

Section 9

Cost and Institutional Analysis

This section presents cost estimates for the various recommended “management options,” and for the full set of Implementation Guidelines (from Section 8). Those cost estimates are then broken down by county and by municipality within the TTF Watershed. Finally, the section outlines the primary roles and responsibilities for the various levels of stakeholders in the implementation of the TTFIWMP.

9.1 Estimated Cost of Implementation

Planning-level costs have been developed for many of the recommended options. Because costs are highly dependent on site specific conditions as well as the extent to which implementation occurs, costs included in this section are only approximate. These costs are useful, however, in providing order of magnitude funding needs, and also as a comparison to potential costs associated with more traditional approaches to CSO control, such as large scale storage tanks designed to reach the 85% capture goal. Planning level costs are provided for each of the options discussed under the three Targets.

The combination of structural BMPs and implementation percentages in this section are suggested as a feasible plan that will equal or exceed the 20% discharge reduction target. The exact combination of BMPs implemented in each area of the watershed will be determined by local municipalities or by a government or institutional body to be chosen at a later time.

Order-of-magnitude, planning-level cost estimates are shown in Tables 9.1 through 9.4. For structural stormwater BMPs, cost estimates are based on an assumed “feasible implementation” percentage shown in Table 7.5 (in Section 7.2.3) and also Table 8.13 (Section 8.3).

Table 9.1 Planning-Level Cost Estimates for Target A Options

	Total		Philadelphia		Montgomery County	
	Annual Cost	One-Time	Annual Cost	One-Time	Annual Cost	One-Time
Regulatory Approaches						
AR1 On-Lot Disposal (Septic System) Management	\$50,000				\$50,000	
AR2 Pet Waste, Litter, and Dumping Ordinances ¹						
Public Education and Volunteer Programs (AP1-3)	\$1,005,000		\$814,044		\$190,644	
Municipal Measures						
AM1-4 Sewer Evaluation, Cleaning, and Rehabilitation ²	\$909,000	\$41,121,000	\$455,000	\$20,592,000	\$454,000	\$20,529,000
AM5 Illicit Discharge, Detection, and Elimination (IDD&E)		\$6,022,000				\$6,022,000
AM6 Stream Cleanup and Maintenance	\$107,000	\$96,000	\$24,000	\$21,000	\$83,000	\$75,000
AO1 Enhancing Stream Corridor Recreational and Cultural Resources ¹						
AMR Monitoring, Reporting, and Further Study ³	\$17,000		\$17,000			
Total Cost for Target A Options	\$2,088,000	\$47,239,000	\$1,310,044	\$20,613,000	\$777,644	\$26,626,000
Cost per acre for Target A Options	\$99	\$2,246	\$108	\$1,693	\$88	\$3,008

1 - Already in place in most locations, or costs difficult to quantify.

2 - Includes CMOM, NMCs, inspection and cleaning, and rehabilitation of combined and sanitary sewers.

3 - Field monitoring cost.

Table 9.2 Planning-level Costs for Target B Options

	Total		Philadelphia		Montgomery County	
	Annual Cost	One-Time	Annual Cost	One-Time	Other Counties	One-Time
Channel Stability and Aquatic Habitat Restoration						
BM1 Bed Stabilization and Habitat Restoration ¹	\$3,000	\$8,131,000	\$1,000	\$4,066,000	\$1,000	\$4,066,000
BM2 Bank Stabilization and Habitat Restoration ¹	\$3,000	\$8,131,000	\$1,000	\$4,066,000	\$1,000	\$4,066,000
BM3 Channel Realignment and Relocation ¹	\$3,000	\$8,131,000	\$1,000	\$4,066,000	\$1,000	\$4,066,000
BM4 Plunge Pool Removal ²						
BM5 Improvement of Fish Passage ³						
Lowland and Upland Restoration and Enhancement						
BM6 Wetland Creation and Enhancement ²						
BM7 Invasive Species Management ²						
BM8 Biofiltration ²						
BM9 Reforestation ⁴						
BMR Monitoring, Reporting, and Further Study ⁵	\$17,000		\$17,000			
Total Cost for Target B Options	\$26,000	\$24,393,000	\$20,000	\$12,198,000	\$3,000	\$12,198,000
Cost per acre for Target B Options	\$1.2	\$1,160	\$1.6	\$1,002	\$0.3	\$1,378

1 - Based on restoration of high-priority reaches at \$700/ft. If actual cost is lower, medium priority reaches may also be restored.

2 - Cost considered under options BM1, BM2, and BM3.

3 - Not evaluated; recommended as a longer-term option.

4 - Cost included in Target V urban tree canopy cost.

5 - Field monitoring cost.

Table 9.3 Planning-level Costs for Target C Options

	Total		Philadelphia		Montgomery County	
	Annual Cost	One-Time	Annual Cost	One-Time	Annual Cost	One-Time
Regulatory Approaches						
CR2 Requiring Better Site Design in Redevelopment ¹		\$300,000		\$100,000		\$200,000
CR3, CR6 Stormwater and Floodplain Management ¹		\$300,000		\$100,000		\$200,000
CR4 Industrial Stormwater Pollution Prevention ²						
CR5 Construction Stormwater Pollution Prevention ²						
Municipal Measures						
CM1 Sanitary Sewer Overflow Detection ³						
CM2 Sanitary Sewer Overflow Elimination: Structural Measures ³						
CM3 Reduction of Stormwater Inflow and Infiltration to Sanitary Sewers ³						
CM4 Combined Sewer Overflow (CSO) Control Program ⁴		\$2,400,000		\$2,400,000		
CM5 Catch Basin and Storm Inlet Maintenance	\$816,000		\$545,000		\$271,000	
CM6 Street Sweeping	\$135,000		\$45,000		\$90,000	
CM7 Responsible Landscaping Practices on Public Lands ²						
CM9 Responsible Bridge and Roadway Maintenance ²						

1 - Estimated cost for ordinance development.

2 - Already in place in most locations, or costs difficult to quantify.

3 - Cost included in options AM1-5.

4 - Includes real time control cost only; other aspects of program included in options AM1-5.

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Table 9.3 Planning-level Costs for Target C Options (continued)

	Total		Philadelphia		Montgomery County	
	Annual Cost	One-Time	Annual Cost	One-Time	Annual Cost	One-Time
Stormwater Management						
Source Control Measures						
CS1 Reducing Effective Impervious Cover Through Better Site Design ⁵						
CS2 Porous Pavement and Subsurface Storage ⁵		\$30,689,000		\$10,985,000		\$19,705,000
CS3 Green Rooftops ⁵	\$100,000	\$1,000,000	\$100,000	\$1,000,000		
CS4 Rain Barrels and Cisterns ⁵		\$622,000		\$424,000		\$199,000
CS5 Increasing Urban Tree Canopy ⁵	\$2,000,000	\$20,000,000	\$1,000,000	\$10,000,000	\$1,000,000	\$10,000,000
Onsite and Regional Stormwater Control Facilities						
CS6 Maintaining/Retrofitting Existing Stormwater Structures ⁵	\$140,000	\$14,000	\$70,000	\$7,000	\$70,000	\$7,000
CS8 Retrofitting Existing Sewer Inlets with Dry Wells ⁵		\$454,000		\$454,000		
CS9 Residential Dry Wells and Rain Gardens ⁵		\$8,476,000		\$5,346,000		\$3,130,000
CS12 Bioretention and Porous Media Filtration ⁵		\$7,910,000		\$2,831,000		\$5,079,000
CS13 Treatment Wetlands: Onsite and Regional ⁵	\$850,000	\$4,562,000	\$425,000	\$2,281,000	\$425,000	\$2,281,000
Use Review and Attainability Analysis		\$100,000		\$100,000		
CMR Monitoring, Reporting, and Further Study	\$17,000		\$17,000			
Total Cost for Target C Options	\$4,058,000	\$76,827,000	\$2,202,000	\$36,028,000	\$1,856,000	\$40,801,000
Cost per acre for Target C Options	\$193	\$3,653	\$181	\$2,958	\$210	\$4,610

1 - Estimated cost for ordinance development.

2 - Already in place in most locations, or costs difficult to quantify.

3 - Cost included in options AM1-5.

4 - Includes real time control cost only; other aspects of program included in options AM1-5.

5 - Implementation levels taken from Section 8, Implementation Guidelines.

Table 9.4 Total Watershed Plan Cost

Total		Philadelphia		Montgomery County	
Annual Cost	One-Time	Annual Cost	One-Time	Annual Cost	One-Time
\$6,172,000	\$148,459,000	\$3,532,000	\$68,839,000	\$2,637,000	\$79,625,000
\$290/ac	\$7,060/ac	\$290/ac	\$5,650/ac	\$300/ac	\$9,000/ac

9.2 Distribution of Costs by Political Boundary

In addition to total estimated costs associated with the TTFIWMP, it is useful to express the costs on an annual basis and in the context of acreage and number of households affected. Presenting costs this way allows comparison to existing wastewater infrastructure-related costs supported by users and taxpayers. Those cost estimates are presented by county and by municipality, below.

9.2.1 Distribution of Costs by County

Table 9.5 compares projected costs on a per-acre basis and per-household basis in the City of Philadelphia and outside the City of Philadelphia. The table shows costs on an annual basis, using a 20-year period to pay off the capital costs. Philadelphia pays approximately 50% of the total annual cost (line 3), while representing approximately 60% of the watershed area. On a per-acre basis, costs within Philadelphia are approximately 70% of costs outside the City. This difference occurs because of the greater land area and length of stream outside Philadelphia. (An illustrative distribution of costs among municipalities in the watershed is shown in Section 9.2.2.)

Table 9.5 Affordability Impact by County

	Philadelphia	Montgomery County
(1) One-Time Cost (Annualized)	\$3,338,000	\$3,875,000
(2) Annual Cost	\$2,598,733	\$2,268,386
(3) Total Annual Cost Associated with WMP	\$5,936,733	\$6,143,386
(4) Cost per acre in watershed	\$487	\$694
(5) 2000 Median Household Income	\$30,746	\$59,621
(6) Estimated Annual Sewer User Charge*	\$343	\$250
(7) WMP cost per household in watershed (in entire municipalities)	\$52.53 (\$10.06)	\$258.93 (\$157.00)
(8) WMP cost as % of mean household income in watershed (in entire municipalities)	0.17% (0.03%)	0.43% (0.26%)
(9) Existing sewer cost + WMP cost in watershed (entire municipalities)	1.59% (1.15%)	0.62% (0.46%)

* The sewer user charge in Philadelphia includes a stormwater collection and treatment fee. Stormwater-related charges outside Philadelphia were not investigated.

In addition to showing costs per unit area, it is useful to express costs on a per-household basis. Line 7 in Table 9.5 expresses cost per household, assuming only households inside the watershed boundaries would be required to pay. This comparison is made because improvements occur, and citizens benefit, primarily within the watershed boundaries. Expressed in this manner, the cost is greater for households outside Philadelphia (line 7, outside

parentheses); because of greater population density within the urban watershed, there are more households to distribute the cost among inside the City. Line 8 of Table 9.5 expresses the per-household cost inside the watershed boundary as a percentage of mean household income (line 8, outside parentheses).

While expressing costs in terms of households inside the watershed boundary allows direct comparison between communities, it is also useful to express costs on the basis of all households within the boundaries of municipalities that intersect the watershed. Currently, most funding and institutional mechanisms occur on a municipal basis. For example, a given township may use a percentage of all water and sewer bills paid to finance improvements related to the TTFIWMP, including bills paid by households outside the TTF watershed boundary.

The numbers in parentheses on lines 7 through 9 of Table 9.5 present the costs in terms of all residents of municipalities intersecting the watershed. These costs are lowest in Philadelphia because it has the greatest number of households; all households paying sewer bills will pay approximately 0.03% of household income to support the TTFIWMP, compared to 0.26% for the remaining communities. Compared to the other municipalities, Philadelphia has many more households to spread the cost of the TTFIWMP over, but will ultimately have additional watersheds that will require management activities. Over time and on a regional basis, watershed management costs are expected to approach 0.3% to 0.5% of mean household income within affected communities.

The costs associated with the TTFIWMP are generally incremental to existing maintenance and management activities associated with water-related infrastructure. Therefore, it is useful to add the TTFIWMP cost to current wastewater charges paid by households to obtain an approximate measure of the total annual cost of watershed and water-related infrastructure management. These costs, shown in the final line of Table 9.5, range from approximately 0.6% to 1.6% of mean household income regionally.

9.2.2 Distribution of Costs by Municipality

Tables 9.6 and 9.7, below, provide data to assist communities in placing projected TTFIWMP costs in a local context. Table 9.6 expresses estimated costs for communities per acre and per household inside the watershed boundaries; Table 9.7 presents costs within the boundaries of all municipalities that intersect the watershed. For the purposes of this illustrative example of cost distribution, general, watershed-related costs for communities outside of Philadelphia are apportioned according to the percentage of the watershed area within each municipality's jurisdiction.

These cost tables are but one illustration of a possible cost distribution, and are provided to aid municipalities in deciding what funding and institutional mechanisms may be most appropriate given local conditions.

Table 9.6 Affordability Impact by Municipality – Rate Payers in TTF Watershed

	Abington	Cheltenham	Jenkintown	Philadelphia	Rockledge
Municipality area in watershed (ac)	2,712	5,691	367	12,178	81
Area of municipality in watershed (% of municipality total)	27%	98%	99%	13%	37%
Households in municipality and watershed	7,147	14,218	2,013	113,022	348
Annual cost associated with TTFWMP	\$807,899	\$1,695,749	\$109,277	\$3,532,000	\$24,075
Cost per acre (within watershed)	\$297.95	\$297.95	\$297.95	\$290.03	\$297.95
Cost per household (within watershed)	\$113.04	\$119.27	\$54.29	\$31.25	\$69.18
Median household income (\$/year)	\$59,921	\$61,713	\$47,743	\$30,746	\$47,958
Cost per household (% of MHI)	0.19%	0.19%	0.11%	0.10%	0.14%

Table 9.7 Affordability Impact by Municipality – All Rate Payers in Municipality

	Abington	Cheltenham	Jenkintown	Philadelphia	Rockledge
Municipality area (ac)	9,893	5,779	369	91,287	219
Watershed area in municipality (ac)	2,712	5,691	367	12,178	81
Watershed area in municipality (% of watershed total)	12.9%	27.1%	1.7%	57.9%	0.4%
Households in municipality	21,690	14,346	2,035	590,071	1,060
Annual cost associated with TTFIWMP	\$807,899	\$1,695,749	\$109,277	\$3,532,000	\$24,075
Cost per acre (whole municipality)	\$81.66	\$293.42	\$296.36	\$38.69	\$109.91
Cost per household (whole municipality)	\$37.25	\$118.20	\$53.70	\$5.99	\$22.71
Median household income (\$/year)	\$59,921	\$61,713	\$47,743	\$30,746	\$47,958
Cost per household (% of MHI)	0.06%	0.19%	0.11%	0.02%	0.05%

9.3 Institutional Analysis

The primary purpose of Section 9 of this plan is to provide recommendations and guidance to stakeholders - primarily state, county, and other government agencies, municipalities, non-government organizations, land owners, and individuals - on ways to better manage the water resources of Tookany/Tacony-Frankford Creek. Everyone in the watershed communities can contribute in numerous ways to the protection of water resources.

Both government and non-government organizations will play a role in the successful implementation of the Tookany/Tacony-Frankford Integrated Watershed Management Plan. The primary roles are outlined below.

9.3.1 PA DEP Role

Two agencies of the Commonwealth of Pennsylvania are directly and indirectly involved in watershed planning in the TTF Watershed: the Department of Environmental Protection (PA DEP) and the Department of Conservation and Natural Resources (DCNR). Achievement of Watershed Plan goals through local implementation will require continued support through funding and integration of the various existing state level stormwater management and runoff related programs. Particular attention should be paid to the following programs:

- Act 167 Plans
- Phase II Stormwater permits
- Act 537 / CMOM Plans
- Construction Stormwater Pollution Prevention
- Industrial Stormwater Pollution Prevention
- Watershed monitoring and performance reporting
- Watershed permitting opportunities

A critical PA DEP role will be activities required under Section 303(d) of the Clean Water Act and the EPA's Water Quality Planning and Management Regulations (40 CFR Part 130). PA DEP will need to actively administer the water quality standards process for portions of the Tookany/Tacony-Frankford Creek in the near future. PA DEP should be active in encouraging municipalities to carry out the requirements of Phase II stormwater permits and Act 167 requirements. This plan provides the blueprint for effectively integrating both programs, and addressing water quantity and quality goals.

9.3.2 PWD Role

PWD, as the primary author of this plan, plays a central role in its implementation, as well as in continued monitoring to chart improvements to water quality. PWD will take a lead role in implementing a variety of the recommendations, including;

- Stream restoration
- Improvement of fish passage
- CSO Control

- Green rooftop demonstrations
- Stormwater BMP installation
- Organization of stakeholder participation
- Monitoring

9.3.3 Municipal Role

Municipalities can play a key role in the implementation of recommendations through the incorporation of water resource strategies into their land use planning and governance functions. Because of the authorities contained in the Pennsylvania Municipalities Planning Code (MPC), municipalities are one of the two main foci of implementation efforts (PWD being the other). Enabled by the MPC, municipalities are the focal point to address runoff from redeveloped and existing developed lands, to address problems associated with sanitary sewer collection systems, to enhance recreational opportunities, and to protect natural resources from the effects of land disturbance.

The most fundamental roles recommended for municipalities are to consider undertaking a comprehensive review of their existing land use regulations, policies, and requirements to identify where they may be unnecessarily causing impacts to water resources, and to undertake the necessary actions needed to eliminate SSOs and sanitary sewer leaks.

The primary actions recommended for municipalities include: encouraging disconnection of roof leaders from storm sewers, reduction of expansive paved (impervious) parking lot requirements and replacement of asphalt with porous paving surfaces or the installation of bioretention structures to handle parking lot stormwater runoff, repair and maintenance of leaking sanitary sewers, and the elimination of SSOs. Municipalities also might consider creating an Environmental Advisory Council (EAC), which is possible under Pennsylvania General Assembly enabling legislation - Act 148 of 1973. The EAC could then participate in the implementation of the plan, and help to coordinate the approach among all the municipalities within the watershed.

9.3.4 County Role

An important role of Montgomery County is to conduct the necessary comprehensive stormwater management studies to:

- Complete an Act 167 stormwater plan that is consistent with and furthers the achievement of the goals and objectives of the TTFIWMP.
- Work with municipalities to update Act 537 plans.

In addition, the Montgomery County Conservation District has several important responsibilities within the watershed, including:

- Chapter 102 Erosion Control: Administer the State's program to control sediment pollution from earth disturbance activities.
- National Pollution Discharge Elimination System (NPDES): Process applications and seek compliance towards stormwater discharge permits for Construction Activities.

- Chapter 105 Waterways and Wetlands General Permitting: Assist applicants with permit information. Process general permits for work within wetlands and streams.

These are important elements in coordinating Act 167 planning requirements with Phase II of the NPDES Stormwater Program.

9.3.5 Non-Government Organization Role

The Tookany/Tacony-Frankford Watershed Partnership will be critical to the successful implementation of the TTFIWMP. As noted in the introduction to Section 9, this newly incorporated watershed organization has formed with the purpose of implementing the recommendations of the TTFIWMP. With representatives of the two counties, several municipalities, and various non-profit organizations making up the Board of Directors of this organization, the vehicle for coordination and collaboration now exists.

Some of the primary functions of the newly formed organization could include:

- Creating a watershed-wide implementation plan and receiving approval from watershed municipalities. This approval includes obtaining signatures from municipalities followed by a letter of support from PA DEP.
- Overseeing the continued implementation of basic, essential services required of all municipalities by stormwater permits (e.g., sewer system maintenance).
- Overseeing continued monitoring, sampling, data analysis, and reporting on both the water quality and biology of the system using the established indicators.
- Providing public participation and public education opportunities (both workshops and other types of participatory programs).
- Exploring innovative solutions to long-term operation and maintenance of stormwater management facilities.
- Requiring that projects within the watershed area applying for state funding (Growing Greener, DCNR) must be reviewed and shown to be consistent with the TTFIWMP. The organization would review all submitted projects and apply a rating scale for consistency with the plan.
- Encouraging the idea of applying for federal funding for regional projects (e.g., stream restoration, regional wetlands); however, most smaller-scale projects would be funded locally. Public funding for major infrastructure projects on private land could be explored.

Another role for the new organization would be created if the State sets up a watershed-based permitting experiment in the watershed. The organization could then function as a Watershed Compliance Association (WCA). A WCA is a Commonwealth-created non-profit entity comprised of public and private entities that hold individual NPDES permits or General Permits to discharge to the creeks. A WCA is specifically created to implement watershed based permitting. The WCA would constitute a point of contact between PA DEP and its co-permittee members on issues related to the group permit for the parameter(s) of concern, once a TMDL is established in the watershed. If the WCA exceeds its parameter limit (load) for the year, the

Association would be out of compliance, and any co-permittee member that exceeds its individual load limit would also be out of compliance and subject to enforcement action. Through the group approach, however, pollution trading can be easily implemented.

9.3.6 Land Owners' Role

Voluntary watershed stewardship by all land owners can contribute significantly toward the protection and restoration of the Tookany/Tacony-Frankford Watershed while simultaneously minimizing the need for additional regulatory controls. Recommended roles for land owners include:

- Implementing “watershed stewardship” practices in their landscape and outdoor housekeeping practices.
- Disconnecting roof leaders and installing rain barrels or dry wells.
- Considering pervious solutions for driveways.
- Joining and supporting the activities of the TTF Watershed Partnership.