videos are both informative and emotionally resonant, even when they are just snapped

with a phone. These media should be consolidated in a visible place. A Facebook page can be useful as a tool for gathering up-to-the-minute information about water issues directly from community members.

DEVELOP A PUBLIC PRESENCE

A communal Facebook page can also be a jumping-off point for another important task: publicizing the goals and efforts of the action group. Local news agencies can be very helpful for increasing the visibility of grassroots organizing, so you might consider offering them your group's story. Also, there are likely to be local community organizations that can offer resources or guidance. Introduce them to your Resident Action Group and its mission! Spreading awareness among both knowledgeable professionals and general community members can be a huge step toward solving community water issues.

PRESENT YOUR CASE TO OFFICIALS

By documenting your problems and publicizing your mission, your concerns will start to get attention.

Your next step might be to call an open meeting and invite several government agencies and politicians to attend it. At this meeting, members of your group can present your case, showing them the problems you have documented and explaining what efforts have and have not worked thus far. Request the assistance you believe they could provide your community. Remember to stay polite at all times, and keep in mind the various constraints acting on any politician or agency (usually funding).

Although clear decisions might appear not emerge immediately, your Resident Action Group's efforts will continue to snowball toward effective solutions.

CASE STUDY: Midlothian, IL

Midlothian is a small town located in the South Suburbs of Chicago. Although the town has suffered from occasional flooding for many decades, residents noticed that the episodes have quickly become more frequent and more severe in recent years. Even small rain events produce flooded homes, garages, yards, and streets, which are not only distressing but also cost community members thousands of dollars in damage.

After a particularly severe flood in 2013, five hard-hit families banded together as the "Floodlothian 5." They began to meet regularly in one member's garage, and they set up a Facebook page where members of the community post can post various updates and links.

Midlothian's Resident Action Group has been extremely successful in publicizing their mission and building relationships with different organizations, agencies, and politicians. They have spoken at innumerable public hearings and discussions, been featured in many videos and newspaper articles, and made significant progress in appealing to influential state agencies for assistance. Although the town's problems have not disappeared, the efforts of its Resident Action Group have helped put Midlothian on the path to becoming RainReady.

We are grateful to the National Flood Forum for helpful guidance in creating this factsheet.

DOES YOUR COMMUNITY HAVE A RAINREADY PLAN? LEARN MORE AT **WWW.RAINREADY.ORG**

Document revised October 2014

Seven Techniques for Capturing Rainwater on Your Property

In RainReady℠ communities, better water management means that homes, schools, and businesses are prepared for rain—whether too much or too little. RainReady programs keep residences secure and dry, services running, and rivers and lakes clean.

There are many actions that you can take as a homeowner to manage water more effectively on your property. The seven improvements outlined in this factsheet can reduce the chance of flooding, protect your building's foundation, and reduce runoff that contributes to pollution. They will also conserve water resources, attract wildlife, and beautify your property.

Before making improvements to your yard, you'll need to understand how water currently moves or collects on your property. You can then use this information to help determine an effective and affordable suite of improvements. By creating a more RainReady property, you are protecting yourself and helping your community at the same time.

THE PROBLEMS

There may be several water management issues you are seeking to address:

TOO MUCH WATER: Conventional lawns and paved surfaces have a limited ability to absorb water, so they are inadequate for draining water during major rain events. Excess water can flood your building, submerge your yard, or pool against your foundation and cause serious structural problems. Excess water can also flood the properties of your neighbors, or it can become runoff that delivers pollutants from your property to nearby bodies of water.

TOO LITTLE WATER: In times of water shortage, dry soil around your home can cause foundation cracking and instability, and it can even cause sinkholes to develop on your property. Because lawns have limited capacity for absorbing water, they need to be continually watered and thus contribute to the depletion of scarce freshwater resources in your region.

POLLUTED WATER: As rainwater runs off your yard onto nearby streets and sidewalks, it picks up pollutants such as gasoline, oil, road salt, fertilizer, commercial and industrial waste, and other debris. Instead of filtering into the soil, the polluted water flows into nearby bodies of water, overloaded storm sewers, or developed properties.

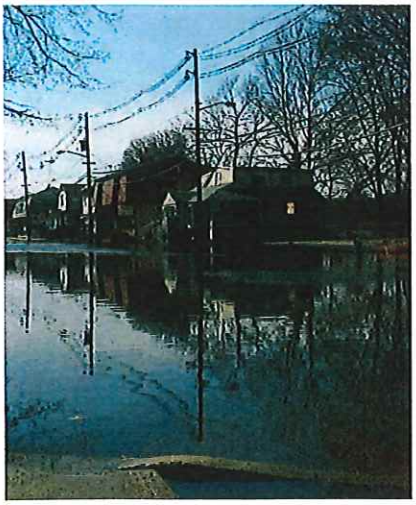


Photo credit: Gardening in a Minute, Flickr Creative Commons

Photo credit: ankraut, Flickr Creative Commons

THE SOLUTIONS

Yard improvements in your community can reduce these problems by slowing the flow of stormwater, filtering out pollutants, and allowing water to percolate into the soil below. We've outlined seven approaches that you and your neighbors can use to capture rainwater in your yards. These improvements will be most effective if they are coordinated carefully with one another. To accomplish this at a neighborhood scale, encourage your municipality to set up a grant program and Rain Fund. See our corresponding factsheets for further information.


Photo credit: CNT

RAIN GARDEN: This is a shallow, heavily vegetated basin that captures stormwater with highly absorbent soil (such as compost) that filters out chemicals, heavy metals, and sediments. Rain gardens should be planted with native, deep-rooted plants, since these allow for easier infiltration of treated water into the soil, require less irrigation, offer greater resilience to drought, and provide a suitable habitat for local wildlife. Property owners can build rain gardens on their own or enlist the help of a specialist.


Photo credit: ckeech, Flickr Creative Commons

SWALE: This is a vegetated, shallowly sloped channel that slows and treats stormwater runoff on your property. Like a rain garden, a swale contains soils and plants that filter pollutants from the stormwater it captures, have minimal watering requirements, and attract local wildlife. Unlike a rain garden, a swale's primary function is to slow and treat water as it continues to flow to an existing stream, rain garden, infiltration drain, or dry well. Be mindful of the water's destination, as you don't want to create new problems for yourself or your neighbors.


Photo credit: Eileen O'Shea, Flickr Creative Commons

FRENCH DRAIN: This is a slightly sloped underground trench that is filled with rocks or gravel in order to move rainwater away from a building. Modern French drains are often laid with a perforated pipe near the bottom in order to maximize how fast they can convey water. The rocks or gravel can reach the surface and simply appear as a landscaping element, or they can be covered with a highly permeable layer of soil and vegetation. French drains can lead to a dry well, rain garden, stream, or other area.


Photo credit: drywellguy, Flickr Creative Commons

DRY WELL: This is an underground chamber that can hold both rainwater and groundwater while they dissipate into the soil. A dry well can receive water from a grass lawn, swale, rain garden, or other areas through a surface drain. It can also receive water from a sump pump, foundation drain, or gutter downspout through an underground pipe. A simple version of a dry well can consist of a pit filled with gravel or other debris, while a more advanced version can consist of a perforated tank that is buried and surrounded with gravel.

Photo credit: roger_mommaerts, Flickr Creative Commons

RAIN BARREL: This is a plastic or wooden container connected to your gutter downspout that collects rainwater to be used for irrigating your property. A rain barrel keeps rainwater away from your building foundation, acts as a measure of insurance against water shortage on your property, and also conserves regional water resources. A rain barrel has an overflow port, which should either lead to a secondary barrel or channel water away from your building to a rain garden, swale, dry well, or other permeable area.

Photo credit: CNT

PERMEABLE PAVING: This is a type of paving system that allows water to infiltrate the soil below instead of collecting on the surface as runoff. These paving systems consist of a porous surface material—such as special pervious concrete, asphalt, or interlocking pavers—installed atop rock and sediment layers that are designed to absorb water, filter out contaminants, and let the water percolate into the soil. Permeable paving systems are frequently installed in parking lots and low-speed streets, but they are also very effective as driveways, patios, and walkways on residential properties, as they reduce how much gasoline, oil, fertilizer, pet waste, and other debris leaves you property as runoff.

Photo credit: CNT

GREEN ROOF: This is a building roof covered with vegetation that absorbs and treats rainwater while also offering numerous other benefits. The vegetation sits atop a set of carefully engineered layers that supports plant growth, filters out pollutants from rainwater, and waterproofs the building. Although green roofs are more expensive to install than standard roofs, they offer long-term financial and social benefits, including reduced costs for building insulation, increased urban agricultural space, improved air quality, reduced air temperatures, improved wildlife habitat, and increased property value.

DOES YOUR COMMUNITY HAVE A RAINREADY PLAN? LEARN MORE AT **WWW.RAINREADY.ORG**

Document revised October 2014

CNT

Making Your Yard RainReady

In RainReady℠ communities, better water management means that homes, schools, and businesses are prepared for rain. RainReady programs keep residences secure and dry, services running, and rivers and lakes clean.

Your yard offers many quick and affordable opportunities to manage flooding, soil erosion, and pollution. You may need an expert to assess the problems and recommend customized solutions, particularly in the case of flooding, since there may be multiple issues affecting your property simultaneously.

RETAINING WATER ONSITE:

By capturing the rain that runs off your yard or roof, you can reduce the risk of it being siphoned into your home or the homes of your neighbors. Onsite retention also reduces the need for irrigation and the impact of drought, and many improvements can attract wildlife.

There are several ways to capture rainwater, such as rain gardens, swales, dry wells, and permeable paving. Rain gardens, for example, can receive the runoff from your downspout. They are also attractive, easy to build, and good for wildlife when planted with native vegetation. Traditional lawns, in contrast, are poor at capturing rain, since they act more like impervious surfaces.

In order to capture as much runoff as possible, make sure that your retention site is at least five or six feet away from your building foundation and that it is located at a low point in your yard. You can also use a French drain to transport runoff from the building to your retention site.

Rain barrels and cisterns are also useful for capturing rain that can be used to water plants. Because of their relatively small capacity, you may need to empty them after each rain event.

PLANT AND LAWN CARE:

Photo credit: Joy Stewart

Although they are the standard in many places, single-species grass lawns (often composed of Bermuda or Rye grass) are poor for water management. Because of their large surface areas and limited ability to absorb water, conventional lawns act like impervious surfaces and contribute to flooding. Lawns are also susceptible to drought, demand regular watering, mowing, and weeding, and require fertilizers and herbicides that pollute rivers and streams.

Plants that are native to your area are better adapted to the local climate than non-native plants, so they are also better able to handle flooding or water scarcity. Additionally, native plants are typically more attractive to wildlife, better at preventing soil erosion, and contribute to less pollution than traditional lawns.

In drought-prone areas, xeriscaping offers an alternative to conventional landscaping. Xeriscaping is landscaping and gardening that reduces or eliminates the need for supplemental water from irrigation. You can employ this technique by limiting turf areas, irrigating efficiently, using mulches, and selecting native, zone-appropriate plants based on the regional climate.

RE-GRADING AND SEALING:

If you find that runoff is pooling against the side of your house, re-grade the land so that water drains away from it. Make sure that sidewalks, patios, decks, and driveways haven't shifted over time, as such movement can cause water to drain toward your home. A rule of thumb for grading is that land should slope downward one inch per horizontal foot for at least six feet from your house.

Photo credit: UrbanGrammar, Flickr Creative Commons

If the concrete near your house does not slope away from your house, you can either replace it or "mudjack" it. This process involves pumping a mixture of "mud" underneath the settling slab in order to lift and stabilize it. The injected mixture of water, soil, sand, and cement will cure to create a solid, stable fill.

Seal any cracks with waterproofing compounds to prevent water from entering the foundation. If there is a risk of water entering your home through window wells, you may need to cement the windows, raise them, or buy window well covers.

REMOVING DRAINAGE BLOCKS:

Most homes are designed so that stormwater can flow away from the building towards common drainage areas near the lot line. Water should either flow to a drainage ditch or storm sewer in the front yard, or a drainage area in the back yard. Make sure that this flow of water isn't blocked by sheds, fences, or other structures—either on your property or that of your neighbors. Remove wood piles or mulch from drainage areas, since they float and can block inlets and sewers. Also make sure that the grates on your street are clear of any debris.

GUTTERS AND DOWNSPOUTS:

The water from your gutters can overwhelm sewer systems and increase the risk of flooding in a neighborhood. If the downspouts from your gutters are connected to the sewer system, have them disconnected and extended at least five feet away from the foundation of your home with an elongated pipe. This is one of the quickest and most cost-effective ways to reduce the risks of flooding caused by basement and sewer backups.

Photo credit: scottie32, Flickr Creative Commons

WALLS AND BARRIERS:

When water flows to a low entry point like a basement stairwell or patio door, constructing a low wall or re-grading the land around this point can keep water away. If the water level does not recede within a few hours, an internal drainage system with a pump may be needed to handle seepage.

Artificial barriers like floodwalls can effectively repel water from properties affected by overland flooding. A floodwall can surround an entire structure or protect individual openings, such as doors, windows, and basements. In some shallow flooding areas, a simple floodwall can effectively protect a vulnerable portion of the structure, but maintenance of the barrier is required to address settling or cracking that will occur over time.

IS YOUR COMMUNITY RAINREADY? LEARN MORE AT **WWW.CNT.ORG/RAINREADY**

Document revised August 2019

EPA
United States
Environmental Protection
Agency

EPA 841-F-03-003

Protecting Water Quality *from* URBAN RUNOFF

Clean Water Is Everybody's Business

In urban and suburban areas, much of the land surface is covered by buildings and pavement, which do not allow rain and snowmelt to soak into the ground. Instead, most developed areas rely on storm drains to carry large amounts of runoff from roofs and paved areas to nearby waterways. The stormwater runoff carries pollutants such as oil, dirt, chemicals, and lawn fertilizers directly to streams and rivers, where they seriously harm water quality. To protect surface water quality and groundwater resources, development should be designed and built to minimize increases in runoff.

The most recent National Water Quality Inventory reports that runoff from urbanized areas is the leading source of water quality impairments to surveyed estuaries and the third-largest source of impairments to surveyed lakes.

Did you know that because of impervious surfaces like pavement and rooftops, a typical city block generates more than 5 times more runoff than a woodland area of the same size?

How Urbanized Areas Affect Water Quality

Increased Runoff

The porous and varied terrain of natural landscapes like forests, wetlands, and grasslands traps rainwater and snowmelt and allows them to filter slowly into the ground. In contrast, impervious (nonporous) surfaces like roads, parking lots, and rooftops prevent rain and snowmelt from infiltrating, or soaking, into the ground. Most of the rainfall and snowmelt remains above the surface, where it runs off rapidly in unnaturally large amounts.

Storm sewer systems concentrate runoff into smooth, straight conduits. This runoff gathers speed and erosional power as it travels underground. When this runoff leaves the storm drains and empties into a stream, its excessive volume and power blast out streambanks, damaging streamside vegetation and wiping out aquatic habitat. These increased storm flows carry sediment loads from construction sites and other denuded surfaces and eroded streambanks. They often carry higher water temperatures from streets, roof tops, and parking lots, which are harmful to the health and reproduction of aquatic life.

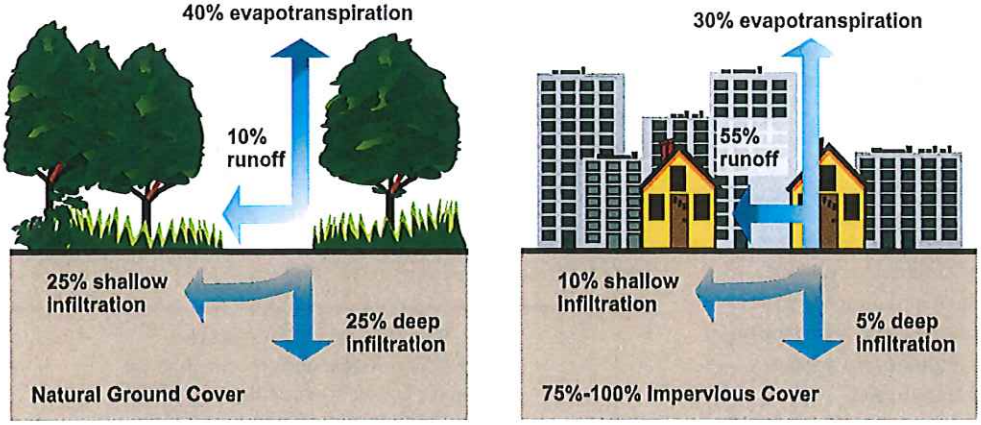
The loss of infiltration from urbanization may also cause profound groundwater changes. Although urbanization leads to great increases in flooding during and immediately after wet weather, in many instances it results in lower stream flows during dry weather. Many native fish and other aquatic life cannot survive when these conditions prevail.

Increased Pollutant Loads

Urbanization increases the variety and amount of pollutants carried into streams, rivers, and lakes. The pollutants include:

- Sediment
- Oil, grease, and toxic chemicals from motor vehicles
- Pesticides and nutrients from lawns and gardens
- Viruses, bacteria, and nutrients from pet waste and failing septic systems
- Road salts
- Heavy metals from roof shingles, motor vehicles, and other sources
- Thermal pollution from dark impervious surfaces such as streets and rooftops

These pollutants can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe and unpleasant.



Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface ruunoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

Managing Urban Runoff

What Homeowners Can Do

To decrease polluted runoff from paved surfaces, households can develop alternatives to areas traditionally covered by impervious surfaces. Porous pavement materials are available for driveways and sidewalks, and native vegetation and mulch can replace high maintenance grass lawns. Homeowners can use fertilizers sparingly and sweep driveways, sidewalks, and roads instead of using a hose. Instead of disposing of yard waste, they can use the materials to start a compost pile. And homeowners can learn to use Integrated Pest Management (IPM) to reduce dependence on harmful pesticides.

In addition, households can prevent polluted runoff by picking up after pets and using, storing, and disposing of chemicals properly. Drivers should check their cars for leaks and recycle their motor oil and antifreeze when these fluids are changed. Drivers can also avoid impacts from car wash runoff (e.g., detergents, grime, etc.) by using car wash facilities that do not generate runoff. Households served by septic systems should have them professionally inspected and pumped every 3 to 5 years. They should also practice water conservation measures to extend the life of their septic systems.

Controlling Impacts from New Development

Developers and city planners should attempt to control the volume of runoff from new development by using low impact development, structural controls, and pollution prevention strategies. Low impact development includes measures that conserve natural areas (particularly sensitive hydrologic areas like riparian buffers and infiltrable soils); reduce development impacts; and reduce site runoff rates by maximizing surface roughness, infiltration opportunities, and flow paths.

Controlling Impacts from Existing Development

Controlling runoff from existing urban areas is often more costly than controlling runoff from new developments. Economic efficiencies are often realized through approaches that target "hot spots" of runoff pollution or have multiple benefits, such as high-efficiency street sweeping (which addresses aesthetics, road safety, and water quality). Urban planners and others responsible for managing urban and suburban areas can first identify and implement pollution prevention strategies and examine source control opportunities. They should seek out priority pollutant reduction opportunities, then protect natural areas that help control runoff, and finally begin ecological restoration and retrofit activities to clean up degraded water bodies. Local governments are encouraged to take lead roles in public education efforts through public signage, storm drain marking, pollution prevention outreach campaigns, and partnerships with citizen groups and businesses. Citizens can help prioritize the clean-up strategies, volunteer to become involved in restoration efforts, and mark storm drains with approved "don't dump" messages.

Related Publications

Turn Your Home into a Stormwater Pollution Solution!
www.epa.gov/nps

This web site links to an EPA homeowner's guide to healthy habits for clean water that provides tips for better vehicle and garage care, lawn and garden techniques, home improvement, pet care, and more.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas
www.epa.gov/owow/nps/urbanmm

This technical guidance and reference document is useful to local, state, and tribal managers in implementing management programs for polluted runoff. Contains information on the best available, economically achievable means of reducing pollution of surface waters and groundwater from urban areas.

Onsite Wastewater Treatment System Resources
www.epa.gov/owm/onsite

This web site contains the latest brochures and other resources from EPA for managing onsite wastewater treatment systems (OWTS) such as conventional septic systems and alternative decentralized systems. These resources provide basic information to help individual homeowners, as well as detailed, up-to-date technical guidance of interest to local and state health departments.

Low Impact Development Center
www.lowimpactdevelopment.org

This center provides information on protecting the environment and water resources through integrated site design techniques that are intended to replicate preexisting hydrologic site conditions.

Stormwater Manager's Resource Center (SMRC)
www.stormwatercenter.net

Created and maintained by the Center for Watershed Protection, this resource center is designed specifically for stormwater practitioners, local government officials, and others that need technical assistance on stormwater management issues.

Strategies: Community Responses to Runoff Pollution
www.nrdc.org/water/pollution/storm/stoinx.asp

The Natural Resources Defense Council developed this interactive web document to explore some of the most effective strategies that communities are using around the nation to control urban runoff pollution. The document is also available in print form and as an interactive CD-ROM.

For More Information

U.S. Environmental Protection Agency
Nonpoint Source Control Branch (4503T)
1200 Pennsylvania Avenue, NW
Washington, DC 20460
www.epa.gov/nps

February 2003

Public Presentation at the Upper Southampton Board of Supervisors for the MS4 Permit Application

September 8, 2020

By: Tri-State Engineers and land Surveyors, Inc.

Upper Southampton Township

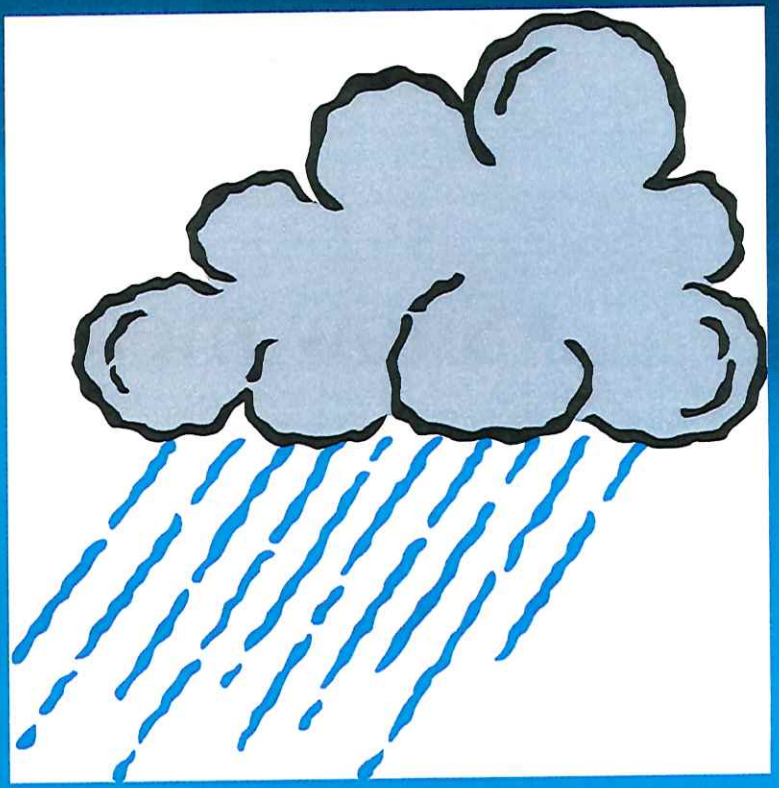
MS4 Permitting

- Pennsylvania Municipalities are required to renew their MS4 permits.
- Upper Southampton permit NPDES Permit No.: PAG 130029 was effective on March 13, 2013 for a period of 5 years
- It expired on March 13, 2018
- A renewal was submitted September 14, 2017
- Comments received from PADEP January 24, 2020

What Is MS4?

Municipal Separate Stormwater Sewer System (MS4) Program

The goal is to reduce pollutants into the Stormwater System going to streams and lakes.



What is Storm Water?

- Rain events
- Snow melt
- Other surface runoff and drainage

Storm Water Pollutants

- Sediment
- Nutrients
- Bacteria
- Oxygen Demand
- Oil and Grease
- Trace Metals
- Toxic Chemicals
- Chlorides
- Thermal Impacts

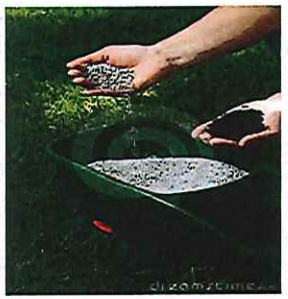
Where Does It All Go

- In developed (urban) areas, it normally goes into the stormwater inlets and pipes
- The stormwater system flows may flow into basins - some seeps into the ground
  - Basin maybe retention, detention or filtration
- In non-urban areas, stormwater flows overland or into roadside swales.
- In all cases, along the way, it picks up pollutants (sediment, nutrients, oils, etc. with final discharge into rivers, streams, lakes, ponds or groundwater

Why is Storm Water a Problem?

- Problem 1: Sediment and Nutrients
- Cause: Surface runoff, fertilizer, pet waste, etc.





- Problem 2: Non-storm water discharges enter systems
- Cause: Illicit discharges
- Cause: Illicit connections

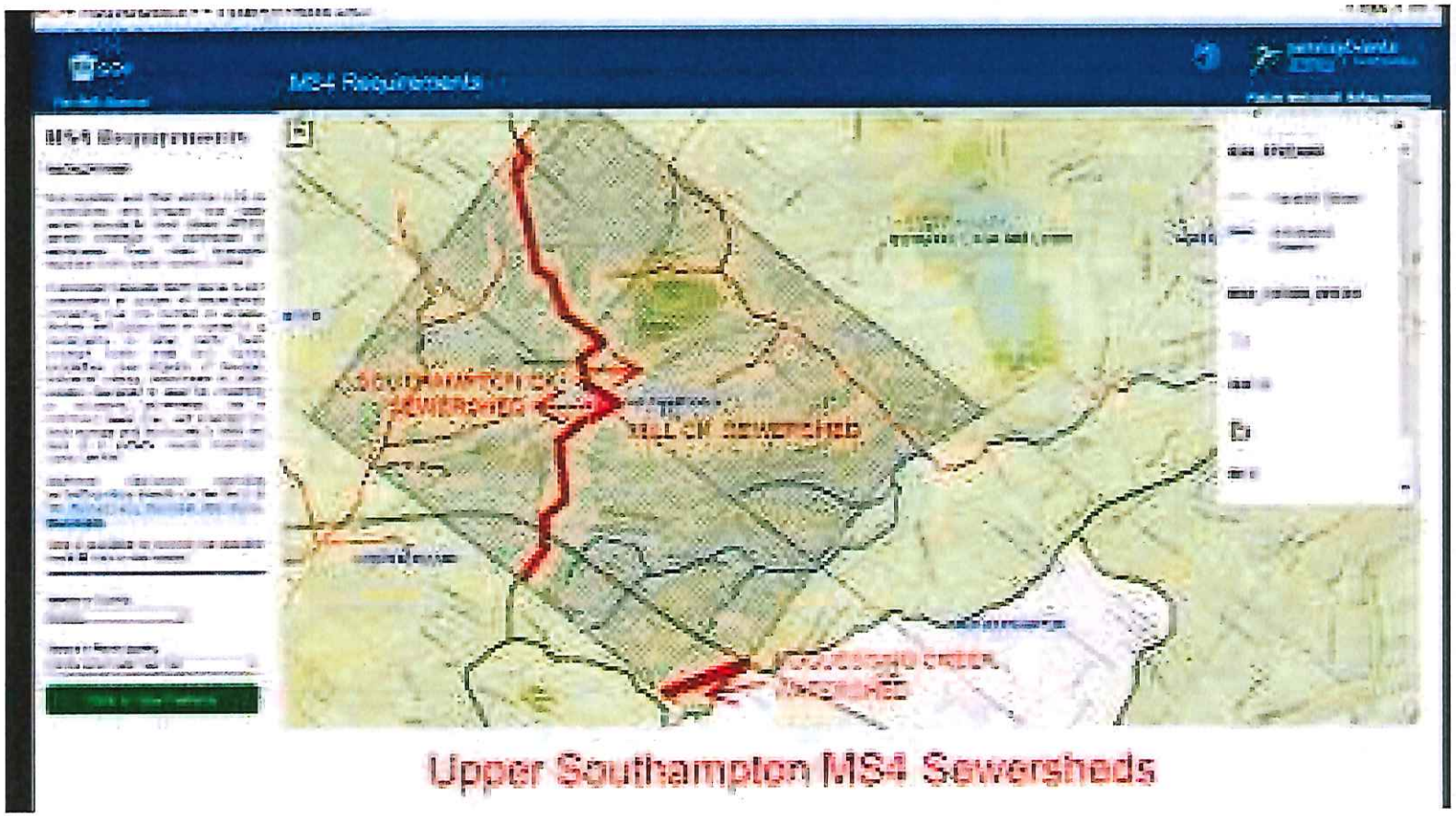
Where Does Storm Water Go In Our Upper Southampton?

- Travels over land
- Carried through municipal separate storm sewer system (MS4)
- The Township is divided into 2 watersheds as the stormwater discharges into the Mill Creek, Southampton Creek
- Portions of these creeks have been determined by PADEP to be impaired

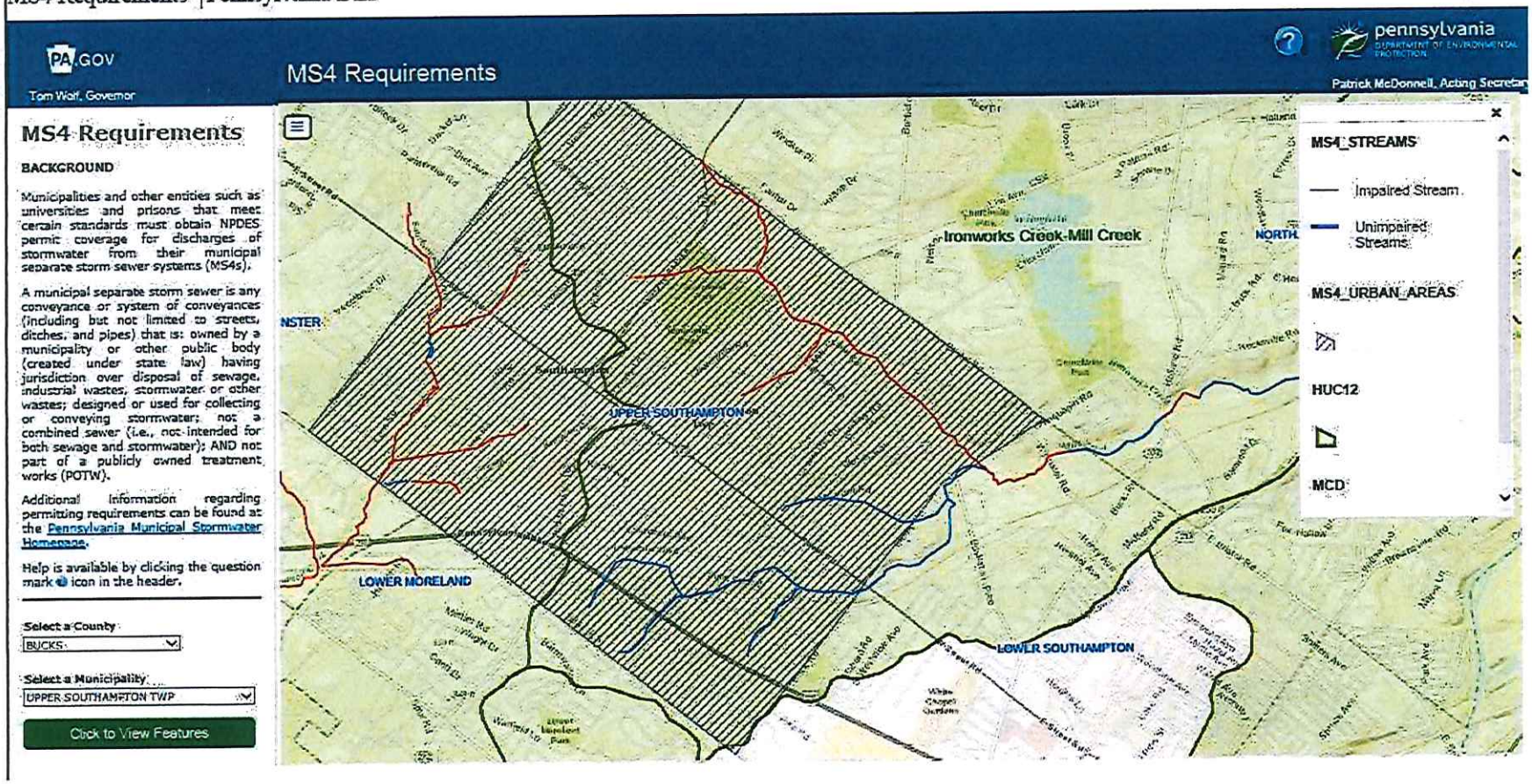
Impaired Stream New Permit Requirements . .

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Bucks County						
UPPER SOUTHAMPTON TWP	PAG130029	Yes	TMDL Plan	Southampton Creek TMDL	TMDL Plan-Nutrients, Organic Enrichment/Low D.O., Siltation (4a)	
				Unnamed Tributaries to Neshaminy Creek		Water/Flow Variability (4c)
				Unnamed Tributaries to Southampton Creek	Appendix B-Pathogens (4a)	
				Southampton Creek		Flow Alterations, Other Habitat Alterations, Water/Flow Variability (4c)
				Mill Creek	Appendix E-Siltation (4a)	Other Habitat Alterations, Water/Flow Variability (4c)
				Pennypack Creek	Appendix E-Siltation (5)	Cause Unknown (5)
				Neshaminy Creek	Appendix E-Siltation (4a), Appendix B-Pathogens (5), Appendix E-Nutrients, Organic Enrichment/Low D.O. (5)	

Upper Southampton Watersheds



PADEP has identified several impaired streams in the Township



Pollution Reduction Plan (PRP)

- Sets efforts to remove 10% of the pollutants over the next 5 years
- PRP will focus only on impaired streams:
  - Southampton Creek
  - Mill Creek

The estimated amount of pollutants to be removed

(10% required over 5-years)

	WIKIWATERSHED AREAS								
	A	B	C	D	E	F	G	H	
	ID	ha	ACRES	S.F. IN TWP	ACRES IN TWP	% IN TWP	PARSED ACRES	NET ACRES	
	CALCS		B*2.47	From Mapping	D/43560	E/C	From Mapping	E-G	
	MILL CREEK WATERSHED								
	4851	245	605	13,755,203	316	52%	7.09	309	
	4852	54	132	1,408,043	32	24%	4.33	28	
	4853	422	1,042	39,746,126	912	88%	79.99	832	
	4854	754	1,862	69,794,326	1,602	86%	31.54	1,571	
	4855	198	489	7,750,517	178	36%	1.77	176	
	TOTALS		4,131	132,454,215	3,041	74%	124.72	2,916	
	SOUTHAMPTON CREEK WATERSHED								
	13036	1,020	2,519	53,476,620	1,228	49%	62	1,166	

	POLLUTANT LOADING CALCULATIONS								
	I	J	K	L	M	N	O	P	Q
ID	Total N (kg/ha)	Total N (lbs/ac)	Total P (kg/ha)	Total P (lbs/ac)	Total SS (kg/ha)	Total SS (lbs/ac)	TOTAL N (LBS)	TOTAL P (LBS)	TOTAL SS (LBS)
CALCS	Wikiwatershed	I*2.20432/2.47	Wikiwatershed	K*2.20432/2.47	Wikiwatershed	M*2.40462/2.47	J*H	L*H	N*H
	MILL CREEK WATERSHED								
4851	5.46	4.87	0.26	0.23	317	283	1,504	72	87,340
4852	6.91	6.17	0.33	0.29	548	489	173	8	13,693
4853	6.62	5.91	0.34	0.30	487	435	4,919	253	361,849
4854	5.82	5.19	0.25	0.22	199	178	8,159	350	278,990
4855	7.11	6.35	0.31	0.28	252	225	1,118	49	39,622
						TOTAL	15,873	732	781,493
						10% REMOVAL			78,149
	SOUTHAMPTON CREEK WATERSHED								
13036	7.03	6.28	1.30	1.16	503	449	7,318	1,356	523,834
					WLA (2008 REPORT)				288,119
					10% REMOVAL OF TOTAL LOAD				52,383

	STREAMBANK RESTORATION LENGTHS								
	MILL CREEK								680
	SOUTHMAPTON CREEK								456
	WIKIWATERSHED REMOVAL VALUE @			115	LBS/FT				
	UNIT CONVERSIONS								
	1 ha = 2.47 ac								
	1 kg = 2.20462 lbs								

Pollutant Removal Goals

- Based upon the previous the TSS removal to be achieved by any new BMP's, by the end of the next 5-years, is estimated at :
- Mill Creek –78,149 lbs/year
- Southampton Creek –52,383lbs/yr

Efficiency of BMP's For TSS Removal (not all are created equal)

- Infiltration Practices – 95%
- Filtering Practices – 80%
- Extended Detention Basins – 60%
- Wet Pond/Wetlands – 60%
- Bioretention/Rain Gardens – 55% to 90% (depends on soils)
- Permeable Paving – 55% to 85% (depends on soils)
- Storm Drain Cleaning – 50% to 80%
- Forest Buffers – 50%
- Tree Planting – 20%
- Dry Detention Basins – 10%
- Street Sweeping – 9%
- Streambank Restoration – 115 lbs/ft (both banks)/year

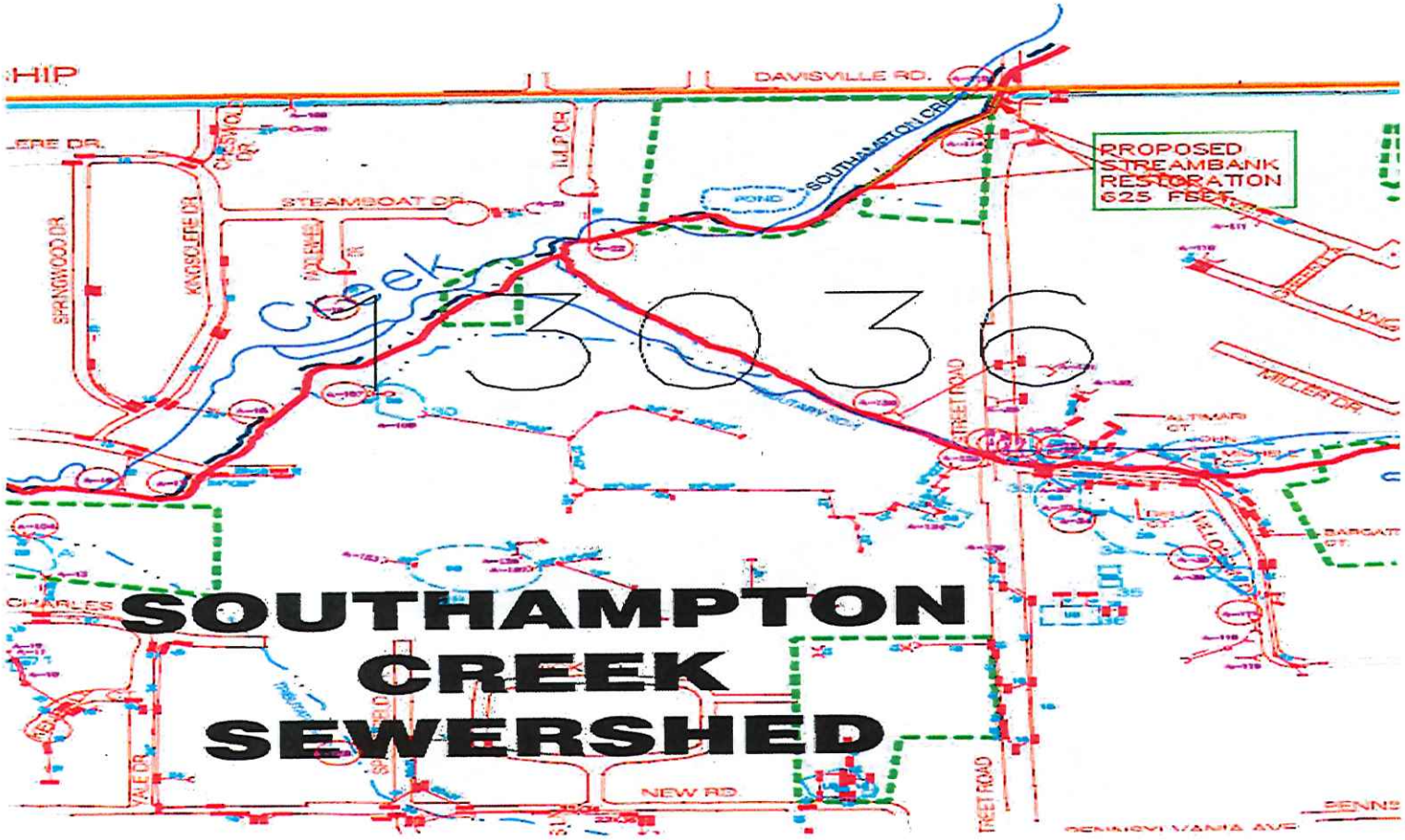
Storm Water Program

BMP's Considered

- Infiltration
- Filtering
- Stormwater Basins
- Bioretention/Rain Gardens
- Permeable Pavement
- Vegetative Buffers
- Forest Buffers
- Street Sweeping
- Streambank Stabilization

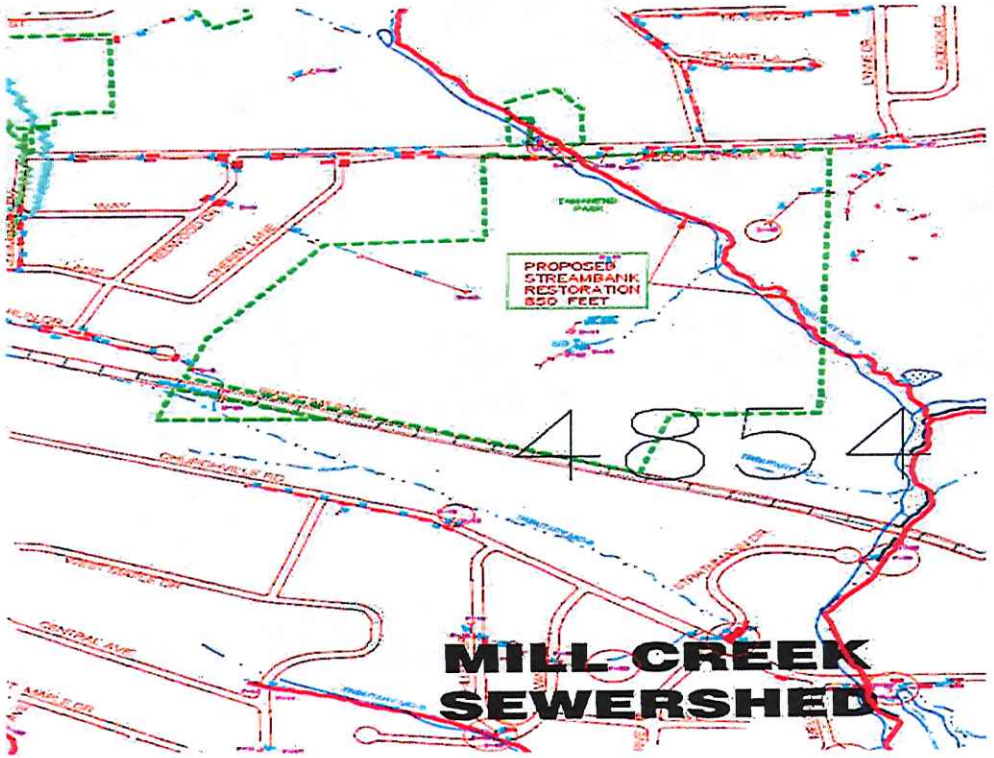
Streambank Stabilization was chosen for the initial 5-year permit period

Area for Southampton Creek



Southampton Creek

Area for Mill Creek (Tamanend Park)

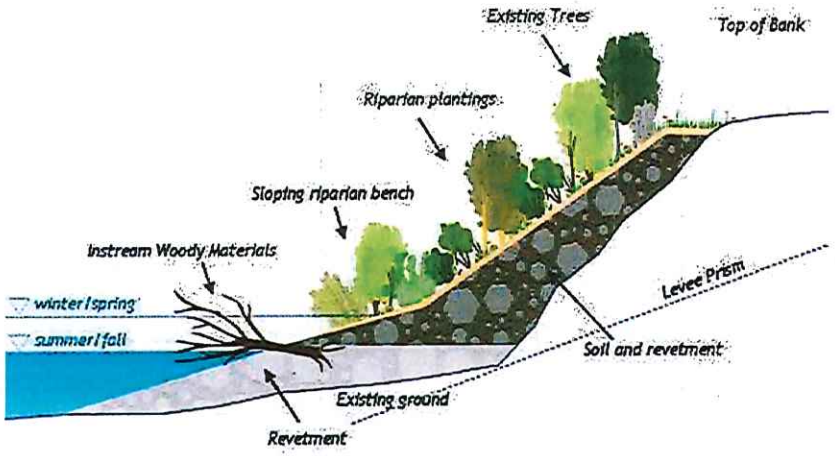


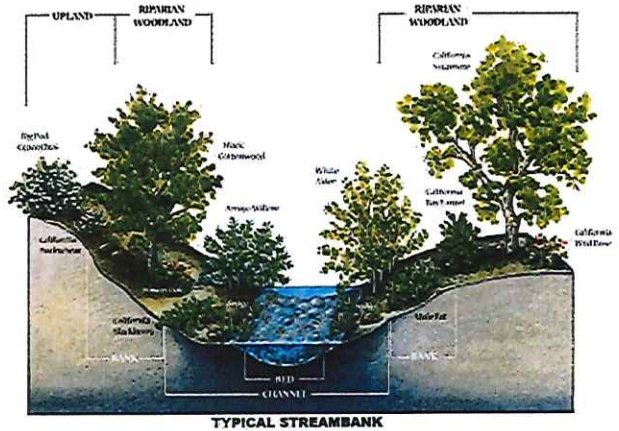
Mill Creek (at Tamanend Park)



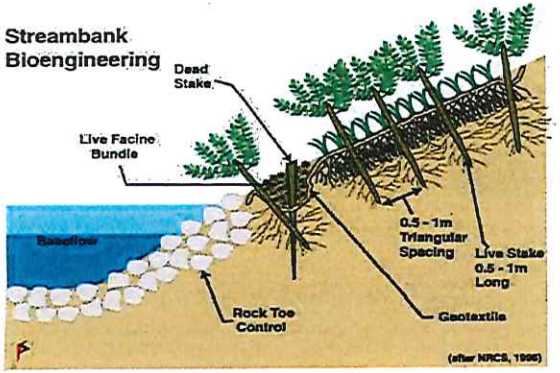


Restoration Methods





TYPICAL STREAMBANK SCENARIO 2



TYPICAL STREAMBNAK SCENARIO 3

What Steps Will Be Taken for this Permit period

- Township will investigate streambanks and drainage areas to determine which areas pose the greatest pollution potential and which areas can be stabilized and/or suitable for vegetative plantings to reduce TSS
- Township will evaluate the most cost effective method to achieve the 10% TSS reduction goal.

Estimated Costs

COST ESTIMATES FOR STREAMBANK RESTORATION					
	$/FOOT				
STREAMBANK RESTORATION	LOW	HIGH	FEET	LOW	HIGH
LAND STUDIES (2018)	$500	$700	1,136	$568,000	$795,200
CHESAPEAKE BAY (2015)	$150	$400	1,136	$170,400	$454,400
WATERSHED BREAKDOWN FOR STREAM RESTORATION					
USING LAND STUDIES COSTS					
SOUTHAMPTON CREEK	$500	$700	456	$228,000	$319,200
MILL CREEK	$500	$700	680	$340,000	$476,000

Questions?

- The public is encouraged to submit questions, in writing, by October 8, 2020, each will be addressed as far as possible.

- All questions will be included in the permit

TRI-STATE ENGINEERS AND LAND SURVEYORS, INC.
Civil Engineers ▪ Sanitary Engineers ▪ Municipal Engineers ▪ Land Surveyors ▪ Land Planners
801 W. Street Road Feasterville, Pennsylvania 19053
Telephone: 215-357-5950 Fax: 215-357-2836 Website: www.tse-ls.com

August 28, 2020

Harris Mahmud – Environmental engineering Specialist
PA Department of Environmental Protection
Southeast Regional Office
2 East Main Street
Norristown, PA 19401

Reference: NPDES Permit for Municipal Separate
Storm Sewer Systems (NPDES MS4)
Upper Southampton Township (PAG 130029)
TSE File No. 19-01004

Dear Mr. Mahmud:

Enclosed, please find the revisions to the NPDES MS4 Individual Permit renewal application for Upper Southampton Township, Bucks County addressing your comments of January 24, 2020. Included with the submittal are the revised Individual permit Application the Township's Pollution Prevention Plan (PRP) and TMDL for the Southampton Creek as specified in the Pennsylvania Department of Environmental Protection (PADEP) Municipal Separate Storm Sewer System (MS4) requirements for their 2018 permit renewal. I believe that the comments in your e-mail (attached) have been addressed as follows. Please note that we are submitting this revision for your preliminary review and comment prior to finalization in order to expedite processing of any additional comments you may have prior to final submission.

1. The General Permit Application has been revised and a list of outfalls to surface water along with maps showing the outfalls has be included. The original application indicated, as you said, only two (2) discharge points, which were those shown on the Pennsylvania eMap as 1091319 and 1091317. In all, there are 185 outfalls now listed in the inventory (attached) and shown on the attached maps as determined from our storm system mapping and field investigations.
2. As said in the above item, maps are included showing the 185 outfalls to surface water.
3. In the PRP, while the Southampton Creek has a TMDL for both sediment and nutrients, per the PADEP, permittees may propose a presumptive approach in which a 10% sediment reduction is assumed to also result in a 5% TP and 3% TN reduction. As such nutrient reductions are assumed to occur with the corresponding 10% reduction in sediment proposed.
4. The Little Mill Creek drainage area is now combined into the overall Mill Creek drainage area.

5. WikiWatershed has now been used to determine revised Total P, Toatl N and Total SS loadings. As WikiWatershed is now used, the value of 115 lbs removal/foot of streambank restoration was used to estimate the amount needed to meet the 10% removal.
6. Railroad rights-of-ways and State/Federal road rights-of-way are used in parsing calculations. have been parsed.
7. The effectiveness values for BMP's are in accordance with from DEP's Effectiveness values Table.
8. A land cover maps is included (as a zoning map). The Urbanized Area encompasses the entire Township area.
9. A public meeting will be held with proper advertisement in a local newspaper will be held prior to the submission of the final revised permit. Due to COVID-19 restrictions, the Township has been unable to have public meetings. As soon as restrictions have been lifted and a public meeting can resume, a presentation will be scheduled, a copy of the revised application will be placed in the Township building for public review and comments will be received and addressed. The timing of this cannot yet be determined.
10. We apologize that this application was not resubmitted within the 60 days' time frame from January 24, 2020 due to the COVID-19 restrictions occurring less than 60 days from the receipt of your comments. The Township appreciates the extensions given during this time.

If you have any questions, please do not hesitate to contact me at the address/telephone number above or directly by e-mail at wplaisted@tse-ls.com.

Sincerely,
TRI-STATE ENGINEERING AND LAND SURVEYORS, Inc.

Wesley E. Plaisted, P.E.
Senior Consultant

w/enclosures

cc: Joseph Golden – Upper Southampton Township Manager (w/enclosure)
Donald Williams, Esq. – Upper Southampton Township

UPPER SOUTHAMPTON TOWNSHIP

MS4 INDIVIDUAL PERMIT APPLICATION

COMMENT RESPONSES

1. Revisions to permit application pages 2 and 3
2. Outfall maps
3. Southampton Creek nutrient reduction
4. Inclusion of Little Mill Creek in Mill Creek watershed
5. Parsing
6. BMP's and Effectiveness values used
7. Land Cover in Township
8. Public Participation
9. Submission

Also included:

Revised Pollution Reduction Plan (PRP)

Revised Southampton Creek TMDL Plan

COMMENT 1. RESPONSE
Revisions to permit application pages 2 and 3

The revised pages 2 and 3 are included in the attached permit application. Individual pages are also attached here.

COMMENT 2. RESPONSE
Outfall Maps

D-size maps are included here showing:

- Overall MS4 system (piping, outfalls, streams, etc.
- Cover map indicating detailed mapping sections A through H
- Detail maps of Sections A through H indicating the 185 outfalls to surface water
- Map of WikiWatershed areas within the Township

COMMENT 3. RESPONSE
Southampton Creek Nutrient Reduction

Per the document below, we are proposing a *"presumptive approach in which a 10% reduction in sediment is assumed to also result in a 5% reduction in TP reduction"* (nutrients).

Thus the proposed 10% reduction in sediment is assumed to meet the nutrient reduction goal of 5%.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

MS4 NPDES PERMITS
FREQUENTLY ASKED QUESTIONS (FAQ)[1]

Revised, October 21, 2019

The Department of Environmental Protection (DEP) has developed this FAQ document to assist entities with small regulated municipal separate storm sewer systems (MS4s) with understanding the MS4 NPDES permit program, including the changes to the program made by DEP through its reissuance of the PAG-13 General Permit in June 2016, which became effective on March 16, 2018 ("2018 PAG-13 General Permit"). This document will be maintained by DEP and updated with additional content over time. Questions on the program may be directed to the appropriate DEP regional office or to DEP's Bureau of Clean Water at (717) 787-5017 or RA-EPPAMS4@pa.gov.

2018 PAG-13 NPDES General Permit

1. What are the biggest changes in the 2018 PAG-13 NPDES General Permit?

A. Pollutant Reduction Plans (PRPs) – The 2013 PAG-13 General Permit required Chesapeake Bay ("Bay") PRPs for discharges to the Chesapeake Bay watershed. The 2018 PAG-13 General Permit continues that obligation, but added the requirements that permittees estimate their existing Sediment, Total Phosphorus (TP), and Total Nitrogen (TN) load to the Bay, and that the PRP identify Best Management Practices (BMPs) that that will reduce the loads by 10%, 5% and 3% respectively within 5 years following DEP's approval of coverage (Appendix D of 2018 PAG-13 General Permit). Permittees may propose a presumptive approach in which a 10% sediment reduction is assumed to also result in a 5% TP reduction and a 3% TN reduction.

The development of a PRP is also required by the 2018 PAG-13 General Permit for discharges to local waters that are impaired for nutrients and/or sediment where there is no wasteload allocation (WLA) in a Total Maximum Daily Load (TMDL). Similar to Bay PRPs, these "Impaired Waters PRPs" require permittees to estimate pollutant loads and reduce those loads within 5 years following DEP's approval of coverage (Appendix E of 2018 PAG-13 General Permit). If the impairment which triggered the need for an Impaired Waters PRP is due to sediment alone, a minimum 10% sediment reduction is required. If the impairment is based on nutrients alone (phosphorus or nitrogen), a minimum 5% Total Phosphorus (TP) reduction is required. If the impairment is due to both sediment and nutrients, both sediment (10%) and TP (5%) must be controlled. Permittees may propose a presumptive approach in which a 10% sediment reduction is assumed to also result in a 5% TP reduction.

COMMENT 4. RESPONSE

Inclusion of Little Mill Creek in Mill Creek watershed

The Little Mill Creek drainage area has now been combined with the Mill Creek drainage area in this submission as shown on the maps and in the Loading Calculation Table.

COMMENT 5. RESPONSE

Parsing

Parsing was not used in the calculations. Experience has indicated that efforts involved in parsing do not materially impact the loading calculations.

COMMENT 6. RESPONSE

BMP's and Effectiveness values used

Tables showing the DEP Effectiveness Values Table and the CB Expert panel Reports are included here. These values were used in the loading reduction calculations.

COMMENT 7. RESPONSE

Land Cover in Township

A copy of the Township Zoning Map showing land uses and a table showing cover within the two (Southampton Creek and Mill Creek) watershed, based on data from WikiWatershed are included here.

COMMENT 8. RESPONSE

Public Participation

As with the initial permit application submission of September 14, 2017, a presentation to the public detailing the re-submission, will be made at a properly advertised public meeting (in all likelihood a regularly scheduled Township Supervisor's public meeting).

Dur to the COVID-19 pandemic and subsequent restrictions since mid-March, there has been no opportunity to make a public presentation.

Once restrictions have been lifted, a public presentation will be scheduled.

In addition to the required advertisement needed for such a public meeting, a copy of the full permit re-submission will be placed in the Township offices for citizen review and comment. A full 30-days will be provided for public comment. All comments will be included in the final submission to DEP as well as information regarding the Township's actions to fully address any comments. Currently, the timing on the presentation is not known.

COMMENT 9. RESPONSE

Submission

In the January 24, 2020 comment e-mail, a resubmission was required with 60-days of the receipt of comments. Again, due to the COVID-19 pandemic and the subsequent orders from the Pennsylvania Governor's office, all essential businesses were required to shutdown, which was the case for Tri-State Engineers and Land Surveyors, Inc., the Upper Southampton Township municipal engineer. The Tri-Sate office did receive a business exemption from the State of Pennsylvania for a partial re-opening in May 2020 with limited staffing and adherence to face coverings and social distancing.

Work on the revisions per the DEP review comments began at that time and this resubmission is the result of these efforts.

Currently, this submission will be a draft submission for preliminary review by DEP to determine that the comments have been adequately addressed prior to final submission.