



A Report on the

---

STATE OF THE SCHUYLKILL RIVER WATERSHED

---

2002

Prepared by The Conservation Fund for the Schuylkill River Watershed Initiative

# TABLE OF CONTENTS

## LIST OF FIGURES

1	..... Regional Location
2	..... Physiographic Regions
3	..... Percentage of Stream Miles by Stream
4	..... Dams in the Schuylkill Watershed
5	..... Land Cover
6	..... 1990-2000 Population Change, by Municipality
7	..... Land Development Trends, Montgomery County
8	..... 1970-95 Trends in Population and Land Consumption, Montgomery County
9	..... Water Supply Intakes
10	..... Seasonal Relationships Between Water Withdrawals and River Flow
11	..... Water Withdrawals in the Schuylkill Watershed
12	..... Monitoring Locations and Tributaries Surveyed by Stroud Water Research Center 1996-2000
13	..... Water Quality Grades, Based Upon a Survey of Macroinvertebrates
14	..... Fish Consumption Advisories
15	..... Fish Passage at Major Dams
16	..... Status of Fish Passage Improvements at Major Dams
17	..... Wissahickon Creek's "Green Ribbon"
18	..... Land Trusts Active in the Schuylkill Watershed
19	..... Status of Land Protection in Selected Counties
20	..... Watershed Communities with Environmental Advisory Councils
21	..... Sustainable Watershed Initiative in Northern Chester County
22	..... Population Trends in Older Riverfront Communities
23	..... Task Force Members – Master Plan for the Lower Schuylkill
24	..... Schuylkill River Water Trail
25	..... Schuylkill River Land Trail
26	..... Assessed and Impaired Streams in the Watershed
27	..... Stream Classifications – Manatawny Creek
28	..... Percentages of Assessed and Impaired Streams
29	..... Streams Impaired by Agriculture
30	..... Agricultural Best Management Practices in the Tulpehocken Watershed
31	..... Streams Impaired by Development and Urban Storm Water
32	..... Status of Storm Water Management Plans in the Watershed
33	..... Public Sewage Treatment Plants
34	..... Status of Sewage Facility (Act 537) Plans in the Watershed
35	..... Industrial Point Sources, by Sub-Watershed
36	..... CERCLA Sites in the Schuylkill Watershed
37	..... Coal Mine Remediation Sites and Streams Impaired by Abandoned Mine Drainage
38	..... Priority Remediation Sites
39	..... Environmental Education Centers Within or Near the Schuylkill Watershed
40	..... Schuylkill River Heritage Corridor Projects from 1995 to 2000

Forward	.....	1	<i>4. Public Awareness and Education</i>	
Introduction	.....	2	Overview	27
			Enhancing Public Awareness	28
			Educating the Next Generation	29
			Environmental Education Centers	30
			Special Recognition of the Schuylkill	31
			<i>5. Looking Out for the Watershed - Who is Involved</i>	
			Public Agencies with Programs	
			Related to the Schuylkill Watershed	32
			Nonprofit Organizations	33
			Partnerships	34
			<i>6. Conclusions - A Call to Action</i>	35
			The Role of Indicators	37
			Report Participants	39
<i>1. The Watershed Today</i>				
Overview	.....	3		
Environmental Setting	.....	4		
Historical Influences	.....	5		
Land Use and Population Change	.....	6		
Community and River Conservation Planning	.....	7		
Trends in Land Consumed for Development	.....	8		
Surface and Groundwater Withdrawals	.....	9		
Biological Health of Schuylkill Waters	.....	10		
<i>2. Schuylkill Resources</i>				
<i>That Need Protection or Enhancement</i>				
Overview	.....	11		
Fisheries	.....	12		
Streamside Areas and Wetlands	.....	13		
Greenways and Watershed Conservation Lands	.....	14		
The Schuylkill and Developing Communities	.....	15		
The Schuylkill and Riverfront Communities	.....	16		
The Schuylkill and the City of Philadelphia	.....	17		
Schuylkill Greenways and Trails	.....	18		
<i>3. Managing Watershed Stresses</i>				
Overview	.....	19		
Assessment of Water Quality Conditions	.....	20		
Agriculture	.....	21		
Impervious Surfaces and Urban Storm Water	.....	22		
Sewage Wastes	.....	23		
Industrial Pollutants	.....	24		
Abandoned Mine Drainage	.....	25		
Monitoring and Research	.....	26		

# FORWARD

The land and waters of the Schuylkill River watershed reflect the heritage of working rivers in Pennsylvania and across America. Three hundred years of human use – from early settlement, through the industrial revolution, to the past century’s rapid development – has left its signature on the landscape. In what condition we will leave this precious resource to our children and grandchildren is the central question underlying this report.

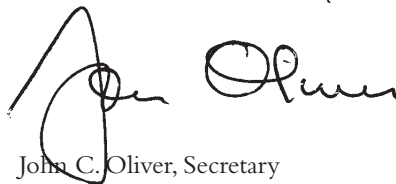
Along the banks of the Schuylkill River, we built our cities, our commerce and our livelihood. Yet at the height of industrial and urban expansion, communities from Pottsville to Philadelphia began to turn their backs to the river. As a consequence, the health, quality, and natural beauty of the Schuylkill River watershed declined. Now our cities and communities are returning to the river. From the headwaters to the Delaware Bay, communities are restoring and protecting the important resources of the Schuylkill River watershed.

Restoring our rivers is an all-hands-on-deck endeavor. Pennsylvania has over 83,000 miles of rivers and streams, more than any other state in the continental United States. Under Governors Ridge and Schweiker, the Commonwealth has taken a leadership role in watershed protection and river restoration. Through Growing Greener, Keystone grants, and the Pennsylvania Recreational Trails program, DEP and DCNR are proud to be working with 25 local and regional nonprofit organizations in the Schuylkill watershed on diverse projects including wetland and riparian restoration, shad conservation, greenway and park development, historic preservation, water quality monitoring, and integrated surface and groundwater management.

We hope the process of developing this report will encourage other river basins to communicate and collaborate with watershed stakeholders. We congratulate The William Penn Foundation, The Claneil Foundation and the Philadelphia Water Department for their leadership and support, as well as The Conservation Fund and the 25 nonprofit organizations who participated in the development and publication of this *Report on the State of the Schuylkill Watershed*.



David E. Hess, Secretary  
Pennsylvania Department of  
Environmental Protection



John C. Oliver, Secretary  
Pennsylvania Department of  
Conservation and Natural Resources



Photo: Gerald S. Williams

“If the Schuylkill can be cleaned up...any river in America can be made to run clear again...”

*Saturday Evening Post, July 9, 1949*

“Congress finds that...there is a longstanding commitment to repairing the environmental damage to the river and its surroundings...”

*Schuylkill River Valley National Heritage Area Act,  
P.L. 106-278, October 6, 2000*



## INTRODUCTION



Figure 1. REGIONAL LOCATION  
Source: Schuylkill Watershed River Conservation Plan - 2001

Watersheds are areas drained by a river or a river system. The Schuylkill watershed is the largest tributary of the Delaware River Basin. Covering about 1,916 square miles (or over 1.2 million acres), the watershed encompasses portions of 11 counties in southeastern Pennsylvania. Originating at Tuscarora Springs in Schuylkill County, the Schuylkill River travels approximately 130 miles to its mouth at the Delaware River in Philadelphia.

In 1996, the *Schuylkill River Watershed Initiative* was formed to increase communication and collaboration among nonprofit organizations and to promote a long-term vision for the watershed. With funding from The William Penn Foundation, Wyomissing Foundation, Claneil Foundation, the Pennsylvania Department of Natural Resources (DCNR) and the Pennsylvania Department of Environmental Protection (DEP), the Initiative has involved over 25 nonprofit organizations and representatives from DCNR, DEP and the Philadelphia Water Department. Managed by The Conservation Fund, the Schuylkill Initiative has been a catalyst for two large-scale projects — the Schuylkill River Conservation Plan and this Report on the State of the Schuylkill Watershed.

A joint project of nonprofit organizations and government, this report is a first attempt in developing indicators to begin to understand the watershed as a whole and how well it is doing. It is intended to serve as a baseline that should be further developed and updated in future years. Its other primary purpose is to encourage continued collaboration among the participating nonprofit groups and others, to strengthen their individual activities in the watershed. We hope that the report will be of interest to a broad audience of watershed communities, nonprofit organizations, current and prospective funders, and the public at-large—to inspire all activities that will benefit the watershed.

The report is organized around the following questions:

1. What are some of the defining characteristics of the Schuylkill as reflected by its natural and human history, its present land use and development patterns, and its water uses and water quality conditions?
2. How is the Schuylkill a resource to the region today, and what activities are underway to protect or enhance those resource values?
3. How are we managing human stresses to maintain and/or restore the health of the watershed ecosystem?
4. How well does the public understand the watershed and its importance, and what programs are in place to enhance public awareness and appreciation of the Schuylkill?
5. And finally, what are some of the agencies and nonprofit organizations involved in the watershed?

These are complex questions and each could fill a report on its own. By addressing them together, we gain in breadth what we lose in depth. The report provides a comprehensive view that helps us evaluate the strengths and weaknesses of what has been done and the potential of what lies ahead.

# 1. THE WATERSHED TODAY



Photo: Gerald S. Williams

## OVERVIEW

The Schuylkill watershed is a large, complex and continually changing place that reflects millions of years of natural history, hundreds of years of human settlement and the forces of human activity in the region today. It is difficult to take a single snapshot that portrays the richness of the watershed, but it does have some defining characteristics.

- The watershed flows through four natural regions whose different geologic and topographic settings provide the foundation for its drainage patterns and the natural characteristics of its ground and surface waters. These regions have strongly influenced historic settlement and land use patterns that help explain why the watershed looks the way it does today.

- Nearly 75 percent of the watershed comprises an intricate network of small headwaters streams that are particularly vulnerable to individual and cumulative land-use decisions and practices.
- Nearly 85 percent of the watershed still remains in agriculture and forest, but an increasing number of its tributaries are affected by suburban development.
- While recent population increases have been moderate, suburban development is consuming large amounts of land, particularly in rapidly growing areas of Chester and Montgomery Counties. If such trends continue, they threaten to consume over 100,000 acres of land every ten years.

- The watershed is an irreplaceable source of water for a region becoming increasingly reliant on groundwater. At the same time, impervious cover created by suburban development is reducing the replenishment of groundwater reserves.
- The biological health of the watershed's aquatic communities is a strong indicator of prevailing water quality conditions. A recently completed five-year assessment of 19 locations, which included most of the watershed's tributaries, revealed a degradation of biological conditions at over half of the study sites.

Critical to our understanding of the watershed is the recognition that it functions as an interconnected system, or what might be called the *watershed ecosystem*. Actions upstream affect conditions downstream. How we use and manage groundwater can have a profound impact on stream flow. Surface water conditions determine the health of aquatic communities. Nearly everything is connected to everything else.

Much of our decision-making within the watershed ecosystem is fragmented. As a result, it is difficult to understand the cumulative and significant impact of individual actions such as an approval of a residential subdivision or a new power plant. However, as we will show, there is a growing concern for the entire watershed as a result of an increasing number of public and non-profit initiatives.

Figure 2.  
PHYSIOGRAPHIC REGIONS  
Source: Academy of Natural Sciences  
of Philadelphia

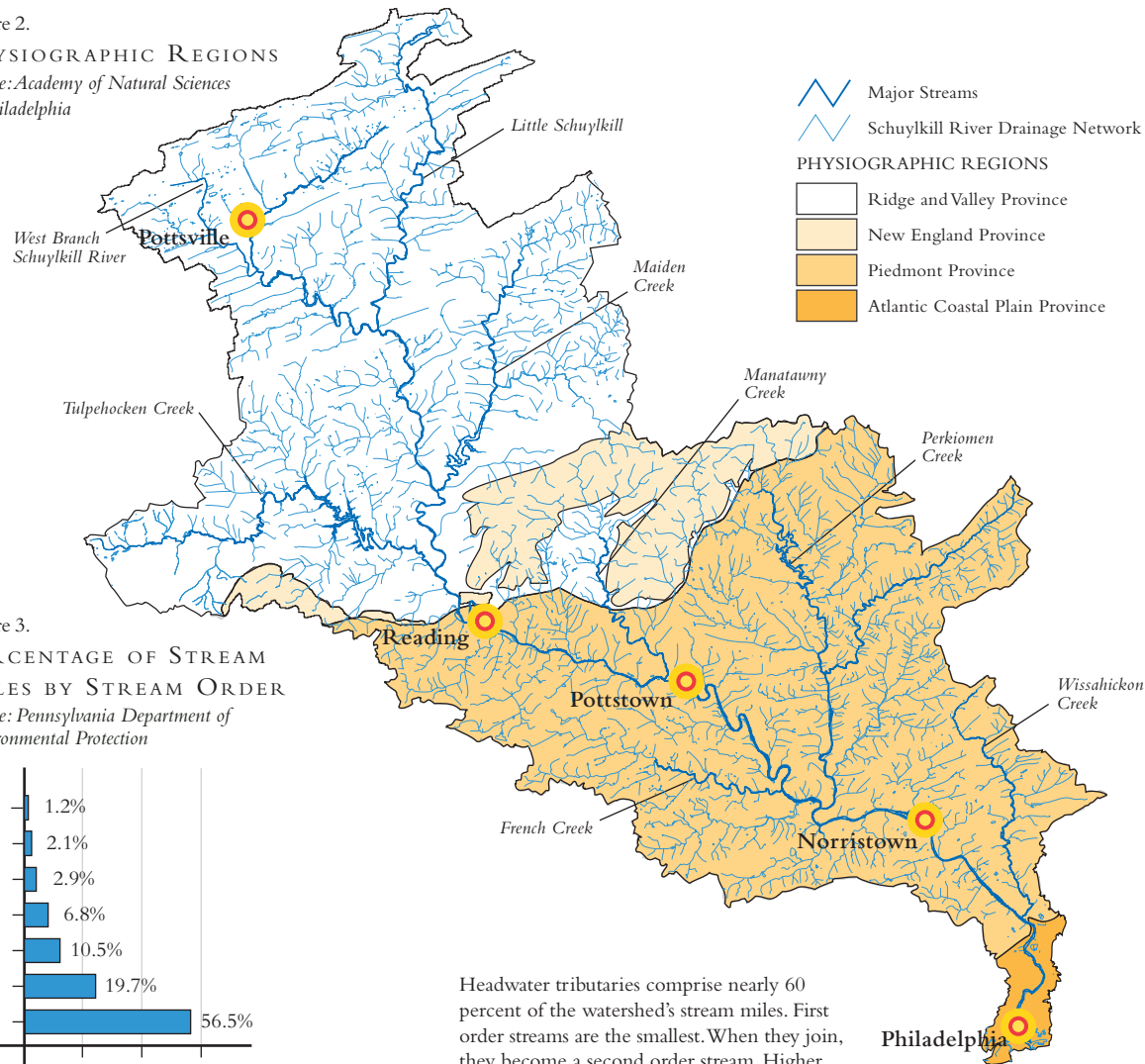
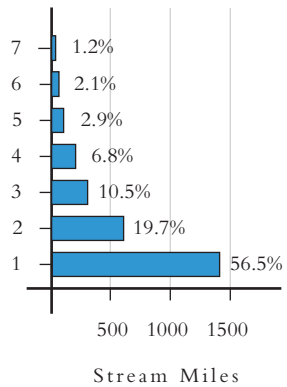


Figure 3.  
PERCENTAGE OF STREAM  
MILES BY STREAM ORDER  
Source: Pennsylvania Department of  
Environmental Protection



Headwater tributaries comprise nearly 60 percent of the watershed's stream miles. First order streams are the smallest. When they join, they become a second order stream. Higher stream orders are formed in the same way, i.e., when two lower order streams join to form a larger one.

## ENVIRONMENTAL SETTING

The watershed falls into four natural regions or “provinces” whose histories have produced different geologic, topographic, hydrologic, soil and climatic conditions. In turn, they have influenced land use and economic development patterns within the watershed.

*Ridge and Valley Province.* The northern section of this province, primarily in Schuylkill County, is made up of numerous long narrow mountain ridges separated by valleys of shales and other sedimentary rocks. It provides the resources for the region's anthracite mining. In contrast, its southern Great Valley section, south of Blue Mountain in Berks County, is a broad lowland with undulating hills and good agricultural soils.

*New England Province.* Underlain by gneiss, quartzite and other hard rocks, this province (known locally as the Reading Prong), comprises extensively forested hills and ridges and is drained by a network of steep, rocky streams.

*Piedmont Province.* Underlain by both sedimentary and crystalline rocks, this Province consists primarily of rolling hills and valleys, with extensive branching streams and prime agricultural soils. It encompasses much of the Philadelphia metropolitan area.

*Atlantic Coastal Plain Province.* Found only in the southern tip of the watershed in the City of Philadelphia, this province comprises gently sloping sands and gravel deposits. Extending into New Jersey, it contains one of the region's most important groundwater resources.

## HISTORICAL INFLUENCES

Initially settled by the Lenape tribe, the region's historic development was influenced strongly by the Schuylkill River. Early agriculture and timber industries relied upon the river for transportation to downstream markets. Industrialization and growth in the 18th and 19th centuries expanded the Schuylkill's uses for transport of material, waste disposal, power and water supply. During that period, the Schuylkill's riverfront communities took shape and flourished.

With late 20th century shifts in America's economy and settlement patterns, many of those communities fell on hard times. But in recent decades, the river and its tributaries have taken on new significance as an amenity with untapped potential to contribute to the quality of our lives.

An understanding of the Schuylkill's history reveals much about conditions in the watershed today. There have been tough challenges in terms of dealing with issues such as toxic wastes and degraded habitats. But early settlement has also left many attributes, such as its historic towns and villages.

No historical imprint has had a greater influence on the river than its network of dams. Many of the early dams were built for industry, public water supply or transportation through the Schuylkill Canal. Others were built for flood control and recreation. More recent dams such as Blue Marsh are serving multiple functions. Many dams may have outlived their original purpose, whereas others need repairs, restoration or removal.

Figure 4.  
DAMS IN THE SCHUYLKILL WATERSHED  
Source: Bureau of Waterways Engineering, Pennsylvania Department of Environmental Protection

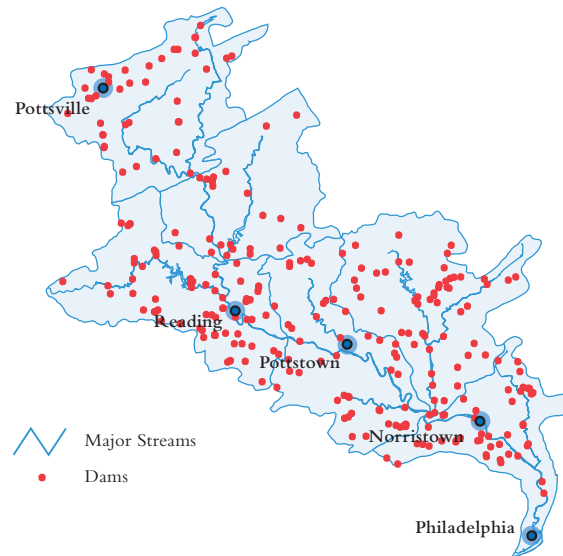


Photo: Gerald S. Williams



The watershed has at least 280 dams, many of which were constructed on tributaries in the 19th century to provide power and water supplies for industry, flood control and the Schuylkill Canal. Dams are monitored by PA DEP's Bureau of Waterways Engineering. As of June 2001, it classified six dams in the watershed as unsafe and requiring corrective action.

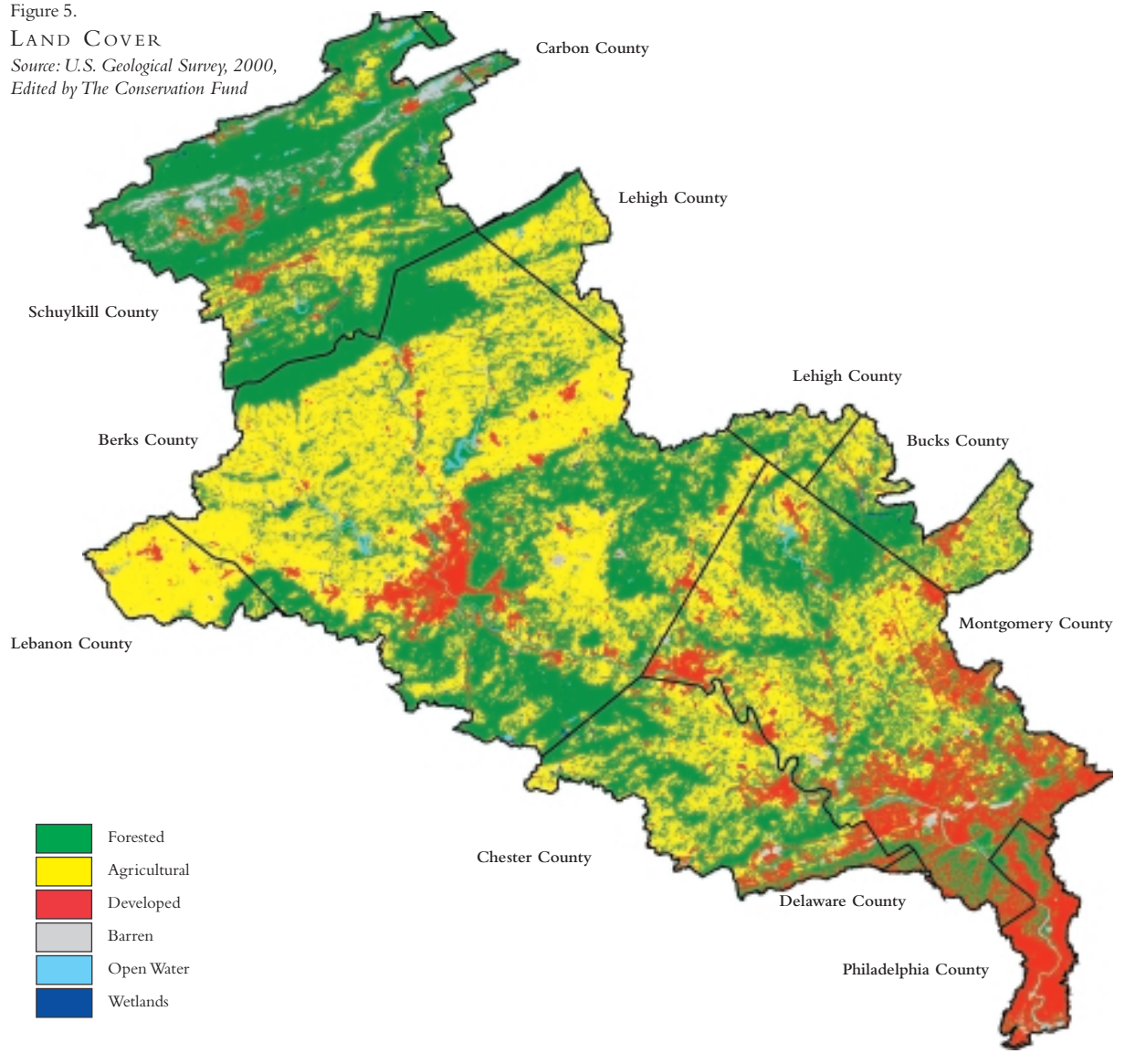
Moore Hall, an 18th century landmark situated at the confluence of the Schuylkill River and Pickering Creek in Chester County, was placed on the National Register of Historic Places by French and Pickering Creeks Conservation Trust in 1974. The earliest importance of the site lays in its use for river transportation, later in regard to the Encampment at Valley Forge (1777) and finally in the 19th Century as a key link on the Underground Railroad. The Trust and the Pennsylvania Historical and Museum Commission gained limited access to this privately owned site and continue, as they have done from the outset, to protect its setting from the surrounding development.

Photo: French & Pickering Creeks Conservation Trust



Figure 5.  
LAND COVER

Source: U.S. Geological Survey, 2000,  
Edited by The Conservation Fund



#### LAND USE AND POPULATION CHANGE

Nearly 85 percent of the watershed remains in agriculture and forest. Such uses are beneficial to the watershed, provided that good management practices, such as soil erosion and pesticide control, are also applied. By allowing rain and snow to seep into the soil, forests and well-managed agricultural lands help to replenish ground and surface waters, and sustain the health of the entire watershed ecosystem.

While watershed-wide land use statistics are meaningful, they can also be misleading. For example, although approximately 15 percent of the entire watershed is developed, some tributaries such as lower Wissahickon Creek, Skippack and Valley Creeks have as much as 45 percent of their land in urban-suburban uses, with more development anticipated. With the continuation of current land use patterns, future growth is likely to have increasing negative consequences on the watershed ecosystem as described elsewhere in this report (see pages 8-10).

Between 1985-1995, population growth increased in the watershed by about 231,000 (see Figure 6). Tributaries especially threatened by growth include the Upper Manatawny, Pickering, Swamp Creek, Hay Creek, French Creek, Unami Creek and the Upper Perkiomen. The impact of population growth is strongest in the small headwater streams. On the other hand, certain parts of the watershed have been losing population for many years. They include portions of Schuylkill County, the City of Philadelphia and many historic riverfront communities.

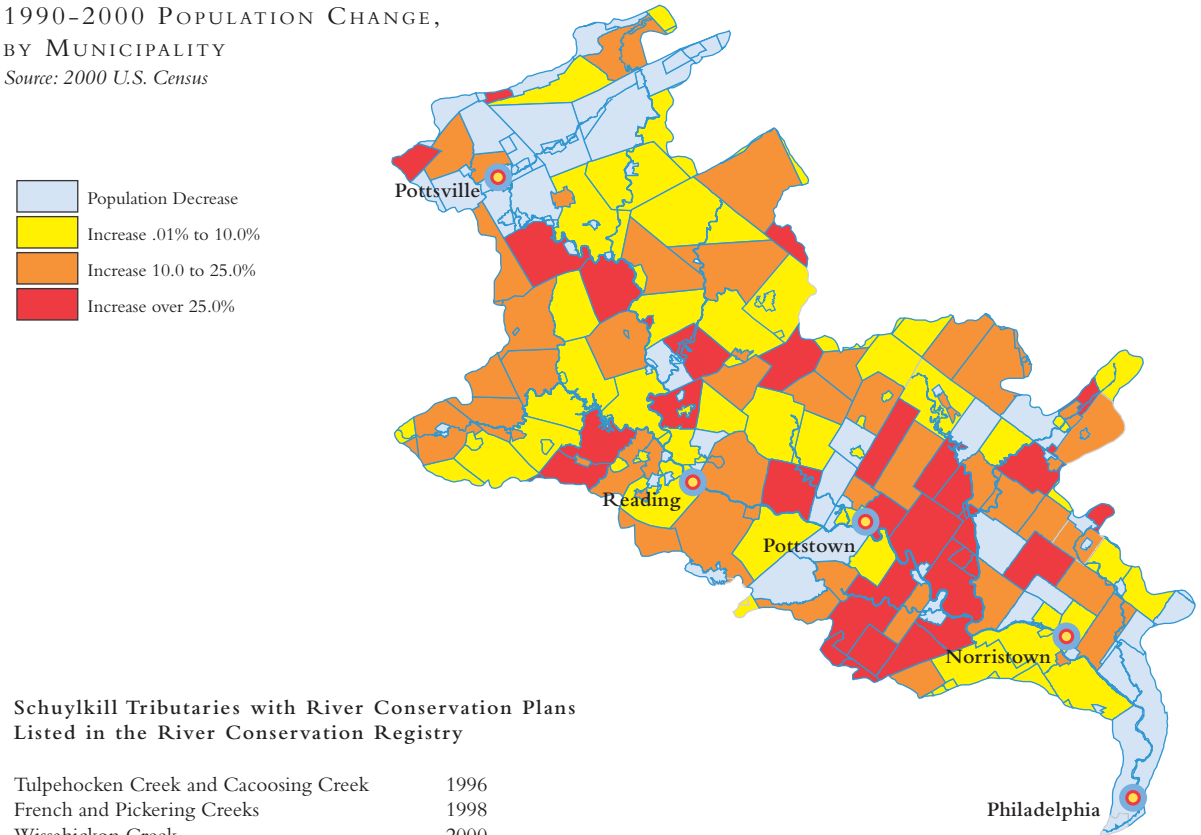


COMMUNITY AND  
RIVER CONSERVATION PLANNING

In the Schuylkill watershed and throughout Pennsylvania, individual municipalities are responsible for land-use planning and decision-making. While capable of making good decisions within their own jurisdictions, it is difficult for municipalities to consider watershed and other concerns beyond their own boundaries. Recent changes in Pennsylvania's Municipalities Planning Code provide more tools and incentives for coordinated inter-municipal planning and zoning, thereby allowing them to consider the watershed impacts of their land-use decisions. However, with more than 235 municipalities in the watershed, this is not an easy task. Therefore, watershed planning initiatives extending beyond municipal and county boundaries are critical to the future of the Schuylkill watershed.

In 2001, with funding from the Pennsylvania Department of Conservation and Natural Resources (DCNR) and The William Penn Foundation, a team of nonprofit organizations completed a river conservation plan for the entire Schuylkill watershed. Led by The Conservation Fund, Natural Lands Trust and The Patrick Center for Environmental Resources, the plan summarizes conditions and trends, identifies major issues and presents broad recommendations for watershed protection (see [www.schuylkillplan.org](http://www.schuylkillplan.org) for more details). DCNR has also provided the stimulus and funding for other river conservation plans for a number of Schuylkill tributaries. Nonprofit organizations have played important roles in those efforts.

Figure 6.  
1990-2000 POPULATION CHANGE,  
BY MUNICIPALITY  
Source: 2000 U.S. Census



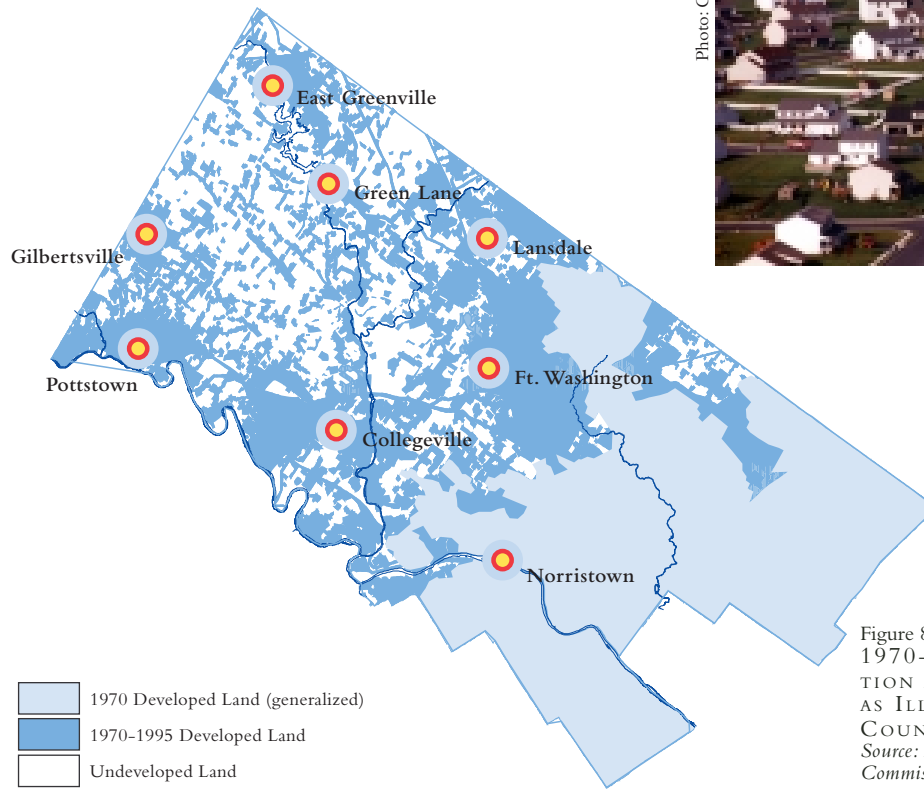
Schuylkill Tributaries with River Conservation Plans  
Listed in the River Conservation Registry

Tulpehocken Creek and Cacoosing Creek	1996
French and Pickering Creeks	1998
Wissahickon Creek	2000
Schuylkill River Basin	2001
Tulpehocken Creek Watershed	2001

Source: Pennsylvania River Conservation Registry, Bureau of Recreation and Conservation, DCNR. November 2001.

Note: Many other river conservation plans have been completed or are in progress for tributaries such as Manatawny Creek, Pigeon Creek, Stony Run Creek, Upper Perkiomen Creek, Perkiomen Creek and Maiden Creek, but they had not been added to the Registry as of November 2001.

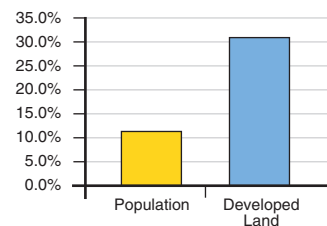
Figure 7.  
LAND DEVELOPMENT TRENDS,  
MONTGOMERY COUNTY  
Source: Delaware Valley Regional Planning Commission



Note: Dedicated park and conservation lands comprising about 9 percent of the total land area in Montgomery County are not shown.



Figure 8.  
1970-1995 TRENDS IN POPULATION AND LAND CONSUMPTION, AS ILLUSTRATED IN MONTGOMERY COUNTY  
Source: Delaware Valley Regional Planning Commission



#### TRENDS IN LAND CONSUMED FOR DEVELOPMENT

In keeping with a national trend, the rate of land consumed for development appears to be far exceeding the rate of population change in the watershed. Data for Montgomery County illustrate what is happening.

Between 1970-95, population growth in the county increased by 10.7 percent, while land converted to development increased by 30.8 percent. As of 1995, more than 50 percent of Montgomery County was developed. At current rates of land consumption, the County could lose nearly all of its currently unprotected open land in the next 30 years.

These land consumption trends appear to be occurring elsewhere in the watershed. Using land consumption data from Montgomery County and estimated 1985-95 population increases of 231,000 in the watershed, it is possible that nearly 130,000 acres of land could be consumed for development in the watershed every ten years. Current patterns of land development bring the prospect of reduced groundwater and stream flow. These effects will be felt most during seasonal dry periods when diminished water quantity and quality could be especially stressful to aquatic communities. They could also curtail the use of the watershed for public water supplies and recreation activities. Guiding suburban development in more compact form, making new investments in older communities, and stepping-up land conservation programs are strategies that can help offset these trends.

## SURFACE AND GROUNDWATER WITHDRAWALS

The Schuylkill River and its tributaries are an essential source of water supply for people living and working in the watershed. Power-generating plants are the largest water consumers, accounting for about 44 percent of the total withdrawals. Additional power plants are under consideration. Public water suppliers, providing water to residential and non-residential customers, are the second principal water users in the watershed. Over 85 percent of the public water supplies serve the needs of nearly 1.5 million people in the Philadelphia metropolitan region.

In 1995, surface water accounted for 83 percent of the water withdrawals in the watershed, with the remaining 17 percent coming from groundwater. Between 1985-95, surface water withdrawals increased by 6 percent, whereas groundwater withdrawals increased by 31 percent. Increasing reliance on groundwater is occurring at the same time that development trends are creating more impervious cover that interferes with the natural recharge of groundwater from precipitation. In turn, reduced recharge will lower the groundwater table and thereby reduce “base flow” of water flowing in streams between periods of precipitation.

Typically, water consumption peaks in the summer months, just as low flows occur in the river. These seasonal imbalances are particularly evident in the Philadelphia area, as shown by the accompanying chart of water treatment plant withdrawals and river flow conditions. Unless we manage the Schuylkill’s surface and groundwaters as one integrated system, we are likely to see a simultaneous increase in groundwater demand with a corresponding decrease in groundwater supply.

Figure 9.  
WATER SUPPLY INTAKES,  
BY POPULATION SERVED  
Source: Bureau of Water Supply Management,  
Pennsylvania Department of Environmental  
Protection, Philadelphia Water Department,  
2000

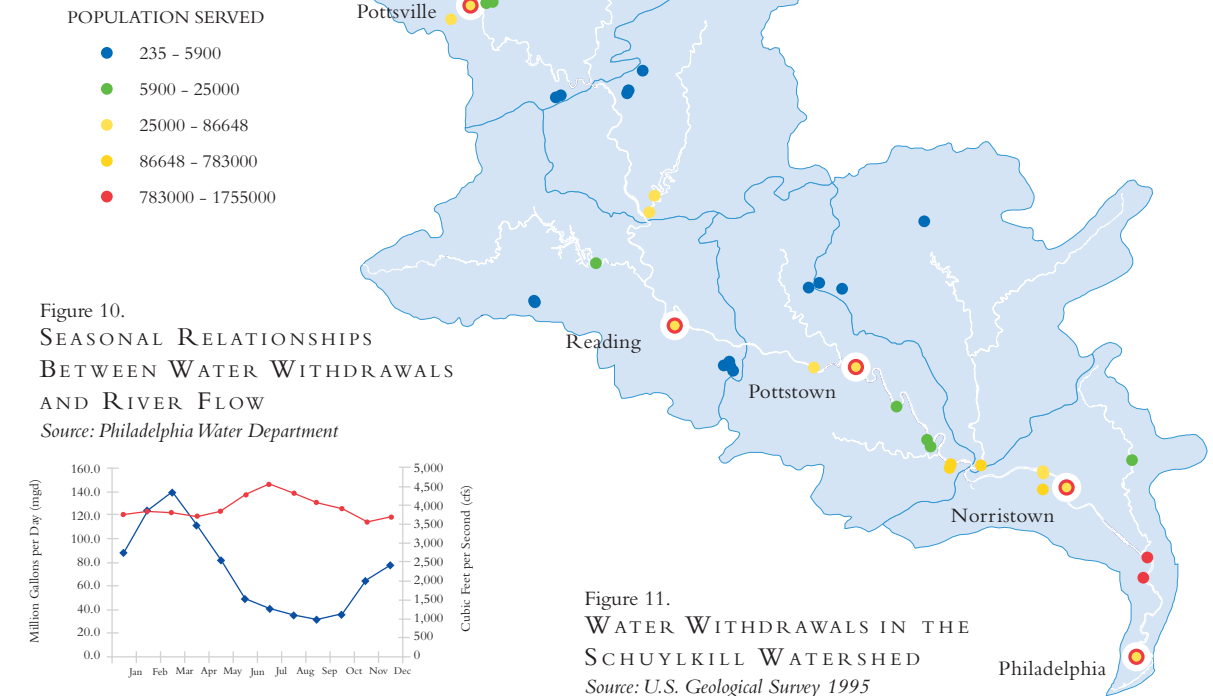
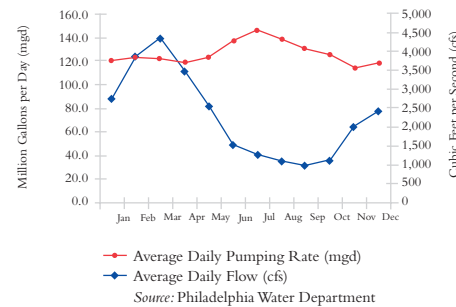


Figure 10.  
SEASONAL RELATIONSHIPS  
BETWEEN WATER WITHDRAWALS  
AND RIVER FLOW  
Source: Philadelphia Water Department



Seasonal Imbalances in Water Withdrawals and River Flow. 1998-2000 average monthly pumping rates (mgd) from the Philadelphia Water Department’s Belmont and Queen Lane treatment plants compared with long-term normal Schuylkill River flow rates (cfs) at Fairmount Dam. Source: Philadelphia Water Department.

Figure 11.  
WATER WITHDRAWALS IN THE  
SCHUYLKILL WATERSHED  
Source: U.S. Geological Survey 1995

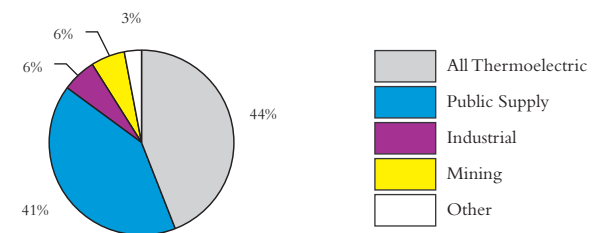


Figure 12.  
MONITORING LOCATIONS AND TRIBUTARIES  
SURVEYED BY STROUD WATER  
RESEARCH CENTER 1996-2000  
Source: *Stroud Water Research Center*

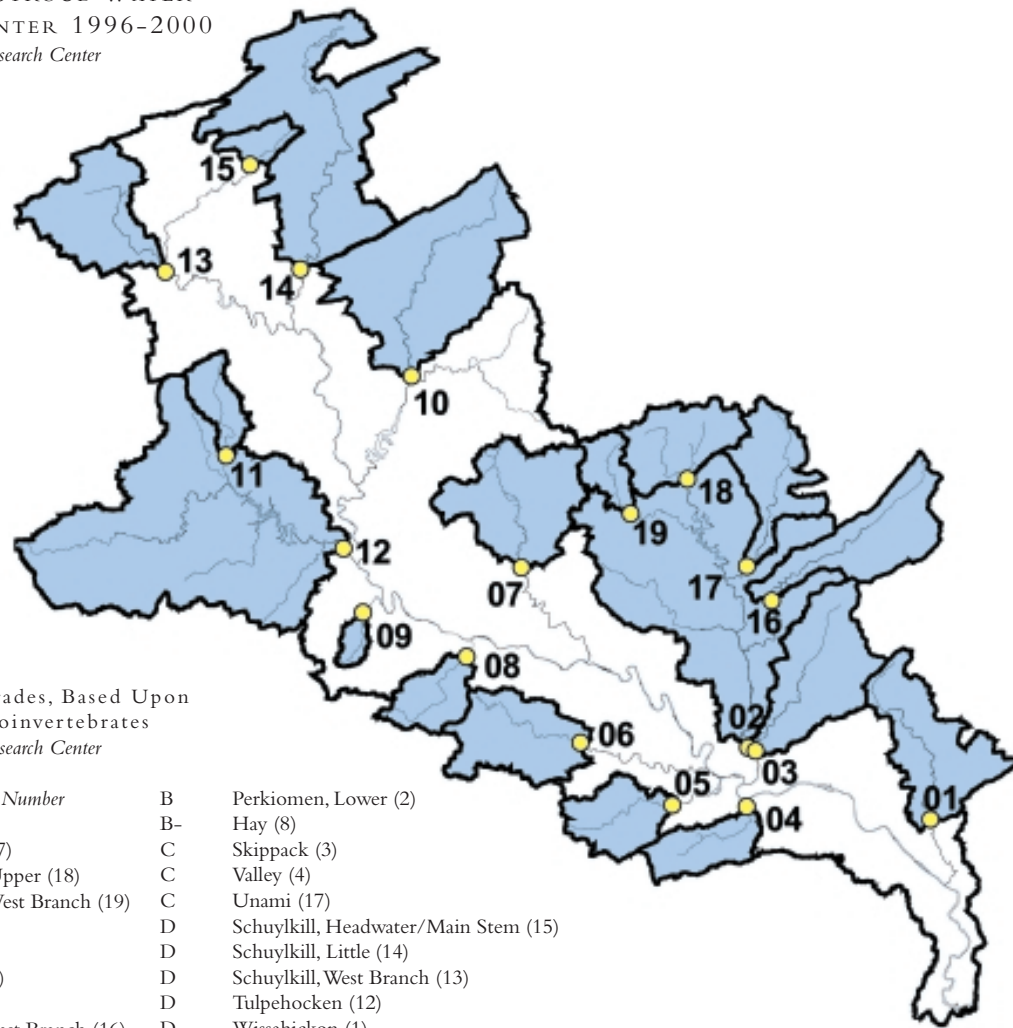


Figure 13.  
Water Quality Grades, Based Upon  
a Survey of Macroinvertebrates  
Source: *Stroud Water Research Center*

Grade	Tributary/Site Number	B	Perkiomen, Lower (2)
A	Maiden (10)	B-	Hay (8)
A	Manatawny (7)	C	Skippack (3)
A	Perkiomen, Upper (18)	C	Valley (4)
A	Perkiomen, West Branch (19)	C	Unami (17)
A	Pickering (5)	D	Schuylkill, Headwater/Main Stem (15)
A-	French (6)	D	Schuylkill, Little (14)
A-	Northkill (11)	D	Schuylkill, West Branch (13)
B	Angelica (9)	D	Tulpehocken (12)
B	Perkiomen, East Branch (16)	D	Wissahickon (1)

## BIOLOGICAL HEALTH OF THE SCHUYLKILL WATERSHED

A five-year study by the Stroud Water Research Center found that water and aquatic habitat quality varies dramatically in the main streams that supply the Schuylkill River. The study sampled stream bottom-dwelling macroinvertebrates (e.g. mayflies and other insects, worms and crayfish) at 19 locations between 1996 and 2000. Overall, the study revealed a degradation of biological conditions at eight of the 19 study sites.

The 19 sites included most major tributaries within the watershed, enabling the Stroud Center to draw general conclusions about water quality. The stream sites that scored highest for water quality (given “A” water quality grades) were the West Branch of the Perkiomen and the Manatawny, both predominantly forested and rural. Among the lowest scoring (given “D” water quality grades) were the Wissahickon, which runs through Philadelphia and its suburbs, and the Tulpehocken above Reading. Also receiving low scores were sites on the headwaters of the main stem of the Schuylkill, Little Schuylkill, and West Branch of the Schuylkill, which are all near mining areas. Higher and lower scores potentially occur at sites not included in the study.

The study demonstrates that land use does affect water chemistry, which in turn affects the numbers and varieties of macroinvertebrates. However, because each site reflects land and water use over a large area, the precise source(s) of water or habitat degradation cannot be identified. The Stroud Center is continuing this study through 2003 to gain a better understanding of water quality in the watershed.



## 2. SCHUYLKILL RESOURCES THAT NEED PROTECTION OR ENHANCEMENT



Photo: The Conservation Fund

The interpretive esplanade along the Schuylkill River at the Fairmount Water Works.

### OVERVIEW

Our vision of the Schuylkill is changing. Once a nearly forgotten post-industrial polluted river, we now recognize its potential as a significant resource of regional and national importance. Through public and nonprofit efforts, many of them collaborative, numerous initiatives are underway to protect, restore or enhance the Schuylkill River and its tributaries. They include:

1. Projects that restore parts of the Schuylkill as a free-flowing river system, enabling the movement of native fish species such as the American shad.
2. Projects that protect and restore streamside vegetation and wetlands, which are essential to healthy streams and wildlife habitat.

3. Projects that help establish a network of greenways and other permanently protected conservation lands in the watershed.
4. Projects that propose strategies for an integrated approach to managing surface and groundwaters. These are especially important to communities under suburban development pressures.
5. Projects that preserve and restore the watershed's heritage, such as historic buildings and sections of the old Schuylkill Canal.
6. Projects that reinvest in historic riverfront communities and the City of Philadelphia, in ways that will enhance quality of life.
7. Projects that build an interconnected network of land and water trails following the Schuylkill and extending into its tributaries.

Most of these initiatives are ambitious in that they require considerable funding, expertise and time. Some began to take shape decades ago, while others are very recent or still in the early planning stage.

Perhaps most promising is a shift in thinking from fragmented remedial actions to correct old problems to actions reflecting a much more positive and comprehensive vision that the Schuylkill has much to offer to present and future generations.



Photo: Eastern PA Coalition for Abandoned Mine Reclamation

Trout are found in Schuylkill waters, particularly in the larger undisturbed cool water tributaries. This trout was caught in the upper part of the Schuylkill where acid mine drainage clean-up projects are improving habitats for trout populations.

Figure 15.  
FISH PASSAGE AT MAJOR DAMS  
Source: DEP, Bureau of Waterways Engineering, 2002



Figure 14.  
FISH CONSUMPTION ADVISORIES  
Source: Pennsylvania Fish and Boat Commission, 2001

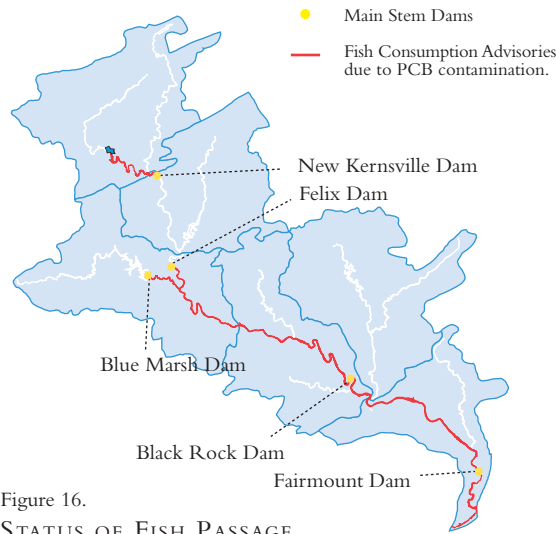


Figure 16.  
STATUS OF FISH PASSAGE  
IMPROVEMENTS AT MAJOR DAMS  
Source: DEP, Bureau of Waterways Engineering, 2002

1. Auburn Dam	No Fish Passage
2. New Kernsville Dam	No Fish Passage
3. Felix Dam	Passable Breech – Dam Removal 2002
4. Vincent Dam	Passable Breech – Planned Dam Removal*
5. Black Rock Dam	Planned Passage by PECO*
6. Norristown Dam	Planned Passage by PECO*
7. Plymouth Dam	Planned Dam Removal*
8. Flat Rock Dam	Planned Fish Passage 2004
9. Fairmount Dam	Existing Passage – Planned Improvements*

\* No information on specific time schedule

## FISHERIES

The Schuylkill and its tributaries provide habitats for a diversity of warm and coldwater fish. Two questions highlight important aspects of the watershed's fisheries. First, to what extent does the Schuylkill function as a free-flowing natural river that enables the movement of American shad and other fish to the habitats they need for their reproduction and survival? Second, how have water quality conditions impacted the health of fish?

The American shad played an important part in United States history. For example, General Washington's troops probably subsisted on salted shad during their winter in Valley Forge. But shad populations declined with dam construction in the early 19th century. Shad spend most of their lives in the ocean and migrate into fresh water to spawn. Because of its dams, the river no longer serves this critical function in the shad's life cycle.

To restore shad to the Schuylkill, the Commonwealth expects to provide for their passage to the Reading area by Spring 2004 by constructing fish ladders and removing several dams on the river. The State released about 500,000 young shad in 1999 and again in 2000 to help restore the population. The Wilderness Club of Philadelphia has been actively supporting that program.

We can only indirectly address the question of fish health through fish consumption advisories. The presence of PCBs and chlordane, i.e., manufacturing chemicals linked to cancer, has resulted in DEP's issuance of public advisories to limit consumption of fish for much of the River's main stem.

## STREAMSIDE AREAS AND WETLANDS

Streamside areas and wetlands are critical elements of the watershed ecosystem. Their disturbance increases the risks of flooding, sedimentation, habitat degradation and invasive non-native plant species.

The watershed contains numerous mostly small wetlands areas, but in total they probably encompass nearly 85,000 acres. Serving as water sponges, they also provide special habitats for wildlife, some of which are globally endangered species. Once losing wetlands every year, the watershed is now benefiting from programs that began with policies for “no net loss” and are now shifting towards achieving a “net gain” of wetlands. PA DEP, with the U.S. Fish and Wildlife Service and the Natural Resource Conservation Service, provides technical and financial assistance for wetland restoration projects.

Pennsylvania *Stream Releaf* is a statewide program led by PA DEP to conserve and restore streamside communities. It encourages voluntary local initiatives, many of which are undertaken by nonprofit organizations. For example The Delaware Riverkeeper Network and its partners have completed dozens of streamside buffer enhancement and restoration projects in the watershed.

Another way to protect streams is through targeted riparian land acquisition. For example, the Wissahickon Valley Watershed Association and French & Pickering Creeks Conservation Trust have focused their efforts on streamside protection through land purchases and conservation easements.



Photo: John Bartram Association

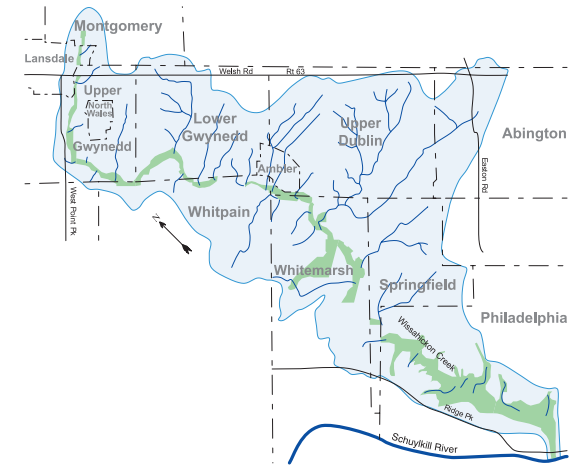
The Historic Bartrams Garden’s recent restoration of a degraded freshwater tidal wetland on its property on the lower Schuylkill River.



Photo: The Nature Conservancy, PA Field Office

The bog turtle, a globally endangered species found in the watershed’s wetland areas, which The Nature Conservancy is helping to protect with the Berks County Conservancy.

Figure 17.  
WISSAHICKON CREEK’S “GREEN RIBBON”  
Source: *Wissahickon Valley Watershed Association, 2001*



Through the remarkable sustained efforts of WVWA and others, a riparian buffer now protects nearly the entire 23-mile length of Wissahickon Creek.

Figure 18.  
LAND TRUSTS ACTIVE IN THE  
SCHUYLKILL WATERSHED

- Bedminster Land Conservancy
- Berks County Conservancy
- Brandywine Conservancy
- Central Bucks Land Preservation Trust
- Conservancy of Montgomery County
- Earth Conservancy
- Farmland and Forest Conservancy
- French & Pickering Creeks Conservation Trust
- Green Valleys Association
- Lower Merion Conservancy
- Montgomery County Lands Trust
- Natural Lands Trust
- Perkiomen Watershed Conservancy
- Schuylkill County Conservancy
- Schuylkill River Greenway Association
- The Conservation Fund, Pennsylvania
- The Nature Conservancy, Pennsylvania
- West Vincent Land Trust
- Wildlands Conservancy
- Wissahickon Valley Watershed Association

Source: *The Conservation Fund, 2002, from the Pennsylvania Land Trust Association*



Photo: Montgomery County Land Trust

Swamp Creek, Montgomery County – an example of one of many tributaries that should be part of a network of streamside conservation lands in the Schuylkill watershed.

Figure 19.  
STATUS OF LAND PROTECTION IN SELECTED COUNTIES  
Source: *GreenSpace Alliance Summer 2000 Newsletter*

County	Total Acres	Acres Protected	%
Berks	539,666	97,140	18.0
Chester	486,207	63,260	13.0
Montgomery	311,860	28,619	9.2
Philadelphia	91,282	11,204	12.3

Philadelphia metropolitan counties vary in percentage of lands permanently protected for conservation purposes. Total acres portray the size of each county. Acres protected are for the entire county (and therefore include lands outside of the watershed). Protected lands include those owned by federal, state and local government, and nonprofit organizations.

## WATERSHED GREENWAYS AND CONSERVATION LANDS

In 1815, the City of Philadelphia created the Fairmount Water Works to provide water supplies for the City. To protect its water quality, the City purchased a large estate upstream of the Water Works that was the beginning of Fairmount Park. Now nearly 190 years later, a similar concept has been proposed for the entire Schuylkill watershed. The Schuylkill Watershed Conservation Plan calls for a minimum of 200,000 acres to be permanently conserved during the next 20 years.

The resulting network of conservation lands would include streamside areas, steep slopes, habitats of rare and endangered species, major blocks of forests, farmland, exceptional value tributaries, and designated scenic river corridors. Protecting those lands would form a system of greenway nodes and corridors throughout the watershed.

In 2000, the Commonwealth adopted *Pennsylvania's Greenways: An Action Plan for Creating Connections*, calling for a distinguishable greenway network throughout Pennsylvania by the year 2020. Nonprofits working with government will play an important role in that effort. For example, Natural Lands Trust and its partners are developing a *Smart Conservation* program that will help policymakers and practitioners establish conservation priorities. Similarly, the Montgomery County Lands Trust works with local land trusts and elected officials to identify common goals. These collaborative efforts are models for the future.



**WATER RESOURCE PROTECTION  
IN DEVELOPING COMMUNITIES**

The need for integrated planning and management of both ground and surface water resources, particularly in developing communities, is becoming increasingly recognized in the watershed. The Delaware River Basin Commission is preparing an integrated comprehensive water resources plan for the entire Basin, and similar community-based initiatives are also underway.

For example, the Green Valleys Association’s (GVA) *Sustainable Watershed Management Program (SWM)* seeks to establish water-based carrying capacities for developing communities. SWM emphasizes the importance of recharging storm water to the groundwater table, and recycling wastewater by land application rather than stream discharge. Using its SWM methodology, GVA is assisting watershed communities in rapidly developing northern Chester County. More communities need to become involved in integrated water resource management planning.

Approximately 33 watershed municipalities have Environmental Advisory Councils (EACs). Initially authorized by the Pennsylvania legislature in 1973, such councils may be created by municipalities to advise elected officials on natural resource protection. The Pennsylvania Environmental Council maintains a membership support network and provides technical assistance to EACs across the Commonwealth. EACs can play a particularly important role in helping communities consider the environmental consequences of their land-use decisions.

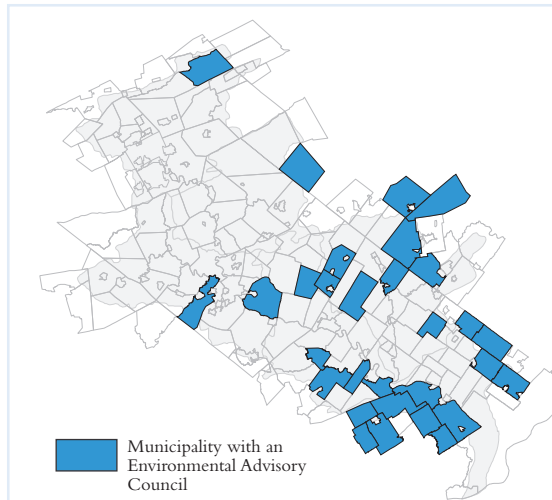


Figure 20.  
MUNICIPALITIES WITH ENVIRONMENTAL  
ADVISORY COUNCILS  
Source: Pennsylvania Environmental Council

Figure 21.  
SUSTAINABLE WATERSHED INITIATIVE IN  
NORTHERN CHESTER COUNTY  
Source: Green Valleys Association

Schuylkill tributaries in northern Chester County and other parts of the watershed are under major threats from suburban sprawl in developing communities. Green Valleys Association is working with municipalities in northern Chester County to help them protect their streams and groundwater resources.

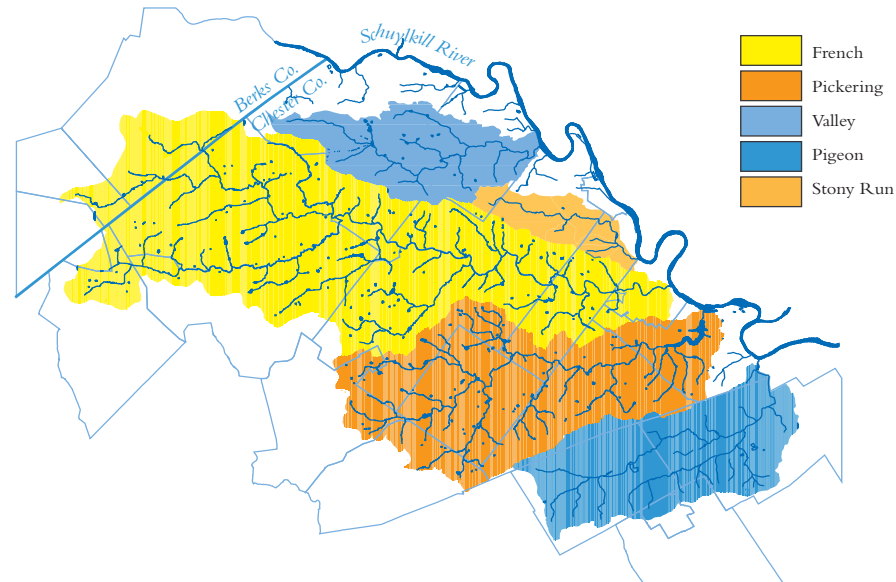


Figure 22.  
POPULATION TRENDS IN OLDER  
RIVERFRONT COMMUNITIES

Source: 2000 U.S. Census

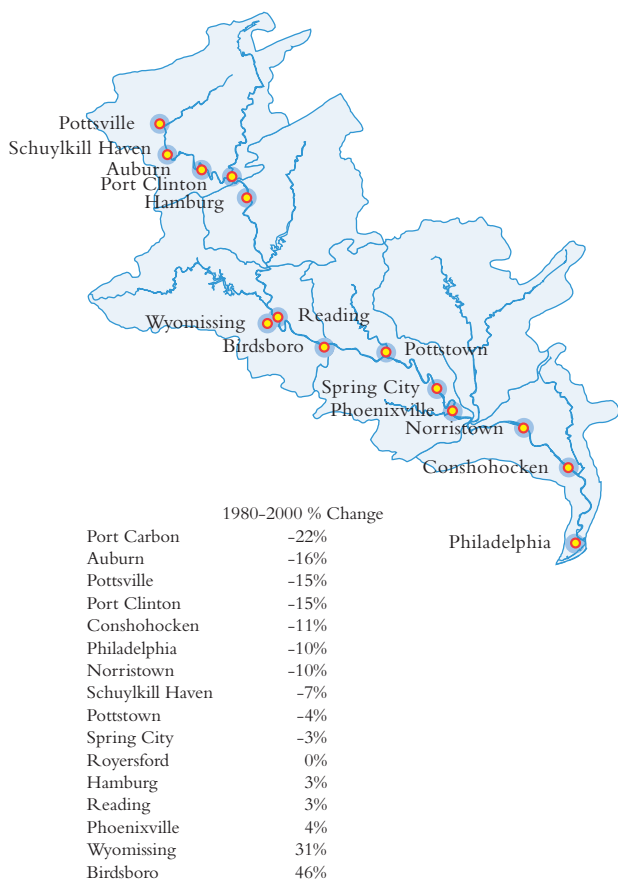
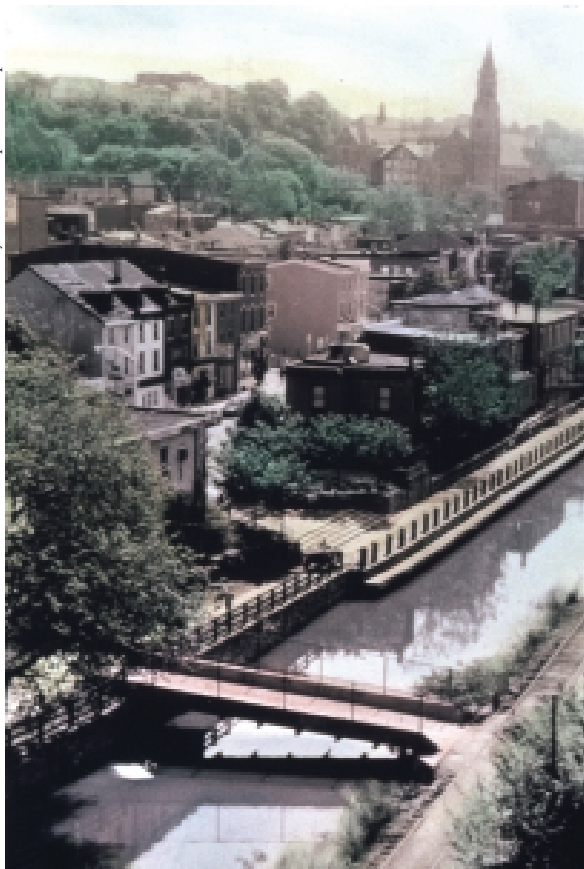


Photo: Manayunk Development Corporation



The Schuylkill Canal and a portion of the Schuylkill River Trail run alongside Manayunk. The Manayunk Development Corporation is working closely with numerous stakeholders to restore the Schuylkill Canal and improve its water quality. This is just one example of how an historic feature can become a community asset.

**THE SCHUYLKILL AND HISTORIC RIVERFRONT COMMUNITIES**  
Communities along the Schuylkill tell the story of early rural settlement and America's industrial revolution. Their subsequent economic struggle closely follows the decline of the region's mining industry, the railroad's replacement of the Schuylkill canal, the depression, and out-migration to the suburbs. Populations trends (1980-2000) reveal that some of these communities have nearly stabilized, while others continue to suffer significant losses.

Today, a number of historic communities are looking to more promising futures. Their small-town appeal and affordable housing make them an attractive alternative to the suburbs. In no small way, the Schuylkill River is an important attribute to their quality of life.

Elected officials and local nonprofit organizations are leading a growing number of community revitalization projects focused on the river. Preservation Pottstown is developing the John Potts County Park along the river. The Phoenixville Area Economic Development Corporation is renovating an historic foundry building. The Manayunk Development Corporation and Schuylkill Canal Association are restoring parts of the Schuylkill Canal. Nonprofit organizations have been especially important in identifying opportunities and developing projects that capitalize upon the Schuylkill as a community asset.

THE SCHUYLKILL  
AND THE CITY OF PHILADELPHIA

The Schuylkill River has played a significant part in Philadelphia's development for more than 300 years, since William Penn's decision in 1681 to build a new city at its confluence with the Delaware. The Schuylkill serves as the central spine for Fairmount Park, which began to take shape in the 1850s. Comprising 8,900 acres of public parkland, including 4,400 acres of greenway bordering the Schuylkill and Wissahickon Creek, it is one of the largest landscaped city parks in the world.

With the City suffering from decades of decline, initiatives have been underway to extend Fairmount Park south through the City, thereby creating a new Schuylkill River Park and a vision for reinvestment in the predominantly industrial corridor of the lower Schuylkill River. Planning and development of a pathway from Kelly Drive to Spruce Street, which began in the late 1960s, is now nearing completion as a \$21 million project. However, public access to the lower Schuylkill River remains a challenge.

Founded in 1992, the nonprofit Schuylkill River Development Corporation (SRDC) has been an important catalyst and fundraiser for the Schuylkill River Park. In 2000, with a Pennsylvania DCNR Growing Greener grant and guidance from a task force representing a cross section of City interests, SRDC began an ambitious *Master Plan* for the lower Schuylkill below Fairmount Dam. The plan envisions improved public access and tourism on the river, reclamation of industrial sites, and land acquisition to create a greenway connected to adjacent residential neighborhoods.



Photo: Gerald S. Williams

A view highlighting the Schuylkill River's significance as a major asset to the City of Philadelphia.



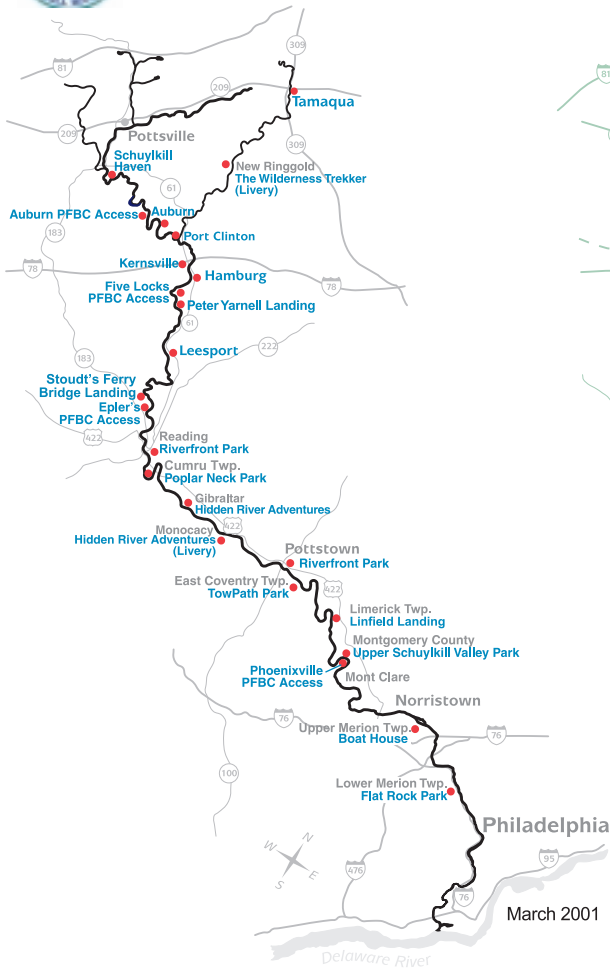
SRDC's Master Plan envisions improved recreation, tourism, greenspace and industrial reclamation centered on the Schuylkill River.

Figure 23.  
TASK FORCE MEMBERS  
MASTER PLAN FOR THE LOWER SCHUYLKILL

- Philadelphia City Council
  - City Planning Commission
  - Center City District
  - Fairmount Park Commission
  - Philadelphia Water Department
  - Philadelphia Department of Commerce
  - Philadelphia Industrial Development Corporation
  - Delaware River Port Authority
  - Delaware Valley Regional Planning Commission
  - Delaware River Basin Commission
  - Pennsylvania Department of Conservation and Natural Resources
  - National Park Service
  - U.S. Department of Housing & Urban Development
  - U.S. Environmental Protection Agency, Region III
  - U.S. Army Corps of Engineers
  - Exelon
  - Sunoco
  - Dupont Marshall Laboratory
  - Montgomery, McCracken, Walker & Rhoads, LLP
  - The Pennsylvania Horticultural Society
  - University of the Sciences in Philadelphia
  - Pennsylvania Environmental Council
  - William Penn Foundation
  - University of Pennsylvania
  - Historic Bartram's Garden
  - Schuylkill River Development Corporation
- Source: Schuylkill River Development Council



Figure 24.  
SCHUYLKILL  
RIVER WATER TRAIL



● Authorized Landing

Source: Schuylkill River Greenway Association



Figure 25.  
SCHUYLKILL  
RIVER LAND TRAIL



■ Funded-In Design  
■ Under Study  
■ Completed

Source: Schuylkill River  
Greenway Association

## SCHUYLKILL GREENWAYS AND TRAILS

For many years, watershed communities, counties and nonprofit organizations have been planning and developing greenways and trails along various segments of the Schuylkill River and its tributaries. It now appears possible to create an interconnected regional network of land and water trails throughout the watershed. Founded in 1974 with a mission “to bring people back to the River,” the Schuylkill River Greenway Association (SRGA) has been a leading advocate and facilitator of efforts to create a regional land trail system. More recently, SRGA has created canoe landings to establish a regional water trail for small boat access to the Schuylkill.

In April 2001, Montgomery County adopted a plan to establish a Schuylkill Greenway corridor that will connect 16 boroughs and townships. The plan envisions three zones along the corridor and establishes a framework for inter-municipal cooperation. Individual communities, often led by nonprofit organizations, are implementing parts of a regional greenway and trail network. One example is the work of the Phoenixville Iron Canal & Trail Association and its partners in creating a greenway trail system in the Phoenixville area. Similarly, the Schuylkill Canal Association has been a leader in restoring remnants of the Schuylkill Canal and towpaths in Upper Providence Township, Montgomery County. With the challenges of planning, funding, land acquisition and trail construction, these kinds of efforts take time. But the results will benefit present and future generations.



### 3. MANAGING WATERSHED STRESSES



Photo: Gerald S. Williams

#### OVERVIEW

Stresses on the Schuylkill watershed come from many kinds of land and water uses, and even natural events such as droughts and floods. How we manage those stresses will determine the extent to which the watershed will serve the needs of present and future generations.

One way to look at watershed stresses is through water use and quality standards. Under the federal Clean Water Act and Pennsylvania statutes, all Pennsylvania waters have been classified for certain uses. Based upon water quality monitoring data, the PA DEP makes periodic watershed assessments that determine if water quality is sufficient to allow such uses. When found insufficient, those assessments attempt to identify the sources of impairment.

PA DEP has classified approximately 24 percent of the Schuylkill watershed as high quality or exceptional waters, and 48 and 24 percent that should be protected

for cold and warm-water fisheries, respectively. Those protected use designations provide the basis for water quality standards in the watershed.

As of 1999, based upon an assessment of 53 percent of the watershed, DEP found that approximately 25 percent of assessed waters were impaired, i.e., they failed to meet their designated water quality standards. Why is that so? A variety of stresses are impacting the entire watershed and, for certain river sections and tributaries, their severity is causing problems. The following indicators provide a broad picture of the major types of stresses in the watershed, as well as some of the actions being taken to manage them.

- About 37 percent of the watershed is in agricultural uses. In the absence of good management practices, agriculture can be a serious threat to water quality. Based upon limited assessments in predominant agricultural areas, approximately 10 percent of the watershed's impaired waters are currently attributed to agricultural operations.
- Impervious surfaces and urban storm water present significant threats, particularly in sub-watersheds experiencing suburban development. As of 2000, only 19 percent of the watershed's municipalities had storm water management plans that were completed or underway.
- About 82 sewage treatment plants are discharging effluent into the river and its tributaries. All but one provides secondary or higher levels of treatment.

Poorly sited and malfunctioning septic systems are also a threat to water quality, but insufficient data are available to assess their impact. Although nearly all watershed municipalities have Act 537 Sewage Facilities Plans, over half are more than ten years old. Untreated sewage is also illegally entering the river and its tributaries, although many municipalities are actively working to correct this problem.

- The watershed has more than 3,000 potential point sources of chemical pollutants that could be released into the watershed's surface or groundwaters. Approximately 400 of those sources are hazardous waste sites, of which 22 are designated by the U.S. Environmental Protection Agency as "Superfund" clean-up sites.
- Approximately 103 miles of assessed streams in the upper watershed are impaired by acidic abandoned mine drainage. Both public and nonprofit efforts are beginning to make progress in dealing with this problem through reclamation and new treatment technologies.

Ongoing monitoring is essential to understanding how well we are doing in managing watershed stresses. Public agencies and nonprofit organizations maintain a number of monitoring programs, but monitoring data are not always readily available in a form meaningful to the general public. Research activities are also important to understanding watershed stresses and identifying those techniques that are most effective in dealing with them.

Figure 26.  
ASSESSED AND IMPAIRED STREAMS  
IN THE WATERSHED

Source: Pennsylvania Department of Environmental Protection (305b Report), 2001

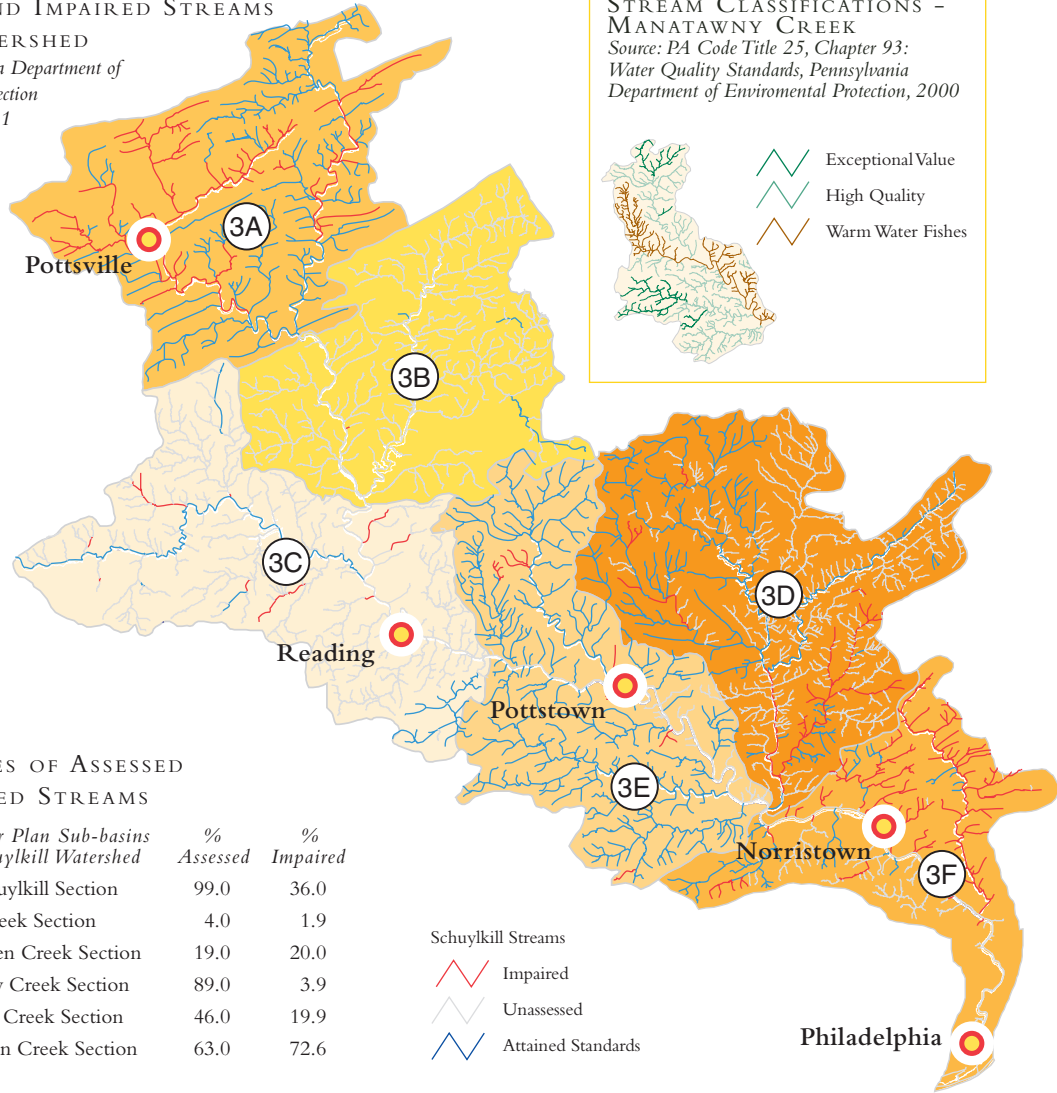
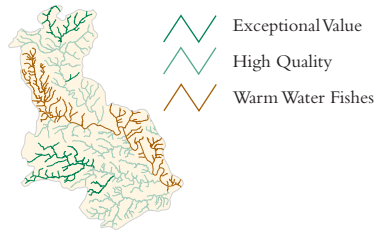


Figure 28.  
PERCENTAGES OF ASSESSED  
AND IMPAIRED STREAMS

State Water Plan Sub-basins in the Schuylkill Watershed	% Assessed	% Impaired
3A Upper Schuylkill Section	99.0	36.0
3B Maiden Creek Section	4.0	1.9
3C Tulpehocken Creek Section	19.0	20.0
3D Manatawny Creek Section	89.0	3.9
3E Perkiomen Creek Section	46.0	19.9
3F Wissahickon Creek Section	63.0	72.6

Figure 27.  
STREAM CLASSIFICATIONS -  
MANATAWNY CREEK  
Source: PA Code Title 25, Chapter 93:  
Water Quality Standards, Pennsylvania  
Department of Environmental Protection, 2000



ASSESSMENT OF  
WATER QUALITY CONDITIONS

The PA Department of Environmental Protection (DEP) has established protected use standards for all of Pennsylvania's streams and rivers. They include: *warm water fishes (WWF)*, *trout stocking (TSF)*, *cold water fishes (CWF)* and *migratory fishes (MF)*. Additionally, streams with excellent water quality may be designated as *high quality waters (HQ)* or *exceptional value waters (EV)*. The water quality of HQ streams can be lowered under certain circumstances, whereas it cannot be degraded for EV waters. The map of Manatawny watershed illustrates how such standards are applied (Fig. 27).

Approximately 24 percent of the watershed is designated as high quality or exceptional waters, whereas 48 percent is designated for cold water fisheries and 28 percent for warm water fisheries. Under the federal Clean Water Act, administered by the U.S. EPA, Pennsylvania and other states are required to assess the water quality conditions of their surface waters and submit reports biannually. PA DEP's 1999 assessment program examined 53 percent of the Schuylkill watershed (compared to 42 percent statewide). DEP will be completing its assessment of all remaining unassessed waters. Approximately 74 percent of those assessed waters were found to be *unimpaired*, i.e., they met water quality standards established to support viable communities of aquatic life (compared to 76 percent statewide). Put another way, approximately 25 percent of the watershed's assessed streams were found to be impaired based on their designated use.

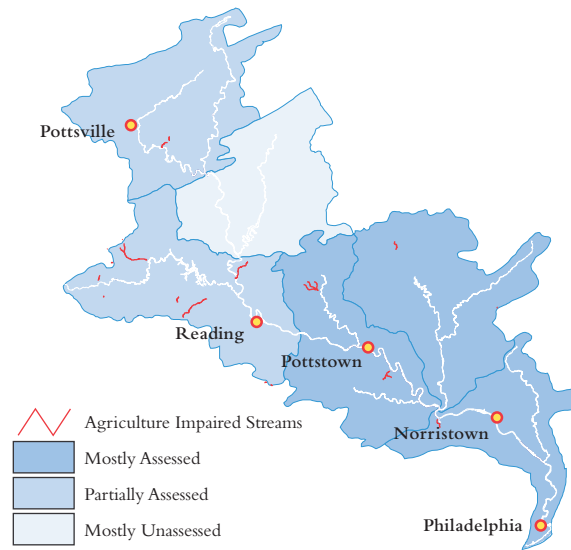
## AGRICULTURE

Under good management practices, agriculture can help sustain natural hydrologic conditions by enabling groundwater recharge and slowing water runoff into surface waters. But under poor practices, agriculture can stress the watershed through soil erosion and sedimentation, and by adding nutrients, chemicals and coliform bacteria to the watershed ecosystem.

Technical and financial assistance programs that contribute to good agricultural practices are available to farmers from the U.S. Department of Agriculture's Natural Resources Conservation Service and U.S. Farm Service Agency, the Pennsylvania Department of Agriculture and County Conservation Districts. A good example of an effective technical assistance program is the work of the Berks County Conservancy and the County Conservation District in helping farmers with their management plans on Tulpehocken Creek, where such efforts are particularly needed to protect Blue Marsh Reservoir.

Berks County also illustrates the challenges facing agriculture in areas experiencing suburban development. In 1999, the County had 2,065 farms totaling 238,500 acres. Conversion of farms to non-agricultural uses is now occurring at the rate of about 2,000 acres annually. Although Berks and a number of other counties have agricultural preservation programs, the continued loss of farmland to development is likely to diminish groundwater recharge in the watershed.

Figure 29.  
STREAMS IMPAIRED BY AGRICULTURE  
Source: Pennsylvania Department of Environmental Protection (305b) Report, 2000



Based upon an assessment of 53 percent of the watershed, approximately 34 stream miles are estimated as impaired because of agricultural activities.



Photo: The Conservation Fund

Contour farming helps to reduce erosion.

Figure 30.  
AGRICULTURAL BEST MANAGEMENT PRACTICES IN THE TULPEHOCKEN WATERSHED

### Waste Management

- Waste storage structures
- Waste storage ponds
- Barnyard runoff management
- Agri-waste stacking and handling pads
- Vegetation of critical areas

### Riparian Areas

- Wetland restoration
- Stream bank protection
- Stabilized livestock stream walkways

### Cropland Treatment

- Strip cropping
- Grassed waterways
- Nutrient management
- Field borders

Source: Berks County District Office, Natural Resource Conservation Service, USDA

Figure 31.  
STREAMS IMPAIRED BY DEVELOPMENT  
AND URBAN STORM WATER  
*Pennsylvania Department of Environmental  
Protection (305b Report), 2000*



Photo: Gerald S. Williams  
Residential subdivisions with wide streets are an example of added impervious surfaces that cause cumulative effects throughout the watershed.

Figure 32.  
STATUS OF STORM WATER  
MANAGEMENT PLANS IN THE WATERSHED  
*Source: Bureau of Watershed Conservation, Pennsylvania Department of  
Environmental Protection, 2000*

- Montgomery County*
  - Completed
    - Stony Creek – Sawmill Run
    - Rock Run – Gully Creek – Mill Creek
  - In Preparation
    - Sandy Run
    - Swamp Creek
- Berks County*
  - Completed
    - Sacony Creek
  - In Preparation
    - Tulpehocken Creek
- Bucks County*
  - In Preparation
    - East Branch of the Perkiomen

## IMPERVIOUS SURFACES AND URBAN STORM WATER

Impervious cover and storm water runoff from roof tops, roads and parking areas are two of the largest stresses on the watershed. They are difficult to manage because they can occur nearly anywhere as “non-point” sources. These stresses will steadily increase unless aggressive actions are taken to deal with them.

The basic problem is that inadequately planned land development significantly reduces groundwater recharge, increases rates and volumes of runoff to surface waters, and adds urban pollutants into the aquatic ecosystem. Affected streams are subject to more frequent and higher intensities of storm flooding and corresponding reduced flows during periods of lower precipitation. In turn, these altered conditions lead to fundamental changes in aquatic habitats.

Approximately one-third of the impaired streams in the watershed are impacted by urban runoff. Most of these are associated with highly developed areas in the watershed, such as Wissahickon Creek.

Pennsylvania’s Storm Water Management Act (Act 167) provides funding for counties to prepare watershed plans to manage storm water runoff. These plans are implemented by municipalities through local ordinances. As of 2000, approximately 45 of the watershed’s 238 municipalities (19 percent) have such plans completed or underway.



## SEWAGE WASTES

Sewage wastes are contributing to 16 percent of the impaired streams in the watershed. Approximately 82 sewage treatment plants are discharging effluent into the Schuylkill River and its tributaries. One plant provides minimal primary treatment, whereas 63 and 35 percent are providing more advanced secondary and tertiary treatment. In some areas, septic systems are leaching inadequately treated wastes into ground and surface waters. This is particularly true in older systems, as well as others that are not maintained properly. Additionally, sewage flows into streams untreated. Those illegal systems are difficult to detect and bring into compliance with state regulations.

Insufficient treatment and management of sewage wastes can contribute significant levels of nitrogen, phosphorus, fecal coliform bacteria and a variety of chemical substances into the watershed ecosystem. Nutrient enrichment can alter aquatic habitats by promoting algae and other plants that thrive under such conditions. This is a particular problem for impoundments such as Blue Marsh and Ontelaunee Reservoir that function as “closed systems” and trap such nutrients.

The Pennsylvania Sewage Facilities Act (Act 537) requires municipalities to develop plans that address their present and future needs. Although nearly all municipalities in the watershed have Act 537 Plans, approximately one-half of them are more than 10 years old. It is important that such plans be periodically reviewed and updated.

Figure 33.  
PUBLIC SEWAGE TREATMENT PLANTS  
Source: Pennsylvania Department of Environmental Protection, 1999

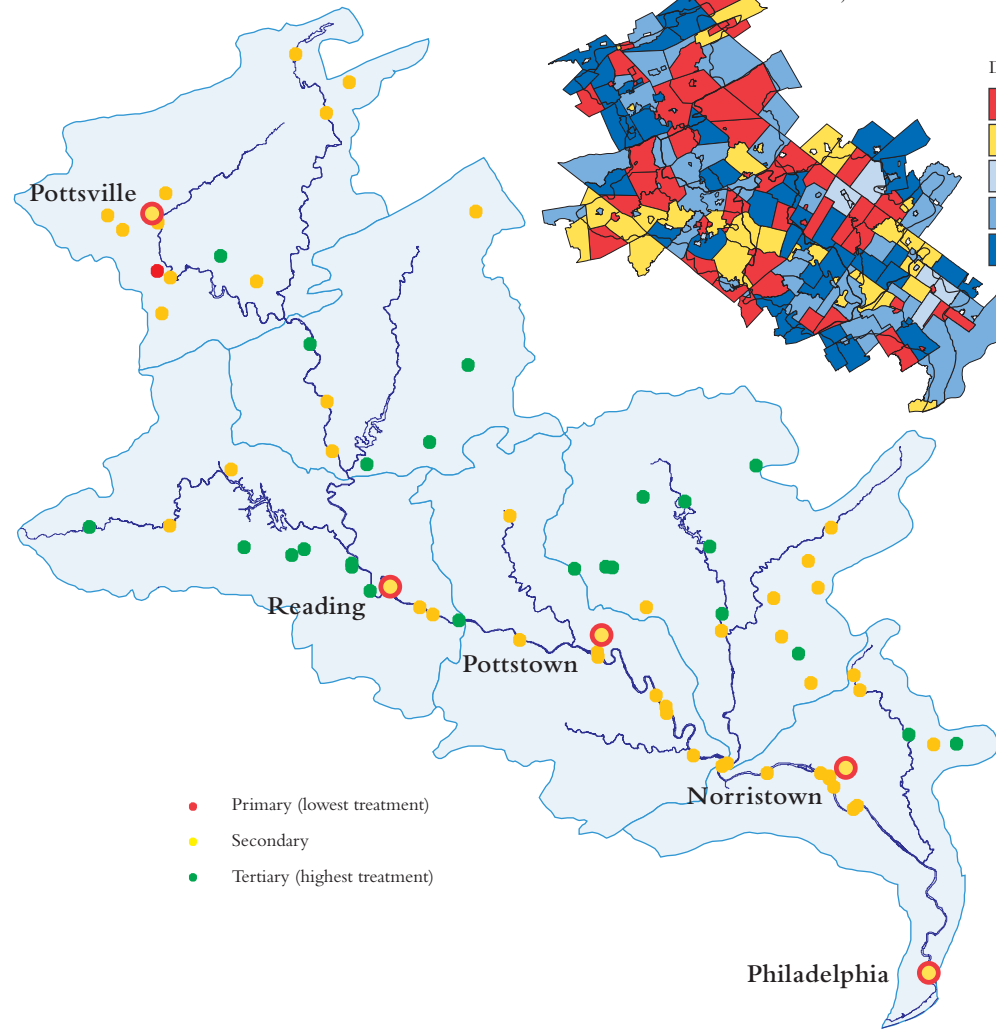


Figure 34.  
STATUS OF SEWAGE FACILITY  
(ACT 537) PLANS IN THE WATERSHED  
Source: Pennsylvania Department of Environmental Protection, 2001

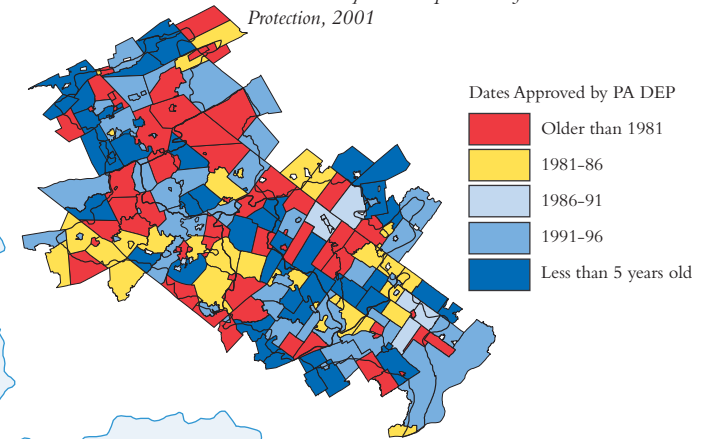


Figure 35.  
NUMBER OF POINT SOURCES,  
BY SUB-WATERSHED

Source: Office of Watersheds,  
Philadelphia Water Department, 2001

POINT SOURCES PER SUB-WATERSHED

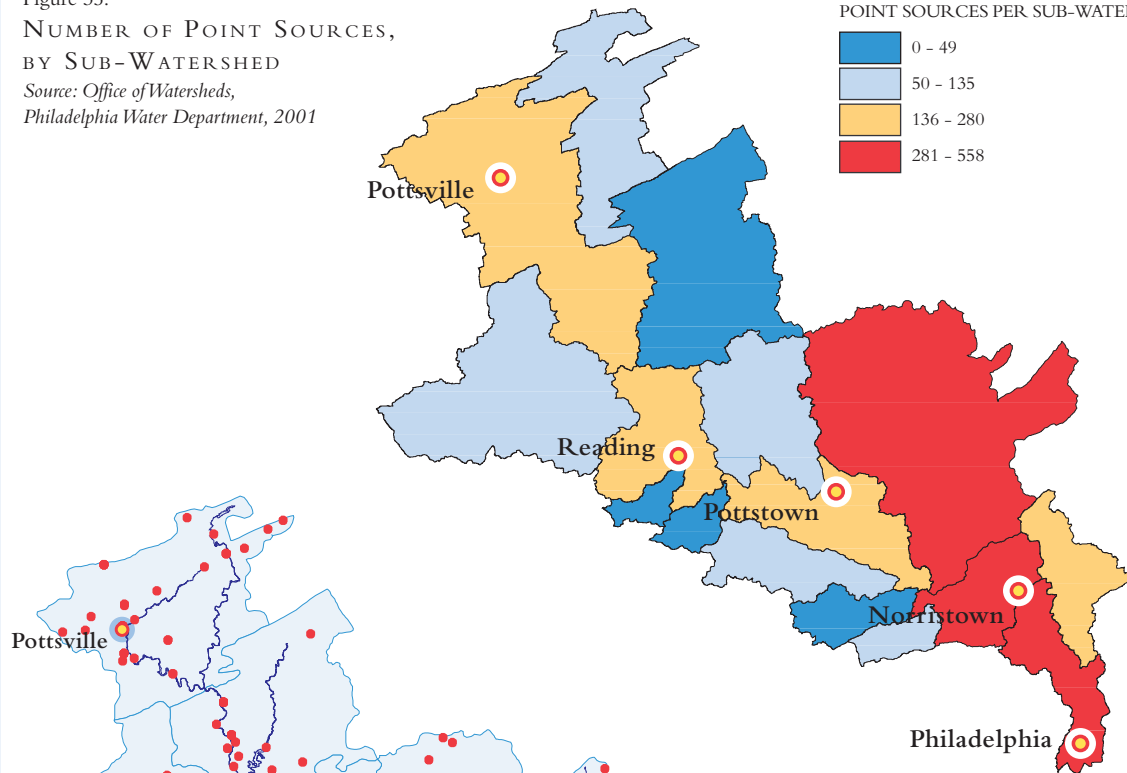
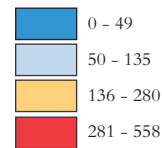
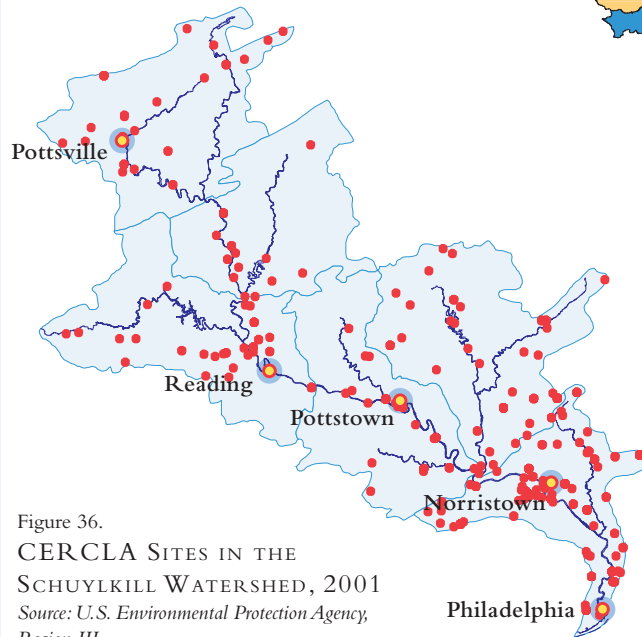


Figure 36.  
CERCLA SITES IN THE  
SCHUYLKILL WATERSHED, 2001

Source: U.S. Environmental Protection Agency,  
Region III



The distribution of hazardous waste sites such as landfills and 'brownfields' is shown on the map of CERCLA sites, comprising approximately 400 of 3,000 potential point sources in the watershed. Data on such sites came from the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) information system. Approximately 22 of the CERCLA sites in the watershed are on the National Priority Inventory list for clean-up as "Superfund" sites.

#### INDUSTRIAL POLLUTANTS

The Schuylkill watershed has more than 3,000 potential "point sources" of chemical pollutants that could be accidentally or intentionally released into the watershed's surface or groundwaters in amounts violating state or federal regulations. Fortunately, most of those sources are small and not expected to discharge into the Schuylkill River. Under the federal Clean Water Act, all facilities discharging to navigable waters must possess a National Pollutant Discharge Elimination System (NPDES) permit.

As part of its *Source Water Assessment Partnership* program, the Philadelphia Water Department (PWD) maintains a database of industrial and other point sources in the watershed. Those data were compiled from several federal and state data sources. Initiated in 2000, the Partnership's goals are to evaluate point sources that could have a potential impact on water suppliers, and to identify appropriate protective measures that should be undertaken beyond those already in place.

The accompanying map (Fig. 35) of sub-watersheds indicates highest concentrations of potential industrial point sources in the Perkiomen, Unami, Skippack and Wissahickon, as well as along the entire corridor of the Schuylkill River. However, comparisons and interpretations are difficult to make in that the total count data contain diverse types of point sources that include both active and abandoned hazardous waste sites, and sites that manufacture, store or use different kinds and quantities of toxic chemicals.

### ABANDONED MINE DRAINAGE

One of the biggest water pollution problems in the upper Schuylkill watershed is acid water and dissolved metals draining from abandoned coal mines. Approximately 103 miles of assessed streams in the upper watershed are impaired by abandoned mine drainage (AMD). But progress is being made. In recent years, more than 16,000 acres of abandoned mines have been reclaimed in Schuylkill County.

Pennsylvania's current *Reclaim PA* program is a combination of planning, funding and technical assistance to increase abandoned mine land reclamation and encourage re-mining of older mines through new "green" technology. The program emphasizes local initiatives and partnerships with nonprofit groups. In the Schuylkill watershed, the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (EPCAMR), working closely with County Conservation Districts, assists local watershed groups and municipalities in developing and obtaining reclamation project funding. One of those groups is the Schuylkill Headwaters Association (SHA), an all-volunteer organization which is enhancing the public's awareness of the Schuylkill.

In 2001, the Schuylkill Conservation District, in association with the EPCAMR, the Delaware Riverkeeper Network's Schuylkill Office and SHA, completed an assessment of the Upper Schuylkill tributaries. It identified 35 mine sites and recommended remediation of 11 priority sites in five sub-watersheds. Remediation strategies include source reduction, wetland construction, limestone channels, vertical drains and active treatment.

Figure 37.  
COAL MINE REMEDIATION  
SITES AND STREAMS IMPAIRED BY  
ABANDONED MINE DRAINAGE  
Source: Pennsylvania Department of Environmental Protection  
and Schuylkill Conservation District, 2000



Photo: Eastern PA Coalition for Abandoned Mine Reclamation

Figure 38.  
PRIORITY  
REMEDIATION SITES  
Source: Upper Schuylkill Tributaries  
Assessment Report, L. Robert Kimball  
& Associates, Inc. 2001

- Oak Hill Boreholes and Pine Knot/  
Oak Hill Mine
- Pine Forest Mine
- Mary D. Mine
- Bell Colliry
- Kaska Mine Outfall
- Silver Creek Mine
- Silt Dam
- Eagle Hill Mine
- Otto Mine
- Morea Mine
- Repplier Mine/Buck Mountain  
Drift



Lower Merion Conservancy's StreamWatch coordinator Ben Wright closely examines a kick net while conducting a rapid bioassessment of Mill Creek. The Conservancy will use this data to begin restoration activities in an eroded streamside park on the creek.

Photo: Lower Merion Conservancy

Patrick Center scientists sample fish communities using a backpack electroshocker. Such research will help to identify and prioritize where riparian reforestation will be most effective in restoring stream health, and to identify where additional measures such as storm water management should be considered.

Photo: Patrick Center for Environmental Research



#### MONITORING AND RESEARCH

Ongoing monitoring and research are essential to understanding conditions in the watershed. Pennsylvania DEP's Surface Water Quality Network, the U.S. Geological Survey's gauging stations, the U.S. EPA's "Storet" database and the volunteer water monitoring database of DEP and the Senior Environmental Corps are important sources of Schuylkill data that are accessible to the public.

The Delaware Riverkeeper Network and the Lower Merion Conservancy illustrate the kinds of monitoring activities undertaken by nonprofit organizations. The Riverkeeper trains and organizes volunteers to undertake targeted chemical sampling as part of its Incident Reporting Program. It also works with citizen groups in stream surveys to assess local stream conditions. In Montgomery County, the Lower Merion Conservancy's StreamWatch program involves a network of volunteers who collect weekly data on Mill Creek.

It is important that volunteers have proper training. One approach to addressing that need is the Stroud Water Research Center's "Stream School," which offers a multi-day program on biological monitoring techniques.

Our knowledge of the watershed has been enhanced by research projects of respected scientific institutions such as the Stroud Center (*see page 10*) and The Academy of Natural Science's Patrick Center for Environmental Research. Currently, the Patrick Center is working on a project funded by the U.S. EPA to assess the ecological benefits of reforesting riparian lands in urban watersheds.



## 4. PUBLIC AWARENESS AND EDUCATION

### OVERVIEW

The future of the Schuylkill watershed will depend largely upon the public's awareness and support for the actions necessary to insure its well-being. Yet in a recent survey, only 31 percent of those interviewed could name the Schuylkill as the watershed they live in. Another 82 percent said that they never or rarely used the Schuylkill River or its tributaries for recreation.

Fortunately, today both public agencies and nonprofit organizations are providing many educational possibilities. These include:

- River trips and other events for people of all ages, such as the annual River Sojourns;
- Watershed education programs for grades K-12, reinforced by the Commonwealth's new Academic Standards for Environment and Ecology;
- At least 19 environmental education centers located within or near the Schuylkill watershed;
- Watershed conferences and workshops, which include the annual Schuylkill Watershed Congress.

Every effort to protect or enhance the watershed also provides an educational opportunity for improving public awareness. Finally, formal legislative recognition of the Schuylkill as a Pennsylvania Scenic River, and its designation as a state Heritage Corridor and a federal Heritage Area provide extraordinary opportunities for public education.

Photo: Charles R. Tobias



Paddlers on the Mont Clare Canal.



Photo: Gerald S. Williams

## HOW PEOPLE REGARD THE SCHUYLKILL WATERSHED

*A 1997 statistical survey of watershed residents found the following:*

- |     |  |     |   |
|-----|--|-----|---|
| 31% | accurately named the Schuylkill as the watershed they lived in. Another 30 percent said they lived in the Delaware Watershed, and 33 percent couldn't say; | 74% | strongly support increased funding to improve water quality;                                |
| 56% | believe that their local stream or river is not safe to swim in;   | 69% | strongly support the purchase and protection of more land for parks;                        |
| 82% | never or rarely use the Schuylkill River and its tributaries for recreational purposes;  | 84% | are willing to pay more for a home that has nearby parks or natural areas; and              |
| 37% | are aware of groups or organizations currently working to protect open space and improve water quality in their community;                                 | 86% | believe that there should be more environmental education programs for children and adults. |

*\*The Survey was conducted of 800 individuals throughout the watershed by the Global Strategy Group, Inc. for The Conservation Fund.*

## ENHANCING PUBLIC AWARENESS

The original meaning of “Schuylkill” as the hidden river may describe the public’s limited awareness of the watershed today. Since 1991, Pennsylvania DCNR has provided funding for River Sojourns to raise awareness of rivers throughout the Commonwealth. Managed by the Schuylkill River Greenway Association (SRGA), the Schuylkill River Sojourn is a canoe trip that travels 108 miles over seven days. It is an annual event that occurs in June. In 2001, more than 180 people participated.

A number of other nonprofit organizations sponsor events to enhance public awareness. The Schuylkill Canal Association holds an “open house” for a locktender’s house. The Association also sponsors an annual Canal Day with canoe races, and it illuminates a section of an old canal path for walks during the Christmas holiday. The Perkiomen Watershed Conservancy holds an annual Earth Day event that attracts around 5000 people. The Conservancy believes that one of its major achievements has been to enhance the public’s awareness of Perkiomen Creek.

Watershed conferences provide an opportunity for the public to acquire a more in-depth understanding of the watershed. In recent years, the Delaware River Network’s Schuylkill Office and its partners have held a Schuylkill Watershed Congress every Spring. Additionally, the Pennsylvania DEP in partnership with the Pennsylvania Organization for Statewide Watersheds and Rivers (POWR) and others, organizes an annual two-day statewide watershed conference in the fall.



## EDUCATING THE NEXT GENERATION

Educating our children is critical to preparing the next generation to become good stewards of watersheds. Based upon recommendations of the Governor's Advisory Commission on Academic Standards, the Commonwealth issued new standards in 2001 for the Pennsylvania Public School Code. Those that are particularly relevant to the Schuylkill watershed include: environment and ecology, science and technology, civics and government, geography, history, and health, safety and physical education.

Academic planning largely remains in the hands of local school districts. One example of an innovative course is The Pottstown Pilot Program, designed by The Peopling of Philadelphia Collaborative, Inc. (POPCI) and the Pottstown School District. Patterned after POPCI's successful experience with a similar program in Philadelphia, it combines environmental and local special history, using the Schuylkill as a major focus. Curriculum development enables teachers to be creative in designing hands-on lessons in collaboration with local institutions such as museums and environmental centers. It is intended to serve as a model for developing similar courses in other school districts in the Schuylkill watershed.

Other nonprofits with environmental education programs include the Perkiomen Watershed Conservancy, the Stroud Water Research Center and the Schuylkill Center for Environmental Education. They play an important role in augmenting formal school programs and educating adult volunteers.



Photo: Perkiomen Watershed Conservancy



Photo: Schuylkill Center for Environmental Education

STUDYING THE ORGANISMS  
TRAPPING THEM IN NETS  
RUNNING RIFFLES  
ECOLOGICAL INQUIRY  
ASSESSING THE STREAM'S HEALTH  
MANY DISCOVERIES

Written by Dennis Arms 7B4, Project Shed  
7th Grade, Pottstown Middle School, June  
2000.



The Fairmount Water Works was built in 1815 to pump water from the Schuylkill River. It is part of the nation's first municipal water system. The Philadelphia Water Department has opened a new Interpretive Center at the Water Works, featuring state-of-the-art exhibits on the site's history, a water laboratory and reconstructed water wheels to educate the public about watershed ecology and urban water uses.

Photo: Philadelphia Water Department

Figure 39.  
ENVIRONMENTAL EDUCATION CENTERS  
WITHIN OR NEAR THE SCHUYLKILL  
WATERSHED\*

Source: Pennsylvania Department of Environmental Protection and Pennsylvania Department of Education, 2001



- Academy of Natural Sciences of Philadelphia
- Briar Bush Nature Center
- Cobbs Creek Environmental Education Center
- Evansburg State Park
- Fairmount Water Works Interpretive Center
- French Creek State Park
- Great Valley Nature Center
- Hawk Mountain Nature Center
- John Heinz National Wildlife Refuge
- J. Larry Bolling Environmental Education Center
- Middle Creek Wildlife Management Area
- Morris Arboretum
- Nolde Forest Environmental Education Center
- Riverbend Environmental Center
- Schuylkill Center for Environmental Education
- Schuylkill County Environmental Education Center
- Stroud Water Research Center
- Welkinweir
- Wissahickon Environmental Education Center

\*This list is not necessarily complete

#### ENVIRONMENTAL EDUCATION CENTERS

Environmental education centers within or near the Schuylkill watershed provide many kinds of educational opportunities for children, adults and families. Operated by research institutions, environmental organizations, and by state, local and federal agencies, they offer various exhibits, workshops, publications, live animal programs, speakers, volunteer projects, educational supplies, and in-school and on-site curricula.

One of the largest is the Philadelphia-based Schuylkill Center for Environmental Education. Founded in 1965, the Center's 500-acre preserve serves as an outdoor classroom for its educational and stewardship activities. Its educational programs range from one-half day lessons to year-long experiences. The Center serves over 60,000 individuals annually, ranging from pre-school children to college students. It also operates an Ecovan, a mobile laboratory and classroom that travels throughout the Delaware Valley's local waterways. Oriented towards 4th-8th graders, the Center provides lessons in water quality monitoring and learning about human impact on watersheds.

Pennsylvania DCNR maintains a large environmental education program at its state parks and forests across the Commonwealth. It offers programs oriented towards field learning experiences, environmental problem solving and watershed education. For example, the 665-acre Nolde Forest Environmental Education Center in Berks County, provides a variety of programs for students, teachers, adult groups and individuals.



## SPECIAL RECOGNITION OF THE SCHUYLKILL

In 1978, the main stem of the Schuylkill became the first scenic river designated under Pennsylvania's Scenic River Act (P.L. 1277), followed by the north branch of French Creek and Tulpehocken Creek. Administered by PA DCNR, the Act requires cooperation among state agencies owning land along scenic rivers. Nonprofits such as the Schuylkill River Greenway Association, French and Pickering Creeks Conservation Trust, Berks County Conservancy and Green Valleys Association have led efforts to obtain scenic river designations. They also help DCNR as local managing organizations for the scenic river program.

In 1995, the Schuylkill Heritage Corridor was established under Pennsylvania's Heritage Parks Program. Administered by DCNR and managed locally by SRGA, the program provides financial and technical support to promote heritage tourism and conserve natural and cultural resources. Public-nonprofit partnerships are an essential element. In 1995, the management plan for the Schuylkill Heritage Corridor identified an \$80 million capital program for developing trails, parks, visitor facilities and other projects. Nearly 60 heritage projects have now been undertaken, with \$1.5 million funded by DCNR and \$2.7 million from other sources.

In 2000, Congress designated the Schuylkill River Valley National Heritage Area. That designation authorizes up to \$10 million in federal funding over 15 years for projects to conserve the watershed's cultural and natural resources. The Schuylkill River Greenway Association also manages the National Heritage Area.



Figure 40.  
SCHUYLKILL RIVER HERITAGE  
CORRIDOR PROJECTS FROM  
1995 TO 2000\*

### SCHUYLKILL COUNTY

- Schuylkill Haven Island Recreational Park Trail
- Bartram Trail - Auburn Bridge
- Tamaqua Train Station Feasibility Study
- Anthracite Tour Brochure
- Hegarty Blacksmith Shop/Photo Archives Collection
- Molly Maguire Auto Tour
- West Branch River Access - City of Pottsville
- Train Station Visitor Center Design - Tamaqua
- Bartram Trail Trailhead Design

### BERKS COUNTY

- Exeter Trail
- Wyomissing Creek Crossing/Hamburg Bridge Rehabilitation
- Agricultural Tour Guides
- Thun Trail Access Signs, Safety Features, etc.
- Peter Yarnell Landing
- Maiden Creek Villages National Register Nominations
- Schuylkill River Bridges Restoration
- West Reading Pedestrian/Bike Trail Link
- North Berks Reconnections Plan

### CHESTER COUNTY

- Renaissance Park
- Iron Link Trail
- Continental Powder Works - E. Pikeland Township
- Phoenixville Foundry and Visitors Center
- Frick's Lock Historic District Economic Study
- Iron and Steel Heritage Initiative
- Schuylkill River Trail Design

### MONTGOMERY COUNTY

- Canoe Launches - Mont Clare Canal
- Lock 60 Cofferdam
- W. Norriton Pedestrian Access
- Rolling Hills Park
- Lock 60 - Construction Drawings
- Agricultural Interpretive Exhibit Design
- Oakes Reach Locktender's House Restoration
- Schuylkill River Greenway Stewardship Mgmt. Plan
- Oakes Reach Canal Forebay Repair

### PHILADELPHIA COUNTY

- Interpretive Signs - East Falls
- Manayunk - Cotton Street Bridge
- Waterwheel Reconstruction Design - Philadelphia Water Dept.
- Schuylkill River Park Construction Documentation
- Botanical Trail - Bartram's Garden
- Industrial Mural - Manayunk
- Trail Feasibility Study - Fort Mifflin
- Schuylkill River Voyager Feasibility Study
- Manayunk Canal Recreation Master Plan
- River House Study
- Wissahickon Valley Trail Signage
- Philadelphia Riverlink Feasibility Study
- "Mills and More" Community Center Curriculum
- Watershed Education Outreach

### REGIONAL PROJECTS

- Desilting Basin Study
- Recreation Business Study
- Environmental/Ethnic History Curriculum
- Schuylkill River Trails Guide, Sign Design
- Reconnections Technical Assistance Program
- Schuylkill River Sojourn

Source: Schuylkill Greenway Association

\* A partial listing of the many projects funded through the Schuylkill Heritage Corridor program.

## 5. LOOKING OUT FOR THE WATERSHED—WHO IS INVOLVED?

### PUBLIC AGENCIES WITH PROGRAMS RELATED TO THE SCHUYLKILL WATERSHED★

#### STATE AGENCIES

Department of Conservation  
and Natural Resources

[www.dcnr.state.pa.us](http://www.dcnr.state.pa.us)

Community Conservation Partnerships  
Environmental Education  
PA Heritage Parks  
Rivers Conservation  
Watershed Planning  
PA Scenic Rivers  
Coldwater Heritage Partnership  
River Sojourns

Department of Environmental  
Protection

[www.dep.state.pa.us](http://www.dep.state.pa.us)

Act 537 Sewage Facilities Program  
Brownfields  
Center for Environmental Education  
Citizens' Volunteer Monitoring  
Conservation Directory  
Dam Safety  
Drinking Water Assessment  
GIS Digital Geographic Information  
Hazardous Sites Clean-Up  
Reclaim PA  
Source Water Protection  
Storm Water Management Planning  
Stream Improvements  
Stream Releaf  
Watershed and Non-Point Source Mgt  
Water Use Planning  
Water Quality Assessment and Standards  
Wetlands

Fish and Boat Commission

[www.fish.state.pa.us](http://www.fish.state.pa.us)

Fish Consumption Advisories  
Fish Stocking  
Fisheries Management Reports  
Maps for Boaters and Anglers

Department of Community and  
Economic Development

[www.inventpa.com](http://www.inventpa.com)

Center for Local Government Service

Game Commission

[www.pgc.state.pa.us](http://www.pgc.state.pa.us)

Historical and Museum  
Commission

[www.phmc.state.pa.us](http://www.phmc.state.pa.us)

PA Geospatial Data Clearing House

[www.pasda.psu.edu](http://www.pasda.psu.edu)

#### FEDERAL AGENCIES

U.S. Environmental Protection  
Agency

[www.epa.gov](http://www.epa.gov)

Water Quality Criteria and  
Standards  
National Pollution Discharge  
Elimination System  
Source Water Assessment  
Watersheds Information Network  
Search Your Community  
Best Management Practices  
Ecological Restoration

U.S. Fish and Wildlife Service

[www.fws.gov](http://www.fws.gov)

Conservation Partnerships  
Endangered Species  
Environmental Education  
Habitat Restoration  
Migratory Bird Management  
National Wetlands Inventory  
National Conservation  
Training Center

National Park Service

[www.nps.gov](http://www.nps.gov)

Rivers and Trails Conservation Assistance  
National Heritage Areas

U.S. Geological Survey

[www.usgs.gov](http://www.usgs.gov)

National Stream Flow  
Information Program  
National Water Quality  
Assessment Program  
Groundwater Resource  
National Water Use

National Resources Conservation  
Service, USDA

[www.nrcs.usda.gov](http://www.nrcs.usda.gov)

Conservation Technical Assistance  
Wildlife Habitat Incentives  
Watershed Surveys and Planning  
Wetlands Reserve  
Conservation Reserve  
Watershed Protection and Flood Prevention

U.S. Army Corps of Engineers

[www.usace.army.mil](http://www.usace.army.mil)

Water Resources Management  
Wetlands Regulations  
Water Conditions and Levels  
Monitoring

#### OTHER AGENCIES

Delaware River Basin Commission

[www.state.nj.us/drbc](http://www.state.nj.us/drbc)

Water Conservation Regulations  
Groundwater Protected Area  
Regulations  
Hydrologic Conditions Report  
Water Quality Information  
Comprehensive Basin Plan

Delaware Valley Regional Planning  
Commission

[www.dvrpc.org](http://www.dvrpc.org)

Horizons 2025 Plan  
Regional Indicators  
Greenway and Open Space Projects  
Data Services

Philadelphia Water Department

[www.phila.gov](http://www.phila.gov)

Watershed Protection  
Water Quality Reports  
Water Treatment, Storage and Distribution  
Storm Water Management  
Education

County Conservation Districts

[www.pacd.org](http://www.pacd.org)

(PA Association of Conservation  
Districts)  
Storm Water Management  
Abandoned Mine Reclamation  
Nutrient Management  
Waterway Protection  
Environmental Education  
Technical Assistance

★This list is incomplete because of limited space. For example, it does not include a number of important county agencies such as planning commissions and water resource authorities, as well as many municipalities that are involved in local watershed protection efforts.

## NONPROFIT ORGANIZATIONS

As noted throughout this report, nonprofit organizations are involved in many activities in the Schuylkill watershed. They vary in their missions and programs, geographic orientation, size, expertise and financial resources. Some of the things they do include:

- Conserving land and assuming responsibilities as land managers;
- Restoring environmentally degraded sites;
- Preserving and managing historically significant buildings and other structures;
- Helping communities preserve their natural and cultural resources;
- Serving as advocates for new governmental policies and programs;
- Monitoring environmental conditions, maintaining data bases and disseminating information;
- Making the public aware of important issues, and running educational programs for people of all ages;
- Raising funds for capital improvement projects;
- Undertaking research on the watershed ecosystem;
- Facilitating communication and decision-making among different interest groups;

Many nonprofits can respond quickly to opportunities, often before government. They develop innovative approaches to problem-solving. They provide a connection to people and an important link between individuals and government. They serve as a means by which individuals can become engaged in worthy causes to improve the quality of life in the watershed and the region.

## Watershed-Based Conservation Organizations

Although often involved in a variety of activities, their general focus is watershed protection. Geographic orientation may be an individual tributary, several sub-watersheds or the entire Schuylkill watershed. *Examples:* Eastern PA Coalition for Abandoned Mine Reclamation, French & Pickering Creeks Conservation Trust, Green Valleys Association, Perkiomen Conservancy, Schuylkill Headwaters Association, Schuylkill River Greenway Association, Delaware Riverkeeper Network and Wissahickon Valley Watershed Association.

## Regional and Community-Based Conservation Organizations

Established to serve the needs of the region or one of its communities, these organizations address a spectrum of resource protection needs that include watersheds along with other concerns such as agricultural lands, woodlands, rare and endangered species, wetlands and historic places. *Examples:* Berks County Conservancy, Lower Merion Conservancy, Montgomery County Land Conservancy, Natural Lands Trust and Wildlands Conservancy.

## National and Statewide Organizations with Regional Offices

These organizations bring a national or statewide perspective to the Schuylkill watershed; their work is often undertaken in affiliation with regional and local organizations. *Examples:* The Nature Conservancy, Pennsylvania Environmental Council and The Conservation Fund.

## Site-Based Organizations

Initially formed to assume stewardship responsibilities for a specific site that may have historic and/or environmental significance, their activities often extend to the surrounding area, when it provides an important context for the site. *Examples:* John Bartram Association, Phoenixville Iron Canal and Trails Association and Schuylkill Canal Association.

## Environmental Education Centers

Using their collections, exhibits, grounds, laboratories and other resources, such Centers provide many kinds of educational experiences, both on- and off-site. *Examples:* Academy of Natural Sciences and Schuylkill Environmental Education Center.

## Research Institutions

With scientific staff in the biological and physical sciences, these institutions undertake research projects that lead to better understanding of watershed ecosystems and the measures required to properly manage them. *Examples:* Patrick Center for Environmental Research and Stroud Water Research Center.

## Economic Development Organizations

These organizations often focus on revitalization of older communities through reinvestment in public spaces such as riverfront parks and trails, and buildings that will attract new business, residents and visitors. *Examples:* Manayunk Development Corporation, Schuylkill Development Corporation, Phoenixville Economic Development Corporation and Preservation Pottstown, Inc.

## Foundations

Public and private foundations are important funding sources for many preservation, education, planning, research and reinvestment initiatives undertaken by nonprofit organizations and communities in the watershed. *Examples:* The William Penn Foundation and Claneil Foundation

## PARTNERSHIPS

Partnerships are the key to restoring and improving the Schuylkill watershed. Such collaborations are especially important because of the watershed's size, its many diverse communities, and a strong Pennsylvania tradition that favors community decision-making and action rather than top-down government control. While often very effective, local initiatives do not always have sufficient resources or scope to make a difference to the larger watershed.

The many collaborative working relationships among government and nonprofits are especially important. Some are informal, intended primarily for information sharing; others are the only means for successfully implementing state and federal programs. Activities such as watershed conservation planning and major greenway projects, require a critical mass of participants who can bring the technical expertise, funding and public support needed to support large-scale endeavors.

How and when are partnerships created? They occur under many different circumstances in which needs or opportunities cannot be addressed by one government agency, municipality or nonprofit organization. Which ones work best and are most important to the Schuylkill? That question is difficult to answer because so many are effectively performing different functions. Therefore, we offer only a sampling of some of the diverse partnerships mentioned in this report.

As this list reveals, many partnerships are operating throughout the watershed with different purposes. However, there is no effort to coordinate activities on a watershed-wide scale. Watershed management could be one way to strengthen and expand conservation activities throughout the watershed.

### *Smart Conservation*

A program to identify, evaluate and prioritize landscape resources, developed by Natural Lands Trust in partnership with other conservation leaders in the region, including the Academy of Natural Sciences of Philadelphia, The Nature Conservancy, the University of Pennsylvania, PA DCNR, U.S. EPA and others.

### *Wissahickon Partnership*

A forum for ongoing dialogue on water quality issues in the Wissahickon watershed, involving the Wissahickon Valley Watershed Association, the Philadelphia Water Department, a number of municipalities and several corporations.

### *Upper Schuylkill Tributaries Assessment*

An assessment of major acid mine drainage sources and strategies to improve water quality, involving the Schuylkill Conservation District, the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation, Schuylkill Headwaters Association, the Delaware Riverkeeper Network's Schuylkill office and others.

### *Montgomery County's Schuylkill Greenway Plan*

A plan, proposing a greenway that will connect communities along the Schuylkill River, developed in 2000 by Montgomery County in association with 16 municipalities and PA DCNR.

### *Schuylkill Heritage Corridor*

A program to both protect the Schuylkill's cultural and natural heritage and to promote heritage-based economic development, led by the Schuylkill Greenway Association in collaboration with Pennsylvania Department of Conservation and Natural Resources, other state agencies and many nonprofit organizations.

### *GreenSpace Alliance*

A program to create a system of protected open space in the greater Philadelphia metropolitan region, led by the Pennsylvania Environmental Council in collaboration with other nonprofit organizations, and state and federal agencies.

### *Master Plan for the Tidal Schuylkill*

A master planning initiative involving a 26 person task force from government, nonprofit and corporate sectors, led by the Schuylkill Development Council, with foundation and state funding from PA DCNR and others.

### *Schuylkill Source Water Assessment Partnership*

An assessment of sources of contamination to local water supplies within the Schuylkill, and development of source water protection strategies, led by the Philadelphia Water Department and other water suppliers, in collaboration with Pennsylvania Department of Environmental Protection and nonprofit watershed organizations.

### *John Potts County Park*

Creation of the new John Potts County Park along the Schuylkill led by a coalition that includes the Tri County Chamber of Commerce, Pottstown Industrial Development Corporation, the Pottstown Downtown Improvement District Authority, Preservation Pottstown and others.

### *Partners for Land Preservation*

A coalition of nonprofit organizations concerned about the preservation of open land and natural resources in Montgomery County, established by the Montgomery County Lands Trust. The partnership seeks to improve communication and coordination of activities of its members.

### *Senior Environmental Corps Water Monitoring*

A water monitoring database for collecting and using information from thousands of citizen volunteer monitors around the Commonwealth, managed by the Environmental Alliance for Senior Involvement, the PA Department of Aging and the PA Department of Environmental Protection.



## 6. CONCLUSIONS—A CALL TO ACTION



Photo: Gerald S. Williams

We hope that this report has shown that the watershed is a complex, changing and interconnected ecosystem. Upstream actions can have a major impact on conditions downstream. Surface waters are closely linked to the groundwater system. The cumulative effects of activities in the watershed are especially important. Small changes, particularly in a headwater tributary, can have profound consequences for the entire watershed. All of these relationships are happening.

Many individuals have helped to bring positive changes to the watershed. Sometimes they have worked through local government, but more often they have joined or

created nonprofit organizations to address the needs at-hand. Without such committed individuals and nonprofits, we would have accomplished far less.

Nonprofit organizations cannot succeed without the support they receive from individuals, foundations and government. Without it, conditions in the watershed would be much worse today and its future much more uncertain. Continued funding is vital to maintaining and improving the Schuylkill watershed.

In addition to providing an overview of the watershed, this report serves as a benchmark for assessing the success

of ongoing and new initiatives to protect and enhance the Schuylkill's resources. By tracking the data presented, we will be able to determine whether present strategies are succeeding.

Consider this report a call to action to citizens, local and state leaders, nonprofit organizations, government agencies and funders. We hope it will help direct a course towards a healthful, prosperous future and inspire continued and greater action on behalf of the Schuylkill watershed and its communities.

### WHERE DO WE GO FROM HERE?

Nonprofit groups participating in the report have suggested the following priority actions to continue to improve conditions in the Schuylkill Watershed. Listed alphabetically, they include:

- *Aquatic Habitat.* Restore shad runs to the greatest extent possible with fish ladders on dams, and protect river stretches providing habitat to endangered and threatened species.
- *Community Revitalization.* Promote community revitalization to conserve the watershed's natural and cultural resources by creating economic and environmental opportunity zones at key points along the river.
- *Environmental Education.* Encourage environmental education in elementary through secondary schools by developing a watershed education atlas guiding teachers to resources about the Schuylkill, and by

arranging for workshops, guest speakers, websites, maps, data and other information.

- *Environmental Indicators.* Monitor key indicators through a broad collaboration of government agencies, non-profit organizations and citizen monitoring efforts, to track changes in environmental conditions over time and publish those results for public discussion.
- *Greenways and Blueways.* Link and protect open space and natural habitats through land-based greenways and water-based blueways to protect natural communities and provide recreational assets for the public's enjoyment.
- *Land Use Planning.* Work with municipalities to promote creative incentives and regulatory changes incorporating best management practices to minimize the impact of development on the river and to protect the watershed.
- *Natural Hydrologic Flows.* Restore the watershed's natural hydrologic flows to the greatest extent possible by removing dangerous or nonfunctional dams and managing storm water to promote the natural infiltration of precipitation into the groundwater.
- *Volunteer Outreach.* Maintain a basin-wide citizen monitoring network by supporting the annual Schuylkill Watershed Congress and promoting its outcomes.

- *Water Quality.* Improve water quality by: (a) completing stream assessments of the watershed, (b) monitoring water quality, (c) reducing non-point source pollution through best management practices, (d) improving sewage treatment plants, (e) cleaning-up abandoned mine drainage; and (f) incorporating riparian restoration into all new riverside development, including Brownfield redevelopments.
- *Watershed Management.* Establish a watershed-wide consortium promoting cooperation and the free flow of information among nonprofit organizations, government agencies and the private sector, to improve the efficiency of environmental protection programs.
- *Watershed Promotion.* Promote the watershed's resources for recreation, education and tourism, to raise public awareness and stimulate local economies.

It is a challenging list, but the goals are achievable. In fact, many efforts are already underway. But success will ultimately require further effective partnerships among many interests in the watershed.

The Schuylkill watershed has a complex management system that involves all levels of government, nonprofit organizations, foundations, businesses and individuals. Although much has been accomplished, this decentralized and multi-tiered system is not always the most effective way of dealing with conservation issues. It will be hard to change because the system has been in place

for many years, but a more centralized management strategy could enhance the long-term protection and sustainable use of the watershed's resources.

The Report on the State of the Schuylkill watershed was conceived as a rallying point for many nonprofits in the watershed to work together for the first time. It is the strength and unity of the nonprofit sector along with core support from government agencies, foundations and individuals that can lead the watershed forward to realize continued successes and changes that will improve our quality of life.

## THE ROLE OF INDICATORS—A SUMMARY

*Indicators* are measures that we use to understand conditions and trends. Ideally, they are readily quantifiable, reliable, informative, and can be updated over time.

One of the goals of this report was to identify a set of useful indicators of conditions and trends in the Schuylkill watershed. It was a challenging task because of the report's broad scope and diverse audiences. Data limitations became a significant factor, because the Schuylkill is a large watershed and most information is available for political jurisdictions and not for the watershed.

As listed below, this report contains a variety of indicators that are not consistent in their level of precision or time periods they represent. In some cases, they describe conditions that have evolved over geologic time, e.g., stream orders, whereas elsewhere they report on water quality surveys undertaken in the last five years. However, collectively we hope they provide an overview of the watershed and that certain indicators will also serve as a benchmark for future efforts.

*What are some of the defining characteristics of the Schuylkill watershed as reflected in its natural and human history, its present land use and development patterns, and its water use and water quality conditions?*

1. The watershed's natural regions and their characteristics as revealed by conditions of climate, geology, groundwater, topography, soils and natural communities.

2. The watershed's drainage patterns, as seen through the structure of its tributaries (stream orders) and the configuration of its sub-watersheds.
3. The watershed's human history as evidenced by historic buildings, dams, canals and locks, and other historic structures.
4. The watershed's land-use patterns, i.e., the extent and distribution of open lands in agriculture and woodlands, and lands disturbed or paved by urban/suburban development.
5. Population change and land development trends, as seen in the patterns of suburban growth, land consumed for development, and the stability of older communities.
6. The extent to which the watershed is an important water source for public water supplies, industrial, agricultural and recreation uses.
7. The biological health of the watershed's aquatic communities, as measured by their diversity and abundance.
8. The extent to which regional, county and municipal plans recognize the watershed, and the status of conservation planning for the river and its tributaries.

*How are the river and its tributaries considered as a resource in the region today, and what activities are underway to protect or enhance those resources?*

9. The general health of the watershed's fisheries, as measured by population levels, reproduction and mortality rates, and whether Schuylkill fish are safe for human consumption.
10. The condition of native fish species such as American shad, and the status of efforts to increase their populations such as providing passages for upstream spawning.
11. The condition of stream banks and associated streamside lands, and the status of efforts to maintain or restore such areas as riparian buffers.
12. The presence and condition of wetlands in the watershed, and the level of effort to protect them and restore those that have been degraded.
13. The existence of a network of permanently protected conservation lands that will protect the watershed ecosystem, and the status of land protection efforts.
14. The extent to which the watershed's developing communities are engaged in comprehensive strategies to protect both their ground and surface waters.
15. The extent to which the watershed's historic riverfront communities and the City of Philadelphia are investing in waterfront parks, pathways, and historic restorations capitalizing on the river as a community asset.

16. The status of efforts to create an interconnected greenway system along the river and its tributaries, and land and water trails for public recreational uses.

*How are we managing human stresses to maintain and/or restore the health of the watershed ecosystem?*

17. Classifications of protected water uses and water quality standards established for the Schuylkill and its tributaries, particularly those waters designated as high quality or exceptional value.
18. Status of water quality assessments in the watershed as required by the federal Clean Water Act, and findings on the extent to which such waters are unimpaired.
19. Extent to which the principal causes of impaired waters are understood in the watershed.
20. Status of agricultural practices in the watershed, and the level of effort underway to improve management of soil erosion, chemical applications and the impacts of livestock operations.
21. Status of management practices to control the impacts of urban storm water, such as Act 167 storm water management plans.
22. Quantities and level of treatment of sewage waste from treatment plants and individual septic systems,

and the status of management programs such as Act 537 sewage facilities plans and funding to improve treatment facilities.

23. Quantities and levels of treatment associated with known and potential industrial pollutants manufactured, used or stored in the watershed, and the status of actions needed to achieve compliance with applicable regulations.
24. Sources of acid water and dissolved metals draining from abandoned coal mines in the watershed, and the status of efforts to reclaim abandoned mine and encourage re-mining of older mines through green technology.
25. Status of stream monitoring and the extent to which monitoring data are organized and available for research, watershed management and education.
26. Scientific research needs in the watershed, and the extent to which they are funded and addressed by research institutions.

*How well does the public understand the watershed and its importance, and what programs are in place to enhance the public awareness and appreciation of the Schuylkill?*

27. Public opinion surveys that reveal the public's awareness, knowledge and opinions of the watershed's condition and resources.

28. Opportunities for the public to participate in events such as river trips, celebrations and watershed conferences.
29. Educational curricula in primary and secondary schools that address watershed ecosystems and provide educational experiences in the field.
30. Numbers of environmental education centers within or near the Schuylkill watershed that provide opportunities for people of all ages to learn about the Schuylkill.
31. The extent to which the Schuylkill and its tributaries have received special recognition under Pennsylvania's Scenic River Act and state and federal heritage programs.

*What kinds of agencies and nonprofit organizations are involved in activities beneficial to the watershed?*

32. Federal, state, regional and local agencies with planning, regulatory, resource management, funding and capital improvement programs.
33. Nonprofits organizations engaged in resource conservation, community development, education, monitoring, and research activities.
34. Public and nonprofit partnerships in the watershed.



# REPORT PARTICIPANTS



Photo: Schuylkill River Greenway Association

Berks County Conservancy  
Joseph Hoffman, Director of Environmental  
Management  
25 N. 11th Street  
Reading, PA 19601  
(610) 372-4992 phone  
(610) 372-2917 fax  
[www.berksconservancy.org](http://www.berksconservancy.org)

The Conservation Fund  
Pennsylvania Office  
Josh First, Pennsylvania Rep.  
105 North Front Street  
Harrisburg, PA 17101  
(717) 230-8166 phone  
(717) 230-8167 fax  
[www.conservationfund.org](http://www.conservationfund.org)

Delaware Riverkeeper Network  
Chari Towne, Director, Schuylkill Office  
P.O. Box 459  
St. Peters, PA 19470-0459  
(610) 469-6005 phone  
(610) 469-6025 fax  
[www.delawariverkeeper.org](http://www.delawariverkeeper.org)

Eastern PA Coalition for Abandoned Mine  
Reclamation  
Robert E. Hughes, Executive Director  
Luzerne Co. Conservation District  
485 Smith Pond Road  
Shavertown, PA 18708  
(570) 674-7993 phone  
(570) 674-7989 fax  
[www.luzerneconservationdistrict.org](http://www.luzerneconservationdistrict.org)

French & Pickering Creeks Conservation Trust, Inc.  
Rita C. Banning, President  
3340 Coventryville Road  
Pottstown, PA 19465  
(610) 469-0150 phone  
(610) 469-6459 fax

Green Valleys Association  
John Hoekstra, Watershed Director  
1368 Prizer Road  
Pottstown, PA 19465  
(610) 469-4900 phone  
(610) 469-4990 fax  
[www.greenvalleys.org](http://www.greenvalleys.org)

Lower Merion Conservancy  
Mike Weilbacher, Executive Director  
1301 Rose Glen Road  
Gladwyne, PA 19035  
(610) 645-9030 phone  
(610) 645-9031 fax  
[www.dragonfly.org](http://www.dragonfly.org)

Manayunk Development Corp.  
Kay Smith, Executive Director  
111 Grape Street  
Philadelphia, PA 19127  
(215) 482-9565 phone  
(215) 487-9137 fax  
[www.manayunk.com](http://www.manayunk.com)

Montgomery County Lands Trust  
Dulcie F. Flaharty, Executive Director  
P.O. Box 300  
Lederach, PA 19450  
(215) 513-0100 phone  
(215) 513-0150 fax  
[www.mclt.com](http://www.mclt.com)

Natural Lands Trust  
Andy Pitz, RLA, Director of Conservation Planning  
1031 Palmers Mill Road  
Media, PA 19063  
(610) 353-5587 phone  
(610) 353-0517 fax  
[www.natlands.org](http://www.natlands.org)

The Nature Conservancy  
Randy Gray, State Director  
1100 East Hector Street, Suite 470  
Conshohocken, PA 19428  
(610) 834-1323 phone  
(610) 834-6533 fax  
[www.nature.org](http://www.nature.org)

Patrick Center for Environmental Research  
Dr. Thomas E. Johnson, Scientist  
1900 Benjamin Franklin Parkway  
Philadelphia, PA 19103-1195  
(215) 299 1118 phone  
(215) 299-1079 fax  
[www.acnatsci.org/research/pcer/index.html](http://www.acnatsci.org/research/pcer/index.html)

Pennsylvania Environmental Council  
Ann Smith, Watershed Director  
117 South 17th Street, Suite 2300  
Philadelphia, PA 19103-5022  
(215) 563-0250 phone  
(215) 563-0528 fax  
[www.pecpa.org](http://www.pecpa.org)

Peopling of Philadelphia Collaborative, Inc.  
Marlene R. Robinson, Executive Director  
1416 2nd Street  
Delanco, NJ 08075  
(856) 824-9399 phone  
(856) 824-1489 fax  
E-mail: [mrpopci@aol.com](mailto:mrpopci@aol.com)

Perkiomen Watershed Conservancy  
Tad Radzinski, Executive Director  
1 Skippack Pike  
Post Office Box 55  
Schwenksville, PA 19473  
(610) 287-9383 phone  
(610) 287-9237 fax  
[www.pvwatershed.org](http://www.pvwatershed.org)

Phoenixville Area Economic Development Corp.  
Barbara Cohen, Executive Director  
171 East Bride Street  
Phoenixville, PA 19460  
(610) 933-3070 phone  
(610) 917-0503 fax  
Email: phochamber@aol.com

Phoenixville Iron Canal and Trails Assoc.  
Mark Connolly, Director, Trails Implementer  
50 Broadwater Lane  
Phoenixville, PA 19460  
(610) 983-9447 phone & fax  
[www.pasd.com/core/picta.htm](http://www.pasd.com/core/picta.htm)

Preservation Pottstown, Inc.  
Tom Hylton, Vice President  
P.O. Box 120  
Pottstown, PA 19462  
(610) 323-6837 phone  
(610) 323-6841 fax  
[www.pottstownpennsylvania.org/index.html](http://www.pottstownpennsylvania.org/index.html)

Schuylkill Canal Association, Inc.  
Betsy Daley, Executive Director  
Post Office Box 3  
Mont Clare, PA 19453  
(610) 933-8036 phone  
(610) 917-8030 fax  
[www.schuylkillcanal.com](http://www.schuylkillcanal.com)

Schuylkill Center for Environmental Education  
Tracy Kay, Executive Director  
8480 Hagy's Mill Road  
Philadelphia, PA 19128-1998  
(215) 482-7300 phone  
(215) 482-8158 fax  
[www.schuylkillcenter.org](http://www.schuylkillcenter.org)

Schuylkill Headwaters  
Bill Reichert, Board Director  
51 N. 4th Street  
Cressona, PA 17929  
(570) 385-2122 phone  
E-mail: breichert@losch.net

Schuylkill River Development Council  
John Randolph, President  
2314 South Street  
Philadelphia, PA 19146  
(215) 985-9393 phone  
(215) 985-0101 fax  
[www.srdc.net](http://www.srdc.net)

Schuylkill River Greenway Association  
Dixie Swenson, Executive Director  
140 College Drive  
Pottstown, PA 19464  
(484) 945-0200 phone  
(484) 945-0204 fax  
[www.schuylkillriver.org](http://www.schuylkillriver.org)

Stroud Water Research Center  
Bernard Sweeney, Executive Director  
970 Spencer Road  
Avondale, PA 19311  
(610) 268-2153 phone  
(610) 268-0490 fax  
[www.stroudcenter.org](http://www.stroudcenter.org)

Wildlands Conservancy, Inc.  
Thomas Kerr, Executive Director  
3701 Orchid Place  
Emmaus, PA 18049-1637  
(610) 965-4397 phone  
(610) 965-7223 fax  
[www.wildlandspa.org](http://www.wildlandspa.org)

Wissahickon Valley Watershed Assoc.  
David Froehlich, Executive Director  
12 Morris Road  
Ambler, PA 19002  
(215) 646-8866 phone  
(215) 654-7489 fax  
[www.wvwa.org](http://www.wvwa.org)

#### FOUNDATIONS

Claneil Foundation  
Dr. Henry Jordan  
630 W. Germantown Pike, Suite 400  
Plymouth Meeting, PA 19462-1059

William Penn Foundation  
Diane Schrauth, Program Officer  
Two Logan Square, 11th Floor  
100 North 18th Street  
Philadelphia, PA 19103-2757  
[www.wpennfdn.org](http://www.wpennfdn.org)

#### PUBLIC AGENCIES

PA Dept. of Environmental Protection  
Patricia Pingel  
Chief, Watershed Assistance Unit  
Bureau of Watershed Conservation  
Rachel Carson State Office Building  
P.O. Box 8555  
Harrisburg, Pa 17105-8555  
[www.dep.state.pa.us](http://www.dep.state.pa.us)

PA Dept. of Conservation and Natural Resources  
Todd Stell, Conservation Planner  
Bureau of Recreation and Conservation  
Rachel Carson State Office Building  
P.O. Box 8475  
Harrisburg, PA 17105-8475  
[www.dcnr.state.pa.us](http://www.dcnr.state.pa.us)

Philadelphia Water Department  
Ed Grusheski, Manager, Public Affairs  
1101 Market Street, 3rd Floor  
Philadelphia, PA 19107-2994  
(215) 685-6110 phone  
(215) 685-6154 fax  
[www.phila.gov/water](http://www.phila.gov/water)

#### ABOUT THE CONSERVATION FUND

The Conservation Fund is a national nonprofit organization that forges partnerships to protect America's legacy of land and water resources. Through land acquisition, sustainable programs and leadership training, the Fund and its partners demonstrate effective conservation solutions emphasizing the integration of economic and environmental goals.

*Sustainable Programs.* The Fund works with communities as well as industry, developers and landowners to demonstrate sustainable practices that balance economic and environmental goals. Ongoing watershed conservation projects include the Chesapeake Bay, the Saginaw Bay, the Mississippi River, and the Schuylkill River Watershed Initiative.

*Land Conservation.* The Fund helps local, state and federal agencies, and nonprofit organizations acquire property to protect open space, wildlife habitat, public recreation areas, river corridors and historic places. Since 1985, the Fund has conserved 3.2 million acres throughout the United States.

*Leadership Training.* The Fund serves as a national resource for environmental organizations by providing financial resources and technical assistance as well as formal training to land conservation professionals from all sectors.

*For further information, contact:*

Edward McMahon, Vice President  
The Conservation Fund  
1800 North Kent Street, Suite 1120  
Arlington, VA 22209  
703-525-6300, 525-4610/fax  
[www.conservationfund.org](http://www.conservationfund.org)

#### FUNDERS

This report was prepared by The Conservation Fund with generous support received from The William Penn Foundation, The Claneil Foundation, the Pennsylvania Department of Conservation and Natural Resources, and the Philadelphia Water Department.

This project was financed in part by a grant from the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation, through The Rivers Conservation Program, a component of the Community Conservation Partnerships Program of the Keystone Recreation, Park and Conservation Fund of 1993.

Through a Growing Greener Grant, the Pennsylvania Department of Environmental Protection has funded a poster and public outreach program based upon this report. The views expressed herein are those of the authors and do not necessarily reflect the views of the Department of Environmental Protection.

#### CREDITS

Elizabeth Kitchel ..... *Director, Schuylkill River Watershed Initiative & Consultant*  
The Conservation Fund, Philadelphia, PA  
[emkitchel@comcast.net](mailto:emkitchel@comcast.net), Bryn Mawr, PA

Michael Clarke and Kathiann Tevlin ..... *Report Preparation and Design*  
Tevlin & Clarke, Lake Placid, NY  
[www.tevlinclarke.com](http://www.tevlinclarke.com)

Nicholas Napoli ..... *Report Research*  
The Conservation Fund, Philadelphia, PA

Gerald S. Williams ..... *Aerial Photography*  
Gerald S. Williams Photography, Clayton, NJ

Lydia L. Denworth ..... *Editor*  
Brooklyn, NY

Credit and thanks are gratefully given to the many nonprofit organizations who participated in this project (see pp. 39 and 40) and who provided valuable insights, guidance and information during its preparation.



