

Section 8

Implementation Guidelines

This section presents guidelines for watershed-wide implementation of the “management options” identified by the Tookany/Tacony-Frankford Watershed Partnership as best meeting the goals and objectives of the TTF Integrated Watershed Management Plan. Following extensive screening and evaluation (described in Section 7), only those options that are likely to be cost-effective and feasible under the specific conditions found in the TTF Watershed are carried over and included in these guidelines. The section begins with tips on how to navigate the information presented.

Navigating Section 8: Summary Tables and Boxes

Following the introductory information below and on the next page, three **summary tables** are presented. These tables categorize the recommended management options according to the agency or level of government responsible for carrying out each recommendation under current regulations: PA DEP, the City of Philadelphia, and the Montgomery County municipalities.

Sections 8.1, 8.2, and 8.3 are then devoted to presenting detailed information about each of those recommended options, grouped under Targets A, B, and C (introduced in Section 2.2.7 and discussed throughout this plan). Most of those options begin with a **summary box** that names (1) “What” the option involves, (2) “Who” is responsible, (3) “Where” the option is to be carried out, and (4) “When.” In addition, each summary box lists the numbers of “Related Goals” and “Related Indicators,” discussed in Sections 3 and 4, respectively. The summary box is followed by text, figures, and tables that further describe the option and the implementation approach being recommended.

Implementation Guidelines and Five-Year Plans

These guidelines present a long-range vision for implementation over a 20-year horizon, with the intent of meeting both Target A (Dry Weather Water Quality and Aesthetics) and Target B (Healthy Living Resources) within a 15-year planning horizon, while simultaneously proposing step-by-step implementation to meet Target C (Wet Weather Water Quality and Quantity), allowing for adaptive management over time. The guidelines provide information on location and degree to which implementation needs to be accomplished in order to meet the targets. Based upon these recommendations, PWD and the Tookany/Tacony-Frankford Watershed Partnership will prepare detailed, 5-year plans to carry out the recommended projects.

The Implementation Guidelines presented here are intended to offer a long-range vision for implementation over the upcoming 20-year horizon, and to be used as a reference by parties creating actual implementation plans in the future. The implementation plan is to be designed to provide a detailed blueprint for specific implementation tasks during the initial five-year period. Detailed planning for implementation of the TTFIWMP will be broken into four sequential five-year periods to cover the 20-year implementation horizon. The Philadelphia Water Department has created and committed to a detailed five-year Implementation Plan for the portion of the

Tookany/Tacony-Frankford Watershed within the City of Philadelphia (see summary in Appendix E). This plan has been designed to begin in 2006 and run through 2011; though the start date for the implementation period is in 2006, many projects have already been initiated.

The cost estimated for full implementation of the TTFIWMP in the Philadelphia portion of the watershed is roughly \$18,000,000, to which PWD has committed staff and resources in the first five years. Detailed comparable costs for the first five years within the Montgomery County portion of the watershed have not yet been derived. A total estimated cost for watershed-wide implementation of this plan for the initial five-year period will be calculated by the Board of the Tookany/Tacony-Frankford Watershed Partnership once budgetary information for municipal implementation is available.

Role of the TTF Watershed Partnership in TTFIWMP Implementation

In the summer of 2005, the Tookany/Tacony-Frankford Watershed Partnership filed official incorporation papers in order to become a 501(c)3 nonprofit watershed organization. As noted in Article 2, Section 2.2 of the TTF Partnership By-Laws:

“The primary purposes of the Corporation are to carry out all activities allowable under Section 501(c)(3) of the Internal Revenue Code (or the corresponding section of any future Internal Revenue Law of the United States), including but not limited to: implement the Integrated Watershed Management Plan for the Tookany/Tacony-Frankford Watershed (“TTF Watershed”); improve stream habitat and integrity of aquatic life; reduce the impact of urbanized flow on living resources; improve dry and wet weather stream quality to reduce the effects on public health and aquatic life; protect and restore stream corridors, buffers, floodplains, and natural habitats including wetlands; identify flood prone areas and decrease flooding; enhance community environmental quality of life; foster community stewardship; and improve inter-municipal, inter-county, state-local and stakeholder cooperation and coordination on a watershed wide basis through dedicated public education and outreach.” (See Appendix C for complete By-Laws.)

This organization will strive to help the municipalities and other stakeholders throughout the watershed to realize the vision of a restored and vital Tookany/Tacony-Frankford Watershed.

Table 8.1 PA DEP Actions

Code	Option	Where	When
CR4	Industrial Stormwater Pollution Prevention	Industrial sites	Short-term
CR5	Construction Stormwater Pollution Prevention	Construction sites	Short-term
N.A.	Stewardship/Advocacy of Watershed Management Plan	Watershed-wide	Short-term
A/B/CMR	Monitoring, Reporting, and Further Study	Watershed-wide	Ongoing

Table 8.2 City of Philadelphia Actions

Code	Option	Where	When
AR2	Pet Waste, Litter, and Dumping Ordinances	Watershed-wide	Short-term
N.A.	Revised Stormwater Ordinance and BMP Manual	Watershed-wide	Short-term
AP1	Public Education	Watershed-wide	Short-term
AP2	School-Based Education	All schools	Short-term
AP3	Public Participation and Volunteer Programs	Watershed-wide	Short-term
AM2	Inspection and Cleaning of Combined Sewers	Watershed-wide	Short-term
AM4	Combined Sewer Rehabilitation	Combined-Sewered Areas	Medium-term
AM6	Stream Cleanup and Maintenance	Tookany/Tacony-Frankford Creek within or along City boundary	Short-term
AO1	Enhancing Stream Corridor Recreational and Cultural Resources	Along the stream corridor	Medium-term
BM1	Bed Stabilization and Habitat Restoration	Tookany/Tacony-Frankford Creek	Short-term
BM2	Bank Stabilization and Habitat Restoration	Middle section of Tookany/Tacony-Frankford Creek	Short-term
BM3	Channel Realignment and Relocation	Tookany/Tacony-Frankford Creek,	Short-term
BM4	Plunge Pool Removal	CSO and stormwater outfalls	Short-term
BM5	Improvement of Fish Passage	Tacony Creek Dams	Short-term
BM6	Wetland Creation	Riparian corridor	Short-term
BM7	Invasive Species Management	Riparian corridor	Short-term
BM9	Reforestation	Riparian corridor	Short-term
CR3	Stormwater and Floodplain Management	Watershed-wide	Short-term
CR6	Post-Construction Stormwater Runoff Management	Watershed-wide	Short-term
CM1	Sanitary Sewer Overflow Detection	Separate-Sewered Areas	Short-term
CM2	Sanitary Sewer Overflow Elimination: Structural Measures	Separate-Sewered Areas	Medium-term
CM4	CSO Control Program	Philadelphia combined sewer system	Short-term
CM5	Catch Basin and Storm Inlet Maintenance	All inlets	Short-term
CM6	Street Sweeping (Philadelphia Streets Department)	Streets and Parking Lots	Short-term
CM7	Responsible Landscaping on Public Lands	Green space	Short-term
CM9	Responsible Bridge and Roadway Maintenance	Roadways and bridges	Short-term
CM3	Green Rooftops	Appropriate public buildings chosen by PWD	Medium-term
CM4	Capturing Roof Runoff in Rain Barrels or Cisterns	Homes where dry wells are not feasible	Medium-term
CM5	Increasing Urban Tree Canopy	Watershed-wide	Medium-term
CS6	Maintaining/Retrofitting Existing Stormwater Structures	Watershed-wide	Short-term
CS8	Retrofitting Existing Sewer Inlets with Dry Wells	Inlets in combined-sewered areas	Long-term
CS9	Residential Dry Wells, Seepage Trenches, and Water Gardens	Homes and schools watershed-wide	Long-term
CS12	Bioretention Basins and Porous Media Filtration	Watershed-wide	Long-term
CS13	Treatment Wetlands: Onsite and Regional	Riparian corridor	Medium-term
A/B/CMR	Monitoring, Reporting, and Further Study	Watershed-wide	Ongoing

Table 8.3 Montgomery County Municipality Actions

Code	Option	Where	When
AR1	On-Lot Disposal (Septic System) Management	All areas with septic systems	Short-term
AR2	Pet Waste, Litter, and Dumping Ordinances	Watershed-wide	Short-term
AP1	Public Education	All Tookany/Tacony-Frankford Creek municipalities	Short-term
AP2	School-Based Education	All schools	Short-term
AP3	Public Participation and Volunteer Programs	All Tookany/Tacony-Frankford Creek municipalities	Short-term
AM1	Capacity Management Operation and Maintenance of Sanitary Sewers	Separate-Sewered Areas	Short-term
AM3	Sanitary Sewer Rehabilitation	Separate-Sewered Areas	Medium-term
AM5	Illicit Discharge, Detection, and Elimination (IDD&E)	All Tookany/Tacony-Frankford Creek municipalities	Short-term
AM6	Stream Cleanup and Maintenance	Tookany/Tacony-Frankford Creek within or along City boundary	Short-term
A01	Enhancing Stream Corridor Recreational and Cultural Resources	Along the stream corridor	Medium-term
BM1	Bed Stabilization and Habitat Restoration	Tookany/Tacony-Frankford Creek	Short-term
BM2	Bank Stabilization and Habitat Restoration	Middle section of Tookany/Tacony-Frankford Creek	Short-term
BM3	Channel Realignment and Relocation	Tookany/Tacony-Frankford Creek	Short-term
BM4	Plunge Pool Removal	Stormwater outfalls	Short-term
BM5	Improvement of Fish Passage	Dam locations	Short-term
BM6	Wetland Creation	Riparian corridor	Short-term
BM7	Invasive Species Management	Riparian corridor	Short-term
BM8	Biofiltration	Locations to be determined	
BM9	Reforestation	Riparian corridor	Short-term
CR2	Requiring Better Site Design in Redevelopment	Watershed-wide	Short-term
CR3	Stormwater and Floodplain Management	Watershed-wide	Short-term
CR6	Post-Construction Stormwater Runoff Management	Municipalities required to do Phase II permit	Short-term
CM1	Sanitary Sewer Overflow Detection	Separate-Sewered Areas	Ongoing program
CM3	Reduction of Stormwater Inflow and Infiltration to Sanitary Sewers	Separate-Sewered Areas	Medium-term
CM5	Catch Basin and Storm Inlet Maintenance	All inlets	Ongoing program
CM6	Street Sweeping	Streets and Parking Lots	Short-term
CM7	Responsible Landscaping on Public lands	Green space	Short-term
CM9	Responsible Bridge and Roadway Maintenance	Roadways and bridges	Short-term
CS2	Porous Pavement and Subsurface Storage	Parking lots watershed-wide	Long-term
CS4	Capturing Roof Runoff in Rain Barrels or Cisterns	Homes where dry wells are not feasible	Medium-term
CS5	Increasing Urban Tree Canopy	Watershed-wide	Medium-term
CS6	Maintaining/Retrofitting Existing Stormwater Structures	Watershed-wide	Short-term
CS9	Residential Dry Wells, Seepage Trenches, and Water Gardens	Homes and schools watershed-wide	Long-term
CS12	Bioretention Basins and Porous Media Filtration	Watershed-wide	Long-term
CS13	Treatment Wetlands: Onsite and Regional	Riparian corridor	Medium-term
A/B/CMR	Monitoring, Reporting, and Further Study	Watershed-wide	Ongoing

8.1 Target A: Dry Weather Water Quality and Aesthetics

Below are the recommended options for Target A. As explained in Section 7, virtually all Target A (and all Target B) options were recommended for implementation. These options are described in detail in the pages that follow.

Section 8.1.1 Regulatory Approaches

- AR1 On-Lot Disposal (Septic System) Management
- AR2 Pet Waste, Litter, and Dumping Ordinances

Section 8.1.2 Public Education and Volunteer Programs

- AP1 Public Education
- AP2 School-Based Education
- AP3 Public Participation and Volunteer Programs

Section 8.1.3 Municipal Measures

- AM1 Capacity Management Operation and Maintenance (CMOM)
- AM2 Inspection and Cleaning of Combined Sewers
- AM3 Sanitary Sewer Rehabilitation
- AM4 Combined Sewer Rehabilitation
- AM5 Illicit Discharge, Detection, and Elimination (IDD&E)
- AM6 Stream Cleanup and Maintenance

Section 8.1.4 Recreational and Cultural Resources

- AO1 Enhancing Stream Corridor Recreational and Cultural Resources

Section 8.1.5 Monitoring and Reporting

- AMR Monitoring, Reporting, and Further Study

8.1.1 Target A Options: Regulatory Approaches

On-Lot Disposal (Septic System) Management (AR1)			
Related Goals: 3			
Related Indicators: 7, 11, 19, 20			
What	Who	Where	When
Septic tank management program required as part of the municipality's Official Act 537 Sewage Facilities Plan.	Municipalities through state certified Sewage Enforcement Officers (SEO). <ul style="list-style-type: none"> All Act 537 plans should be updated as necessary. 	All areas with septic systems (see Table 8.4).	Within next 5 years.

Septic tank management programs are currently required of all Pennsylvania municipalities as part of their Official Act 537 Sewage Facilities Plans. Keeping these plans up to date, including provisions related to operation and maintenance of on-lot sewage disposal systems (OLDS), is an important means of controlling the release of pathogens and nutrients within the watershed.

The Pennsylvania Sewage Facilities Act (Act 537) requires that all Commonwealth municipalities develop and implement comprehensive official plans that provide for resolution of existing sewage disposal problems, provide for future sewage disposal needs of new land development, and provide for future municipal sewage disposal needs. When a municipality adopts a plan, the plan is submitted for review and approval by the Pennsylvania Department of Environmental Protection. By regulation, the planning process is not final until an Act 537 Plan has been approved by PA DEP. Municipalities are required to revise (unless they are exempt from revising) the "Official Plan" if a new land development project is proposed or if unanticipated conditions or circumstances arise, making the base plan inadequate. There are two basic types of plan changes: "Plan revisions" resulting from new land development are completed using "planning modules" that are specific to individual projects; an "update revision" is used by municipalities to make broad changes to their Official Plan.

Act 537 planning has been a municipal requirement since July 1, 1967. Legally, all municipalities have an Act 537 Plan; however, some plans are newer and more detailed than others. A list of municipalities within the Tookany/Tacony-Frankford Creek Watershed indicating the status of their Act 537 Plans is presented in Table 8.4. Note that most of the plans are quite outdated. The municipalities are shown in Figure 8.1.

Table 8.4 Act 537 Municipal Sewage Facilities Plans

Municipality	County	Plan Approval Date	Status (as of 12/2005)
Abington Township	Montgomery	12/16/99	Plan older than 5 years
Cheltenham Township	Montgomery	1/1/73	Plan older than 30 years
Jenkintown Borough	Montgomery	1/1/73	Plan older than 30 years
Philadelphia	Philadelphia	11/10/93	Plan older than 10 years
Rockledge Borough	Montgomery	1/1/73	Plan older than 30 years

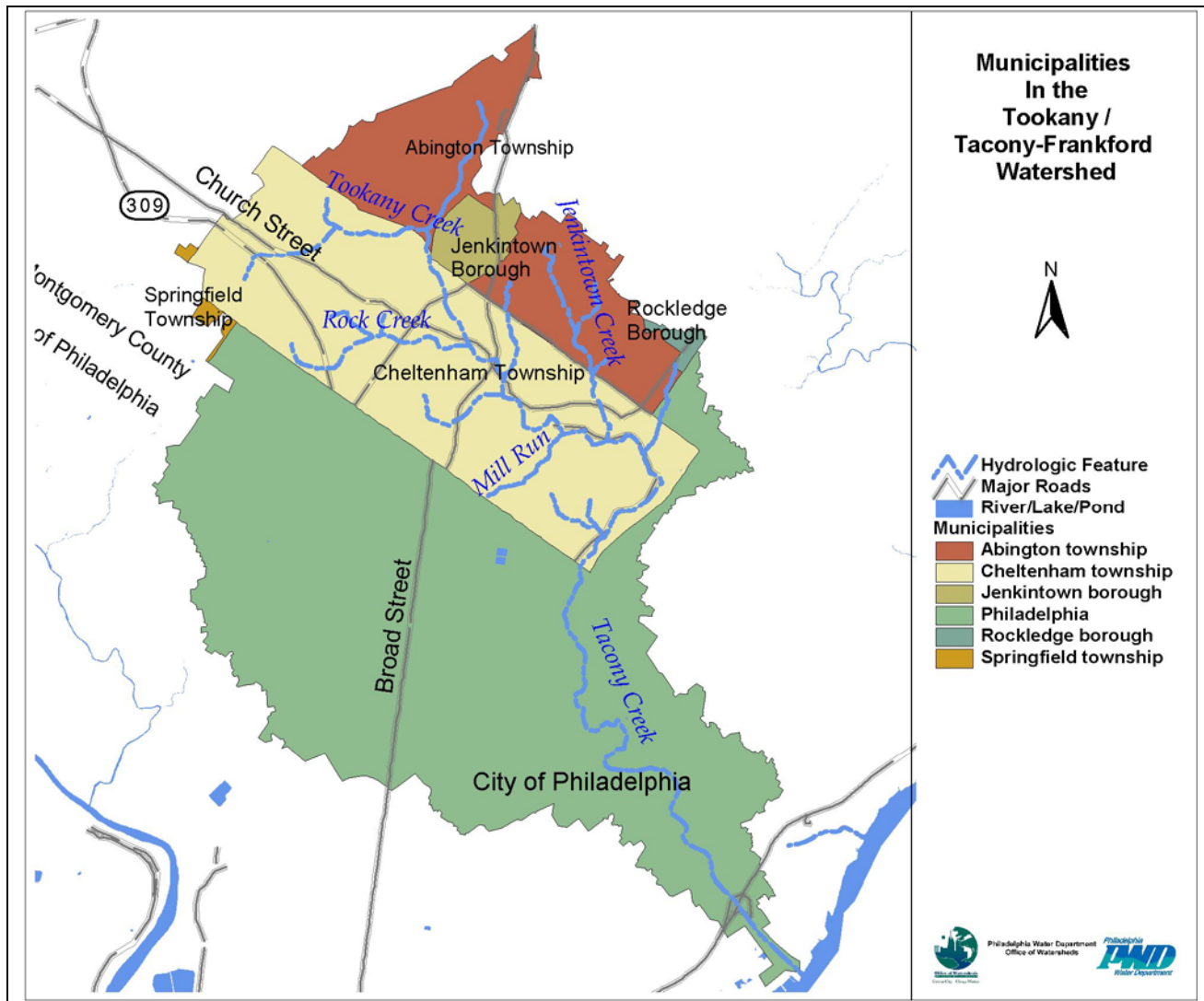


Figure 8.1 Tookany/Tacony-Frankford Watershed Municipalities

Relevant Provisions of Act 537

- All municipalities must develop and implement an official sewage plan that addresses their present and future sewage disposal needs. Local agencies are required to employ both primary and alternate Sewage Enforcement Officers (SEO) responsible for overseeing the daily operation of that agency’s OLDS permitting program.
- Local agencies, through their SEO, approve or deny permits for construction of on-lot sewage disposal systems prior to system installation. The SEO is responsible for conducting soil profile testing, percolation testing, OLDS design review, and approving or denying OLDS permit applications.
- Local agencies, through their SEO, must manage the permitting program for individual on-lot disposal systems and community on-lot systems with design flows of 10,000 gallons-per-day or less.

- Municipalities are required to assure the proper operation and maintenance of sewage facilities within their borders.

Municipalities should maintain information on the location, type, and operational status of existing sewage facilities, as well as results of sanitary surveys. This information, however, is often incomplete. Septic tank data were included in the U.S. census through 1990, but were believed to be inaccurate and were not included in the 2000 census. County health departments may have information, and assessments have been attempted through voluntary questionnaires submitted by municipalities. These tasks have proven to be difficult but can be completed through perseverance.

Implementation of a Comprehensive Septic Tank Management Program

Each municipality shown in Table 8.4 should update its Act 537 Plan in the coming five-year period, as necessary.

Table 8.5 presents 1990 census sanitary survey results along with the area within the watershed. Better counts and, if appropriate, implementation of septic system management programs should be actively pursued in municipalities that have a large estimated number of septic systems and a high percentage of their total area within the watershed: Philadelphia, and Abington and Cheltenham townships.

The implementation of comprehensive septic tank management programs in those three municipalities ideally will be consistently designed to provide degrees of protection based on an assessment of the environmental sensitivity of the area.

Table 8.5 Septic System Data from 1990 Census*

Municipality	Area (Acres)	Area in Watershed (Acres)	Percent of Area in Watershed (Acres)	Housing Units with Public Sewer	Housing Units with Septic Systems	Total Housing Units Occupied
Abington Township	9,893	2,712	12.9%	10,717	101	10,818
Cheltenham Township	5,779	5,691	27.0%	14,174	262	14,436
Jenkintown Borough	369	12,178	57.7%	2,072	0	2,072
Philadelphia City	91,287	367	1.7%	134,408	706	135,114
Rockledge Borough	219	81	0.4%	751	0	751
Springfield Township	4,352	65	0.3%	1,186	3	1,189

* Septic data is unavailable for 2000 Census.

The EPA has recently issued Voluntary National Guidelines for Management of Onsite and Clustered Wastewater Treatment Systems (EPA 832-B-03-001), covering all aspects of a comprehensive program, from design, inspection, and enforcement to public education and

long-term planning. This document presents several different management models (see below) to choose from; division of responsibility and ownership between private land owners and public agencies varies between the different models. Municipalities should select that approach which best suits their conditions.

The Five Management Models

- Management Model 1 - “Homeowner Awareness” specifies appropriate program elements and activities where treatment systems are owned and operated by individual property owners in areas of low environmental sensitivity. This program is adequate where treatment technologies are limited to conventional systems that require little owner attention. To help ensure that timely maintenance is performed, the regulatory authority mails maintenance reminders to owners at appropriate intervals.
- Management Model 2 - “Maintenance Contracts” specifies program elements and activities where more complex designs are employed to enhance the capacity of conventional systems to accept and treat wastewater. Because of treatment complexity, contracts with qualified technicians are needed to ensure proper and timely maintenance.
- Management Model 3 - “Operating Permits” specifies program elements and activities where sustained performance of treatment systems is critical to protect public health and water quality. Limited-term operating permits are issued to the owner and are renewable for another term if the owner demonstrates that the system is in compliance with the terms and conditions of the permit. Performance-based designs may be incorporated into programs with management controls at this level.
- Management Model 4 - “Responsible Management Entity (RME) Operation and Maintenance” specifies program elements and activities where frequent and highly reliable operation and maintenance of decentralized systems is required to ensure water resource protection in sensitive environments. Under this model, the operating permit is issued to an RME instead of the property owner to provide the needed assurance that the appropriate maintenance is performed.
- Management Model 5 - “RME Ownership” specifies that program elements and activities for treatment systems are owned, operated, and maintained by the RME, which removes the property owner from responsibility for the system. This program is analogous to central sewerage and provides the greatest assurance of system performance in the most sensitive of environments.

Pet Waste, Litter, and Dumping Ordinances (AR2) Related Goals: 3, 6, 7 Related Indicators: 7, 8, 9, 10, 11, 16, 17, 18, 19, 20			
What	Who	Where	When
Adopt and enforce ordinance to require the removal of pet waste by the animal's owner within the municipality. Adopt and enforce ordinance to prohibit littering and dumping within the municipality.	See Table 8.6 (may not identify all municipalities with ordinance).	Entire watershed.	Within 5 years; update as needed.

A study was conducted to identify municipalities in the watershed that have adopted an ordinance to address removal of pet waste by the animal's owner and an ordinance that prohibits littering and dumping. The study verified existing ordinances related to pet waste, litter, and illegal dumping only in the City of Philadelphia; the study is believed to be comprehensive, but it is possible that additional ordinances exist that were not identified by the study. Table 8.6 shows the municipalities in the watershed that are known to have adopted pet waste and littering ordinances.

Table 8.6 Pet Waste and Littering Ordinances in the Tookany/Tacony-Frankford Watershed

Municipality	Pet Waste Ordinance	Littering and Dumping Ordinance
Abington Township		
Cheltenham Township		
Jenkintown Borough		
Philadelphia County	X	X
Rockledge Borough		

Source: www.ordinance.com, Delaware Valley Regional Planning Commission

Municipalities currently without ordinances are strongly encouraged to adopt them within the next two years. As an example of possible ordinance language, excerpts from Philadelphia County appear on the following page.

Pet Waste Ordinance	Littering and Dumping Ordinance
<p><u>CHAPTER 10-100. Animals §10-105. Animals Committing Nuisances</u> No person, having possession, custody or control of any animal, shall knowingly or negligently permit any dog or other animal to commit any nuisance upon any gutter, street, driveway, alley, curb or sidewalk in the City, or upon the floors or stairways of any building or place frequented by the public or used in common by the tenants, or upon the outside walls, walkways, driveways, alleys, curbs or stairways of any building abutting on a public street or park, or upon the grounds of any public park or public area, or upon any private property, including the property of the owner of such animal.</p>	<p><u>CHAPTER 10-700. REFUSE AND LITTERING §10-702. Litter in Public Places</u> No person shall place or deposit litter in or upon any street, sidewalk or other public place within the City except in public receptacles or in authorized private receptacles.</p>

Source: <http://www.phila.gov/philacode/html/maintoc.htm>, *The Philadelphia Code and Charter*

While pet waste and littering ordinances are enacted primarily for aesthetic purposes, reduction of pathogens and debris in stormwater, and thus in the Tookany/Tacony-Frankford Creek, can be reduced through their enforcement. Municipalities can assist residents in abiding by ordinances by placing trash cans in areas with higher pedestrian traffic. Plastic bags should be provided with trash cans in areas heavily used by dog owners, perhaps following the model established by the Partnership for the Delaware Estuary’s “Dogi Pots” pet waste control program. Homeowners’ associations should also be asked to notify residents of these ordinances and to provide trash cans and plastic bags in those neighborhoods as well.

8.1.2 Target A Options: Public Education and Volunteer Programs

Public Education (AP1)			
Related Goals: 4, 6, 7			
Related Indicators: 16, 17, 18, 19, 20, 21			
What	Who	Where	When
Public Education Plan. Educational Program Implementation.	Municipalities on the Phase II List (see Table 8.7).	All municipalities in the TTF Watershed.	Short-term: first 5 years coinciding with the stormwater permit (see Table 8.8).

Public education about watershed management is an integral part of plan implementation. It will be designed to educate citizens on the importance of the watershed to the community, and on ways that individual behavior can impact water quality and the riparian and aquatic environment associated with Tookany/Tacony-Frankford Creek. In accordance with the TTFIWMP's stated purpose of integrating various existing programs, and to avoid duplication of effort, the recommended implementation plan follows the Stormwater Management Program Protocol to meet the six Minimum Control Measures required of municipal permittees under Phase II NPDES Stormwater Regulations (listed in Section 1.4.1 of this report, and found at 40 CFR § 122.26 – 123.35). In this way, implementation of these public education measures by municipalities will satisfy federal NPDES permit requirements for municipal separate storm sewer systems (MS4s), described in detail at 40 CFR §122.34.

Table 8.7 below lists the municipalities participating in the Phase II program that could work together with the City of Philadelphia on Public Education about watershed management issues. Assuming that a single, watershed-wide public education campaign focusing on all three Targets (A, B, and C) can be implemented, municipalities would meet their regulatory requirements while helping to implement the TTFIWMP, and avoiding the duplication of work with limited resources that would occur if each municipality were to initiate their own outreach campaign.

Table 8.7 Tookany/Tacony-Frankford Creek Municipalities on Phase I or II Stormwater List

Municipality	County	% of Muni. Area Drained by Watershed	% of Watershed within Muni.
Abington Township	Montgomery	27.41%	12.85%
Cheltenham Township	Montgomery	98.48%	26.98%
Jenkintown Borough	Montgomery	99.47%	1.74%
Rockledge Borough	Montgomery	36.89%	0.38%
Springfield Township	Montgomery	1.49%	0.31%

Public Education Plan

PWD and watershed municipalities should jointly develop a public education plan. The public education plan must target three audiences – homeowners, business owners, and developers – focusing on connections between their actions, stormwater runoff, and water quality. By the end of Year 1 of the permit cycle, cooperating municipalities should have a comprehensive plan in place that will help tap into the target audiences’ existing communication channels to inform them about improving stormwater quality. During the following permit years, municipalities should monitor the effectiveness of the plan, and update it to ensure information about the target audiences is accurate.

PA DEP has guidelines for a public education plan. The plan should include an approach to collecting information on the three target audience categories. Municipalities should create a comprehensive inventory of the newsletters, newspapers, web sites, meetings, magazines, organizations, associations, etc. used by the target audiences. Cooperation of the municipalities with the assistance of the Tookany/Tacony-Frankford Watershed Partnership in gathering this information should help eliminate redundancy of effort. During the remaining years of the stormwater permit, municipalities are responsible for ensuring that information in the public education plan is accurate and current.

The River Conservation Plans (RCPs) recommend developing a comprehensive educational program for private land owners and businesses. A “do’s and don’ts” format is suggested. The RCPs contain additional details and mapping for the following recommendations:

- Holy Sepulchre Cemetery to Ralph Morgan Park: Emphasize effect of land management practices on the creek.
- Washington Lane Underpass to Church Road: Focus on effects of land management on the creek. Target homeowners.
- High School Park to Ashbourne Road along the Tookany Creek Parkway: Emphasize infiltration BMPs.
- Unnamed Tributary in Glenside: Target homeowners, businesses, and SEPTA. Focus on rain barrels and riparian buffer zones.
- Baeder Creek Watershed: Focus on riparian buffer management and native species. Target land owners and apartment complexes.
- Rock Creek Watershed: Emphasize effect of land management practices on the creek.
- Mill Creek Watershed: Emphasize effect of land management practices on the creek.
- Leeches Run Watershed: Emphasize effect of land management practices on the creek. Target religious organizations and land owners.
- Township Line Road near Foxcroft Road to Main Stem: Focus on “no mow” zones, management of lawn waste, bank restoration, and invasive species.
- Township Line Road to Tookany Creek Parkway: Emphasize effect of land management practices on the creek.
- Rising Sun Avenue to Roosevelt Boulevard: Focus on illegal dumping.

- Castor Avenue to Erie Avenue: Emphasize effect of land management practices on the creek. Target local business owners, high school teachers, and students.
- Aramingo Avenue between Wheatshaf Lane and Church Street: Emphasize effect of land management practices on the creek. Target local business owners, high school teachers, and students.
- Holy Sepulchre Cemetery to Ralph Morgan Park: Work with Bishop McDevitt to implement BMPs to focus on decreasing stormwater runoff from property.
- Wyncote Post Office to Washington Lane Underpass: PECO energy environmental department should be contacted for information regarding the results of studies being done in this area.
- Washington Lane Underpass to Church Road: The township should develop a dialogue and educate SEPTA regarding the needs of the bird sanctuary, the health of the creek, and railroad track safety.
- Eastern Branch of the Baeder Creek: Work with Abington Township School District to develop a land management plan. Focus on increasing on site infiltration.

In addition, other information relevant to watershed management should be included on topics such as:

- Improper Disposal to Storm Drains
- Automobile Maintenance
- Car Washing
- Animal Waste Collection
- Restorative Redevelopment: Public Education Aspects

Public Education Implementation

Once the public education plan is developed, it must be implemented. This means distributing educational materials provided by PA DEP or others that contain messages related to watershed (and stormwater) management. Municipalities can find educational materials needed to implement the educational program on the PA DEP website at <http://www.dep.state.pa.us/dep/deputate/watermgt/wc/NPDSMS4/MS4CD/>.

To fulfill NPDES stormwater permit requirements, municipalities should implement two phases of educational outreach. During the first stage, the focus is on raising the awareness of target audiences. In the second stage, municipalities should aim to educate the target audiences about the problems and potential solutions. PA DEP presents requirements in the stormwater permit for the “what” and “when” of this minimum measure component, but it does not specify the “how.” Municipalities should use their Public Education Plan to determine the most effective means of getting educational materials into the hands of target audiences. Any additional educational activities should show compliance with this Minimum Control Measure. This includes educational activities by watershed groups, and certainly should make use of the existing Tookany/Tacony-Frankford Watershed Partnership activities.

In Year 1, municipalities are required to start raising target audience awareness. Raising awareness can be accomplished by use of PA DEP materials. PA DEP has made available copies of the pamphlet entitled “When It Rains, It Drains” (available on the PA DEP website, <http://www.dep.state.pa.us/dep/deputate/watermgt/wc/NPDSMS4/MS4CD/>).

This document addresses the issue of pollution related to stormwater runoff and activities that citizens can use to improve stormwater quality. It also provides an overview of a typical stormwater management program. Using the information on distribution channels in the Public Education Plan, municipalities should disseminate these pamphlets to all the target audience categories in the community.

In Year 2, municipalities should begin to educate all the target audiences. This includes distributing fact sheets to developers about their responsibilities under the state and federal stormwater regulations. To meet this requirement, municipalities should distribute the Fact Sheets prepared by PA DEP, and run a “stormwater ad” in local newspapers.

In addition to targeting developers, municipalities may distribute posters to schools, community organizations and institutions, and businesses. Topics such as responsible vehicle maintenance, household hazardous waste disposal, and pet waste are important to stormwater management. PA DEP has developed a series of posters that convey messages about these topics.

Another useful measure is storm drain stenciling. While not required by the Stormwater Management Program Protocol, any stenciling done by outside organizations may contribute to meeting permit requirements for this Minimum Control Measure.

Public education directors should check any links to PA DEP’s stormwater website and update the links if necessary.

In Years 3-5, the implementation continues. This consists mainly of continuing with distribution of posters and fact sheets, and running additional ads in local newspapers.

The schedule for developing and implementing the plan to meet Phase II stormwater requirements is shown in Table 8.8.

Table 8.8 Schedule for Implementation of the Public Education Program

PERMIT YEAR		
	Education Plan	Educational Program
Year 1	Determine Target Audience. Develop Public Education Plan. Raise Target Audience Awareness.	<ul style="list-style-type: none"> • Disseminate materials to all target audiences using appropriate distribution channels. • Newspaper advertisement. • Other components of Plan.
Years 2-5	Implement the plan. Revise Plan as needed.	<ul style="list-style-type: none"> • Disseminate materials to all target audiences using appropriate distribution channels. • Newspaper advertisement. • Other components of Plan.

Source: PA DEP MS4 Stormwater Management Program Protocol, 2003

School-Based Education (AP2) Related Goals: 6, 7 Related Indicators: 17, 18, 21			
What	Who	Where	When
Implement PA Environmental Education Curriculum.	School districts, supported by municipal governments and non-profits.	All schools.	Short-term (within 5 years).

Besides requirements found in the MS4 Stormwater Management Program Protocol, another important aspect of public education is to reach children through school curricula.

School-based watershed education takes many forms, from lesson plans within the classroom, to hands-on activities outside of the classroom such as field trips to Tookany/Tacony-Frankford Creek and nearby nature centers, as well conducting actual restoration projects. Teacher training programs, developed to assist teachers in bringing watershed concepts to their students, are critical. Being engaged in actual restoration projects, whether through service learning, after school clubs, or integrated as a part of lesson plans helps to translate these lessons into actions.

Sources for lesson plans include the following:

- Incorporate the Pennsylvania Environmental Education Curriculum developed by PA DEP into middle school curricula. This curriculum introduces concepts in watersheds, wetlands, stormwater, drinking water, and water and air pollution.
- Use local examples of watershed protection and restoration to enhance the program, work with schools to provide watershed-based educational opportunities, including the Environmental Scholars Program, Tree Survey Project, Urban Watershed Program, Environmental Clubs, Learning Grove/Trail Development Project, Park Management Program, and Teacher Training Program.

The River Conservation Plans (RCPs) suggest that a statewide environmental education curriculum could spark the interest of younger members of the watershed therefore making them aware of the problems at an earlier age. This could include incorporating riparian buffer restoration with some of the mandatory ecology curriculum.

Public Participation and Volunteer Programs (AP3)			
Related Goals: 3, 4, 5, 6, 7			
Related Indicators: 10, 11, 12, 13, 14, 15, 16, 17, 18, 21			
What	Who	Where	When
Public Participation. Volunteer Monitoring and Storm Drain Stenciling.	Municipalities.	All municipalities in the TTF Watershed.	First 5 years coinciding with the stormwater permit.

Public participation is another facet of implementation that must follow the PA DEP Stormwater Management Program Protocol to meet the six Minimum Control Measures required of municipal permittees under the Phase II NPDES Stormwater Regulations (listed in Section 1.4.1 of this report, and found at 40 CFR §§ 122.26 – 123.35). The public must participate in issues related to municipal actions to address stormwater impacts on water quality. This includes new planning initiatives, changes to ordinances and other local regulations. This requirement overlaps the public participation aspects of the watershed management plan, and suggests that a unified and coordinated approach between municipalities would be most efficient. All municipalities in the watershed (listed in Table 8.7) are required to have a public participation program. Again, the Tookany/Tacony-Frankford Watershed Partnership would be able to assist in fostering this coordination and performing public outreach.

Prior to adoption of any ordinance required under the PA DEP Stormwater Protocol, municipalities must provide adequate public notice and opportunities for public review and input, and hold hearings to obtain public feedback. This can be done in conjunction with normal public sessions of the municipal governing body. The notice must be published in a local newspaper of general circulation. Involving citizen groups, watershed organizations, and businesses as much as possible will obtain broad support for stormwater management efforts. The TTF Partnership itself is an obvious example of such inclusion, and can help municipalities to meet this requirement.

Although the actual public participation requirements can be met by following guidelines for Act 167 planning, it is recommended that municipalities go beyond the minimum. Some options for additional public participation are listed below.

- Develop a Public Involvement and Participation Plan: By the end of Year 1, a municipality may want to have a comprehensive plan in place that will guide your efforts to recruit volunteers and obtain participation at public meetings. This could be part of the Public Education Plan discussed above (see Option AP1).
- Produce strategies for recruiting participation from six categories of stakeholders: municipal employees, homeowners, businesses, schools, watershed associations and other volunteer groups, and developers.
- Develop a comprehensive stakeholder mailing list.

- **Conduct Public Meetings:** PA DEP suggests using a general stormwater public meeting to kick-off public education and participation efforts. This has already been done for the Tookany/Tacony-Frankford Partnership and Steering Committee, and municipalities are encouraged to make use of this. Invite representatives from all six stakeholder categories. It is important that all stakeholder interests have the opportunity to participate. Meeting agendas should include, but not be limited to, the overview presentation on the watershed management and stormwater program and time for questions from the audience.

An important aspect of public participation is the establishment of volunteer programs. There are many types of volunteer programs that can help manage stormwater and improve a community's water quality. The goal of the volunteer program is to obtain and sustain volunteer support that will aid watershed management efforts. To reach this goal, it is important to develop a program that reflects stakeholders' concerns and interests. Examples of volunteer programs are:

- **Volunteer Monitoring Program:** Municipalities should determine which type of assessment the program will undertake and develop a study design using the manual entitled "Designing Your Monitoring Program: A Technical Handbook for Community-Based Monitoring in Pennsylvania" as the basis for planning and implementing your monitoring program (PA DEP, 2001).
- **Storm Drain Stenciling Program:** Municipalities should establish procedures for storm drain stenciling and organize volunteers to carry out the program. PA DEP has provided resource materials in a References and Resources CD-ROM on developing and implementing a storm drain stenciling program.
- **Stream Cleanup and Restoration Activities:** Citizen participation in stream cleanups is a good way to get the community involved in keeping the streams free of trash and debris. In Philadelphia, stream cleanups can be coordinated with PWD's Waterways Restoration Unit. Other participatory activities can include support of riparian plantings during stream restoration activities.

The River Conservation Plans (RCPs) suggest that increased volunteer work will increase the general awareness regarding what citizen can do to keep the watershed free of problems. For example, at the Washington Lane Underpass to Church Road, a group could be organized to adopt the bird sanctuary area.

8.1.3 Target A Options: Municipal Measures

Capacity Management Operation and Maintenance (CMOM) (AM1)			
Related Goals: 1, 2, 3 Related Indicators: 7, 9, 11			
What	Who	Where	When
Program to manage and maintain sewer systems; plans in place to track SSOs and overflow response plan.	Separate Sewered Municipalities.	Separate Sanitary Sewer Areas.	Medium term: 5+ years.

Capacity, management, operation, and maintenance (CMOM) programs are recommended for all areas with separate sanitary sewer systems and are an important component of Target A because they help prevent dry weather discharges. Recommendations in this section cover both the dry and wet weather aspects of the program; recommendations that are specific to SSO abatement are included here for completeness and are referred to under Target C. The recommendations in this section are adapted from the “Consensus Recommendation of the SSO Federal Advisory Subcommittee,” published in October 1999.

1) General Standards

- Properly manage, operate, and maintain, at all times, all parts of collection system. Perform maintenance and inspections using techniques similar to those recommended for combined sewers in Option AM2.
- Provide adequate capacity to convey base flows and peak flows for all parts of the collection system.
- Take all feasible steps to stop, and mitigate the impact of, sanitary sewer overflows in portions of the collection system.
- Provide notification to parties with a reasonable potential for exposure to pollutants associated with the overflow event.
- Develop a written summary of the CMOM program and make it, and the audit under section (5), available to any member of the public upon request.

2) Management Program

Develop a CMOM program to comply with the above general standards. If any element of this section is not appropriate or applicable for the CMOM program in question, it does not need to address the element, but a written summary must explain why that element is not applicable. The management program should consist of the following six components:

1. Goals

The program must identify in detail the major goals of the CMOM program consistent with the general standards identified above.

2. Organization

(A) Identify administrative and maintenance positions responsible for implementing measures in the CMOM program, including lines of authority by organization chart or similar document, and (B) establish the chain of communication for reporting SSOs from receipt of a complaint or other information to the person responsible for reporting to the NPDES authority.

3. Legal Authority

Include legal authority, through sewer use ordinances, service agreements or other legally binding documents, to:

- (A) Control infiltration and connections from inflow sources;
- (B) Require that sewers and connections be properly designed and constructed;
- (C) Ensure proper installation, testing, and inspection of new and rehabilitated sewers (such as new or rehabilitated collector sewers and new or rehabilitated service laterals);
- (D) Address flows from satellite municipal collection systems; and
- (E) Implement the general and specific prohibitions of the national pretreatment program that you are subject to under 40 CFR 403.5.

4. Measures and Activities

The CMOM program must address the elements listed below that are appropriate and applicable to the sewer system and identify the person or position in the organization responsible for each element.

- (A) Maintenance of facilities.
- (B) Maintenance of a map of the collection system.
- (C) Management of information and use of timely, relevant information to establish and prioritize appropriate CMOM activities, and to identify and illustrate trends in overflows.
- (D) Routine preventive operation and maintenance activities.
- (E) Assessment of the current capacity of the collection system and treatment facilities.
- (F) Identification and prioritization of structural deficiencies and identification and implementation of short-term and long-term rehabilitation actions to address each deficiency.
- (G) Appropriate training on a regular basis.
- (H) Equipment and replacement parts inventories including identification of critical replacement parts.

5. Design and Performance Provisions

(A) Requirements and standards for the installation of new sewers, pumps, and other appurtenances, and for rehabilitation and repair projects.

(B) Procedures and specifications for inspecting and testing the installation of new sewers, pumps, and other appurtenances, and for rehabilitation and repair projects.

6. Monitoring, Measurement, and Program Modifications

Monitor the implementation and, where appropriate, measure the effectiveness of each element of the CMOM program. Program elements must be updated as appropriate based on monitoring or performance evaluations. The summary of the CMOM program should be modified as appropriate to keep it updated and accurate.

3) Overflow Response Plan

An overflow response plan should be developed and implemented that identifies measures to protect public health and the environment including, but not limited to, mechanisms to:

- (i) Ensure that all overflows are made aware of (to the greatest extent possible);
- (ii) Ensure that overflows are appropriately responded to, including ensuring that reports of overflows are immediately dispatched to appropriate personnel for investigation and appropriate response;
- (iii) Ensure appropriate reporting pursuant to 40 CFR 122.42(e);
- (iv) Ensure appropriate notification to the public, health agencies, and other impacted entities (e.g. water suppliers) pursuant to 40 CFR 122.42(h). The CMOM plan should identify the public health and other officials who will receive immediate notification;
- (v) Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained; and
- (vi) Provide emergency operations.

4) System Evaluation and Capacity Assurance Plan

A plan should be prepared and implemented for system evaluation and capacity assurance if peak flow conditions are contributing to an SSO discharge unless either (1) already taken steps to correct the hydraulic deficiency or (2) the discharge meets the criteria of 122.42(g)(2). At a minimum the plan must include:

- (i) Evaluation: Steps to evaluate those portions of the collection system which are experiencing or contributing to an SSO discharge caused by hydraulic deficiency or to noncompliance at a treatment plant. The evaluation should provide estimates of peak flows (including flows from SSOs that escape from the system) associated with conditions similar to those causing overflow events, provide estimates of the capacity of key system components, identify hydraulic deficiencies, including components of the system with limiting capacity and identify the major sources that contribute to the peak flows associated with overflow events.
- (ii) Capacity Enhancement Measures: Establish short- and long-term actions to address each hydraulic deficiency including prioritization, alternative analysis, and a schedule.
- (iii) Plan Updates: The plan should be updated to describe any significant change in proposed actions and/or implementation schedule. The plan should also be updated to reflect available information on the performance of measures that have been implemented.

5) CMOM Program Audits

As part of the NPDES permit application, an audit should be conducted, appropriate to the size of the system and the number of overflows, and a report submitted of such audit, evaluating the CMOM program and its compliance with this subsection, including its deficiencies and steps to respond to them.

6) Communications

The permittee should communicate on a regular basis with various interested parties on the implementation and performance of its CMOM program. The communication system should allow interested parties to provide input to the permittee as the CMOM program is developed and implemented.

Inspection and Cleaning of Combined Sewers (AM2) Related Goals: 3, 4, 7 Related Indicators: 11, 19			
What	Who	Where	When
Inspection activities, routine maintenance, monitoring activities.	PWD	Combined Sewered Areas (see Figure 8.3).	First 5 years coinciding with the stormwater permit.

Maintenance of sewers includes activities required to keep the system functioning as it was originally designed and constructed. Any reinvestment in the system, including routine maintenance, capital improvements for repair or rehabilitation, inspection activities, and monitoring activities are generally classified as maintenance.

An inspection program is vital to proper maintenance of a wastewater collection system. Without inspections, a maintenance program is difficult to design, since problems cannot be solved if they are not identified. Sewer inspections identify problems such as blocked, broken, or cracked pipes; tree roots growing into the sewer; sections of pipe that settle or shift so that pipe joints no longer match; and sediment and other material building up and causing pipes to break or collapse. The elements of an inspection program include flow monitoring, manhole inspections, smoke/dye testing, closed circuit television inspection, and private sector inspections. Private sector building inspection activities include inspection of area drains, downspouts, cleanouts, sump discharges, and other private sector inflow sources into the system.

In addition to inspection, routine maintenance must also include sewer cleaning, root removal/treatment, cleaning of mainline stoppages, cleaning of house service stoppages, and inspections and servicing of pump stations.

PWD is responsible for implementation of this option in the combined sewer areas of the Tookany/Tacony-Frankford Watershed, but municipalities with separate sewers should have similar permanent and active sewer maintenance programs in place under CMOM (see Option AM1). In Section 4.4.1, Figure 4.19 illustrated the areas where sanitary sewers and combined sewers exist. All municipalities in the watershed are responsible for sewer maintenance.

PWD has combined sewer maintenance responsibilities in the Tookany/Tacony-Frankford Watershed. CSO regulations (including the Nine Minimum Controls discussed in Section 1.4.5) have required that PWD carry out improved sewer maintenance. Some of the activities PWD is carrying out include the review and improvement of ongoing operation and maintenance programs, and comprehensive inspection and monitoring programs to characterize and report overflows and other conditions in the combined sewer system.

Sanitary Sewer Rehabilitation (AM3)			
Related Goals: 3 Related Indicators: 7, 11			
What	Who	Where	When
Perform major repairs or replacement on sections of sewer determined to be in poor condition.	All municipalities with separate sanitary sewer systems.	All municipalities with separate sanitary sewer systems.	Medium-term.

The CMOM and sewer inspection programs discussed in the two preceding sections may identify segments of sewer that are in poor condition and in need of major repair or replacement. The information in this section is adapted from fact sheets on the EPA web site: <http://www.epa.gov/owm/mtb/rehabl.pdf>.

Under the traditional method of sewer relief, a replacement or additional parallel sewer line is constructed by digging along the entire length of the existing pipeline. While these traditional methods of sewer rehabilitation require unearthing and replacing the deficient pipe (the dig-and-replace method), trenchless methods of rehabilitation use the existing pipe as a host for a new pipe or liner. Trenchless sewer rehabilitation techniques offer a method of correcting pipe deficiencies that requires less restoration and causes less disturbance and environmental degradation than the traditional dig and-replace method.

Trenchless Sewer Rehabilitation Methods:

- Pipe Bursting, or In-Line Expansion
- Sliplining
- Cured-In-Place Pipe
- Modified Cross Section Liner

These alternative techniques must be fully understood before they are applied. These four sewer rehabilitation methods are described further below:

Pipe Bursting or In-Line Expansion: Pipe bursting, or in-line expansion, is a method by which the existing pipe is forced outward and opened by a bursting tool. The Pipebursting™ method, patented by the British Gas Company in 1980, was successfully applied by the gas pipelines industry before its applicability was identified by other underground utility agencies. Over the last two decades, other methods of in-line expansion have been patented as well. During in-line expansion, the existing pipe is used as a guide for inserting the expansion head (part of the bursting tool). The expansion head, typically pulled by a cable rod and winch, increases the area available for the new pipe by pushing the existing pipe radially outward until it cracks. The bursting device pulls the new pipeline behind itself.

Sliplining: Sliplining is a well-established method of trenchless rehabilitation. During the sliplining process, a new liner of smaller diameter is placed inside the existing pipe. The annular

space, or area between the existing pipe and the new pipe, is typically grouted to prevent leaks and to provide structural integrity.

Cured-In-Place Pipe: During the cured-in-place pipe (CIPP) renewal process, a flexible fabric liner, coated with a thermosetting resin, is inserted into the existing pipeline and cured to form a new liner. The liner is typically inserted into the existing pipe through an existing manhole. The fabric tube holds the resin in place until the tube is inserted in the pipe and ready to be cured. Commonly manufactured resins include unsaturated polyester, vinyl ester.

Modified Cross Section Lining: The modified cross section lining methods include deformed and reformed methods, sewagelining™, and rolldown. These methods either modify the pipe's cross sectional profile or reduce its cross sectional area so that the liner can be extruded through the existing pipe. The liner is subsequently expanded to conform to the existing pipe's size. Another method of obtaining a close fit between the new lining and existing pipe is to temporarily compress the new liner before it is drawn through the existing pipeline. The sewagelining™ and rolldown processes use chemical and mechanical means, respectively, to reduce the cross-sectional area of the new liner.

External Sewer Rehabilitation Methods (adapted from EPA/600/R-01/034)

External rehabilitation methods are performed from the above ground surface by excavating adjacent to the pipe, or the external region of the pipe is treated from inside the pipe through the wall. Some of the methods used include:

- External Point Repairs
- Chemical Grouting (Acrylamide Base Gel, Acrylic Base Gel)
- Cement Grouting (Cement, Microfine Cement, Compaction)

Internal Sewer Rehabilitation Methods

The basic internal sewer rehabilitation methods include:

Chemical Grouting: Internal grouting is the most commonly used method for sealing leaking joints in structurally sound sewer pipes. Chemical grouts do not stop leaks by filling cracks; they are forced through cracks and joints, and gel with surrounding soil, forming a waterproof collar around leaking pipes. This method is accomplished by sealing off an area with a "packer," air testing the segment, and pressure injecting a chemical grout for all segments which fail the air test. The three major types of chemical grout are: Acrylic, Acrylate, and Urethane.

Continuous Pipe: Insertion of a continuous pipe through the existing pipe (Polyethylene and Polypropylene).

Segmental: Short segments of new pipe are assembled to form a continuous line, and forced into the host pipe. Generally, this method is used on larger sized pipe and forced into the host pipe. (Polyethylene, Polyvinyl Chloride, Reinforced Plastic Mortar, Fiberglass Reinforced Plastic, Ductile Iron, Steel).

Fold and Form Pipe: This is similar to sliplining, except that the liner pipe is deformed in some manner to aid insertion into the existing pipe. Depending on the specific manufacturer, the liner pipe may be made of PVC or HDPE. One method of deforming the liner is to fold it into a "U" shape before insertion into the existing pipe. The pipe is then returned to its original circular shape using heated air or water, or using a rounded shaping device or mandrel. Ideally, there

will be no void between the existing pipe and the liner pipe after expansion of the liner pipe with the shaping device. For the “U” shape liner, the resulting pipe liner is seamless and jointless.

Spiral Wound Pipe: This involves winding strips of PVC in a helical pattern to form a continuous liner on the inside of the existing pipe. The liner is then strengthened and supported with grout that is injected into the annular void between the existing pipe and the liner. A modified spiral method is also available that winds the liner pipe into a smaller diameter than the existing pipe, and then by slippage of the seams, the liner expands outward.

Combined Sewer Rehabilitation (AM4) Related Goals: 3, 7 Related Indicators: 7, 8, 9, 10, 11, 19, 20			
What	Who	Where	When
Perform major repairs or replacement on sections of sewer determined to be in poor condition.	PWD	Combined-Sewered Areas.	Medium-term.

Rehabilitation of combined sewers is conceptually similar to rehabilitation of separate sanitary sewers. Refer to Option AM3 above for information on specific techniques.

Illicit Discharge, Detection, and Elimination (IDD&E) (AM5) Related Goals: 3, 6, 7 Related Indicators: 7, 8, 9, 10, 11, 16, 19, 20			
What	Who	Where	When
IDD&E Program in conformance with Phase II Stormwater Permits and the LTCP for PWD.	All Municipalities required to do Phase II permit (see Table 8.7); PWD in CSO Areas.	All areas with a storm sewer or combined sewer (see Figure 8.3).	5-year program associated with stormwater permit (see Table 8.10).

In accordance with the Tookany/Tacony-Frankford Watershed Plan’s stated purpose of integrating various existing programs, and to avoid duplication of effort, the recommended implementation plan follows the PA DEP Stormwater Management Program Protocol to meet the six minimum control measures required of municipal permittees under the Phase II NPDES Stormwater Regulations (listed in Section 1.4.1 of this report, and found at 40 CFR §§ 122.26 – 123.35). One of the six minimum controls is an IDD&E program. The IDD&E program can be summarized as consisting of the following steps:

- Develop map of municipal separate storm sewer system outfalls and receiving water bodies.
- Prohibit illicit discharges via PA DEP-approved ordinance.
- Implement an IDD&E Program that includes 1) field screening program and procedures and 2) elimination of illicit discharges.
- Conduct public awareness and reporting program (see Option AP1, “Public Education,” in Section 8.1.2).

A similar approach to controlling dry weather flows is being followed by PWD under the Long Term Control Plan (LTCP) for CSOs.

Each step is explained in more detail below:

Develop an Outfall Map

The federal regulations define an outfall as “a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the United States.” A “point source” is defined as “any discernable, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel, or other floating craft from which pollutants are or may be discharged.”

Many of the outfalls along Tookany/Tacony-Frankford Creek have already been located under the studies performed for the Tookany/Tacony-Frankford Creek RCP. Municipalities should work with PWD to develop a consistent set of outfall maps that meet the specific requirements of the Phase II program.

Illicit Discharge Ordinance

A model ordinance is available from PA DEP and should be used as is. PA DEP discourages changes to the model ordinance, because it has been prepared to meet the MS4 permit requirements. However, some municipalities already have good stormwater ordinances. Municipalities who do not wish to enact the model ordinance in its entirety must get approval from PA DEP to ensure that the MS4 permit requirements are met.

The model ordinance must be enacted in the first year of the permit term, except where a municipality commits to a multi-municipal, watershed-based program following the Stormwater Management Program Protocol, in which case the schedule is delayed one year. Subsequent to completion of the Act 167 Plan (or Plan Update), the ordinance must be modified to reflect Plan requirements. Regardless of the timing of the Act 167 Plan (or Plan Update) an ordinance must be enacted within the first two years of the permit term for all municipalities in the Tookany/Tacony-Frankford Watershed.

IDD&E Program

Following the PA DEP Protocol, the IDD&E Program must consist of the following three elements, which must be implemented according to the schedule shown below:

- Conduct Field Screening.
- Identify Source of Illicit Discharges.
- Develop and Implement a Strategy to Remove or Correct Illicit Discharges.

Field Screening: Field screening is necessary to identify source(s) of actual illicit discharges. Field screening must start in Year 2 of the permit. PA DEP provides a checklist that must be used when conducting field screening. Every outfall in priority areas must be screened two times a year. This activity can be accomplished concurrently with other existing field activities, such as regularly scheduled fire hydrant inspections, road repairs, landscaping activities, other field work conducted during county preparation of the Act 167 stormwater plan, etc.

Using a PA DEP supplied Checklist, the staff designated to conduct field screening collect visual data. The screening should be conducted at least 72 hours since the last precipitation event, and at least 48 hours should pass between the first screening at a particular outfall and the second screening at that outfall. If someone conducting the field screening discovers a dry-weather flow, they (or another designated individual with the proper training) must collect a sample of that flow for analysis. Such a discovery triggers the requirements under the other two program elements, below.

Identify Source of Illicit Discharges: The following IDD&E Program elements apply only if a dry-weather flow is identified during field screening activities in Years 2, 3, 4, and/or 5.

If field inspectors identify a dry-weather flow at an outfall during field screening, they should take two grab samples of the flow and analyze the samples for the characteristics and pollutants listed in the Table 8.9 below.

Table 8.9 Dry-Weather Flow Sampling Analysis Requirements

Characteristic/Pollutant	Method
Color	Visual observation
Odor	Visual observation
Turbidity	Visual observation
Sheen/scum	Visual observation
PH	In-field analysis
Total chlorine	In-field analysis
Total copper	In-field analysis
Total phenol	In-field analysis
Detergents/surfactants	In-field analysis
Flow	In-field measurement
Bacteria	Laboratory analysis

The data obtained from visual, in-field, and laboratory analyses will provide the information necessary to determine the source of the dry-weather flow or floatables. Based on the pollutants contained in the sample, it should be possible to determine if the source is from illegal dumping in a storm drain, a cross-connection, or a leak in a pipe. Potential sources of the dry-weather flow can be located by tracing the flow upstream using storm drain maps and by inspecting upgradient manholes and storm drains. If need be, a more focused test to pinpoint the source can be tried, such as dye testing, smoke testing, and television camera inspection.

Remove or Correct the Illicit Discharge: Once the source has been identified, municipalities need to determine if it is a case of improper dumping or if a property owner has an improper physical connection to the storm sewer system. This will help to select the most appropriate method for correcting or removing the discharge. If it is a case of improper dumping, the only recourse may be to conduct intensified education of residents living in and traveling through that area. If it is a case of an improper physical connection, the appropriate action can be taken to correct the discharge. A plan of action to eliminate illicit connections might include plugging discharge points or disconnecting and reconnecting lines.

If a violation is found, the property owner should be notified of the violation and given a timeframe for removal of the source. After that time has passed, the outfall can be screened to identify the dry weather discharge. The property should be visited a final time to confirm that the property owner removed or corrected the source. The results of all discussions, tests, and screenings should be documented for follow-up purposes. Progress evaluation of the municipal IDD&E program will depend on the ability to tabulate the number of illicit connections corrected and the status of those in the process of being corrected.

All municipalities within the Tookany/Tacony-Frankford Watershed that have a sanitary sewer system are required to carry out this program. Table 8.7 lists the municipalities, and Figure 8.3 shows the location of the sewered areas.

The PA DEP Protocol has laid out a very specific time table for completion of this program by the municipalities. The timing is shown in Table 8.10 below.

Table 8.10 Implementation Schedule for IDD&E Program

PERMIT YEAR	IMPLEMENTATION SCHEDULE PERMIT REQUIREMENTS AND MEASURABLE GOALS			
	Mapping	Ordinance	Program	Education
Year 1	Complete map of all outfalls.	Adopt and enact.	Screen Priority Areas. Take corrective actions to remove illicit discharges (as needed).	Presentation on IDD&E. Program and Ordinance during a public meeting. Distribute educational material (see Public Education and Outreach Minimum Measure).
Years 2 - 5	Establish priority areas for 25% of system.	Implement and enforce.	Screen Priority Areas. Take corrective actions to remove illicit discharges (as needed).	Distribute educational material (see Public Education and Outreach Minimum Measure).

The River Conservation Plans (RCPs) noted the following:

- Rising Sun Avenue to Roosevelt Blvd: Investigate exposed pipe at Tabor Road.

Stream Cleanup and Maintenance (AM6)			
Related Goals: 1, 3, 4, 6, 7			
Related Indicators: 3, 4, 5, 6, 10, 11, 15, 16, 17, 19, 20			
What	Who	Where	When
Remove litter and heavy debris. Maintain habitat improvements (fish ladders, FGM, elimination of plunge pools).	PWD Waterways Restoration Unit; Fairmount Park volunteers and other volunteer groups.	Entire creek system.	Begin within 5 years; monthly maintenance schedule to be determined.

Keeping streams free of trash is a continuous activity. Fairmount Park volunteers alone have removed over 2,000 bags of trash from the stream corridor since 1998. Public education should help in reducing trash and debris reaching the streams; however, PWD and municipalities need to put into place a permanent maintenance schedule. PWD has implemented a permanent Waterways Restoration Unit. This team periodically removes trash and large debris from Tookany/Tacony-Frankford Creek on a rotating schedule. For reaches of stream within the City or along the City boundary, the team will focus on removal of litter and heavy debris, and maintenance of instream aquatic habitat improvement projects including fish ladders, fluvial geomorphologic restoration projects, and elimination of outfall plunge pools. For reaches of stream outside the City, municipalities should organize periodic stream cleanups using volunteer groups.

In addition to noting the specific trouble spots listed below, the River Conservation Plans (RCPs) recommend a general cleanup routine be established to conserve both the biological and aesthetical quality of the rivers. Any plans that reduce the amount of trash or illegal dumping would be considered essential. Local township volunteers can be of great assistance in this particular BMP.

- Wyncote Post Office to Washington Lane Underpass: Investigate dumping of construction material.
- Rock Creek Watershed: Monitor commercial areas for illegal dumping.
- Rising Sun Avenue to Roosevelt Boulevard: Erect a barricade to deter illegal dumping.
- Roosevelt Boulevard to Whitaker Avenue: Install a barrier to stop dumping at Whitaker Ave. Bridge.
- Whitaker Avenue to Wyoming Avenue: Erect a barricade to deter illegal dumping.
- Aramingo Avenue between Wheatsheaf Lane and Church Street: Install fence barrier at Aramingo Ave. overpass to stop illegal dumping.
- Holy Sepulchre Cemetery to Ralph Morgan Park: Conduct regular trash removal.
- Ralph Morgan Park to Greenwood Avenue: Clear debris blocking stormwater outlets and ask staff not to dump leaves in the creek.

- Greenwood Avenue to Wyncote Post Office: Routinely clear creek of trash and debris after storms.
- Wyncote Post Office to Washington Lane Underpass: Major cleanup required. SEPTA should be contacted to clean railroad debris.
- Washington Lane Underpass to Church Road: Remove trash, storm debris, and graffiti.
- High School Park to Ashbourne Road along the Tookany Creek Parkway: Conduct regular trash removal.
- Unnamed Tributary in Glenside: Clean up trash and storm debris along Tyson Ave. SEPTA should monitor culverts for blockage.
- Rock Creek Watershed: Continue to improve infrastructure that has a negative impact on water quality. Conduct regular trash removal.
- Abington Country Club to Township Line Road: Clean and maintain channelized portion of the creek on a regular basis.
- Township Line Road near Foxcroft Road to Main Stem (unnamed tributary): Clear entire reach of storm debris.
- Abington Friends School to Township Line Road: Regularly remove trash in the creek area.
- Township Line Road to Tookany Creek Parkway: Conduct regular trash/debris removal.
- Cheltenham Avenue to Adams Avenue: Clear creek of debris. Concentrate on woody debris at bridge. Evaluate trash pick-up schedule with Fairmount Park.
- Crescentville and Adams Avenues to Rising Sun Avenue: Conduct regular trash removal.
- Rising Sun Avenue to Roosevelt Boulevard: Conduct a massive trash removal, concentrating at the F Street site. Clear overgrown vegetation.
- Roosevelt Boulevard to Whitaker Avenue: Conduct massive trash removal of the whole segment.
- Wyoming Avenue to Castor Avenue: Conduct a trash cleanup. Contact Ferko Playground regarding trashcans and regular trash removal.
- Castor Avenue to Erie Avenue: Remove graffiti from walls and secure access areas.
- Aramingo Avenue between Wheatsheaf Lane and Church Street: Clear creek of all debris.
- Rohm & Haas, 5000 Richmond Street: Conduct trash removal at mouth of embankment.
- Intersection of Adams and Newtown Avenue: Investigate illegal dumpsite and install fencing.
- Driveway connecting Adams Ave to Godfrey Ave: Investigate illegal dumpsite and install fencing.
- Castor Avenue near Wyoming Avenue: Investigate illegal dumpsite and install fencing.
- I and Ramona: Investigate illegal dumpsite and install fencing.
- Awbury Arboretum: Investigate illegal dumpsite and install fencing.

8.1.4 Target A Options: Recreational and Cultural Resources

Enhancing Stream Corridor Recreational and Cultural Resources (AO1)			
Related Goals: 4, 6, 7			
Related Indicators: 16, 17, 18, 19, 20, 21			
What	Who	Where	When
Establish and improve trails and greenways using measures recommended in the RCPs and the Fairmount Park Trails Master Plan. Protect historic sites listed in the RCPs.	Outside Philadelphia: partnership of Department of Conservation and Natural Resources (DCNR), county planning departments, and municipalities. Inside Philadelphia: Fairmount Park Commission.	See Figures 8.2.	Medium-term: 5-15 years.

Part of Target A addresses the accessibility of Tookany/Tacony-Frankford Creek. Once dry weather water quality and aesthetics have been improved, the recreational value of the Creek will be enhanced, and better accessibility becomes important. A stream accessibility analysis (Section 4.6.4, Indicator 18) illustrated that much of the headwaters and the downstream portion of the Tookany/Tacony-Frankford are inaccessible. The recommended actions focus primarily on improving access to public lands where recreational potential is greatest.

The River Conservation Plans (RCPs) recommend improving existing stream corridor recreation resources in order for the watershed to gain value as a civic asset. This goal can be achieved through building/repairing trails or by blocking disruptive activities (such as ATV use). Protecting historically significant items is also a recommendation. The RCPs noted in particular:

- Church Road at Cheltenham Hills Drive to Church Road near Ogontz Field: Remove millstones for historic display at Wall House.
- Rock Creek Watershed: Consider a trail or greenway along township-owned segments.
- Cheltenham Avenue to Adams Avenue: Repair trail erosion at benches. Recommend repair or removal of exercise stations.
- Crescentville and Adams Avenues to Rising Sun Avenue: Research and implement swimming deterrents.
- Whitaker Avenue to Wyoming Avenue: Create barriers to stop ATV use.
- Holy Sepulchre Cemetery to Ralph Morgan Park: Create a parks master plan for this area.

Fairmount Park’s Natural Lands Restoration and Trails Master Plan contains specific recommendations for creating and enhancing trails in their park system. These are shown in Table 8.11 and Figure 8.2 on the pages that follow.

Table 8.11 Fairmount Park Trails Master Plan Recommendations

- Provide maximum support and development of positive volunteer educational and restoration efforts already in place.
- Eliminate redundant and problematic trails that are contributing to the ecological decline of the natural areas.
- Increase perceived safety by providing better trail sight lines and perimeter lighting.
- Create well-defined trail heads that have good transit and regional connections.
- Provide access points/gateways to adjacent neighborhoods.
- Provide interpretive and educational opportunities for the diverse ecological and cultural settings of the park.
- Provide for adequate parking and controlled access to the trails to eliminate/reduce likelihood of trails as entrance points for motorized vehicles (particularly ATV's and abandoned autos).
- Provide maintenance strategies and restoration solutions for eroded and degraded trails that will continue to be used.

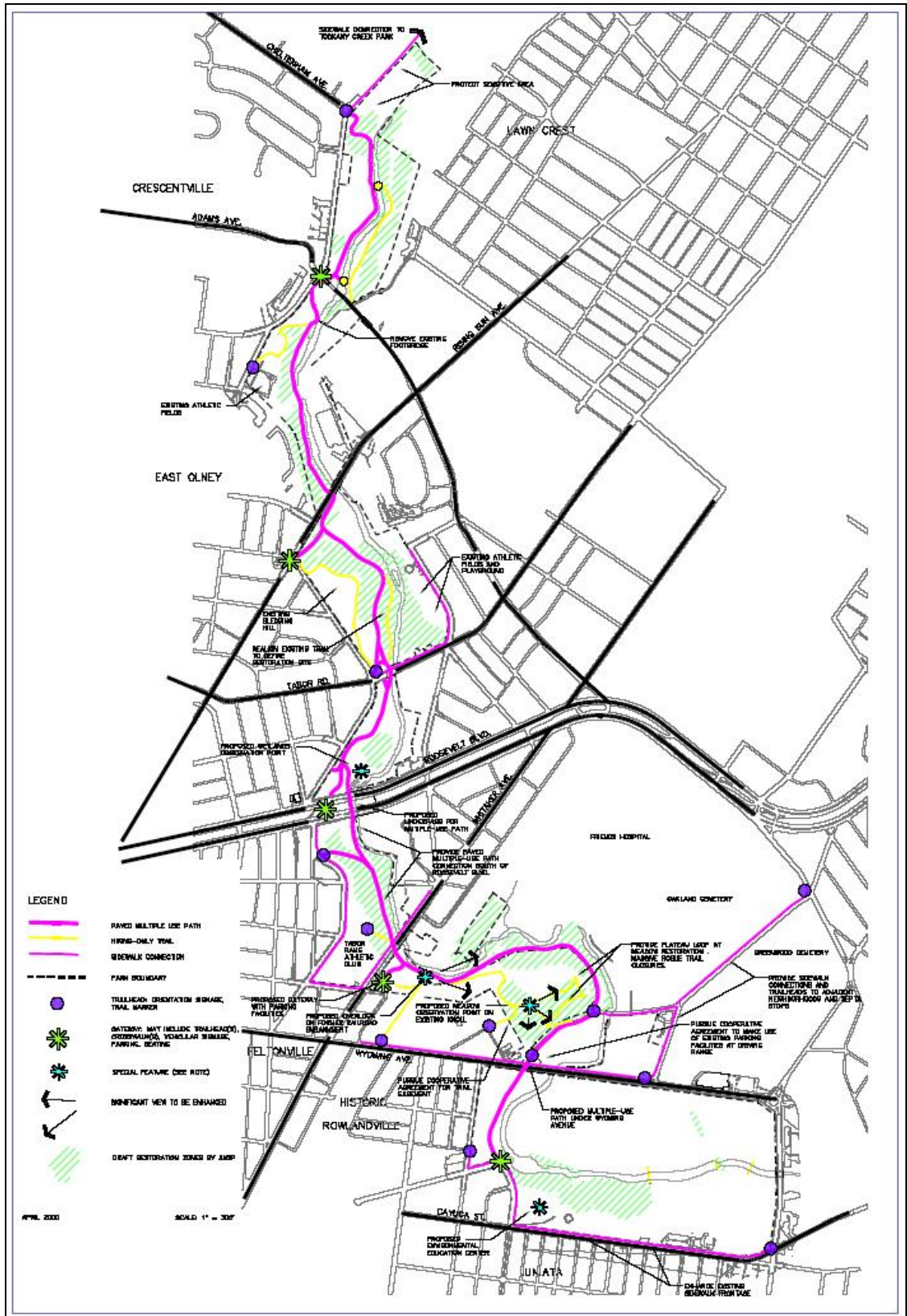


Figure 8.2 Fairmount Park's Proposed Trails Plan for Tookany/Tacony-Frankford Creek

8.1.5 Target A Options: Monitoring and Reporting

Monitoring, Reporting, and Further Study (AMR)			
Related Goals: Related Indicators: 16, 17, 18, 19, 20, 21			
What	Who	Where	When
Monitor and collect data in areas where more information is needed to clarify the situation or establish a proper BMP.	PWD in CSO areas; municipal townships in separate sewered areas.	See Figure 8.3.	Short-term: 1-5 years.

The River Conservation Plans (RCPs) recommend monitoring sites where there is an unexpected substance, odor, or bacteria. A comprehensive water quality analysis is also recommended.

- Ralph Morgan Park to Greenwood Avenue: Identify the orange milky substance. Focus on water quality.
- Wyncote Post Office to Washington Lane Underpass: Investigate orange gel-like substance. Township to lead investigation.
- Rock Creek Watershed: Continue to monitor the areas with excessive coliform levels.
- Rising Sun Avenue to Roosevelt Boulevard: Target the cause of sewer odor and rectify.
- Roosevelt Boulevard to Whitaker Avenue: Target outfalls. Investigate possible disconnected sewer line.
- Wyoming Avenue to Castor Avenue: Target outfalls. Investigate sewage smells.
- Aramingo Avenue between Wheatsheaf Lane and Church Street: Investigate discharge from outfall pipe.

In the first five-year implementation plan, additional studies will be recommended to focus on dissolved oxygen, sources of fecal coliform, and the potential causes of large dissolved oxygen swings in the lower portion of the watershed.

8.2 Target B: Healthy Living Resources

Given the historic degradation of the water quality and ecology of Tookany/Tacony-Frankford Creek and its tributaries from urbanization, an interdependent set of corridor improvement actions are recommended. Because of that interdependent nature, this section begins with an overview that addresses various points common to many or all of the recommended Target B options. Following that overview, the individual options – all of which were recommended for implementation (as explained in Section 7) – are described in detail.

Section 8.2.1 Overview: Stream and Riparian Corridor Improvement

Section 8.2.2 Channel Stability and Aquatic Habitat Restoration

- BM1* Bed Stabilization and Habitat Restoration
- BM2* Bank Stabilization and Habitat Restoration
- BM3* Channel Realignment and Relocation
- BM4* Plunge Pool Removal
- BM5* Improvement of Fish Passage

Section 8.2.3 Lowland and Upland Restoration and Enhancement

- BM6* Wetland Creation and Enhancement
- BM7* Invasive Species Management
- BM8* Biofiltration
- BM9* Reforestation

Section 8.2.4 Monitoring and Reporting

- BMR* Monitoring, Reporting, and Further Study

8.2.1 Overview: Stream and Riparian Corridor Improvement

This Tookany/Tacony-Frankford Integrated Watershed Management Plan proposes a comprehensive stream and riparian corridor restoration strategy. The recommended actions presented throughout Section 8.2 – ranging from conservation of existing open spaces, to stream stabilization actions, to creation of new wetlands and biofiltration areas – together constitute a fully integrated riparian corridor improvement strategy that provides new habitat and water quality improvement. In the Philadelphia portion of the riparian corridor, this approach is intended to complement and expand the Fairmount Park Commission’s Environmental Stewardship and Education Program.

These riparian corridor improvement actions, when implemented simultaneously, will result in improvements that span the waterway and riparian corridor. Thus, riparian corridor actions improve the ecology of the Tookany/Tacony-Frankford Creek landscape and optimize the ways in which the limited remaining open space can help improve water quality. The long-term benefits of an integrated riparian strategy significantly outweigh the short-term construction disturbances that are needed to implement the Tookany/Tacony-Frankford Creek riparian corridor improvements.

The riparian corridor is defined here as the land area that borders a stream and which directly affects and is affected by the water quality, including floodplains, shorelines, wetlands, and riparian forest. For the purposes of the Tookany/Tacony-Frankford Creek riparian corridor improvement strategy, the riparian area also includes the stream channel. Thus, the full undeveloped land and waterway area between the existing land development that surrounds the corridor will be considered for ecological improvement and for biofiltration functions that will improve water quality. Listed below are the options recommended for implementation across the corridor, from the lowest point in the landscape (the stream channel) to the highest (upland forest).

The most effective approach to riparian corridor improvement is to perform all the proposed streambed, streambank, wetland, and riparian upland improvements simultaneously along a reach, or stream section, to realize the synergy of the full set of landscape improvements. When one stream segment is completed, work would shift to the next priority location, section by section, for the length of the Tookany/Tacony-Frankford Creek corridor.

Implementing one set of corridor actions, for example, bed stabilization, without complementary actions, such as bank stabilization, will result in only limited success, because the aquatic and streamside land environments must function interactively to provide optimal stability. For this reason, the riparian corridor improvement strategy is both a short-term and long-term plan. Restoration activities in sections of the watershed that are in greatest need of improvement should be implemented early (targeting stream sections that are causing or contributing to water quality or ecological impairment first). For the Tookany/Tacony-Frankford Creek corridor, it is anticipated that significant improvements in water quality and ecology can be realized by addressing high priority locations that are principally upstream during the first 5 years, with sections downstream of Castor Ave. that require further evaluation of water quality issues receiving riparian corridor improvement during a second 10 year period (see Figure 8.4 and Table 8.12). It is important to note that the next step in implementing the riparian corridor

improvement strategy is to develop a corridor improvement facilities plan, under which integrated designs are prepared for the full range of corridor improvements (e.g., bed and bank stabilization, and wetland creation and enhancement).

PWD recently performed stream assessments along the entire Tookany/Tacony-Frankford Creek corridor. The results of this study will provide more specific guidance on priority stream sections and recommended improvements.

The River Conservation Plans (RCPs) include the following recommendations for restoring buffer zones and undercut creek banks in an effort to control both stream contamination and flooding:

- Holy Sepulchre Cemetery to Ralph Morgan Park: Initiate plan to study geomorphology and sinuosity. Restore and enforce riparian buffer regulations. Conduct streambank stabilization.
- Ralph Morgan Park to Greenwood Avenue: Restore banks where there is severe undercutting. Plant creek banks to prevent washed out areas. Create “no-mow” zones. Remove a retaining wall, regrade, and plant the bank to facilitate a natural retaining basin. Relocate and replace the macadam walking path with natural material.
- Church Road at Cheltenham Hills Drive to Church Road near Ogontz Field: Possible relocation of playground equipment away from stream bank to promote healthier buffer zone. Check stability of rip-rap and stacked cement retaining wall. Restore and/or stabilize some of the undercut bank and root exposed trees.
- High School Park to Ashbourne Road along the Tookany Creek Parkway: Initiate plan to study local geomorphology and sinuosity. Conduct streambank stabilization.
- Unnamed Tributary in Glenside: Redesign, regrade, and plant banks along Grove Park. Create “no-mow” zone. Create riparian buffer zone, restore streambank along Waverly Rd. Formally name all unnamed tributaries.
- Baeder Creek Watershed: Consider removal of vertical gabion baskets and concrete wall in place of natural bank slopes. Conduct a hydrological assessment to correct serious flooding and bank instability; much of the creek’s geometry has been altered. Conduct biotechnical streambank stabilization in most severe areas.
- Rock Creek Watershed: Restore the riparian buffer.
- Mill Run Watershed: Restore the riparian buffer. Enforce regulations.
- Abington Country Club to Township Line Road: Re-establish riparian buffer, possibly a 20-ft “no-mow” zone.
- Township Line Road near Foxcroft Road to Main Stem (unnamed tributary): Restore and stabilize some of the undercut and eroded banks.
- Abington Friends School to Township Line Road: Consider restoration of natural riparian buffer and channel along residential areas. Repair eroded areas using naturalized approaches such as native plantings.

- Township Line Road to Tookany Creek Parkway: Replant riparian areas and restore riparian buffer. Enforce regulations. Conduct biotechnical streambank stabilization.
- Cheltenham Avenue to Adams Avenue: Restore creek banks where there is severe undercutting.
- Crescentville and Adams Avenues to Rising Sun Avenue: Restore creek banks where there are exposed roots.
- Rising Sun Avenue to Roosevelt Boulevard: Repair undercut streambanks.
- Roosevelt Boulevard to Whitaker Avenue: Restore creek banks where there is severe erosion.
- Whitaker Avenue to Wyoming Avenue: Restore creek banks and repair restoration site.
- Wyoming Avenue to Castor Avenue: Repair undercut and exposed streambank. Repair manmade restoration project.
- Aramingo Avenue between Wheatsheaf Lane and Church Street: Restore creek banks.
- Holy Sepulchre Cemetery to Ralph Morgan Park: Remove fencing crossing stream; it appears to impede normal flow.

8.2.2 Target B Options: Channel Stability and Aquatic Habitat Restoration

Bed Stabilization and Habitat Restoration (BM1)			
Related Goals: TK Related Indicators: TK			
What	Who	Where	When
Text to be inserted	Placeholder box	Text to be inserted	Placeholder box

Bank Stabilization and Habitat Restoration (BM2)			
Related Goals: TK			
Related Indicators: TK			
What	Who	Where	When
Text to be inserted	Placeholder box	Text to be inserted	Placeholder box

Channel Realignment and Relocation (BM3)			
Related Goals: TK Related Indicators: TK			
What	Who	Where	When
Text to be inserted	Placeholder box	Text to be inserted	Placeholder box

Plunge Pool Removal (BM4) Related Goals: 5, 7 Related Indicators: 3, 15, 19, 20			
What	Who	Where	When
Remove plunge pools below stormwater and CSO outfalls.	PWD, and municipalities bordering streams recommended for restoration.	Outfalls shown in Figure 8.3.	Begin within 5 years; monthly maintenance schedule to be determined.

When stormwater and combined sewer outfalls discharge directly to the stream channel, they may create deep, poorly mixed pools. Both types of outfalls discharge along the length of the Tookany/Tacony-Frankford and its tributaries (Figure 8.3). Because these pools are typically near the bank and not in the main flow, they can become poorly mixed during low flow. These pools often have increased odors and reduce the aesthetic quality of the stream. Biological activity in the sediment and water column can reduce dissolved oxygen to low levels, and this low-DO water can be flushed out and affect downstream areas during wet weather. The depression of DO is a function of both pollutant loads from the outfalls and in stream baseflow, and the physical condition of the channel. When DO is in an acceptable range in the well-mixed portion of the channel but not in nearby plunge pools, elimination of the plunge pools can eliminate a water quality condition that might affect the aquatic ecosystem.

When possible, outfalls can discharge further up the bank into a wetland or biofiltration area; these areas provide detention, evaporation, cooling, and treatment of pollutant loads in addition to protecting the integrity of the stream channel. Opportunities for creation of these areas (Options BM6 and BM8, respectively) will be discussed later in this section. Where the only place for an outfall to discharge is directly into the stream channel, the area may be protected using appropriate bed and bank stabilization features (Options BM1 and BM2), as discussed above.

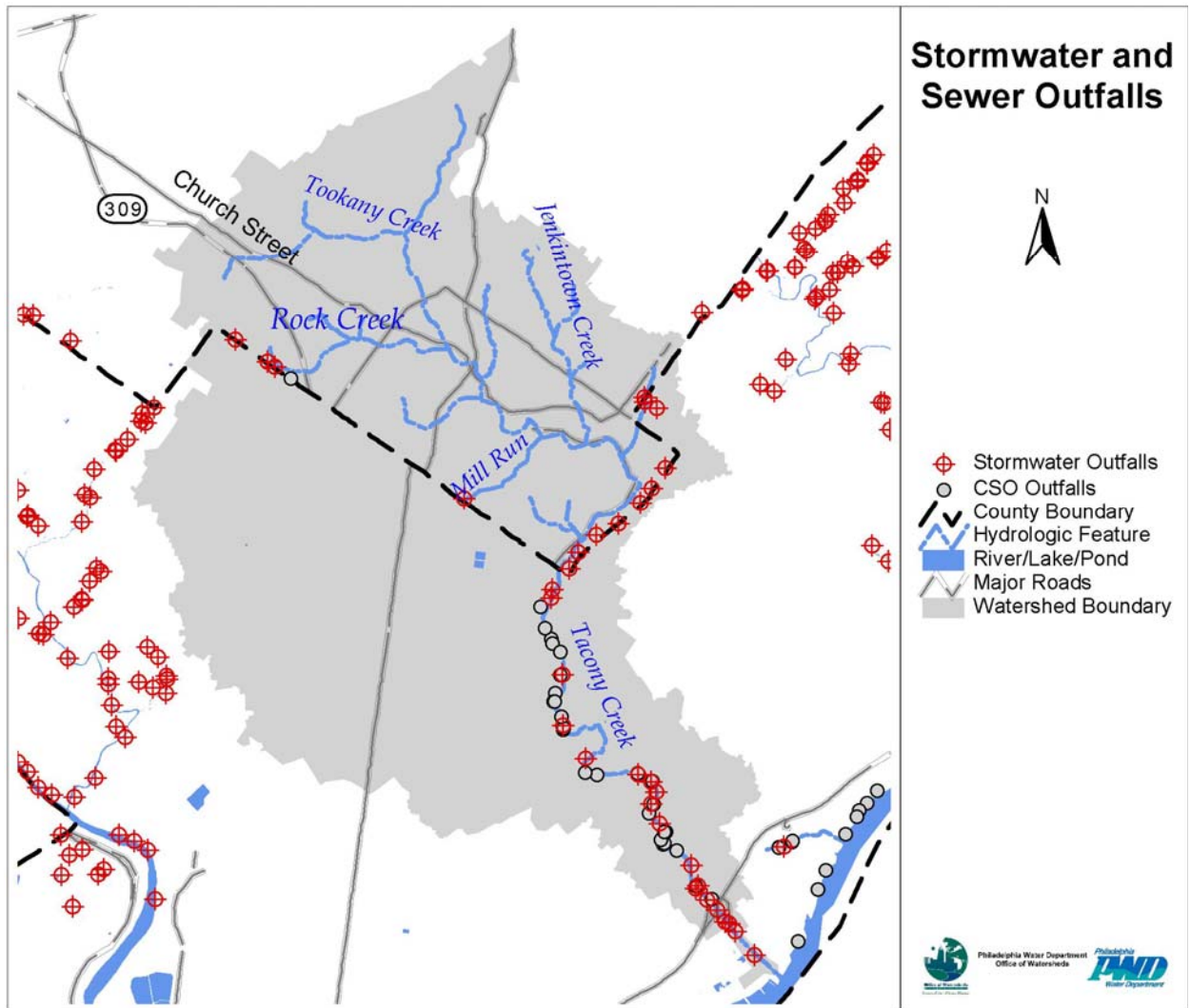


Figure 8.3 Stormwater and CSO Outfalls in the Philadelphia Portion of the Tookany/Tacony-Frankford Watershed

Improvement of Fish Passage (BM5)			
Related Goals: 1, 6, 7			
Related Indicators: 3, 5, 6, 16, 19, 20, 21			
What	Who	Where	When
Assess potential to improve fish migration through dam modification or installation of fish ladders.	PWD; Fairmount Park Commission.	To be determined by future study.	Long-term; after pollutant sources in lower Tacony are addressed.

For the Tookany/Tacony-Frankford Creek, the State-designated aquatic life uses for the non-tidal portion of the creek are Warm Water Fishes (WWF) and Migratory Fishes (MF). The designated recreational water uses also include boating, when surface water flow or impoundment conditions allow; fishing, for recreation and/or consumption; water contact sports; and aesthetics.

Investigation and restoration of fish migration is recommended as a long-term goal. However, areas of low dissolved oxygen (DO) have been identified south of Castor Avenue. Further investigation and remediation of this problem is recommended as a short-term goal; efforts to remove barriers to fish migration will not succeed in restoring populations until water quality conditions are sufficient to support fish.

The River Conservation Plans (RCPs) noted the following:

- Township Line Road to Tookany Creek Parkway: Work with landowner to remove wooden plank to allow fish to pass through.

8.2.3 Target B Options: Lowland and Upland Restoration and Enhancement

Wetland Creation and Enhancement (BM6)			
Related Goals: 1, 2, 3, 4, 5, 7			
Related Indicators: 1, 2, 3, 4, 7, 8, 9, 15, 19			
What	Who	Where	When
Wetland creation and enhancement for flood flow alteration, groundwater recharge, increased habitat, increased plant and animal diversity, and improved water quality.	PWD; Fairmount Park Commission. Municipalities bordering streams recommended for restoration.	Recommended locations for floodplain wetland creation; areas for pocket wetland creation need to be field determined, based on where they are adjacent to lands proposed for stream realignment and bank restoration (see Figure 8.5).	Prototype design and evaluation phase, followed by upstream creation/enhancement in years 1-5; downstream implementation over two 10-year phases.

One high-priority riparian corridor improvement action, from both an ecological and water quality improvement perspective, is creation and enhancement of wetlands along the Tookany/Tacony-Frankford Creek. The Fairmount Park Commission has proposed four vegetation restoration sites along the creek, two of which are wetland sites. The Tookany/Tacony-Frankford Creek subwatersheds were field surveyed in 2002/2003 to assess wetland improvement opportunities for existing wetlands, and wetland creation opportunities for new locations. Existing wetlands were evaluated for their ability to perform important wetland functions (e.g., flood flow alteration, water quality improvement, and habitat), where degraded actions were evaluated to improve compromised functions. Existing wetlands were then assessed to determine if they might be effectively expanded. Finally, locations where new wetlands could be created were identified. New wetland creation opportunities were classified into two groups:

- Wetlands immediately adjacent to the waterway and which would receive flood flows frequently during the year (< one year storm); and
- Pocket wetlands that can be created using checkdams that are higher in the landscape and that would receive stormwater flows from adjacent subwatershed areas, but would receive flood flows only from major storm events.

Wetlands Enhancement

The wetland field investigations for the TTF Watershed rated the opportunity to improve and expand existing wetlands, by evaluating opportunities to reconnect the wetland to the waterway, to receive additional overland flows, to remove sources of encroachment, and to expand the size of the wetlands. Nearly all the 24 existing wetlands exhibited potential for functional improvement through hydrologic improvements, re-vegetation, or reducing historic

disturbance. The field analysis indicates significant opportunity for wetland improvement, as shown in Table 8.12 and Figure 8.4.

Table 8.12 Wetland Improvement Potential

Wetland Improvement Potential	
Improvement Rating	Wetland Areas
High	15
Moderate	8
Low	1

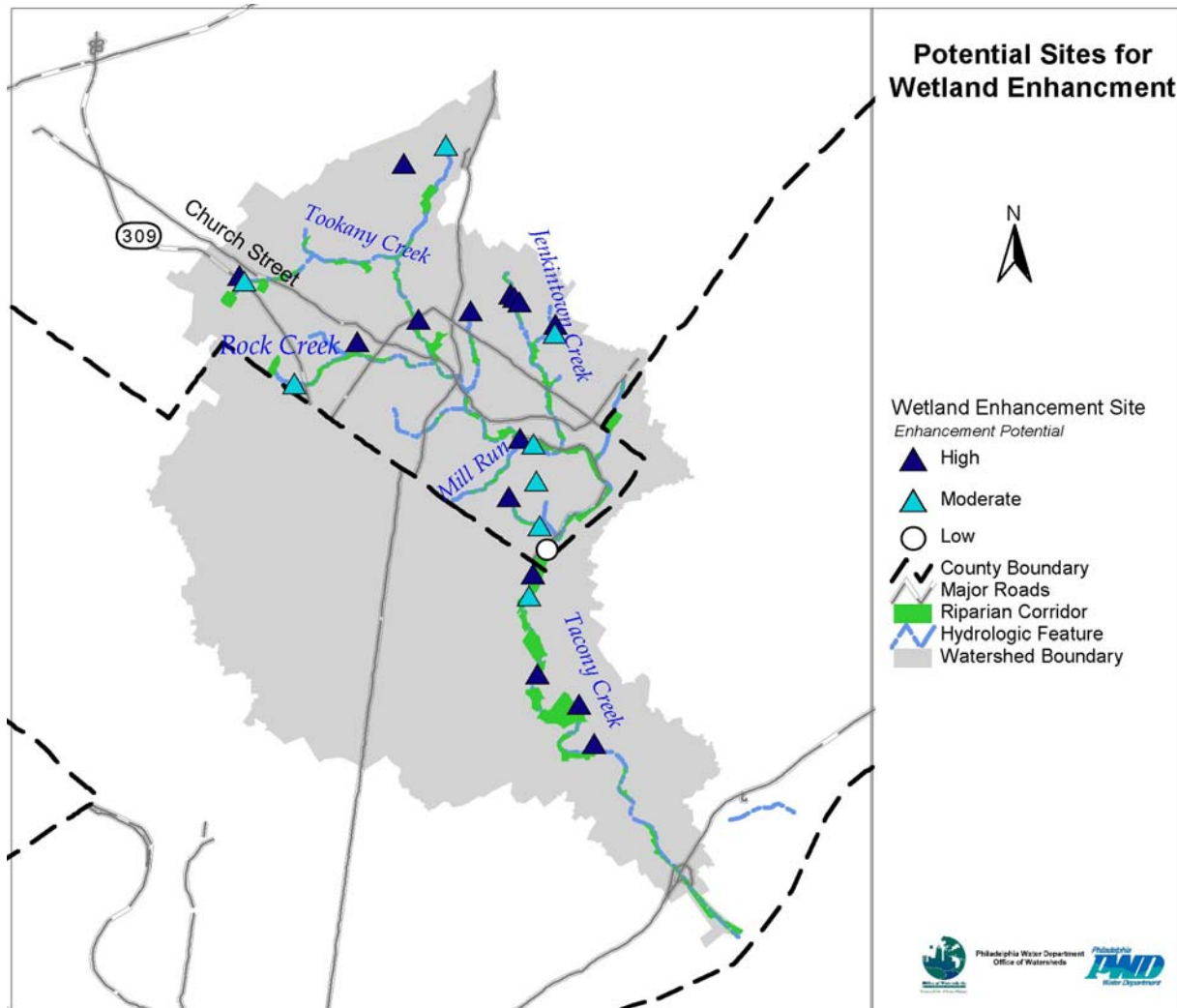


Figure 8.4 Potential Sites for Wetland Improvement

While there are many opportunities for wetland improvement, there is only limited opportunity for wetland expansion. The total potential estimated increase in wetland area for the moderate and high potential wetland sites was limited to less than 3 acres, increasing the existing inventory from about 15 acres to 18 acres. Greater opportunity for increasing wetland acreage is available from wetland creation/re-creation activities.

Wetlands Creation

The wetland field analysis also included an evaluation of potential opportunities for wetland creation along the riparian corridor. The evaluation of wetland creation potential was focused on the physical potential (undeveloped land area present, proximity to waterway, position in landscape) and did not address institutional or ownership factors.

Because stream relocation and realignment typically involve extensive grading and replanting, new runoff patterns and hydrology can be created that are more similar to original riparian conditions, whereby riparian corridor wetlands could receive storm runoff sheet flow from the adjacent landscape. In addition, wetland habitats can be created that allow more diverse habitat. Wetlands are rich habitats that rely on saturated soils and vegetation adapted to these conditions. They could be recreated concurrently with channel realignment, bank restoration, and planting of more diverse native vegetation, including hydrophytic species adapted to saturated soil conditions.

Wetlands must have an adequate input of water, either by flooding or runoff, to maintain the soil and vegetation characteristics that are unique to wetlands. Field investigation of wetlands revealed, however, that several factors constrain the creation of extensive areas of new wetland. These include:

- Extensive urban and suburban encroachment into the riparian corridor;
- Competing active recreational uses along the waterway; and
- Steep slopes adjacent to the waterway limiting potential for floodplain hydrology.

Field estimates indicate that over 24 acres of wetland might be created in 26 separate creation locations. This would result in a more than 150% increase in wetland acreage along the riparian corridor. If wetland expansion potential were also included, the wetland acreage along the riparian corridor could be increased by 175% to about 42 acres. These estimates represent a highly optimistic wetland expansion scenario, but indicate the significant potential to at least double the area of wetland along the riparian corridor. These wetland creation locations are identified in Figure 8.5 below.

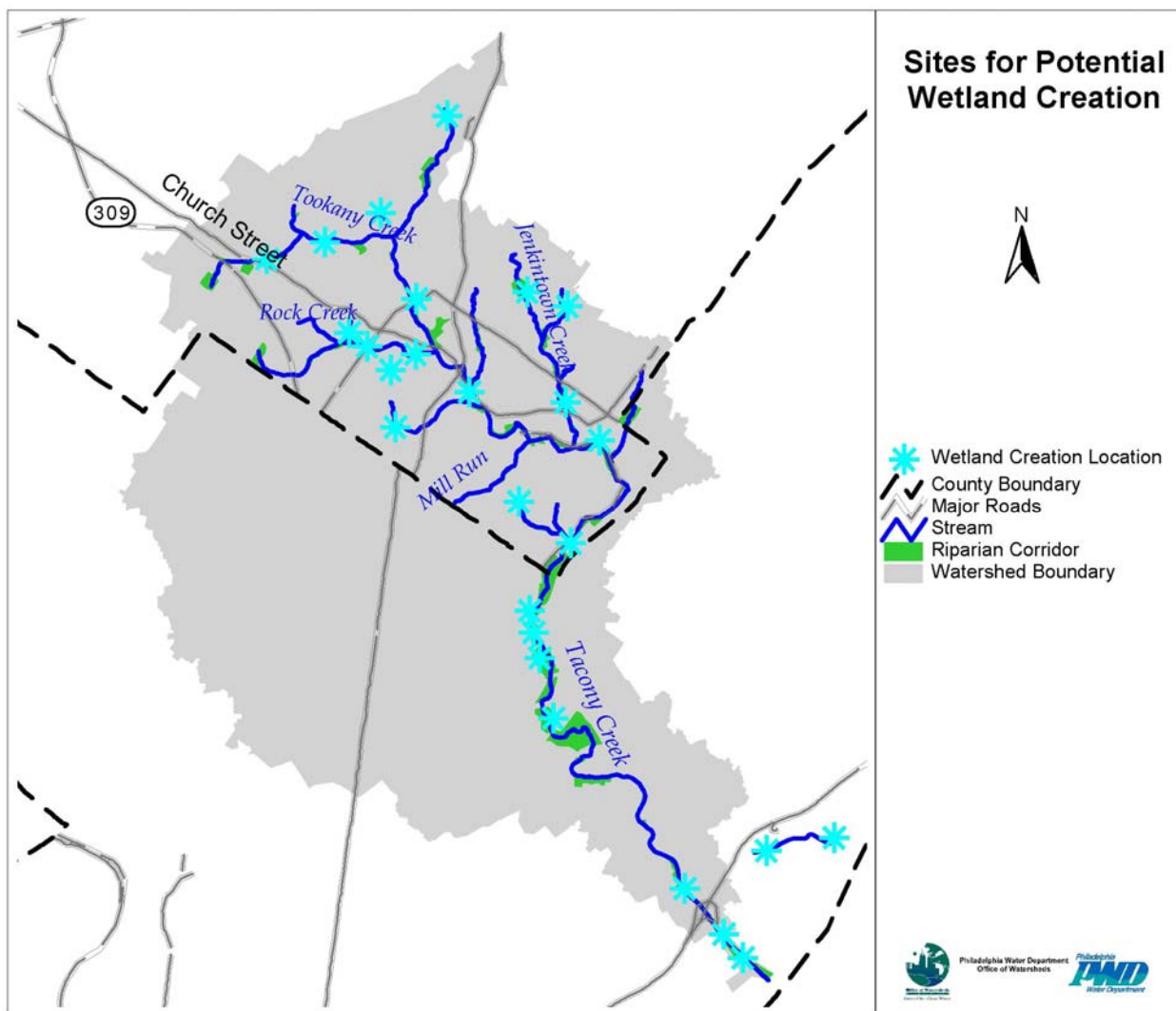


Figure 8.5 Potential Sites for Wetland Creation

In general, priority will be given to wetland creation and improvement over reforestation of uplands because of the greater water quality benefits provided by wetlands.

As noted above, two types of wetland creation are recommended: floodplain wetlands and pocket wetlands. There are numerous opportunities for creation of pocket wetlands throughout the watershed; as stormwater runoff from the adjacent subwatershed is redirected over the riparian landscape, checkdams and piping may be used to spread the runoff over the vegetated riparian land surface. More specific locations for creating pocket wetlands will need to be evaluated in the future as the riparian corridor restoration design is developed during the facilities planning stage. This is because opportunities for creation of pocket wetlands arise from bank restoration, revegetation, and biofiltration actions that will be implemented as part of the integrated riparian corridor improvement strategy for the TTF Watershed.

Both floodplain wetlands and pocket wetlands offer significant opportunity for water quality and ecological improvement along the Tookany/Tacony-Frankford Creek riparian corridor, and both will play a central role as the design of the riparian corridor improvements is developed.

Assuring long term success for wetland creation projects will involve future monitoring to measure integration of the wetland into the riparian landscape and to correct defective conditions, where possible. However, proper design of the wetland to assure adequate input of water (via flooding or runoff), protection from erosion, and maintenance of the diverse planted vegetation is essential to long-term success. Wetland creation projects typically involve monitoring and maintaining the created wetland's hydrology, vegetation (including invasive species, discussed below), and erosion characteristics for a period of three years following creation.

Further investigation of all potential wetland enhancement and creation opportunities should include the following: identification of landowners, rainfall data collection and evaluation, runoff calculations, soils investigation, water budget, native species investigation, and groundwater/soil saturation monitoring.

Invasive Species Management (BM7)			
Related Goals: 4			
Related Indicators: 12, 13, 14, 19			
What	Who	Where	When
Implement an Invasive Species Management Plan (already in effect in Fairmount Park).	PWD; Fairmount Park Commission.	Lowland and upland habitat restoration sites.	Within 5 years.

A plan to control invasive plant species is necessary when restoring or enhancing wetlands and riparian forests. Invasive species provide little value to native animals that depend on native species for habitat and food. Japanese knotweed (*Polygonum cuspidatum*) is one prevalent invasive species that was observed during the field reconnaissance. In many areas, knotweed, due to its aggressive nature, has already out-competed native vegetation. Maintaining a healthy riparian plant community along Tookany/Tacony-Frankford Creek will retain biodiversity and support a healthy stream ecosystem.

The Fairmount Park Commission has implemented an invasive species control program in the Fairmount Park portion of the stream corridor. It is recommended that invasive species control be expanded to the remaining natural areas of the corridor. Implementation of an invasive species management plan would assist natural succession within the riparian buffer and decrease further impacts of invasive species.

Planting plans for all restoration efforts should complement the invasive species management plan by recommending appropriate native planting to supplement areas where invasives have been eliminated. Although invasive species management priority areas are considered those that contain 80% or greater invasive species, the most practical approach is to recommend invasive species management be implemented for all riparian restoration sites. An invasive species management plan will require, at a minimum, a three-year commitment to ensure success.

The River Conservation Plans (RCPs) highly recommend removing invasives and replant native vegetation. The most common invasive was Japanese knotweed. Specific sites noted include:

- Holy Sepulchre Cemetery to Ralph Morgan Park: Control invasive plants and replant with natives.
- Ralph Morgan Park to Greenwood Avenue: Remove Japanese Knotweed and replant with natives. Remove invasive vines from trees.
- Greenwood Avenue to Wyncote Post Office: Remove invasive plants from banks and replant with natives.
- Washington Lane Underpass to Church Road: Remove invasive vines from trees and knotweed. Replant native shrubs and groundcover.

- Church Road at Cheltenham Hills Drive to Church Road near Ogontz Field: Remove knotweed and other invasives. Replant a native buffer zone.
- High School Park to Ashbourne Road along the Tookany Creek Parkway: Eradicate invasive plants and replant with natives.
- Unnamed Tributary in Glenside: Clear knotweed.
- Baeder Creek Watershed: Eradicate invasives and replant natives.
- Rock Creek Watershed: Plant creek banks with natives to prevent invasives from dominating.
- Mill Creek Watershed: Eradicate invasive plants and replant with natives.
- Cheltenham Avenue to Adams Avenue: Remove invasives and replant with natives.
- Crescentville and Adams Avenues to Rising Sun Avenue: Remove invasives and replant with native plants.
- Rising Sun Avenue to Roosevelt Boulevard: Remove invasives and replant with native plants.
- Roosevelt Boulevard to Whitaker Avenue: Remove invasives and replant with native plants.
- Whitaker Avenue to Wyoming Avenue: Remove invasives and replant with native plants.
- Wyoming Avenue to Castor Avenue: Remove invasives and replant with native plants.
- Castor Avenue to Erie Avenue: Remove Japanese knotweed.
- Aramingo Avenue between Wheatshaf Lane and Church Street: Remove Japanese knotweed.
- Rohm & Haas, 5000 Richmond Street: Remove invasives.

Biofiltration (BM8) Related Goals: 1, 2, 3, 5, 7 Related Indicators: 1, 2, 3, 4, 15, 19, 20			
What	Who	Where	When
Biofiltration involves creating sheet flow over the vegetated landscape to slow the rate of runoff, facilitate groundwater recharge, and remove sediment, nutrients, and toxicants from the runoff.	PWD; Fairmount Park Commission.	Throughout Tookany/Tacony-Frankford riparian corridors; focus on vegetated landscape.	Two 10-year implementation phases (high and medium priority).

The goal of the Tookany/Tacony-Frankford Creek riparian corridor improvement strategy is to identify all opportunities along the riparian corridor for natural landscape designs that achieve water quality improvement. For higher landscape positions at the outer edges of the riparian corridor there are extensive opportunities to implement biofiltration to improve runoff. Biofiltration involves creating sheet flow over the vegetated landscape to slow the rate of runoff, facilitate groundwater recharge, and remove sediment, nutrients, and toxicants from the runoff. Typical biofiltration approaches include installation of stormwater swales and checkdams along natural drainage-ways that spread runoff, creation of bioretention plantings and hydrology, and creation of hydrologic features that allow sheet flow to spread over grassed and shrub/scrub fields to achieve water quality improvement. The advantage of biofiltration is that it is compatible with recreational use of the riparian corridor, because flows are very shallow and are usually present only during rainfall events.

Analysis of the existing stormwater management in the Tookany/Tacony-Frankford Watershed shows that most stormwater outfalls discharge directly to the waterway. However, if the stormwater was redirected over the vegetated landscape higher in the stream valley, it would follow the natural slope and land contour as it traveled down to the stream. There are over 685 acres of undeveloped land along the Tookany/Tacony-Frankford Creek riparian corridor, but almost none of that land carries runoff sheet flow because the stormwater piping system conveys all flows, from storms large and small, directly to the stream. In order to achieve water quality improvement goals, it is important to optimize the ability of this vegetated riparian land to receive overland runoff, rather than piping the runoff directly into the stream.

Biofiltration has an effectiveness range of about 25-60% in removing suspended solids from runoff, and the concept of directing runoff to sheet flow over the vegetated riparian landscape matches fully with the way that such lands function naturally in an undeveloped watershed. Thus, the goal of biofiltration is to restore sheet flow of runoff over the landscape, by using piping and hydraulic controls to spread runoff from smaller storms over the vegetated surface. To avoid erosion, it is essential that the design for biofiltration provide for high velocity flows from major storms to be bypassed.

Reforestation (BM9)			
Related Goals: 1, 2, 4, 5, 6, 7			
Related Indicators: 1, 2, 4, 12, 13, 16, 18, 19			
What	Who	Where	When
Reforestation adjacent to the channel to provide wetland habitat and other associated benefits.	PWD; Fairmount Park Commission. Municipalities bordering streams recommended for restoration.	Priority reforestation sites: lands adjacent to the creek that are not developed and are currently unforested. Potential reforestation sites are existing ball fields, golf courses, hospital grounds, seminaries, and cemeteries located adjacent to the channel. These should also be evaluated.	Begin within 5 years; monthly maintenance schedule to be determined.

The riparian corridor restoration and enhancement plan being proposed in this section covers the width of the stream corridor from developed edge to developed edge, including both lowland and upland forest. Reforestation that occurs adjacent to the channel will provide wetland habitat and other associated benefits. Although priority reforestation areas consist of floodplains, steep slopes, and wetlands, smaller areas such as public rights-of-way, parks, schools, and neighborhoods also provide reforestation opportunities. Benefits of reforestation are numerous: cooler temperatures, rainfall interception, reduced runoff, reduced sediment load, reduced discharge velocities, increased groundwater recharge, increased species diversity and habitat, and improved air quality and aesthetics.

At this time, only the recommendations from the River Conservation Plans (RCPs) are available. These include:

- Washington Lane Underpass to Church Road: Have SEPTA plant low growing shrubs in the areas of the bird sanctuary to develop wildlife habitat.
- Unnamed Tributary in Glenside: Partner with SEPTA to plant native vegetation that is in keeping with their track maintenance requirements in order to reduce NPS pollution and stabilize soil to prevent erosion and downstream sedimentation.

8.2.4 Target B Options: Monitoring and Reporting

Monitoring, Reporting, and Further Study (BMR)			
Related Goals: 1, 2, 3, 4, 5, 6, 7			
Related Indicators: all indicators relevant to Target B			
What	Who	Where	When
Monitoring of implementation and benefits for all Target B options. Creation of a Tookany/Tacony-Frankford Stream Corridor Restoration Master Plan.	PWD; Fairmount Park Commission; municipalities bordering streams.	All implementation sites.	Monitoring and reporting to begin immediately and continue throughout the life of the plan. Master Plan creation within 5 years.

The preceding sections are a first step in identifying proposed projects that can lead to comprehensive stream corridor restoration. However, additional planning is needed to ensure that individual projects do not interfere with one another. For example, realignment of a stream section might eliminate a proposed wetland or reforestation site; or removal of a dam might increase stream velocity and erode restored streambanks or eliminate flow of water to a riparian wetland. Creation of a more detailed Restoration Master Plan for the stream corridor is necessary before individual projects can proceed. This plan will be primarily graphical and will identify boundaries and key elevations for existing features and proposed projects. Detailed designs on individual projects will be required to be consistent with the Master Plan. The plan will show the following on a single map:

- Proposed stream bank stabilization and bed stabilization;
- Proposed stream realignment and relocation;
- Proposed dam modification or fish ladder sites;
- Stream obstructions proposed for further study or removal;
- Existing wetlands; proposed wetland creation and enhancement;
- Existing habitat not to be disturbed, including threatened or endangered species;
- Proposed reforestation and habitat creation areas;
- Existing and proposed upland BMPs (biofiltration); and
- Key recreation and access facilities (trails, parking lots).

Before habitat restoration is recommended, however, water quality problems that might now be the cause of poor fish species diversity must be better investigated, and eventually solved.

8.3 Target C: Wet Weather Water Quality and Quantity

Target C must be approached somewhat differently from the first two targets. Full achievement of this target means meeting all water quality standards during wet weather, as well as eliminating all flooding. Clearly, that will be difficult, particularly with regard to wet weather water quality. It would certainly be extremely expensive, and would require a long-term effort. The only rational approach to full achievement of Target C goals is through stepped implementation with interim targets for reducing wet weather pollutant loads and stormwater flows. During implementation, monitoring must continuously assess the effectiveness of the program. Based on the extensive modeling analysis carried out for Tookany/Tacony-Frankford Creek to date, an initial goal of a 20-25% reduction in stormwater flows and stormwater/CSO related pollutant loads has been identified as a challenging but achievable goal. The stakeholders have identified Mill Creek (also called Mill Run) as a priority area for stormwater control.

It is expected that changes to the approach required to meet Target C, and even to the desired results, will occur as measures are implemented and results are monitored. With most discharge permits of five-year duration, discharge targets and reduction targets must be set and implementation designed in the first five years. Implementation for meeting Target C will begin over the next five years with Targets A and B, while monitoring for effectiveness in order to utilize an adaptive management approach for subsequent years to achieve full implementation of Target C. During the final five-year period, PWD should also work with the regulatory agencies to review water quality standards and determine whether any adjustments to them may be appropriate based on the results of monitoring.

Below are the Target C options that were “recommended” (either fully or conditionally) in Section 7. Most of these options are described in detail in the pages that follow.

Section 8.3.1 Regulatory Approaches

- CR2 Requiring Better Site Design in Redevelopment
- CR3 Stormwater and Floodplain Management
- CR4 Industrial Stormwater Pollution Prevention
- CR5 Construction Stormwater Pollution Prevention
- CR6 Post-Construction Stormwater Runoff Management
- CR8 Use Review and Attainability Analysis
- CR9 Watershed-Based Permitting

Section 8.3.2 Public Education and Volunteer Programs

- CP1 Public Education and Volunteer Programs

Section 8.3.3 Municipal Measures

- CM1 Sanitary Sewer Overflow Detection
- CM2 Sanitary Sewer Overflow Elimination: Structural Measures
- CM3 Reduction of Stormwater Inflow and Infiltration to Sanitary Sewers
- CM4 Combined Sewer Overflow (CSO) Control Program
 - Nine Minimum Controls
 - Long Term CSO Control Plan
 - Watershed-Based Planning
- CM5 Catch Basin and Storm Inlet Maintenance
- CM6 Street Sweeping

- CM7 Responsible Landscaping Practices on Public Lands
- CM9 Responsible Bridge and Roadway Maintenance

Section 8.3.4 Stormwater Management

Source Control Measures

- CS1 Reducing Effective Impervious Cover Through Better Site Design
- CS2 Porous Pavement and Subsurface Storage
- CS3 Green Rooftops
- CS4 Capturing Roof Runoff in Rain Barrels or Cisterns
- CS5 Increasing Urban Tree Canopy

Onsite and Regional Stormwater Control Facilities

- CS6 Maintaining/Retrofitting Existing Stormwater Structures
- CS8 Retrofitting Existing Sewer Inlets with Dry Wells
- CS9 Residential Dry Wells, Seepage Trenches, and Rain Gardens
- CS12 Bioretention Basins and Porous Media Filtration
- CS13 Treatment Wetlands: Onsite and Regional

Section 8.3.5 Monitoring and Reporting

- CMR Monitoring, Reporting, and Further Study

Table 8.13 Maximum Feasible Reductions for BMPs with Quantifiable Benefits

Target C	Maximum Feasible Implementation	Volume Reduction		Pollutant Reduction
		CSO	Stormwater	
Municipal Measures				
CM4 Combined Sewer Overflow (CSO) Control Program				
Real Time Control	2 sites	5.9%	N/A	6.1%
Stormwater Management				
<i>Source Control Measures</i>				
CS1 Reducing Impervious Cover Through Better Site Design	1% reduction in DCIA	0.5%	0.5%	1.0%
CS2 Porous Pavement and Subsurface Storage	50% of parking lots	8.0%	3.3%	11.6%
CS3 Green Rooftops	5% of rooftops	1.8%	0.9%	2.7%
CS4 Capturing Roof Runoff in Rain Barrels or Cisterns	10% of homes	1.4%	0.1%	1.8%
CS5 Increasing Urban Tree Canopy	5% of watershed area	0.3%	0.3%	0.5%
<i>Onsite and Regional Stormwater Control Facilities</i>				
CS8 Retrofitting Existing Sewer Inlets with Dry Wells	100% of inlets	6.9%	0.3%	7.5%
CS9 Residential Dry Wells, Seepage Trenches, Rain Gardens	school grounds; 25% of homes	5.7%	0.8%	10.4%
CS12 Bioretention Basins and Porous Media Filtration	50% of parking lots	6.3%	2.1%	11.6%
CS13 Treatment Wetlands: Onsite and Regional	100% of identified potential	1.4%	0.4%	2.5%

8.3.1 Target C Options: Regulatory Approaches

Requiring Better Site Design in Redevelopment (CR2) Related Goals: 1, 2, 4, 7 Related Indicators: 1, 12, 13, 16, 19, 20			
What	Who	Where	When
Adopt or improve ordinances to encourage developers to use low impact methods for new (“greenfield”) development and redevelopment of urban areas.	See Table 8.14 (may not identify all municipalities with ordinances).	Entire watershed.	Within 5 years; update as needed.

Environmentally friendly site design, also called low impact development (LID) and conservation site design, encompasses a range of site design elements for developers, and design requirements from municipalities. Some examples of LID design concepts include maintaining stream buffers, designing for open space, reduced street and sidewalk footprints where appropriate, and parking lot designs that reduce runoff and encourage infiltration. Stormwater source controls, infiltration BMPs, and treatment BMPs can be integrated with LID designs. Recommendations for incorporating these features in the Tookany/Tacony-Frankford Watershed are found throughout Target C.

LID is intended to reduce the impact of development on natural resources and water resources. Municipal design requirements are intended to preserve or increase open space, protect sensitive natural resources, and limit impervious cover. The environmental goals of land development and stormwater ordinances are closely related, although the ordinances themselves and mechanisms for enforcing them may be separate.

It appears that some of the municipalities in the Tookany/Tacony-Frankford Watershed encourage several standard low impact development practices through their existing land use ordinances. However, these guidelines tend to focus on clustering housing by allowing higher-density multi-family residential developments with common open spaces. Separate language focusing specifically on the protection of natural resources is recommended. While some municipalities in the watershed have already adopted a steep slope ordinance, Abington and Cheltenham Townships are currently the only municipalities within the watershed with cluster development ordinances and non-binding wetlands protection ordinances in place. Table 8.14 demonstrates that all municipalities located in the watershed have adopted some aspects of low impact development.

Table 8.14 Better Site Design in Existing Ordinances

Municipality	Better Site Design Ordinance (at least one component)	Comments
Abington Township	X	Cluster development for residential zoning districts; max. impervious cover by zoning type; wetlands conservation; steep slope conservation overlay district.
Cheltenham Township	X	Planned cluster development; open space requirements; designated wetlands; steep slope conservation district.
Jenkintown Borough	X	Minimum street, sidewalk widths; maximum grades; non-binding guidelines for density and open space.
Philadelphia County	X	Max. impervious cover requirements; minimum street, driveway widths.
Rockledge Borough	X	Max. impervious cover requirements by zoning type.

Source: www.ordinance.com, Delaware Valley Regional Planning Commission

The Delaware Valley Regional Planning Commission (DVRPC) has recently completed the task of reviewing the municipal zoning ordinances of the Delaware Valley’s 353 municipalities. Based upon this analysis, DVRPC has created a list of “outstanding sample natural resource and open space protection ordinances.” These model ordinances as well as additional information on DVRPC’s program are available at these sites:

- DVRPC Natural Resource Protection Information:
<http://www.dvrpc.org/planning/community/ProtectionTools.htm>
- Model Ordinances:
<http://www.dvrpc.org/planning/community/ProtectionTools/ordinances.htm>

Guidelines for LID in an Urban Setting

Table 8.15 (see below) identifies various zoning ordinances that could be adopted by the municipalities in the Tookany/Tacony-Frankford Watershed. While some municipalities already incorporate elements of these zoning measures within their existing code, it is recommended that ordinances specific to low impact development be adopted to better facilitate future growth and redevelopment. Model ordinances for each of these examples are available on the DVRPC website at the address listed above.

Table 8.15 Selected Components of Low Impact Development Ordinances

Municipal Zoning Ordinance	Description
"Net-Out" of Resources / Site Capacity Calculations	Protect wetlands, floodplains, and riparian buffers by removing them from the area considered for new development and redevelopment. In calculating the developable area, environmentally sensitive areas should be excluded. Some local governments allow increased densities in the remaining developable land area to provide an incentive for protecting sensitive environments. Existing trees should be protected if possible; if not, the land owner may contribute to a mitigation fund for each tree cut down.
Wetlands Management Ordinance	Protects environmentally sensitive wetlands areas. This ordinance usually requires wetlands delineation within the municipality and prohibits any type of development in a delineated wetland area.
Cluster Development Ordinance	Allows developers to build at higher densities on one portion of a site in exchange for preserving another portion as open space. Land preservation percentages and densities vary, but the preferred percentage is for at least 50% of the tract to remain as open space. Achieving a landowner's financial objectives may be a function both of partial development and donation of a conservation easement (and its inherent deductibility under the federal tax code).
Planned Residential Development (PRD)	Facilitates residential development in areas designated by the municipality. Provisions are made for higher housing densities, thereby creating larger contiguous common open spaces, and providing for pedestrian access between residential areas.
Steep Slope Ordinance	Regulates development on areas designated as steep slopes. The minimum gradient classified as steep varies by municipality, but, according to DVRPC, 8% is typical.
Transfer of Development Rights (TDR)	Designates areas of a municipality as "sending" and "receiving" areas. Allows community to preserve open space and natural features while still permitting growth. Development is moved from large tracts of rural land (sending area) to areas designated for higher densities (receiving area).

While the measures above were originally intended for new development, they may be adapted for larger redevelopment projects in urban areas. Older areas often have large areas of vacant and abandoned properties that may be demolished all at once, creating significant open space. Cluster development, for example, could be applied on these larger sites.

In addition to the specific ordinances above, municipalities should require, or provide strong incentives for, innovative site design when urbanized areas are redeveloped. Effective conservation design techniques to consider include the following:

- Review municipal codes for any minimum size requirements for impervious surfaces, such as road and sidewalk widths. Review any stipulation of a minimum size lot that development and stormwater ordinances apply to. In the City of Philadelphia, the ordinance requiring all downspouts to be connected directly to the sewer system is not appropriate in all cases; wherever feasible, infiltration (e.g., using dry wells) should be encouraged over disposal of stormwater to combined or separate storm sewers.

- Depending on the zoning classification, specify a maximum effective impervious cover allowed after construction. Many publications recommend that impervious cover connected directly to the drainage system be limited (see Section 8.3.4, Option CS1, “Reducing Effective Impervious Cover through Better Site Design,” for specific recommendations). Developers are then free to choose a combination of methods to meet the requirement: an absolute reduction in impervious cover, directing runoff onto depressed landscaped areas, tree credits, and structural BMPs. Consider incentives in the stormwater control calculations to reduce directly connected impervious surfaces.
- For areas experiencing redevelopment, structural stormwater controls may be tied to the impervious area calculations discussed above. Developers have an incentive to reduce impervious area because it may be more cost effective than installing structural stormwater BMPs. Specific recommendations for stormwater ordinances are discussed below, under Option CR3, “Stormwater and Floodplain Management.”
- Promote discussions early in the development review process at the sketch plan/conceptual plan level (before developers have spent large sums of money on design and engineering). A number of municipalities around the U.S. have concluded that sketch/conceptual plans are more important in the planning process than preliminary plans because early intervention and change allows greater opportunity to include innovative low impact development designs. Some municipalities have opted to eliminate the final plan and accept the preliminary plan as the final plan as an incentive to developers to participate.
- After the final plan is submitted, require a pre-construction meeting and a site visit to discuss construction issues and pollution prevention.
- Consider incentives in addition to regulations; for small sites, incentives alone may be sufficient. For example, award density or stormwater control bonuses for reducing impervious cover. Streamline project reviews and waive permit fees when conservation design objectives are met. Tie stormwater fees and/or property taxes to impervious cover and stormwater management practices.

The River Conservation Plans (RCPs) noted the following:

- Church Road at Chelten Hills Drive to Church Road near Ogontz Field: For areas that are redeveloped, landscape architects should design a more natural buffer zone.

Stormwater and Floodplain Management (CR3) Related Goals: 1, 2, 3, 4, 5, 7 Related Indicators: 1, 2, 12, 13, 15, 19, 20			
What	Who	Where	When
Participate in finalization of the watershed-wide Act 167 plan and model ordinance being developed in the watershed. Adopt and enforce the model ordinance.	Counties to adopt plan and ordinance first, followed by all municipalities (see Table 8.16).	Entire watershed.	Begin within 5 years; update as needed.

Table 8.16 identifies the municipalities in the Tookany/Tacony-Frankford Watershed that currently have a floodplain protection or stormwater ordinance in place.

Table 8.16 Floodplain and Stormwater Ordinances in the TTF Watershed

Municipality	Floodplain Ordinance	Stormwater Ordinance	Erosion and Sedimentation Control	Comments
Abington Township	X	X	X	Stormwater design requirements; floodplain conservation district; erosion and sedimentation control plan.
Cheltenham Township	X	X	X	Storm drainage requirements; floodplain conservation district; soil erosion and sediment control (DEP Manual compliance).
Jenkintown Borough	X	X	X	Storm drainage design requirements; floodplain conservation district; erosion and sedimentation control measures required (no description).
Philadelphia County	X	X	X	Stormwater management controls; erosion and sedimentation control measures – engineer required.
Rockledge Borough				No stormwater/floodplain ordinances; all development served by public sewer and public water.

Source: www.ordinance.com, Delaware Valley Regional Planning Commission

The majority of municipalities in the watershed have adopted ordinances limiting development in the floodplain or designating a floodplain conservation district. The protection offered varies by municipality, but an effective ordinance should place controls on land development within the 100-year floodplain as well as limit development within riparian corridors. EPA posts a model floodplain preservation ordinance at: www.epa.gov/owow/nps/ordinance/osm1.htm

Philadelphia and Montgomery Counties are cooperating to develop an official Act 167 Stormwater Management Plan and model ordinance. The model ordinance will specify

measures that must be undertaken to promote infiltration, improve water quality, reduce streambank erosion rates, and protect against flooding. These requirements will apply to both new (also called “greenfield”) development and redevelopment (including brownfields or former industrial sites), and to both separate-sewered and combined-sewered areas. The plan and model ordinance shall be completed with county and municipal input by late 2007.

Adoption and implementation of the model ordinance is a critical step that will allow municipalities to begin implementing many of the wet weather management measures mentioned later under Target C. For example, the ordinance may require a specific storage volume to be created on a developed site and may indicate that it must be a BMP capable of water quality treatment. The developer will then consult a state or local stormwater manual designated by the municipality to determine an appropriate BMP and appropriate design criteria.

While many of the state manuals provide excellent guidance for new development, PWD plans to develop a manual with guidance for redevelopment projects given local conditions. Some preliminary ideas for this BMP manual are listed below.

Commercial/Industrial Land Uses

1. Encourage better site design techniques, impervious cover disconnection, and tree credits to decrease impervious cover directly connected to the drainage system.
2. Directly-Connected Parking Lots:
 - Encourage a bioretention system if sufficient space is available to meet parking needs.
 - In highly urban areas where adding landscaping is not possible, encourage porous pavement (or other drainage mechanism) and subsurface storage if feasible.
3. Directly-Connected Rooftops:
 - If parking lot storage is installed, recommend routing rooftop drainage to the storage.
 - If parking lot storage is not feasible, route rooftop drainage to dry wells. If dry wells are not feasible, route rooftop drainage to rain barrels or tanks.
 - Other approaches may be proposed and considered on a case-by-case basis.

Residential Land Uses

1. Encourage better site design techniques, impervious cover disconnection, and tree credits to decrease impervious cover directly connected to the drainage system.
2. Route roof runoff to dry wells if feasible. If dry wells are not feasible, route rooftop drainage to rain barrels or tanks.
3. Other approaches may be proposed and considered on a case-by-case basis.

The River Conservation Plans (RCPs) recommend the following:

- Holy Sepulchre Cemetery to Ralph Morgan Park: Purchase properties in floodplain to convert land to open space.
- Mill Creek Watershed: Relocate or purchase then demolish structures in the floodplain.
- Church Road at Chelton Hills Drive to Church Road near Ogontz Field: Assess upstream issues to see why Shoemaker Road area floods more.

Industrial Stormwater Pollution Prevention (CR4)			
Related Goals: 1, 2, 3, 7			
Related Indicators: 1, 2, 3, 4, 7, 8, 9, 10, 19, 20			
What	Who	Where	When
Enforcement of NPDES requirements for Industrial Stormwater Management.	PA DEP is the Designated Authority responsible for issuing, administering, and enforcing NPDES permits.	All sites contributing stormwater discharges associated with industrial activity within the watershed.	Within 5 years.
Dissemination of information on spill prevention and pollution prevention plans.	Municipalities are responsible for information dissemination.		

Industrial stormwater pollution prevention measures can contribute significantly to achieving the watershed plan’s wet weather implementation targets. These measures include monitoring and enforcing existing industrial stormwater permit requirements under Phase I of the NPDES program, as well as Official Industrial Pollution Prevention Plans and Spill Response Actions required by the state. Full implementation of these measures should be monitored and enforced throughout the watershed.

NPDES Industrial Stormwater Permits

All sites contributing stormwater discharges associated with industrial activity, defined in federal regulations (40 CFR §§ 122.26(b)(14)(i)-(xi)), are required to be covered under Phase I of the NPDES stormwater program. This includes discharges from any conveyance that is used for collecting and conveying stormwater and that is directly related to manufacturing, processing, or raw materials storage areas at an industrial plant. This includes, but is not limited to, stormwater discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling sites; refuse sites; sites used for the application or disposal of process waste waters; sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and final products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to stormwater. The term “material handling activities” includes storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, final product, by-product, or waste product.

The PA DEP is the Designated NPDES Authority responsible for issuing, administering, and enforcing NPDES stormwater permits under the EPA’s regulatory provisions set forth in 40 CFR.

Stormwater discharges from most industrial facilities are covered under General Permits when they discharge into municipal separate sanitary sewers. General NPDES permits have a fixed term not to exceed five years. An operator of a stormwater discharge associated with industrial activity which discharges through a large or medium municipal separate storm sewer system shall submit, to the operator of the municipal separate storm sewer system receiving the discharge, the following information: the name of the facility; a contact person and phone number; the location of the discharge; a description, including Standard Industrial Classification, which best reflects the principal products or services provided by each facility; and any existing NPDES permit number.

In addition, the operator of a stormwater discharge associated with industrial activity covered under a general, group, or individual permit, shall provide the following minimum information (40 CFR § 122.26 (c)(i)):

- A site map showing topography, drainage features, buildings, and areas where materials or activities may contribute pollutants to stormwater.
- An estimate of the area of impervious surfaces (including paved areas and building roofs) and the total area drained by each outfall (within a mile radius of the facility) and a narrative description of materials handled or stored as well as measures taken to control pollutants in the runoff.
- A certification that all outfalls that should contain stormwater discharges associated with industrial activity have been tested or evaluated for the presence of non-stormwater discharges which are not covered by a NPDES permit. Tests for such non-stormwater discharges may include smoke tests, fluorometric dye tests, analysis of accurate schematics, as well as other appropriate tests. The certification shall include a description of the method used, the date of any testing, and the onsite drainage points that were directly observed during a test.
- Existing information regarding significant leaks or spills of toxic or hazardous pollutants at the facility that have taken place within the three years prior to the submittal of this application.

Quantitative data based on samples collected during storm events from all outfalls containing a stormwater discharge associated with industrial activity for a number of water quality parameters.

Industrial Pretreatment Requirements

Industrial pretreatment requirements are another area where enforcement can result in lower pollutant concentrations in stormwater. Under PA Code Title 25 § 94.15, the operator of the sewerage facilities in cases where pollutants contributed by industrial users result in interference or pass through, and the violation is likely to recur, must develop and implement specific local limits for industrial users and other users, as appropriate, that together with appropriate sewerage facility or operational changes, are necessary to ensure renewed or continued compliance with the plant's NPDES permit or sludge use or disposal practices.

Additional Measures

Information on existing pollution prevention plans and spill response requirements should be provided to relevant industries in the watershed as part of the Phase II public education measures.

Industrial Pollution Prevention Plans are one means to prevent spills and accidental releases. Under PA Code Title 25 § 91.34 (Activities Utilizing Pollutants):

- Persons engaged in an activity which includes the impoundment, production, processing, transportation, storage, use, application, or disposal of pollutants shall take necessary measures to prevent the substances from directly or indirectly reaching waters of this Commonwealth, through accident, carelessness, maliciousness, hazards of weather, or from another cause.
- PA DEP may require a person to submit a report or plan setting forth the nature of the activity and the nature of the preventative measures taken. The Department will encourage consideration of the following pollution prevention measures, in descending order of preference, for environmental management of wastes: reuse, recycling, treatment, and disposal.

Spill response is another area that can improve wet weather water quality in Tookany/Tacony-Frankford Creek. Spill response requirements are promulgated under PA Code Title 25 and issued under section 5 of The Clean Streams Law (35 P. S. § 691.5).

Under PA Code Title 25 § 91.33 (Incidents Causing or Threatening Pollution):

- If, because of an accident or other activity or incident, a toxic substance or another substance which would endanger downstream users is discharged, it is the responsibility of the person at the time in charge of the substance to immediately notify PA DEP by telephone of the location and nature of the danger and, if reasonably possible to do so, to notify known downstream users of the waters.
- In addition to the notices, the person shall immediately take steps necessary to prevent injury to property and downstream users, and within 15 days from the incident, remove from the ground the residual substances to prevent further pollution.

The River Conservation Plans (RCPs) noted the following:

- Rising Sun Avenue to Roosevelt Boulevard: Examine car-recycling shop for runoff and determine if it's a legal operation.

Construction Stormwater Pollution Prevention (CR5) Related Goals: 1, 2, 3, 7 Related Indicators: 1, 2, 3, 4, 7, 8, 9, 10, 19, 20			
What	Who	Where	When
Construction Site Stormwater Program in conformance with Phase II Stormwater Permits: <ul style="list-style-type: none"> • Enact an ordinance. • Review and approve Erosion and Sediment Control Plans. • Distribute educational materials. 	All municipalities required to do Phase II permit (see Table 8.7).	N/A	5-year program associated with stormwater permit (see Table 8.17).

In accordance with the TTF Integrated Watershed Management Plan’s stated purpose of integrating various existing programs, and to avoid duplication of effort, the recommended implementation plan follows the PA DEP Stormwater Management Program Protocol to meet the six minimum control measures required of municipal permittees under the Phase II NPDES Stormwater Regulations (listed in Section 1.4.1 of this report, and found at 40 CFR §§ 122.26 – 123.35). One of the six minimum controls is a Construction Site Stormwater (CSS) Program.

In Pennsylvania, two programs currently exist that address stormwater runoff from construction activities: 1) the Erosion and Sediment Control Program under 25 Pa. Code Chapter 102, and 2) the NPDES Stormwater Construction Permit Program.

The Erosion and Sediment Control Plan submitted by the developer must contain BMPs appropriate to the site and the surrounding area that might be impacted by the construction activities, as well as for post-construction runoff. Construction activity-related BMPs are available to developers and others through the Erosion and Sediment Pollution Control Program Manual (PA DEP ID: 363-2134-008) at www.dep.state.pa.us (directLINK “stormwater”), as well as at the County Conservation District (CCD).

The CSS program can be summarized as consisting of the following steps:

- Enact, implement, and enforce a stormwater control ordinance using PA DEP model language;
- Coordinate the review and approval of Erosion and Sediment Control Plans with the County Conservation District(s) (CCD) or PA DEP for any earth disturbance of one acre or more causing runoff, or for any earth disturbance of five acres or more. Make approval of the Erosion and Sediment Control Plan a prerequisite for the formal approval of land development and redevelopment plans or the issuance of building permits; and

- Distribute educational materials to land developers with the applications for building permits and other land development/redevelopment.

Municipalities must have an agreement with their local CCD that addresses these reviews and permitting requirements. This agreement ensures the close coordination between the municipality and the CCD on these important issues affecting water quality. Note that a NPDES Stormwater Construction Permit is required for earth disturbance activities where the construction disturbs five acres or more, or where there is a discharge from a site to the MS4 where earth disturbance is one acre or more.

In most cases, the County Conservation District implements these two programs, and PA DEP is responsible for implementing and enforcing these programs in cases where the County does not have this responsibility. By requiring review and approval of Erosion and Sediment Control Plans by the CCD or PA DEP (and proof of NPDES Stormwater Construction Permits where required), and by coordinating building permit and other land development permits or approvals with the CCD (or PA DEP in some cases), municipalities will meet MS4 permit requirements for this component of the Construction Stormwater Runoff Management Minimum Control Measure. Utilizing this existing statewide program, the municipality avoids the need to do a duplicative, independent review of every Erosion and Sediment Control Plan.

All municipalities in the watershed are required to fulfill this aspect of the stormwater regulations. Table 8.17 shows the schedule for implementation.

Table 8.17 Implementation Schedule for Construction Stormwater Pollution Prevention

PERMIT YEAR	IMPLEMENTATION SCHEDULE	
	Construction Site Stormwater Program	Developer Education
Year 1	<p>Ordinance: Enact an ordinance requiring:</p> <ul style="list-style-type: none"> • the review and approval of Erosion and Sediment Control Plans by the local County Conservation District or PA DEP; • for any earth disturbance one acre or more with runoff to the MS4, or five acres or more regardless of the planned runoff; and • as a prerequisite for the formal approval of land development plans or the issuance of building permit. <p>Process: Establish an agreement with the local CCD for the review and approval of Erosion and Sediment Control Plans for all earth disturbance activities equal to or greater than one acre with runoff to the MS4 (or five acres or more regardless of the planned runoff).</p> <p>Standard: Require that the Erosion and Sediment Control Plans be developed in accordance with the requirements of Chapters 102 (erosion and sedimentation) of the PA DEP regulations.</p>	Meet permit requirements and measurable goals for Year 1 under Public Education and Outreach MCM.
Years 2-5	Implement the ordinance and agreement for review of Erosion and Sediment Control Plans.	Meet permit requirements and measurable goals for Year 2 under Public Education and Outreach MCM.

Post-Construction Stormwater Runoff Management (CR6) Related Goals: 1, 2, 3, 7 Related Indicators: 1, 2, 3, 4, 7, 8, 9, 10, 19, 20			
What	Who	Where	When
Post-Construction Stormwater Runoff Management in conformance with Phase II Stormwater Permits: <ul style="list-style-type: none"> • Enact ordinance. • Coordinate review and approval of Plans. Ensure BMP maintenance.	All Municipalities required to do Phase II permit (see Table 8.7).	N/A	5-year program associated with stormwater permit (see Table 8.18).

In accordance with the TTFIWMP’s stated purpose of integrating various existing programs, and to avoid duplication of effort, the recommended implementation plan follows the PA DEP Stormwater Management Program Protocol to meet the six minimum control measures required of municipal permittees under the Phase II NPDES Stormwater Regulations (listed in Section 1.4.1 of this report, and found at 40 CFR §§ 122.26 – 123.35). One of the six minimum controls is a Post-Construction Stormwater Runoff Management Program. The program can be summarized as consisting of the following steps:

- Enact, implement, and enforce a stormwater control ordinance using PA DEP model language;
- Coordinate the review and approval of post-construction BMPs simultaneously with the review and approval for construction Erosion and Sediment Control Plans as described in the Construction Minimum Control Measure; and
- Ensure long-term operation and maintenance of the BMPs.

PA DEP links management of post-construction runoff with the Construction Minimum Control Measure component discussed above (see Option CR5). Approvals for construction activities will be dependent on how post-construction issues are addressed. For example, if an applicant’s plan for a land development or redevelopment project adequately addresses stormwater issues during construction but does not do so for post-construction impacts, then it must not be approved until the post-construction issues are addressed.

Ordinance

Municipalities must enact, implement, and enforce a stormwater control ordinance using PA DEP model language. The ordinance must address the proper standard for BMPs and operations

and maintenance requirements for the BMPs. The ordinance will apply a statewide post-construction requirement until the water quality-based Act 167 Plan is adopted by the County and implemented by the municipality, at which time the municipality will need to amend it to include those requirements.

The ordinance should require that all development and redevelopment activities with earth disturbance one acre or more with runoff to the MS4 (or five acres or more regardless of the planned runoff) be conducted in accordance with the ordinance. No formal approval of land development plans or issuance of building permits should occur without municipal approval of post-construction stormwater controls. A model ordinance is available from PA DEP.

Implement Program

The municipalities must commit resources or establish an agreement with the local County Conservation District (CCD) or other service provider (e.g., municipality's consulting engineer) for coordination of post-construction BMP approvals. There must be a process to review the post-construction controls in conjunction with the review process for construction approval.

Municipalities must ensure that the post-construction controls will meet state water quality requirements. Those requirements depend upon the status of the Act 167 Stormwater Management planning in the watershed. Where a water-quality-based Act 167 plan has been completed (or updated), those local watershed requirements apply. Otherwise, statewide requirements must be implemented.

While it is the municipalities' responsibility to ensure that the BMPs meet the water quality requirements, PA DEP will be reviewing post-construction plans for individual permits, and some County Conservation Districts have the expertise to conduct the reviews under an agreement with the municipality similar to that for the Construction Minimum Control Measure.

Operation and Maintenance of Post-Construction BMPs

It is the municipalities' responsibility to ensure that the post-construction BMPs required and approved pursuant to the program are constructed, operated, and maintained. Many BMPs may be "non-structural," and will require no operation or maintenance. Examples are use of open space and vegetated buffers in development design, minimization of soil disturbance and compaction during construction, and minimization of directly connected impervious areas. Other BMPs – "structural BMPs" – will require proper operation and maintenance. Examples include wet ponds, grassed swales, infiltration basins, and bioretention areas.

Municipalities will need to have a monitoring program that ensures that the post-construction BMPs are constructed, operated, and maintained, within the first permit term of five years. The program must have two elements:

- **Implementation**: Ensure installation of the BMPs as designed. Coordinate the monitoring with the CCD, especially where a permit has been issued.
- **Operation and Maintenance**: Some of the structural BMPs will require maintenance over time to be effective. Municipalities must have a system to monitor these BMPs. If any BMPs

are not operated or maintained and are ineffective, municipalities must develop a plan to address them. The PA DEP Model Ordinance provides legal tools to accomplish this.

All municipalities within the Tookany/Tacony-Frankford Watershed must carry out this program (see Table 8.7). The schedule for full implementation is provided, in accordance with the new Phase II rules, in the table below.

Table 8.18 Post-Construction Stormwater Runoff Management: Implementation Schedule

<i>IMPLEMENTATION SCHEDULE</i>		
<i>PERMIT YEAR</i>	Stormwater Management Program	Long Term Operation and Maintenance
Year 1	<p>Ordinance: Enact an ordinance requiring:</p> <ul style="list-style-type: none"> • No formal approval of land development plans or issuance of building permits without municipal approval of post-construction stormwater controls. • Development and redevelopment activities with earth disturbance of one acre or more with runoff to the MS4, or five acres or more regardless of the planned runoff, must be conducted in accordance with the ordinance. <p>Process: Rely on PA DEP review of permits where applicable; where no PA DEP review of post-construction controls is conducted, use municipal resources, or establish an agreement with the local CCD or other service provider (e.g., municipal engineer) for coordination of post-construction BMP approvals.</p> <p>Standard: Require post-construction structural and non-structural BMPs be designed, constructed, and maintained to meet (1) the requirements of the approved Act 167 plan and the municipal ordinance, or (2) the PA DEP statewide water quality requirements, until such Act 167 Plan is in place.</p>	Ensure that stormwater BMPs are built, operated, and maintained as designed.
Years 2-5	<ul style="list-style-type: none"> • Implement the ordinance and post-construction BMP approval process. 	Ensure that stormwater BMPs are built, operated, and maintained as designed.

Use Review and Attainability Analysis (CR8)			
Related Goals: 1, 2, 3, 4			
Related Indicators: 7, 8, 9, 10, 11			
What	Who	Where	When
Coordinate water quality standards review and revision with PWD's CSO LTCP	EPA and PADEP in partnership with PWD and other permitted dischargers	The Tookany/Tacony-Frankford creek and tributaries	Within 5 years (1 NPDES CSO permit cycle)

The CSO Policy calls for the development of a long-term control plan (LTCP) which includes measures that provide for compliance with the Clean Water Act, including attainment of water quality standards. The CSO Policy provides that “development of the long term plan should be coordinated with the review and appropriate revision of water quality standards (WQS) and implementation procedures on CSO-impacted receiving waters to ensure that the long-term controls will be sufficient to meet water quality standards” (59 FR 18694).

As part of a renewed focus on this commitment, EPA has issued a guidance document, Coordinating CSO Long-Term Planning with Water Quality Standards Reviews (EPA-833-R-01-002). This document lays a strong foundation for integrating water quality standards reviews, implementation of high-priority CSO controls, and development of well-designed and operated LTCPs that support attainment of water quality standards without causing substantial and widespread economic and social impacts. In addition to CSO impacts, many of the processes, procedures and ideas presented can be used to address wet weather issues such as stormwater and other point and nonpoint sources on a watershed basis. An iterative, phased implementation of CSO controls fits well with the watershed approach.

Depending on the impacts, possible water quality standards revisions could include:

1. Re-evaluating recreational uses and applying criteria for bacteria at the point of contact rather than at the end-of-pipe,
2. Segmenting the water body to preserve recreation in areas where it actually occurs, and
3. Revising the use by creating subclasses to recognize intermittent exceedances of bacteriological criteria.

Watershed-Based Permitting (CR9) Related Goals: 2, 3, 4, 5, 7 Related Indicators: 1, 2, 3, 7, 10, 11, 15, 16, 19			
What	Who	Where	When
Explore approaches to developing NPDES permits for multiple point sources located within the watershed	PADEP	Watershed-wide	Long term

Source: Watershed-Based National Pollutant Discharge Elimination System (NPDES) Permitting Implementation Guidance, December 2003 (EPA 833-B-03-004)

Watershed-Based NPDES Permitting

Watershed-based NPDES permitting is an approach to developing NPDES permits for multiple point sources located within a defined geographic area (watershed boundaries) to meet water quality standards. This approach, aimed at achieving new efficiencies and environmental results, provides a process for considering all stressors within a hydrologically defined drainage basin or other geographic area, rather than addressing individual pollutant sources on a discharge-by-discharge basis. This plan provides the first steps in this process. In the long term, a watershed-based permit in the Tookany/Tacony-Frankford system can provide the regulatory framework for implementation of this integrated watershed management plan.

A truly comprehensive watershed management approach should bring together key programs under the Clean Water Act, such as the NPDES Program, the TMDL Program, the Section 319 Nonpoint Source Program, and Section 404 Wetlands Permitting, as well as the Source Water Assessment Program under the Safe Drinking Water Act. Watershed-based NPDES permitting can be another tool to facilitate comprehensive programmatic integration at a watershed level and ensure that permitting activities tie into existing watershed management efforts.

Developing and Implementing a Watershed-Based NPDES Permitting Approach EPA’s suggested process for developing and implementing a watershed-based NPDES permitting approach consists of the following six steps. This integrated watershed management plan fulfills most requirements of the first three steps.

Step One - Select a Watershed and Determine the Boundaries

Step Two - Identify Stakeholders and Facilitate Their Participation

Step Three - Collect and Analyze Data for Permit Development

Step Four - Develop Watershed-Based Permit Conditions and Documentation

Step Five - Issue Watershed-Based NPDES Permit

Step Six - Measure and Report Progress

8.3.2 Target C Options: Public Education and Volunteer Programs

Public Education and Volunteer Programs (CP1)			
Related Goals: 4, 6, 7			
Related Indicators: 16, 17, 18, 19, 20, 21			
What	Who	Where	When
See Public Education and Volunteer Programs under Target A options (Section 8.1.2).	All municipalities.	All municipalities.	Short-term: first 5 years coinciding with the stormwater permit (see Table 8.8).

8.3.3 Target C Options: Municipal Measures

Sanitary Sewer Overflow Detection (CM1)			
Related Goals: 3, 7			
Related Indicators: 10, 11, 19, 20			
What	Who	Where	When
SSO Detection Program.	Municipalities with separate sewer systems in TTF Watershed (see Table 8.7).	See Figure 8.3 (map of separate sewers and responsible authorities).	Permanent ongoing program should be part of each agency's program.

Discharges from sanitary sewers to Tookany/Tacony-Frankford Creek during wet weather are suspected in some areas. Some of the techniques used for inspection of sewer lines can also be used for identifying potential locations of SSOs. Some of the most effective techniques for identifying the location of SSOs are listed below. (Source: Protocols for Identifying Sanitary Sewer Overflows, American Society of Civil Engineers EPA Cooperative Agreement #CX 826097-01-0, June 2000.)

Sewer System Mapping

GIS maps of the sewer system should be developed in all municipalities. These maps serve as the basis for hydraulic modeling, and are key to many of the techniques described below.

Customer and/or Public Complaint

When a basement backup occurs or an SSO occurs in an area exposed to view, it is almost certain that someone will call the sewerage agency and report the incident. The agency should have a plan in place to investigate the reported SSO, find its cause, and take remedial measures to avoid recurrence of the SSO.

Visual Inspections after Overflows

Visual inspections can be used to confirm the occurrence of SSOs at suspected locations. The agency should develop a list of such locations and update it periodically. Immediately following a major storm, an inspection team should be sent to investigate these locations. A visual inspection program can be enhanced by encouraging participation of the public through providing opportunities for the public to become part of the solution.

Scheduled Maintenance Inspection

Municipal sewerage agencies should be performing routine maintenance inspections of their system. While the maintenance crew is performing the inspection, it can also look for signs of SSOs. These are most likely to occur at pumping stations, manholes, stream crossings, and cleanouts.

GIS-Based Analysis of Past SSOs

GIS analysis can answer questions related to location, condition, trends, patterns, and modeling. Listed below are some typical questions that GIS can answer:

- What exists at a given location?
- Where is the location of an object or outcome with a number of specific characteristics?
- What has changed over a given period?
- What is the spatial distribution of areas with a certain attribute?

Sanitary Sewer Management Systems

A Sanitary Sewer Management System (SSMS) can be used to store, organize, and analyze large quantities of data associated with sewer system operation, maintenance, inspection, modeling, and rehabilitation. The SSMS may include the following modules:

- Inventory Module
- Flow Module
- Modeling Module
- Inspection Module
- Maintenance Module
- Rehabilitation (CIP) Module
- Mapping Module

Analysis of the data in the SSMS can reveal many problem areas, trends, and patterns. For example, the database can be searched to develop a list of lines with flat slopes or areas where frequent maintenance is needed. Another application of the SSMS is analysis of historical data.

Flow Monitoring

Flow monitoring at strategic locations may be used to identify potential locations of SSOs. Flow monitors can be installed in open channels and pumping stations to obtain the data necessary for proper system evaluation. In conjunction with flow monitoring, rain gauges should also be installed. Many open channel temporary flowmeters have both velocity and depth measuring sensors. Municipalities should use the existing rain gauge network in the TTF Watershed.

Flow data can be used to determine the average daily flow, the infiltration rate, and the inflow rate. The rain gauge data can be used to determine the recurrence interval or severity of the storm event (for example, 5-year) that caused the inflow. The flow data will also indicate whether a surcharge occurred during the flow monitoring period.

Monitoring of Receiving Stream for Sewage Indicators

This technique may be used for identifying the locations of dry weather SSOs. Samples from a nearby stream are taken at regular intervals along the stream and tested for fecal coliforms. Significant presence of these bacteria could be an indication of sewage leaking from the sewer line into the stream.

Closed Circuit Television (CCTV) Inspection

CCTV inspection has been widely used for inspection of sewer line interiors. The final product of a CCTV inspection is videotape and a field log prepared and narrated by an operator. The

videotape provides a visual and audio record of problem areas in the sewer line. Evaluation of the CCTV records help identify structural problems; locate leaking joints and non-structural cracks, blockages, and dropped joints; and identify areas of root intrusion.

Sewer Scanner and Evaluation Technology Surveys (SSET)

The SSET is a new pipeline inspection technology developed in Japan. The equipment consists of a scanner, a CCTV, and a three-axis mechanical gyroscope. The mechanics of placing the SSET in the sewer line are similar to those of CCTV inspection. The images produced by SSET are of higher quality than CCTV images. Interpretation of the results is done in the office by an engineer rather than in the field by a technician. This increases the speed of field operations and reduces the cost.

Surcharge Level Alarms/Remote Monitoring

These devices can be placed at strategic locations in the manholes and pumping stations. Once the flow reaches a certain elevation, the alarm goes off and sends a signal to a control center via a telephone line or SCADA system. The sewerage agency should have a plan in place to respond immediately to such alarms. In addition, the responding agency should also record the event in a database.

Dye Tracing

Dyed water testing consists of dye tracing or flooding, and is done to locate possible sources of inflow such as area drains or catch basins suspected of being connected to the sewer line, or sources of rainfall-induced infiltration/inflow which indirectly contribute to the flow in the sewer line through the soil and pipe cracks. Dye testing is normally used to complement smoke testing of suspect areas. The downstream manhole is monitored to see if the dye water injected into an outside source such as a downspout has found its way into the sewer system. Color CCTV may also be used for locating problem areas after the dye enters the pipeline through the surrounding soil.

Smoke Testing

The purpose of smoke testing is to locate rainfall-dependent I/I (Inflow and Infiltration) sources which could lead to SSOs during a storm events. Public notification is an important and critical element of any smoke testing program. Specific I/I sources detected by smoke testing includes roof, yard, and area drain connections; catch basins; and broken service lines. The testing procedure consists of pumping non-toxic smoke through a manhole into the sewer pipe for distances up to 600 ft. The smoke will surface through open breaks in the pipe connections. All such sources are photographed and documented.

Aerial Monitoring

Aerial monitoring by helicopter may be used to gain a general understanding of conditions along a sewer line which may lead to an SSO. For example, washout may expose a section of pipe, which would then be at risk of damage and subsequent SSO. Examples of features which may be observed during such monitoring include manholes with broken or missing covers and sewer lines exposed by erosion.

Monitoring of Grease Buildup

A significant cause of SSOs during dry weather is sewer stoppages resulting from grease buildup. Such stoppages occur most frequently in downtown areas where restaurants are major sources of flow in the sewer system. A list of locations of grease buildup should be developed and these locations should be regularly inspected. Grease buildup can be prevented by enforcing grease ordinances, by effective pretreatment programs, and by promoting public education. The grease accumulations can be removed using the many available cleaning techniques, such as bucket machines with brushes, power rodders, and high velocity jet cleaners. Bioaugmentation, which involves the addition of bacteria cultures to sewers to speed up the breakdown of grease deposits, can also be effective.

Pump Station Inspection

Pump station failures can lead to significant SSO problems. Such failures can be avoided by regular inspections. The frequency of inspections may vary from once a day to once a month, depending on the size and criticality of the station, and reliance on monitoring by means such as the SCADA system.

Manhole Inspection

Manhole interiors are inspected for physical soundness for evidence surcharging such as high water marks on manhole walls. The observed defects should be compiled into a database that will be used to estimate the I/I attributable to each manhole and to establish manhole maintenance and rehabilitation program.

Line Lamping

Line lamping is done in conjunction with manhole inspection by inspecting the interior of the sewer lines connected to the manhole using an artificial light and a mirror. Lamping helps identify pipe defects and provides a basis for selecting sewers for television inspection.

Building Inspection

Building inspections are conducted to investigate extraneous flow from connections to sump pumps, foundation drains, downspouts, or leaking laterals. Building inspections should include investigation of the causes of basement backups.

Ground Penetrating Radar

Ground penetrating radar uses the transmission and reflection properties of an electromagnetic wave passing through the soil to determine soil properties and the depth and extent of subsurface objects. The speed and amplitude of the electromagnetic wave are dependent on the moisture content of the soil. This principle can be used to detect leaking joints in the line and voids around the pipe, which may be caused by soils being washed out. In such locations, the signal will be delayed because the speed of the wave will be reduced, and the amplitude of the wave will be attenuated.

Soil Moisture and Temperature Monitoring

When the ground is relatively dry, a larger portion of the rainfall will penetrate the soil, which will result in a decrease of groundwater to sanitary sewers. However, as the soil moisture increases, the amount of infiltration to sewers increases. For this reason, the impact of

subsequent storm will be more severe: while the system did not overflow during the first storm, it will do so during the second storm, although the second storm of smaller intensity than the first. By monitoring the soil moisture and temperature, it may be possible to develop a measure for assessing the occurrence of SSOs.

Inspections of Stream Crossings and Parallel Lines

Pipes running alongside or crossing streams are often vulnerable to SSOs. If the sewer is buried under the stream bed, the scouring action of the stream bed will eventually expose it, causing the pipe to lose its soil support. The pipe segments may move under the water pressure and joints may open, or the pipe may become exposed as a result of bank erosion. Any such openings admit significant amounts of flow, which may exceed the capacity of the sewer pipe. Stream crossings that include inverted siphons often become clogged with accumulations of silt and debris, which may cause an overflow upstream. The foundations of aerial stream crossing piers are also subject to scouring and may lead to foundation failure of the sewer line.

Sewer pipes that cross or parallel streams should be inspected to ensure that they are not broken or cracked. The manholes on each side of the stream should be checked for excess flow, which would indicate a leaking sewer under the stream. Since these sewers are usually in remote areas, they are vulnerable to vandalism and can overflow undetected for long periods.

All municipalities in the Tookany/Tacony-Frankford Watershed should have a routine and effective SSO detection program. Once SSOs are found and the cause determined, proper measures to eliminate the SSO should be taken.

All municipalities with separate sanitary sewers are responsible for developing an effective SSO detection program.

The River Conservation Plans (RCPs) recommend the following:

- Greenwood Avenue to Wyncote Post Office: Inspect and repair manhole covers as needed.
- Wyncote Post Office to Washington Lane Underpass: Inspect and repair all manhole covers and cement encasements.

Sanitary Sewer Overflow (SSO) Elimination: Structural Measures (CM2)			
Related Goals: 3, 7			
Related Indicators: 10, 11, 19, 20			
What	Who	Where	When
Implement a CMOM program (see Option AM1). Update and implement official Act 537 Sewage Facilities Plans.	Municipalities with separate sewer systems in Tookany/Tacony-Frankford Creek (see Table 8.7).	See Figure 8.3 (map of separate sewers and responsible authorities).	Short-term (within 5 years of SSO detection).

Discharges to U.S. waters from municipal sanitary sewer collection systems are prohibited, unless authorized by an NPDES permit. Permits authorizing discharges from such systems must contain technology-based effluent limitations, based upon secondary treatment and applicable water quality standards. NPDES permits for municipal wastewater treatment plants should require record-keeping and reporting of overflows that result in a discharge. Permits should also contain requirements for operation and maintenance of the sanitary sewer collection system.

The EPA and PA DEP are continuing to address SSO problems with compliance assistance and enforcement in accordance with the Compliance and Enforcement Strategy Addressing Combined Sewer Overflows and Sanitary Sewer Overflows, issued April 27, 2000. In addition to the national policy, Act 537, enacted by the Pennsylvania Legislature in 1966, requires that every municipality in the state develops and maintains an up-to-date sewage facilities plan. The main purpose of a municipality’s sewage facilities plan is to ensure that the sewage collection and treatment systems have adequate capacity to convey present and future to sewage flows to a wastewater treatment facility. Official plans contain comprehensive information, including:

- The location of treatment plants, main intercepting lines, pumping stations and force mains, including their size, capacity, point of discharge and drainage basin served (preferably in a GIS format);
- Descriptions of problems with existing sewerage facilities and operation and maintenance requirements; and
- Planning objectives and needs:
 - Physical description of planning area
 - Evaluation of existing wastewater treatment and conveyance systems
 - Evaluation of wastewater conveyance and treatment needs

EPA has developed a comprehensive management framework called Capacity, Management, Operations, and Maintenance (CMOM) to assist municipalities in developing more comprehensive sanitary sewer system management programs. A CMOM program (described in Section 8.1.3, Option AM1) helps to prevent SSOs. Once a recurring SSO is detected using the methods recommended under Option CM1, measures must be taken to eliminate the discharge.

Reduction of Stormwater Inflow and Infiltration (RDII) to Sanitary Sewers (CM3) Related Goals: 3, 7 Related Indicators: 10, 11, 19, 20			
What	Who	Where	When
RDII Reduction Program.	Municipalities with separate sewer systems in TTF Watershed (see Table 8.7).	See Figure 8.3 (map of separate sewers and responsible authorities).	Short-term.

Where significant RDII is detected, measures can be taken to seal the sanitary sewer system to reduce inflow of stormwater and groundwater. These measures are discussed in detail under Option AM3, “Sanitary Sewer Rehabilitation” (in Section 8.1.3).

Combined Sewer Overflow (CSO) Control Program (CM4) Related Goals: 3, 7 Related Indicators: 7, 8, 9, 10, 11, 19, 20			
What	Who	Where	When
Nine Minimum Controls (NMCs). Long Term Control Plan (LTCP) Capital Projects, including real time control (RTC). Watershed Plan development.	PWD	Philadelphia combined sewer system.	NMCs complete and ongoing. RTC short-term (within 5 years).

The fundamental goal of the Philadelphia Water Department’s (PWD) combined sewer overflow (CSO) program is to improve and preserve the water environment in the Philadelphia area and to fulfill PWD’s obligations under the Clean Water Act and the Pennsylvania Clean Streams Law by implementing technically viable, cost-effective improvements and operational changes.

The PWD’s strategy to attain these goals has three primary phases: aggressive implementation of a comprehensive program for Nine Minimum Controls; planning, design, and construction of capital projects that further enhance system performance and reduce CSO volume and frequency; and comprehensive watershed-based planning and analyses that will identify additional, priority actions to further improve water quality in Philadelphia area water bodies.

The implementation of each of these control measures is discussed briefly below.

Nine Minimum Controls

In the first phase of PWD’s CSO strategy, and in compliance with its NPDES permits, PWD submitted CSO Documentation: Implementation of Nine Minimum Controls to the PA DEP on September 27, 1995. The nine minimum controls are low-cost actions or measures that can reduce CSO discharges and their effect on receiving waters, do not require significant engineering studies or major construction, and can be implemented in a relatively short time frame. To provide information needed for the development of the Nine Minimum Controls (NMC) program, PWD instituted a \$6.5 million project to upgrade its comprehensive system flow monitoring network. This program provides information necessary to identify and eliminate dry weather overflows, monitor system performance and operation, and configure and calibrate computer hydraulic models needed to develop the NMCs and long-term CSO control plans. This information provided the basis for the System Hydraulic Characterization Report that was submitted to the PA DEP in June 1995 and provided the technical basis for the development of the NMC plan.

Extensive data from the PWD’s Geographic Information System (GIS), flow monitoring system, the U.S. Army Corps of Engineer’s Storage, Treatment, Overflow, Runoff Model (STORM), and the EXTRAN and RUNOFF blocks of the EPA Stormwater Management Model (SWMM) were

used to support each phase of the CSO program. These tools were developed to support concept engineering through implementation and post-construction monitoring. The monitoring system, models, and GIS will serve as the basis for planning improvements and enhancing operation of the sewerage system over the long-term.

Using the above tools, the PWD's NMC program includes comprehensive, aggressive measures to maximize water quality improvements through the following nine measures:

1. Review and improvement of ongoing operation and maintenance programs.

CSO Regulator Inspection & Maintenance Program

PWD has committed to demonstrating an improved follow-up response to sites experiencing a dry weather overflow. PWD has instituted a policy of next day follow-up inspection at sites that experience an overflow. PWD will conduct an evaluation of the effectiveness of twice-weekly inspections.

A database has been developed to document the maintenance performed on each CSO site. This system will ensure that proper regulator settings are maintained and system changes are documented. This database can also store scanned plan view and profile view drawings of CSO regulator and hydraulic control point chambers for inclusion in the filed inspection report forms.

Additional components of the O&M program include:

- Pumping Station Maintenance
- Sewer Cleaning Contracts
- Inflow Prevention Program
- Tide Gate Inspection and Maintenance Program
- Emergency Overflow Weir Modification

2. Measures to maximize the use of the collection system for storage.

Use of the collection system for storage has long been recognized as a potentially cost-effective means to mitigate the occurrence and impacts of CSOs. PWD has been implementing in-system storage in Philadelphia's combined sewer system for nearly 20 years, using a variety of technologies:

- Reducing tidal inflows at regulators can reduce CSO overflows to Tookany/Tacony-Frankford Creek by increasing available treatment capacity at the POTW.
- A program to install tide gates or other backflow prevention structures at Tookany/Tacony-Frankford Creek regulators to protect these regulators from potential inundation.
- Another approach that can be implemented to gain additional in-system storage is to raise the overflow elevation by physically modifying the overflow structure (e.g., raising an overflow weir). However, this approach must be implemented cautiously, since raising the overflow elevation also raises the hydraulic grade line in the combined trunk sewer during storm flows, and therefore increases the risk of basement and other structural flooding within the upstream sewer system due to backup or surcharge problems.

3. Review and modification of PWD's industrial pretreatment program.

(Also see Section 8.3.1, Option CR4, "Industrial Stormwater Pollution Prevention.")

- Over the years, PWD has implemented a rigorous industrial pretreatment program. The effectiveness of this program has allowed the City to develop one of the largest and most successful biosolids beneficial reuse programs in the nation. As part of the nine minimum controls effort, PWD is committed to taking actions to encourage industries to better manage their process water discharges to the sewer collection system during wet weather periods.

4. Measures to maximize flow to the wastewater treatment facilities.

As a minimum control, maximizing flow to the publicly owned treatment works (POTW) means making simple modifications to the sewer system and treatment plant to enable as much wet weather flow as possible to reach the treatment plant and receive treatment. The secondary capacity of the treatment plant should be maximized, and all flows exceeding the capacity of secondary treatment should receive a minimum of primary treatment (and disinfection, when necessary). The most effective way to determine the ability of the POTW to operate acceptably at incremental increases in wet weather flow, and to estimate the effect of the POTW's compliance with its permit requirement, is to perform stress testing to determine optimum flows, loads, and operations of the plant's unit processes.

5. Measures to detect and eliminate dry weather overflows.

Relevant measures are discussed in Section 8.1.3, which details various recommended Target A Municipal Measures.

6. Control of the discharge of solid and floatable materials.

Solids are waterborne waste material and debris consisting of sand, gravel, silts, clay, and organic matter. Significant concentrations of solids are not only a visual nuisance, but can affect turbidity and dissolved oxygen, and carry pathogens in the receiving water. In addition, excessive amounts of solids can affect the combined sewer system by decreasing hydraulic capacity, thus increasing the frequency of overflows. Solids can enter the system through domestic and industrial wastewater, and debris washed from streets.

Floatables are waterborne waste material and debris (e.g., plastics, polystyrene, and paper) that float at or below the water surface. Floatables seen in significant quantities are aesthetically undesirable and can cause beach closings, interfere with navigation by fouling propellers and water intake systems, and impact wildlife through entanglement and ingestion.

Floatables and solids control measures consist of non-structural and structural technologies.

Non-structural technologies include combined sewer system maintenance procedures such as sewer flushing, street sweeping, and catch basin cleaning. Public education, land use planning and zoning, and ordinances are also considered non-structural technologies implemented to reduce solids and floatables entering the combined sewer system. (These technologies are discussed elsewhere in Section 8, under various relevant options.)

Structural controls typically consist of abatement devices that would be constructed near the point of discharge. Technologies used for removing solids and floatables from CSOs include: Baffles, Booms, Catch Basin Modifications, Netting Systems, Swirl Concentrators, Screens, and Trash Racks. (Modification of storm and combined sewer inlets for solids control, as well as catch basin and storm inlet maintenance are also discussed elsewhere under Section 8 options.)

Solids and floatables discharged from CSOs may represent a potentially significant impact to Tookany/Tacony-Frankford Creek. PWD currently expends considerable effort to minimize the potential discharge of solids and floatables.

- PWD performs over 50,000 inlet cleanings each year preventing many tons of street surface-related materials from discharging to waterways through CSOs. The significant pipe cleaning and grit removal activities conducted by PWD also remove a great deal of material that otherwise might discharge through CSO outlets during wet weather.
- The continued practice of regularly cleaning and maintaining grit pockets at critical locations in the trunk and interceptor system is an important part of the CSO control strategy. Grit buildup reduces the hydraulic capacity of the interceptor both by constricting its cross sectional area, and by increasing its frictional resistance. For example, quarterly cleaning of the 100-foot deep siphon grit pocket located at the Central Schuylkill wastewater pumping station is a major undertaking requiring specialized equipment and the commitment of significant labor resources. This practice has been shown to reduce the hydraulic grade surface at the siphon, increasing the wet weather flow capacity to the SWWPCP. Prior to the institution of this cleaning practice, the grit pit at this location had not been cleaned regularly in over 40 years.
- Operation condition inspections of regulator chamber and backflow prevention devices are conducted for each structure approximately weekly, resulting in more than 10,000 inspections conducted each year. Additionally, comprehensive structural and preventative maintenance inspections are performed annually.
- A pilot, in-line, floatables netting chamber was constructed as part of a sewer reconstruction project at CSO T-4 Rising Sun Ave. east of Tacony Creek. The construction of the chamber was completed in March 1997 and the netting system continues to operate. The quantity of material collected is weighed with each net change. On an area weighted basis, the inlet cleaning program data suggests that street surface litter dominates the volume of material that can enter the sewer system. The pilot in-line netting system installed at T-4 has been shown to capture debris on the same order as the WPCP influent screens indicating that effective floatables control needs to target street surface litter in order to effectively reduce the quantity of debris likely to cause aesthetic concerns in receiving streams.
- Debris grills are maintained regularly at sites where the tide introduces large floating debris into the outfall conduit. This debris can then become lodged in a tide gate thus causing inflow to occur. Additionally, these debris grills provide entry restriction, and some degree of floatables control. Repair, rehabilitation, and/or expansion of debris grills were performed at outfall F05 during calendar year 2002.

7. Implementation of programs to prevent generation and discharge of pollutants at the source.

Most of the city ordinances related to this minimum control are housekeeping practices that help prohibit litter and debris from being deposited on the streets and within the watershed. These measures include litter ordinances and illegal dumping policies and enforcement (see Section 8.1.1, Option AR2). If such pollutants eventually accumulate within the watershed, practices such as street sweeping and regular maintenance of catch basins can help to reduce the amount of pollutants entering the combined system and ultimately, the receiving water.

8. Measures to inform the public about the occurrence, location, and impacts of CSOs.

PWD has developed and will continue to develop a series of informational brochures and other materials about its CSO discharges and the potential affect on the receiving waters, in addition to information regarding dry weather flows from its stormwater outfalls. The brochures provide phone contacts for additional information. Also, the opportunity to recruit citizen volunteers to check or adopt CSO outfalls in their watersheds (e.g., notifying PWD of dry weather overflows, etc.) will be explored through the watershed partnership framework. Brochures and other educational materials discuss the detrimental affects of these overflows and request that the public report these incidences to the department. In addition, the Water Department has enlisted watershed organizations to assist it with this endeavor. PWD continued with this focus in 2002 to raise the level of awareness in its citizens about the function of combined and stormwater outfalls through a variety of educational mediums. The watershed partnerships are important for this kind of public/private effort to protect stream water quality. Lastly, the Department's Waterways Restoration Unit will investigate the feasibility of installing signs that can withstand nature and vandals at PWD outfalls.

9. Comprehensive inspection and monitoring programs to characterize and report overflows and other conditions in the combined sewer system.

Monitoring and characterization of CSO impacts from a combined wastewater collection and treatment system are necessary to document existing conditions and to identify water quality benefits achievable by CSO mitigation measures. Tables are compiled annually to represent average annual CSO overflow statistics as required in the NPDES Permit.

Long Term Control Plan Capital Projects

The second phase of PWD's CSO strategy is focused on technology-based capital improvements to the City's sewerage system that will further increase its ability to store and treat combined sewer flow, reduce inflow to the system, eliminate flooding due to system surcharging, decrease CSO volumes, and improve receiving water quality. The recommended capital improvement program is the result of a detailed analysis of a broad range of technology-based control alternatives.

A Real Time Control (RTC) center is being established at PWD's Fox Street facility. The ultimate goal for this center is to house a centralized RTC system that will allow telemetered commands to be sent to site-specific, automated controls located throughout the collection and treatment facilities. These signals may be transmitted based upon an optimized response to rainfall patterns and are intended to further enhance capture of CSO volume. Establishing a RTC center will enable PWD to provide 24-hour monitoring and, eventually, control of key collection

system facilities including automated CSO regulators, pump stations, and inter-district diversions.

Two RTC projects are currently being designed for regulators that discharge to Tacony Creek. The trunk sewer discharging to regulator structure T-14 near Juniata Park and Tacony Creek Park contains excess storage capacity that can be utilized by increasing the overflow elevation during smaller rain events. A dynamic gate is ideal because the original overflow capacity is still needed to provide adequate drainage during very large storms. The project will reduce discharge volume associated pollutants such as bacteria, organic matter, solids, and litter from both untreated stormwater and wastewater.

The trunk sewer discharging to regulator structure T-08, near Nedro Avenue and Hammond Street in Tacony Creek Park, also has excess storage capacity during smaller storms. A similar dynamic gate is being proposed for this location to take advantage of this capacity and increase capture of combined sewage during wet weather. These projects are cost-effective because they modify existing infrastructure rather than requiring construction of new infrastructure. Both areas are in or near parkland used by the public for recreation.

Watershed-Based Planning and Management

The third component of the City's CSO strategy involves a substantial commitment by the City to watershed planning to identify long term improvements throughout the watershed, including possibly additional CSO controls, which will result in further improvements in water quality and, ultimately, the attainment of water quality standards. The need for this watershed initiative is rooted in the fact that, prior to development of the Integrated Watershed Management Plan, insufficient physical, chemical, and biological information existed on the nature and causes of water quality impairments, sources of pollution, and appropriate remedial measures. Because of this deficiency, it was impossible to determine what needed to be done for additional CSO control or control of other wet weather sources throughout the watershed. This deficiency, especially with respect to the effects of wet weather discharges and receiving water dynamics, is increasingly recognized nationwide and has led to a broader recognition of the need for watershed-based planning and management to properly define water quality standards and goals. PWD believes that the National CSO Policy, state and federal permitting and water quality management authorities, cities, environmental groups, and industry, now recognize that effective long-term water quality management can be accomplished only through watershed-based planning. Completion of the Tookany/Tacony-Frankford Integrated Watershed Management Plan represents the realization of this commitment to watershed-based planning.

Catch Basin and Storm Inlet Maintenance (CM5) Related Goals: 3, 5, 6, 7 Related Indicators: 11, 15, 16, 19, 20			
What	Who	Where	When
Regularly inspect catch basins (in combined areas) and storm inlets (in separate areas). Remove sediment as needed.	Sewer owners (PWD and municipalities).	All inlets throughout watershed.	Continue existing programs.

Catch basins and storm inlets that are part of the stormwater collection and conveyance system should be cleaned on a regular basis. Sediment, leaves, grass clippings, pet wastes, litter, and other materials commonly accumulate in catch basins. These materials can contain significant concentrations of nutrients, organics, bacteria, metals, hydrocarbons, and other pollutants. When a storm occurs, runoff entering the basin may dislodge and suspend some of this material. This debris can be conveyed along the storm sewer system and released to a surface water body. Catch basin clean out should be scheduled for the fall and early spring in order to remove leaves and road salt and sand before the spring rains. In general, this is done with vacuum trucks, with disposal of the debris handled as solid waste.

In separate sewer areas of the Tookany/Tacony-Frankford Watershed, each municipality is responsible for an effective storm sewer cleaning program. In Philadelphia, PWD has this responsibility.

Street Sweeping (CM6)			
Related Goals: 3, 5, 6, 7			
Related Indicators: 11, 15, 16, 19, 20			
What	Who	Where	When
Evaluate existing Street Sweeping programs and implement enhanced practices.	All municipalities.	Streets and parking lots in commercial and dense residential areas.	Within next 5 years.

Street and parking lot cleaning performed on a regular basis in urban and dense residential areas can be an effective measure for minimizing stormwater pollutant, sediment, and floatables loading to receiving waters.

Street sweeping programs had largely fallen out of favor as a pollutant removal practice following the 1983 NURP report. Recent improvements in street sweeper technology, however, have enhanced the ability of the machines to pick up the fine grained sediment particles that carry a substantial portion of the stormwater pollutant load, and have led to a recent reevaluation of their effectiveness. New studies show that conventional mechanical broom and vacuum-assisted wet sweepers reduce non-point pollution by 5 to 30 percent and nutrient content by 0 to 15 percent. However, newer dry vacuum sweepers can reduce non-point pollution by 35 to 80 percent and nutrients by 15 to 40 percent for those areas that can be swept (Runoff Report, 1998). A benefit of high-efficiency street sweeping is that by capturing pollutants before they are made soluble by rainwater, the need for structural stormwater control measures might be reduced. Structural controls often require costly added measures, such as adding filters to remove some of these pollutants and requiring regular maintenance to change filters. Street sweepers that can show a significant level of sediment removal efficiency may prove to be more cost-effective than certain structural controls, especially in more urbanized areas with greater areas of pavement.

Computer modeling of pollutant removal in the Pacific Northwest suggests that the optimum sweeping frequency appears to be once every week or two (CWP, 1999). More frequent sweeping operations yielded only a small increment in additional removal (Bannerman, 1999; Claytor, 1999).

The following measures should be implemented toward achieving non-point source reductions in wet weather pollutant loads:

- Evaluate existing street and parking lot sweeping practices by municipalities with urban and dense residential areas contributing stormwater runoff to the watershed.
- Implement enhanced street and parking lot sweeping programs in urban and dense residential areas, prioritizing those not served by existing stormwater BMPs designed to reduce stormwater pollutant, sediment, or floatables loading to the receiving waters.

Responsible Landscaping Practices on Public Lands (CM7)			
Related Goals: 1, 2, 3, 4, 6, 7			
Related Indicators: 1, 10, 11, 12, 13, 16, 19			
What	Who	Where	When
Incorporate integrated pest management (IPM) to reduce chemical use on public lands. Prevent clippings and cuttings from being transported by stormwater, and dispose of them through composting if possible.	Fairmount Park Commission, municipalities. PennDOT for vegetation along state roads.	Parks, golf courses, school and institutional grounds, roadside vegetation.	Short-term (within 5 years).

Common pesticides such as diazinon and chlorpyrifos can be harmful to aquatic life even at very low levels (CWP, 1999; Schueler, 1995). Proper use of these chemicals can be encouraged through public relations campaigns and demonstrated on public lands. Clippings and cuttings carried into the stormwater system and receiving streams can degrade water quality in a variety of ways. A related problem exists with the illegal dumping of clippings and cuttings in or near drainage facilities. Recommended controls include:

- Consider an integrated pest management (IPM) program that encourages the use of alternatives to chemical pesticides. An IPM program incorporates preventative practices in combination with non-chemical and chemical pest controls to minimize the use of pesticides and promote natural control of pest species. In those instances when pesticides are required, programs encourage the use of less toxic products such as insecticidal soaps. The development of higher tolerance levels for certain weed species is a central concept of IPM programs for reducing herbicide use. This approach should be balanced with the invasive species control methods discussed in Section 8.2.3, Option BM7.
- Collect clippings and cuttings on slopes and the bottom of stormwater control facilities and near stormwater inlets. Avoid mowing when significant rain events are predicted. Dispose of material through composting when possible.

The River Conservation Plans (RCPs) recommend the following:

- High School Park to Ashbourne Road along the Tookany Creek Parkway: Educate Cheltenham Township Public Works in ecological maintenance practices. Encourage the two golf courses to evaluate fertilizing, mowing regime. Consider Audubon Golf Certification Program.
- Baeder Creek Watershed: Work with Abington Jr. High School to restore riparian buffer. Establish “no-mow” zone 30 feet from creek and plant native plants.

- Rock Creek Watershed: The mowed township-owned park would benefit from a change to a wooded area for both habitat enhancement and increased infiltration.
- Abington Country Club to Township Line Road: The Club greens should be maintained in a way to protect water quality.
- Abington Friends School to Township Line Road: Alter land management practices in the park to the restored pond shoreline including BMPs for the chip and putt course.
- Wyoming Avenue to Castor Avenue: Meet with Juniata golf course to discuss creating a “no mow” zone.

Responsible Bridge and Roadway Maintenance (CM9)			
Related Goals: 1, 2, 4, 7			
Related Indicators: 1, 19			
What	Who	Where	When
Incorporate BMPs into regular repairs and maintenance: Road and bridge resurfacing practices, Deicing chemicals and practices, and Existing bridge drains.	Bridge and roadway owners (municipalities and PennDOT).	Roadways and bridges (Figure 8.6).	Short-term (within 5 years).

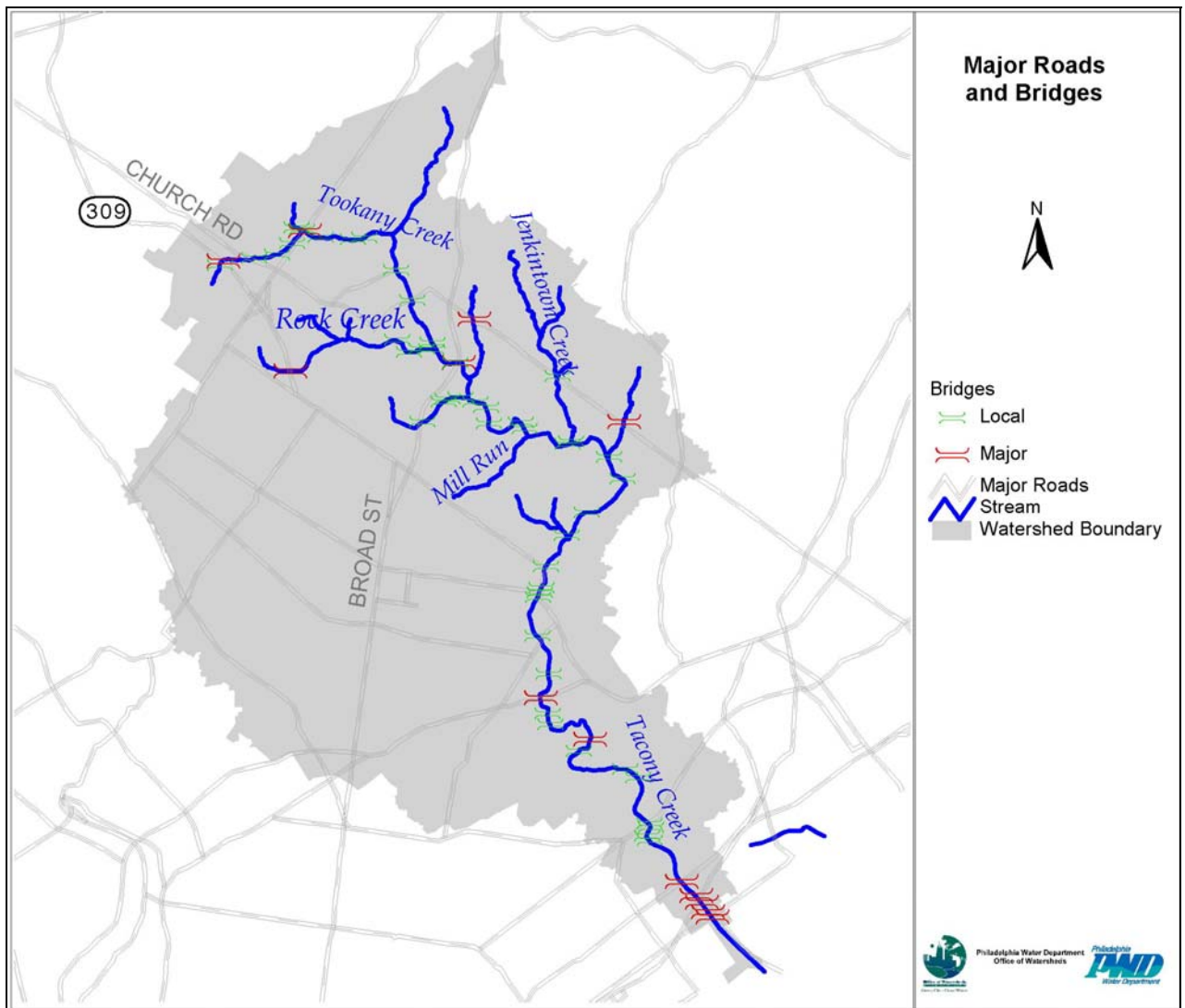


Figure 8.6 Major Roads and Bridges

Sediment and pollutants are generated during daily roadway and bridge use and scheduled repair operations, and these pollutants can impact local water quality by contributing heavy metals, hydrocarbons, sediment, and debris to stormwater runoff. The use of road salt is a public safety and a water quality issue. Aside from contaminating surface and groundwater, high levels of sodium chloride from road salt can kill roadside vegetation, impair aquatic ecosystems, and corrode infrastructure such as bridges, roads, and stormwater management devices.

Recommended techniques are as follows:

- Consider alterations to road and bridge resurfacing practices near the creeks (Figure 8.6). Perform paving operations only under dry conditions. Cover storm drain inlets and manholes during paving operations, use erosion and sediment control measures, and use pollution prevention materials such as drip pans and absorbent material for all paving machines to limit leaks and spills of paving materials and fluids. Finally, consider using porous asphalt for shoulder areas to reduce runoff.
- Consider adjusting the use and application of deicing materials as summarized below.

Table 8.19 Watershed Protection Techniques for Snow and Snowmelt Conditions

<p>Use of De-icing Compounds:</p> <ul style="list-style-type: none">▪ Consider alternative de-icing compounds such as CaCl_2 and calcium magnesium acetate (CMA).▪ Designate salt-free areas on roads adjacent to key streams, wetlands, and resource areas.▪ Reduce use of de-icing compounds through better driver training, equipment calibration, and careful application.▪ Sweep accumulated salt and grit from roads as soon as practical after surface clears. <p>Storage of De-icing Compounds:</p> <ul style="list-style-type: none">▪ Store compounds on sheltered, impervious pads.▪ Locate at least 100 feet away from streams and floodplains.▪ Direct internal flow to collection system and route external flow around shelters. <p>Dump Snow in Pervious Areas Where It Can Infiltrate:</p> <ul style="list-style-type: none">▪ Stockpile snow in flat areas at least 100 feet from stream or floodplain.▪ Plant stockpile areas with salt-tolerant ground cover species.▪ Remove sediments and debris from dump areas each spring.▪ Choose areas with some soil-filtering capacity. <p>Blow or Shovel Snow from Curbside to Pervious Areas.</p> <p>Operate Stormwater Ponds on a Seasonal Mode.</p> <p>Use Level Spreaders and Berms to Spread Meltwater Over Vegetated Areas.</p> <p>Intensive Street Cleaning in Early Spring Can Help Remove Particulates on Roads.</p>
--

- Consider alterations to existing bridge drains. Scupper drains can cause direct discharges to surface waters and have been found to carry relatively high concentrations of pollutants (CDM, 1993). At a minimum, routinely clean existing drains to avoid sediment and debris buildup, and consider retrofitting with catch basins or redirecting runoff to vegetated areas to provide treatment.

Runoff from bridges and roadways can become a serious hazard to water quality when the toxic pollutants from vehicles are taken into consideration.

The River Conservation Plans (RCPs) recommend the following:

- Ralph Morgan Park to Greenwood Avenue: Communicate with SEPTA regarding their maintenance practices of the parking lot.
- Cheltenham Avenue to Adams Avenue: Check railroad area for possible chemical runoff.

8.3.4 Target C Options: Stormwater Management

Source Control Measures

Reducing Effective Impervious Cover through Better Site Design (CS1)			
Related Goals: 3, 5, 7			
Related Indicators: 1, 15, 16, 19			
What	Who	Where	When
Reduce effective impervious cover by approximately 1% through: Downspout disconnection. Pervious landscaping. Sidewalk and driveway width reduction. Vacant lands management.	All municipalities require and/or encourage these measures using regulatory and/or public education options discussed elsewhere in this section.	All areas.	Long term: 15+ years.

Small changes in site design can lead to a gradual reduction in effective impervious cover that becomes significant over time. When applied consistently, the measures above can result in a 5-10% reduction in areas that are redeveloped. Assuming 10% of the watershed might be redeveloped over the planning horizon, a reduction in effective impervious area of 1% is a reasonable goal. Programs to require or encourage these practices are discussed under the regulatory approaches and public education options (Sections 8.3.1 and 8.3.2, respectively).

Downspout disconnection: In highly urbanized areas of the watershed, it is not always possible to direct runoff to pervious areas, and an informal inspection of lower density areas indicates that many properties are already disconnected. However, a further reduction in directly connected roof leaders from just 10% of residences will result in an effective impervious cover reduction of about 5%.

Pervious Landscaping: When repaving parking lots and loading areas, conversion of 10% of the area in half of parking lots to pervious landscaping (a measure required by some municipalities, including Portland, OR) will decrease watershed effective impervious cover by approximately 0.5%.

Sidewalk and Driveway Width Reduction: Reducing sidewalk and driveway widths by one foot will result in a watershed effective impervious cover reduction of approximately 1%.

Vacant Lands Management: Vacant and abandoned lands in Philadelphia are gradually being acquired and demolished by the City. Proper grading of these sites to encourage infiltration, or addition of small, inexpensive BMPs if needed, can eliminate runoff from these sites during all but the largest storms. Similar techniques can be followed for vacant and abandoned lands in the other municipalities.

Porous Pavement and Subsurface Storage (CS2) Related Goals: 1, 2, 3, 4, 6, 7 Related Indicators: 1, 10, 11, 16, 19, 20			
What	Who	Where	When
Install porous pavement and subsurface storage in 10-50% of parking lots; coverage to be chosen by municipality to meet a share of watershed-wide reduction targets. Route runoff from nearby impervious cover to storage when possible.	Public and private parking lot owners.	See Figure 8.7.	Long-term: 15+ years

As discussed in Section 7.2.3, subsurface storage under parking lots is one of the most feasible and effective ways to create storage and promote infiltration in a highly urbanized environment. Porous pavement is an effective way of directing parking lot runoff to storage, but more conventional inlets or grates are also possibilities. The depth of storage is important. Whenever possible, runoff from nearby impervious areas should be routed into the storage under nearby parking lots. When this is not possible, only a few inches of gravel are needed to store a chosen design storm. Storage designs always include an overflow mechanism for very large storms.

The total parking lot area in the TTF Watershed is estimated at 1039 acres in the combined-sewered portion and 623 acres in the separate-sewered portion. Philadelphia has approximately 75% of parking lot area in the watershed. Other municipalities with large parking lot areas are Cheltenham Township (16%), Abington Township (7%), and Jenkintown Borough (2%). Other municipalities have smaller percentages as listed in Figure 8.8.

Because this BMP is believed to be the most important, an ambitious target is proposed. Begin with demonstration projects on public land. Over the long term, convert 10%-50% of parking lots watershed-wide to porous pavement with subsurface gravel storage.

There are a variety of approaches for implementing porous pavement and other structural BMPs. Regulatory and incentive-based approaches were discussed under low-impact redevelopment (see Option CR2, in Section 8.3.1). Distribution of structural BMPs may also be incorporated in a pollution trading program.

- Install demonstration projects in public parking lots.
- Consider requiring all parking lots to be retrofitted with porous pavement (or other drainage mechanisms) and subsurface storage when they are redone. Private land owners cannot be expected to bear the entire cost of this approach; municipalities should consider funding the additional cost of these changes either directly or through tax incentives.

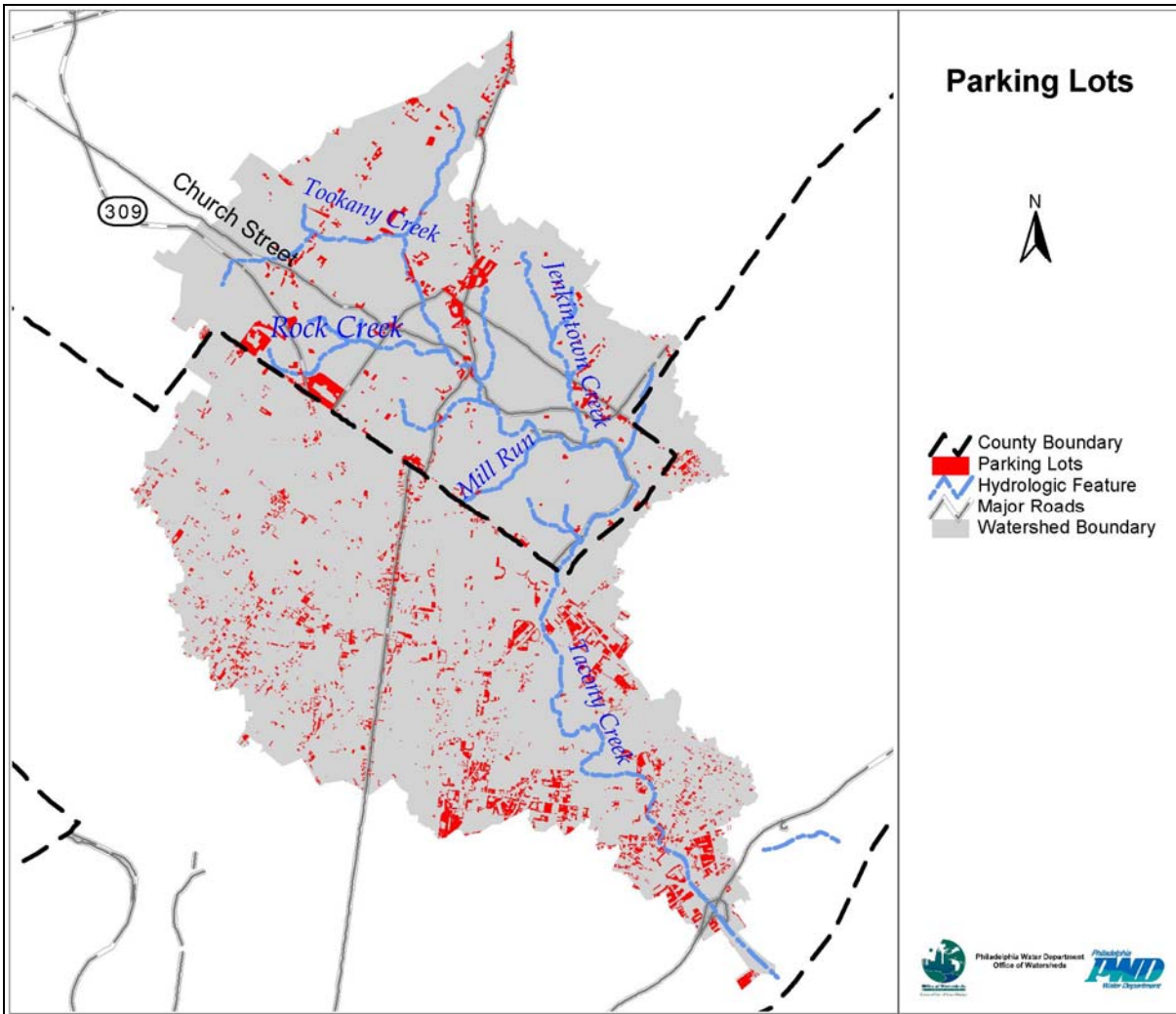


Figure 8.7 Parking Areas in Tookany/Tacony-Frankford Creek Watershed

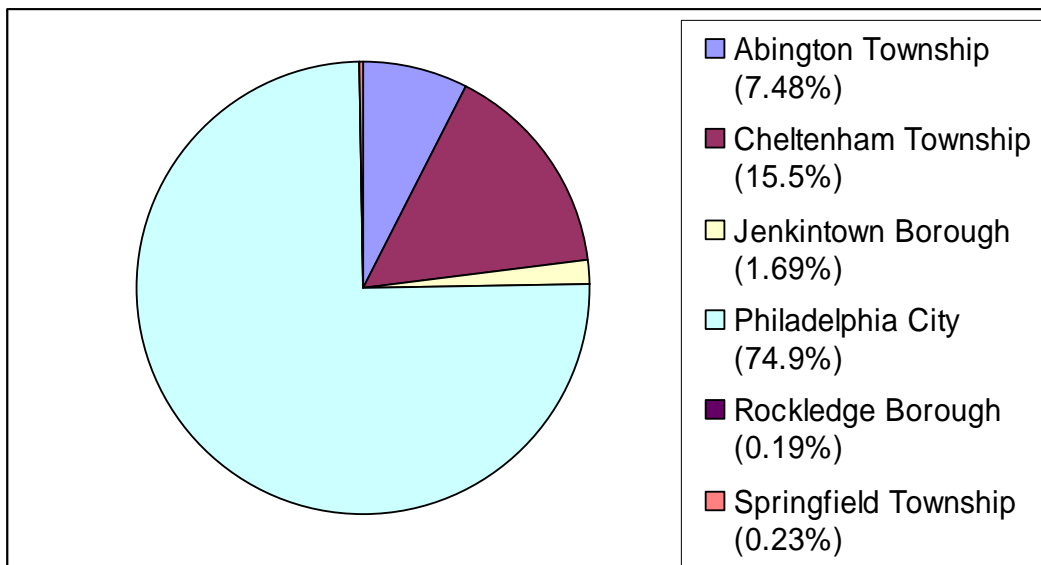


Figure 8.8 Percent of Total Parking Area by Municipality

The River Conservation Plans (RCPs) recommend the following:

- Greenwood Avenue to Wyncote Post Office: If parking lots are renovated, use pervious material to reduce pollutants from washing into creek.

Green Rooftops (CS3)			
Related Goals: 1, 2, 4, 6, 7			
Related Indicators: 1, 16, 18, 19, 20			
What	Who	Where	When
Green rooftop demonstrations. Targeted public information campaign on advantages of green roofs. Feasibility study and green roof implementation plan.	PWD	Appropriate public buildings chosen by PWD.	Medium term: 5-15 years.

The analyses in Section 7.2.3 indicate that green rooftops, while highly effective at detaining and evaporating stormwater, are not currently a cost-effective option for the Tookany/Tacony-Frankford Watershed. However, there is the potential for them to become more cost-effective in the future. As more successful demonstration projects are implemented in the United States, the materials and construction techniques will become more common and the economies of scale will improve. To facilitate this long-term change locally, this plan recommends that Philadelphia take the lead and implement one or more projects on public buildings in the City. Along with this project, we recommend a feasibility study of the potential for a larger-scale green roof program throughout the watershed. The feasibility study will form the basis for future recommendations when this plan is revised. In addition, we recommend a public relations campaign to change the perceptions of citizens, public officials, and contractors.

Capturing Roof Runoff in Rain Barrels or Cisterns (CS4) Related Goals: 1, 2, 4, 6, 7 Related Indicators: 1, 16, 18, 19			
What	Who	Where	When
Install rain barrels on 5 - 25% of homes; coverage to be chosen by municipality to meet a share of watershed-wide reduction targets.	Homeowners through municipal incentive and education programs.	Homes where dry wells are not feasible.	Medium term: 5-15 years.

The Tookany/Tacony-Frankford Watershed Partnership initiated a rain barrel project in 2002, which placed 215 rain barrels at homes throughout the watershed. Rain barrels can be an effective stormwater management tool if they are properly designed and maintained. For detention of residential roof runoff, dry wells are the preferred technique because they have a larger capacity, require no maintenance, and allow more infiltration. Rain barrels are recommended as a secondary technique in areas where dry wells are infeasible. Proper design, including an appropriate slow release, is the responsibility of the municipality or non-profit group leading the rain barrel program. Proper maintenance is accomplished through an intensive public education campaign and series of workshops. An ambitious target is to install rain barrels on 5-25% of homes within a small subshed of “sewershed” area within the watershed in the medium term.

Increasing Urban Tree Canopy (CS5) Related Goals: 1, 2, 4, 6, 7 Related Indicators: 1, 4, 13, 16, 17, 18, 19, 20			
What	Who	Where	When
Increase tree canopy in the watershed from 27% to 32%.	Municipalities (through ordinances, education, and incentive programs affecting land owners).	Private property, parking lots, streets. Parks (riparian corridors under Target B, Section 8.2).	Medium-term (5-15 years).

Tree planting and urban reforestation programs provide hydrologic benefits in addition to quality of life improvements. Leaf surfaces intercept some rainfall that might otherwise fall on impervious surfaces. The rainfall then either evaporates or is conveyed more slowly to the ground along plant stems and trunks. American Forests has assessed tree canopy in the TTF Watershed at 27% (report “Urban Ecosystem Analysis, Delaware Valley Region” available at www.americanforests.org). American Forests recommends the following levels of tree canopy coverage for urban watersheds:

- 40% overall
- 50% in suburban residential zones
- 25% in urban residential zones
- 15% in central business districts

A goal of increasing tree canopy by 5% of the watershed over the medium term was selected as a feasible implementation level. Several regulatory and incentive-based strategies to achieve these goals are listed below. (Also see Option CR2 in Section 8.3.1 on Regulatory Approaches.)

- Requirements to protect existing trees on private property, or creation of “tree banks” to offset loss.
- Tree credits for redevelopers as part of impervious cover requirements or incentives. The City of Portland, Oregon has given developers an impervious cover credit equal to 25% of tree canopy over impervious area.
- Parking lot landscaping or shade requirements.
- Reforestation in parks and along the stream corridor.
- Increases in the number of trees along public streets and on vacant lots. The City of Philadelphia is taking this approach as part of its Green City Strategy.

Tree canopy over an additional 5% of impervious cover will result in an effective impervious cover reduction of approximately 2% over the watershed.

Municipalities with tree related ordinances are shown in Table 8.20.

Table 8.20 Landscape and Tree Related Ordinances

Municipality	Landscaping	Shade Tree/ Street Trees	Wooded Lots*	Tree Advisory Commission	Comments
Abington Township	X	X	X		Buffer areas; tree-planting requirements (streets/parking lots); open space standards/preservation.
Cheltenham Township		X	X	X	Buffer areas; green areas; Tree Commission regulations; Preservation Overlay District.
Jenkintown Borough		X		X	Shade tree-planting desirable along streets; Tree Commission regulations.
Philadelphia County	X	X		X	Fairmount Park Commission regulations; required tree/landscaping ratios in certain residential districts.
Rockledge Borough	X	X			Residential landscaping/buffer area requirements; parking buffer areas for Institutional District; common open space preservation.

Source: www.ordinance.com, Delaware Valley Regional Planning Commission

* **Note:** “Wooded Lots” refers to any ordinance directly involving the preservation of open space/undisturbed natural areas. Most of the municipality ordinances included the intention of open space preservation under general goals.

Forming a tree commission is one way of implementing an urban forestry program in Pennsylvania. The powers and responsibilities of a tree commission are based on state statute and are assumed by local government. By forming and empowering a tree commission, a community can empower and motivate volunteers to run an effective urban forestry program. Tree commissions are either advisory or administrative and may have various responsibilities, including the following:

- Advise community leaders and staff on administering the community forest.
- Stimulate and organize tree planting and maintenance.
- Develop and implement urban forest inventories, management plans, and ordinances.
- Lessen liability by arranging to remove hazardous trees and repair damage caused by trees.

In Pennsylvania, a tree commission created by municipal ordinance as a decision-making body has exclusive control over a community’s shade trees. No tree can be planted or removed within the public right-of-way except under the auspices of the tree commission. This includes public

trees that may be planted or removed in conjunction with subdivisions or approved development plans. Tree commissions can be given additional power within a municipality by a council, including:

- Control over all public trees such as trees within community parks.
- Review and approval of landscaping proposed in development plans.

The formation and empowerment of a tree commission can be a crucial element in developing broad-based support for community trees and ensuring long-term success and continuance of a community forestry program. (For more information, contact the Extension Urban Forestry Program, School of Forest Resources, The Pennsylvania State University, 108 Ferguson, University Park, PA 16802, or call 814-863-7941.)

Onsite and Regional Stormwater Control Facilities

Maintaining/Retrofitting Existing Stormwater Structures (CS6) Related Goals: 1, 2, 3, 4, 5, 7 Related Indicators: 4, 11, 15, 19			
What	Who	Where	When
Inventory structures. Assess potential for increased infiltration.	Municipalities.	Entire watershed.	Short term (within 5 years).

PWD performed an inventory of existing privately owned stormwater control basins in 2000. The results of this study indicate seven confirmed structures within the Philadelphia portion of the watershed. Other municipalities are asked to inventory and inspect existing stormwater control structures. Although this is not an explicit requirement of the Act 167 program, it is a reasonable task to include within the Act 167 framework. Older dry and wet detention basins may have been designed to reduce flood peaks but not to facilitate infiltration; this approach helps prevent property damage but may actually increase stream erosion. In some cases, it may be possible to retrofit these older basins to allow infiltration. Specific guidance on retention times and design recommendations will be included in the Act 167 Plan.

Retrofitting Existing Sewer Inlets with Dry Wells (CS8) Related Goals: 3, 5, 7 Related Indicators: 11, 15, 19			
What	Who	Where	When
Retrofit 5 - 100% of existing stormwater catch basins in the combined sewer area to provide storage and allow infiltration.	PWD	5 - 10% of existing inlets in combined-sewered areas.	Long-term: 15+ years.

As discussed in Section 7 (especially Section 7.2.3), retrofitting existing sewer inlets with dry wells is an expensive but effective measure in combined-sewered areas. Each inlet provides small amounts of storage and detention; distributed over a significant area, these measures reduce the number and duration of overflows.

During the first permit cycle that this plan is in effect, inlets that are being repaired or replaced can be retrofitted at the same time. If, after the first five years, the program is not on track to affect the targeted number of inlets in 15 years, existing inlets in good condition may be retrofitted.

Residential Dry Wells, Seepage Trenches, and Rain Gardens (CS9)			
Related Goals: 1, 2, 3, 4, 5, 6, 7			
Related Indicators: 1, 11, 15, 16, 17, 19			
What	Who	Where	When
Install dry wells in 5-10% of residential yards; coverage to be chosen by municipality to meet a share of watershed-wide reduction targets. Install water gardens on school grounds.	Municipalities. School boards.	Dry wells throughout watershed. Water gardens in school yards with enough space.	Long term: 15+ years.

Routing residential roof runoff to dry wells is recommended as a priority control for the Tookany/Tacony-Frankford Watershed. Dry wells are cost-effective, can potentially affect a large portion of impervious cover, and require virtually no maintenance. They are clearly applicable in the lower density residential areas but can also be installed in some higher density areas; only a small lawn area is necessary. A properly sited and designed dry well will not cause basement flooding. Where soil conditions are insufficient to infiltrate all roof runoff, excess flows can be routed to a combined or sanitary sewer. Because dry wells are a priority control, they are recommended for implementation in the yards of 5%-10% of all homes in the watershed.

Rain gardens are recommended for implementation on school grounds, where they can both promote infiltration and educate students about stormwater management.

The River Conservation Plans (RCPs) recommend the following:

- High School Park to Ashbourne Road along the Tookany Creek Parkway: Incorporate stormwater infiltration devices.
- Rock Creek Watershed: Incorporate stormwater infiltration devices especially in commercial areas.

Bioretention Basins and Porous Media Filtration (CS12) Related Goals: 1, 2, 3, 4, 5, 7 Related Indicators: 1, 7, 8, 9, 15, 19, 20			
What	Who	Where	When
Install bioretention and/or sand filters in 10-50% of parking lots; coverage to be chosen by municipality to meet a share of watershed-wide reduction targets.	Public and private parking lot owners.	Everywhere in watershed.	Long-term: 15+ years. Focus on redevelopment.

The screening and detailed evaluation analyses in Section 7 targeted parking lot runoff for widespread implementation of BMPs. The preferred approach for parking lots is to route runoff to subsurface gravel storage through porous pavement, inlets, or grates. However, there will be cases where that approach is not feasible. The second preferred alternative is to direct parking lot runoff to a bioretention basin and/or a porous media filter. These systems infiltrate smaller storms completely, detain larger storms, and provide effective water quality treatment in separate sewered areas. 10-50% of parking lots are targeted for retrofit with bioretention. Over the long term, it is the goal to retrofit as many parking lots as possible with either subsurface storage or bioretention. However, private land owners should not necessarily be expected to bear the entire cost of this approach; municipalities should consider funding the additional cost of these changes either directly or through tax incentives.

The River Conservation Plans (RCPs) recommend the following:

- Holy Sepulchre Cemetery to Ralph Morgan Park: Incorporate stormwater filtration devices.
- Abington Country Club to Township Line Road: The stormwater management facilities for the parking lots should be examined to see if BMPs are being used to help reduce runoff.

Treatment Wetlands: Onsite and Regional (CS13) Related Goals: 1, 2, 3, 4, 7 Related Indicators: 1, 10, 11, 13, 19			
What	Who	Where	When
Create or enhance wetlands to treat as much runoff as possible in Philadelphia and Montgomery County.	Municipalities.	See Figure 8.4 for proposed sites.	Medium term: 5-15 years.

Wetland creation and enhancement has benefits in terms of habitat, water quality, and water quantity. These benefits as well as proposed sites are discussed extensively under Option BM6, in Section 8.2.3.

8.3.5 Monitoring and Reporting

Monitoring, Reporting, and Further Study (CMR)			
Related Goals: 7			
Related Indicators: 16, 17, 19			
What	Who	Where	When
Monitoring of implementation and benefits for all Target C options.	City of Philadelphia and Municipalities.	Watershed-wide.	Annually beginning after the first year of implementation is initiated

The preceding are a series of implementation options identified as initial measures geared toward meeting Target C. This Target will be more difficult to achieve than Targets A and B as it entails meeting all water quality standards during wet weather, as well as eliminating all flooding. Based on the extensive modeling analysis carried out for Tookany/Tacony-Frankford Creek to date, an initial goal of a 20-25% reduction in stormwater flows and stormwater/CSO related pollutant loads has been identified as a challenging but achievable goal.

The suggested approach to full achievement of Target C goals is through the use of adaptive management while utilizing stepped implementation with interim targets for reducing wet weather pollutant loads and stormwater flows. During implementation, monitoring must continuously assess the effectiveness of the program. Based on monitoring results of each option, recommendations will be made for future implementation. It is expected that changes to the approach, or potentially even to the desired results, will occur as measures are implemented monitored.