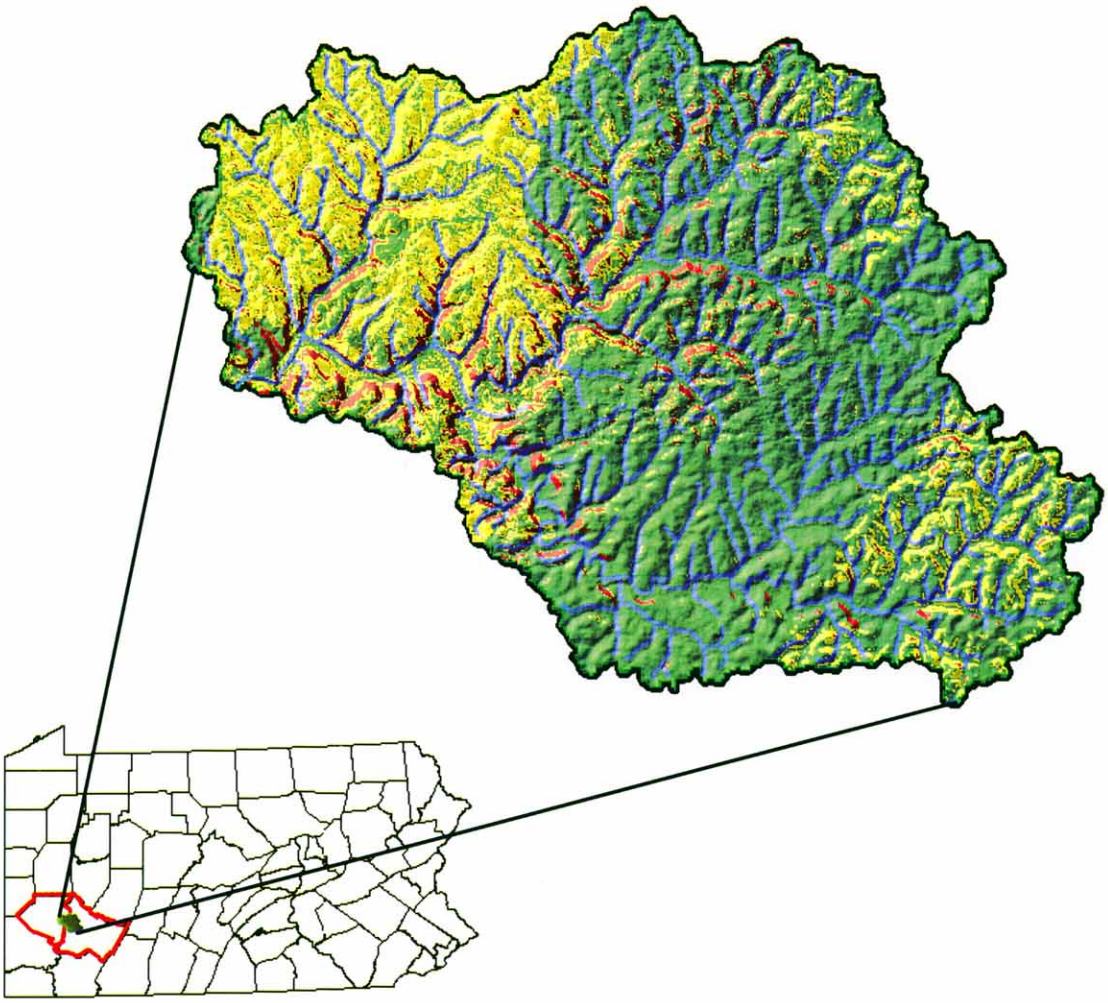
TURTLE CREEK WATERSHED RIVER CONSERVATION PLAN

DCNR

The Pennsylvania Department of Conservation and Natural Resources

DCNR Rivers Conservation Program

VOLUME 1: THE PLAN



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APRIL 30, 2002

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PREFACE

The development of a River Conservation Plan (RCP) for the Turtle Creek Watershed is an initiative of the Turtle Creek Watershed Association (TCWA), a qualified, IRS § 501 (c) (3) tax exempt, nonprofit corporation. The TCWA was established in 1971 primarily through the efforts of its first Board of Directors, the Westmoreland County Soil and Water Conservation District, the Allegheny County Soil and Water Conservation District, the Allegheny County Commissioners, and Westinghouse Electric Corporation. The TCWA initially operated as a Pennsylvania-chartered environmental planning agency involved with erosion, sedimentation, flood control, sewage, and abandoned mine drainage issues within the 147-square mile Turtle Creek watershed. Over the years, the TCWA has managed projects that have also addressed recreation, trout stocking, environmental education, and natural resource conservation throughout the watershed.

The Pennsylvania Department of Conservation and Natural Resources (PADCNR) developed the Pennsylvania River Conservation Program as a statewide initiative to conserve and enhance river resources through preparation and execution of locally initiated conservation plans. This program is funded through the Keystone Recreation, Park, and Conservation Fund Act (Act 50 of July 2, 1993, Public Law 359; or "Key 93") to assist municipalities and watershed organizations that are interested in conserving their local river resources. This program provides technical and financial assistance for planning, implementation, acquisition, and development activities for these locally initiated and executed water resource plans.

According to PADCNR (1999), the objectives of an RCP are to: (1) inventory the significant natural, recreational, and cultural resources within the watershed; (2) solicit public input to identify issues, concerns, and threats to river resources and values; and (3) formulate an action plan for public and private actions and initiatives to conserve, enhance, and restore river resources and values. Once an RCP is prepared, a river can be placed on the Pennsylvania Rivers Conservation Registry. The Registry acts as a vehicle to recognize the river and those individuals and organizations that were involved with completing a comprehensive RCP for the resource, as well as endorse local initiatives in a statewide recognition program. After the RCP is placed upon the Registry, the river becomes eligible for implementation, development, or acquisition grants for the installation of the Action Plan identified in the RCP.

To expand their conservation efforts, the TCWA applied for a grant from the PADCNR to prepare a RCP for the entire Turtle Creek watershed. When the grant was received, the TCWA established a Steering Committee to manage the development of the RCP. The Steering Committee, in turn, hired Civil & Environmental Consultants, Inc. (CEC) from Pittsburgh to gather data, conduct the necessary analyses, and prepare the RCP. A Project Advisory Council was formed to represent the public, provide input into the development of the RCP, and ensure that the RCP would meet community needs. Sixteen concerned citizens, community leaders, and stakeholders who live and work within the Turtle Creek watershed comprised the Project Advisory Council, having backgrounds in planning, economic development, life sciences, engineering, recreation, and government. The Project Advisory Council reviewed the work of CEC, recommended changes, and helped publicize the RCP within their own organizations and communities.

In addition to regular meetings with the Steering Committee and Project Advisory Council, the RCP planning process solicited and incorporated public involvement through public meetings, newsletters, an issues survey, press releases, and updates to the TCWA website. These public involvement activities are described and documented in Appendix H of the plan (Volume 2).

TCWA used a subwatershed planning approach to prepare a scientifically credible, effective, and locally-based RCP that meets the water resource goals of the Turtle Creek watershed (the subwatershed approach is discussed in Section 1.3). The Turtle Creek watershed is composed of many individual subwatersheds that have their own unique water resource issues and needs. Fourteen subwatershed planning units were selected for the Turtle Creek Watershed RCP (shown in Figure 3 and subwatershed overlay). The subwatershed approach allows these individual issues to be identified and addressed in a more effective manner, within the comprehensive framework of the RCP to achieve the water resource goals for the watershed as a whole.

The Turtle Creek Watershed River Conservation Plan is organized into two volumes, including *Volume 1: The Plan*, which presents the narrative portion of the plan in six sections and fourteen maps (Figures 1-14) with two overlays, and *Volume 2: Appendices*, which contains supporting technical and documentary information in eight Appendices. Section 4 of Volume 1 presents the action plan developed for the Turtle Creek watershed and subwatersheds, including specific initiatives, projects, and implementation strategies for protecting, restoring, and enhancing the natural and cultural resources and recreational uses of the watershed. The fourteen maps used to illustrate watershed characteristics and features were produced using the Turtle Creek Watershed Geographic Information

System (GIS), a powerful database tool developed as part of the RCP project. This GIS database contains a wealth of geographically referenced information, including topography, streams, floodplains, wetlands, water quality data, land use, soil maps, geologic features, outdoor recreation areas, infrastructure, etc. The TCWA will maintain the GIS database and new information can be added to the GIS as it becomes available through local, state, and federal agencies, private groups, and implementation of the action plan in this RCP.

SECTION 1
CHARACTERISTICS OF THE TURTLE CREEK WATERSHED

1.1 LOCATION

The Turtle Creek watershed is situated in western Westmoreland County and eastern Allegheny County in southwestern Pennsylvania (Figure 1). The watershed drains an area of 147.41 square miles (381.8 square kilometers) that includes forest, farmland, industry, abandoned mined lands, and urban, and suburban residential communities. Turtle Creek flows west from its source in Delmont, Westmoreland County to its mouth where it enters the Monongahela River in North Versailles Township, Allegheny County.

Thirty-three municipalities are located within the Turtle Creek watershed (Figure 2). Sixty-six percent of the watershed is situated in Westmoreland County, 34 percent in Allegheny County. The lower watershed lies in a heavily urbanized area between the cities of Pittsburgh and McKeesport. The Turtle Creek watershed is roughly bound by State Route 66 (S.R. 66) to the east, S.R. 380 to the north, and U.S. Route 30 to the west and to the south.

1.2 ECOREGION

Ecoregions are large contiguous land areas where local ecosystems reoccur more or less throughout the region in a predictable pattern. Ecoregions provide a geographic framework for assessment, research, inventories, monitoring, and management of environmental resources. The United States Environmental Protection Agency (USEPA) has compiled ecoregion maps for North America, based on analyzing patterns of the abiotic and biotic factors that shape ecosystems, including geology, physiography, climate, hydrology, soils, vegetation, wildlife, and land use (USEPA 2000).

The Turtle Creek watershed is located in the Western Allegheny Plateau Ecoregion. This ecoregion consists of unglaciated, hilly, wooded terrain, dissected by perennial streams in narrow valleys. Second-growth mixed mesophytic and mixed oak forests characterize the Western Allegheny Plateau. Currently, most of the steep, rounded hills remain in forest, while most of the valleys have been developed for agriculture (dairy, livestock, and cropland), industry, and commercial and residential development. The horizontally bedded sedimentary rock that underlies the Western Allegheny Plateau Ecoregion has been extensively mined for bituminous coal.

1.3 WATERSHED AND SUBWATERSHEDS

Turtle Creek is a fifth-order stream employing Strahler's (1964) method of stream ordering. Approximately 315 miles of streams drain the 147.4-square mile area comprising the Turtle Creek watershed. A dendritic pattern of drainage is prevalent in the watershed (Figure 1), which is typical of an area composed of relatively uniform sandstone and shale geology (Gordon et al. 1992). Major tributaries to Turtle Creek include Steels Run and Haymaker Run in the upper Turtle Creek watershed, Abers Creek, Lyons Run, and Brush Creek in the middle Turtle Creek watershed, and Dirty Camp Run, Thompson Run, Sawmill Run, and Ardmore Run in the lower Turtle Creek watershed (Figure 1).

The Turtle Creek watershed lies within the lower Monongahela River basin, identified by the U. S. Geological Survey's (USGS) 8 digit Hydrologic Unit Code (HUC) 05020005. The entire Turtle Creek watershed has been designated as State Water Plan (SWP) 19A by the Pennsylvania Department of Environmental Protection (PADEP). The SWP system was developed by PADEP as a tool to manage Pennsylvania's waters on a comprehensive and coordinated basis. Under PADEP's Unified Watershed Assessment program, SWP 19A is listed as a Category IV watershed. Category IV watersheds are "watersheds with insufficient data to make an assessment" (i.e., less than 10 percent of the waters assessed; PADEP 2000a).

The Turtle Creek watershed is composed of many smaller stream watershed areas, each with their own unique water resource issues and needs. The Center for Watershed Protection (1998) maintains that watershed planning is more effective when larger watersheds are divided into smaller subwatershed management units. This approach has been adopted for the Turtle Creek Watershed RCP, thus providing a comprehensive framework for managing subwatersheds to achieve the water resource goals for the whole watershed.

The Center for Watershed Protection (1998) defines a subwatershed as having a drainage area of 2 to 15 square miles. Using this general guideline, the Turtle Creek watershed was divided into 14 subwatershed planning units for the major tributaries to Turtle Creek (Table 1). The drainage areas of the Turtle Creek mainstem and Brush Creek exceed this planning unit guideline, so the watersheds for these two streams were divided into subwatersheds based on hydrologic and water quality characteristics. The Turtle Creek mainstem watershed was divided into three subwatershed units, named the Lower, Middle and Upper Turtle Creek

subwatersheds. The Brush Creek watershed was divided into the Lower and Upper Brush Creek subwatershed units.

TABLE 1

Subwatershed Planning Units for the Turtle Creek Watershed

Subwatershed	Drainage Area	
	Square Miles	Square Kilometers
Abers Creek	10.64	27.56
Ardmore Run	3.16	8.18
Brush Creek, Lower	17.43	45.14
Brush Creek, Upper	26.13	67.68
Bushy Run	13.94	36.1
Dirty Camp Run	3.23	8.37
Haymaker Run	10.97	28.41
Lyons Run	8.78	22.74
Sawmill Run	2.02	5.23
Steele's Run	4.81	12.46
Thompson Run	15.87	41.1
Turtle Creek, Lower	10.02	25.95
Turtle Creek, Middle	7.43	19.24
Turtle Creek, Upper	12.98	33.62
Total	147.41	381.79

The boundaries of the 14 subwatersheds are delineated in Figure 3. An 8.5 x 11-inch clear acetate overlay with the delineated subwatershed boundaries is provided in a pocket in the Figures section to superimpose subwatershed boundaries on Figures 2 through 14.

1.4 TOPOGRAPHY

Total vertical relief in the Turtle Creek watershed is approximately 801 feet, ranging from 718.7 feet National Geodetic Vertical Datum (NGVD) at the mouth of Turtle Creek (Monongahela River, Pool 2 normal elevation) to 1520.0 feet NGVD in the eastern portion of the watershed near the headwaters of Brush Creek. Hilltop elevations generally range from 1,200 to 1,400 feet NGVD. Valley sides are generally steep (>15% slopes), with moderately sloped intermediate land (Figure 4). As a result, numerous headwater gullies and streams dissect the Turtle Creek

watershed. In its lower reaches, Turtle Creek lies at the bottom of a 350-foot-deep gorge near the Westinghouse Bridge (U.S. Route 30).

The hilltops of the Turtle Creek watershed are broadly rounded and dissected by tributary streams. Valleys along the smaller tributaries are generally narrow, but lower Turtle Creek exhibits a relatively broad floodplain ranging from 1,000 to 2,000 feet wide in several locations. Above its confluence with Brush Creek, the Turtle Creek valley ranges between 500 and 1,000 feet in width. The floodplain of Brush Creek varies between 200 and 1,000 feet in width. The valley floor of Thompson Run and other secondary tributaries range from 200 to 500 feet in width.

The channel of lower Turtle Creek has an average slope of approximately six feet per mile, gradually increasing upstream to approximately eight feet per mile before the confluence with Brush Creek. Above the confluence, the channels of upper Turtle Creek and upper Brush Creek have average slopes of approximately 18 feet and 14 feet per mile, respectively. Thompson Run has an initial slope of approximately 23 feet per mile and averages approximately 37 feet per mile over the main stem. Headwater tributary streams exhibit slopes ranging from 50 feet to approximately 400 feet per mile.

Numerous commercial, residential, and industrial developments have resulted in hilltop cut and side slope fill projects that have altered topographic conditions throughout many portions of the Turtle Creek watershed. The impoundment of the Monongahela River for commercial navigation purposes has also had a significant effect on the hydrologic regime of the lower Turtle Creek valley. Lock and Dam No. 2, located on the Monongahela River just downstream of the mouth of Turtle Creek, creates a backwater condition on the lower mainstem of Turtle Creek. Extensive residential, commercial, and industrial development has occupied the wide floodplain in the lower Turtle Creek valley. Stream channelization and bank stabilization projects associated with this development, as well as a U. S. Army Corps of Engineers (USACOE) flood control project completed in 1967, have also greatly influenced the flow regime in the lower portion of the watershed.

1.5 GEOLOGY

The Turtle Creek watershed is located in the Pittsburgh Low Plateau Section of the Appalachian Plateaus Physiographic Province in Pennsylvania. Typically, the Appalachian Plateau consists of Pennsylvania-Age rock that previously formed a broad, rolling plain. The plain was uplifted to form the plateau, which exhibits a southwest-trending dip. The Appalachian Plateau has been dissected by numerous watercourses over geologic time to form relatively narrow, steep-walled, moderately

incised stream valleys. Dendritic stream patterns are exhibited on upland surfaces of the Appalachian Plateau (Schultz 1999). Structural jointing also appears to be an important factor influencing stream morphology, as incised stream valleys exhibit many straight segments.

The base of the Pittsburgh Low Plateau Section has developed in predominantly shale bedrock, with locally dominant sandstone, siltstone and limestone. Most strata are gently folded with amplitude increasing to the northeast. In addition to the southwest slope of regional bedrock, the rocks have been buckled into a series of long, narrow, northeast-southwest trending folds. The structural ridges of these folds are called anticlines and the troughs are called synclines. Subdued anticlines and synclines are commonly reflected in equally subdued topographic highs and lows. Specific synclines and anticlines are named for one or more of the communities they pass under. Five prominent structural folds have been mapped across the Turtle Creek watershed. Progressing from east to west across the watershed are the Greensburg Syncline, the Grapeville Anticline, the Irwin Syncline, the Murrysville Anticline, and the Duquesne Syncline (Wagner et al. 1975a). These folds influence the surface topography and appear to influence stream morphology. For example, Thompson Run and the lower segment of Turtle Creek roughly parallel the Duquesne Syncline, and Haymaker Run and the middle section of Turtle Creek roughly parallel the Murrysville Anticline.

Mapped surface geology of the Turtle Creek watershed consists primarily of Pennsylvania Age rock of the Monongahela, Allegheny, and Conemaugh Groups with small inclusions of Pennsylvanian-Permian Age rock of the Waynesburg Formation of the Dunkard Group, and one isolated area of Quaternary Age alluvium (Wagner et al. 1975b; Figure 5). The Monongahela Group covers 51.12 square miles or 34.7 percent of the Turtle Creek watershed area (Table A-1 in Appendix A). It is expressed at the surface in three general areas of the watershed: (1) along the eastern edge of the watershed near Greensburg; (2) on the heights paralleling the Irwin Syncline from Irwin northeast to Export; and (3) in the highlands extending from North Versailles to Monroeville and westward towards Wilkinsburg (see Figure 5 and municipality overlay). The Monongahela Group consists of cyclic sequences of shale, limestone, sandstone, and coal with the economically important Pittsburgh Coal seam at its base (Wagner et al. 1975b).

The Allegheny Group covers 1.42 square miles or 1.0 percent of the Turtle Creek watershed area (Table A-1 in Appendix A). It is exposed at the surface in only two areas of the watershed: at the crest of the Murrysville Anticline, parallel with a four-mile segment of Haymaker Run and middle Turtle Creek upstream of its confluence with Haymaker Run; and at the crest of the Grapeville Anticline in

Hempfield Township near the headwaters of Brush Creek (Figure 2). The Allegheny Group consists of cyclic sequences of shale, sandstone, limestone, and coal with the Brookville Coal seam at its base and the Upper Freeport Coal seam at the top. Numerous mineable coals and clays are found in this formation (Wagner et al. 1975b).

The Waynesburg Formation of the Dunkard Group covers 1.77 square miles or 1.2 percent of the Turtle Creek watershed area (Table A-1 in Appendix A). It is expressed at the surface as inclusions inside the Monongahela Group situated in the highest areas of North Huntingdon Township, Penn Township, and Export. The Waynesburg Formation consists of cyclic sequences of sandstone, shale, limestone, and coal with the Waynesburg Coal seam at its base (Wagner et al. 1975b).

The Conemaugh Group comprises most of the remaining surface geology of the Turtle Creek watershed. The Conemaugh Group consists of the Casselman Formation (57.43 square miles, 39.0 percent) and the Glenshaw Formation (35.67 square miles, 24.2 percent) that are separated by the fossiliferous Ames Limestone marker bed (Table A-1 in Appendix A). These formations consist of cyclic sequences of sandstone, shale, red beds, thin limestone, and coal. The rocks of the Conemaugh Group are the most landslide prone of any group in the Turtle Creek watershed, especially in the red clay shale units known locally as the "Pittsburgh Red Beds" (Wagner et al. 1975b).

Quaternary Age alluvium is found in one isolated area of the Turtle Creek watershed on the Monongahela River's abandoned "Parker Strath" floodplain terrace in East Pittsburgh (Wagner et al. 1975b). These deposits are of the Carmichael's Formation and contain a higher percentage of fine silt and clay than the fluvioglacial sand and gravel deposits characteristic of the Allegheny and Ohio River systems. These fine sediments were deposited in the Monongahela and Youghiogheny River when Illinoian-Age glacial outwash materials clogged the Allegheny River and Ohio River valleys and impounded the flow of the Monongahela River system (Adamson et al. 1949).

1.6 MINERAL RESOURCES

Coal has been the principle mineral resource extracted from the ground within the Turtle Creek watershed. Four coal seams have been subject to deep mining and surface mining within the watershed (Dodge 1985; Skema 1988). For approximately 100 years (1850s – 1950s), the Pittsburgh Coal seam has been extensively mined where it was present within the watershed. Approximately 95% of the Pittsburgh Coal seam has been mined-out using deep mine, room-and-pillar

extraction methods (Pullman Swindell 1977). The majority of the Pittsburgh Coal in the Turtle Creek watershed has been mined from the Irwin Syncline. Smaller areas in the watershed have been subject to surface mining practices. The deep mined areas are affiliated with surface geology mapped as the Monongahela Group.

Redstone Coal and Upper Freeport Coal have also been mined in the Turtle Creek watershed. These coal seams are less prominent in areal extent within the watershed. Redstone Coal has been mined in the vicinity of Greensburg, Irwin, Monroeville, and North Versailles. It is generally positioned 70 to 100 feet above the top of the Pittsburgh Coal seam in the Monongahela Group. The Upper Freeport Coal has been mined in the headwaters of Abers Creek and Thompson Run. This coal seam is located at the top of the Allegheny Group and all extraction was completed using deep mining methods.

Other commercially valuable coal and clay seams are present in the geologic columns within the Turtle Creek watershed. Most early mining activity was not recorded and the historic record provides little or no information on the extent of deep mine activities associated with the removal of these resources. In addition to coal mineral development, numerous oil and gas extraction wells were developed within the watershed in the late 19th and early 20th Centuries. However, mostly all of these wells have been abandoned.

The locations of hazard areas, including abandoned mine areas and steep slopes are included in Figure 4 and summarized in Table A-4 of Appendix A. Many of the abandoned mine areas identified contribute significant amounts of abandoned mine drainage (AMD) into surrounding surface waters. Pollution from AMD at these locations remains a constant reminder of the watershed's history of coal mining. AMD ranks with urban runoff as the most serious threat to restoring the water quality of Turtle Creek. Additionally, several steep slopes have been identified within the watershed. Hilltop elevations generally range from 1,200 to 1,400 feet NGVD. Valley sides in these areas are generally steep (>15% slopes), with moderately sloped intermediate land (Figure 4). This is particularly evident along the lower reaches of Turtle Creek where the stream lies at the bottom of a 350-foot deep gorge near the Westinghouse Bridge (U.S. Route 30).

1.7 SOILS

Eleven native soil series have been mapped within the Turtle Creek watershed (Table A-2, Appendix A). The upland and valley wall soils of the watershed are comprised mainly of silty clays. The watershed's floodplain soils are composed of silty and gravelly sands, much of which has been covered with industrial debris.

Many Soil Series within the Turtle Creek watershed contain soil mapping units listed as Prime Agricultural Soils as well as soil mapping units listed on the Allegheny and Westmoreland County Hydric Soils List either because of major hydric components (e.g., Atkins and Brinkerton soils) or because they contain inclusions of hydric components (e.g., Weikert and Wharton soils)(Figure 6).

The Culleoka and Philo soil series comprise 22.26 square miles or 15.1 percent of the watershed area (Table A-2, Appendix A). These soils have a moderate rate of infiltration when wetted and consist mainly of moderately deep to deep, moderately well to well drained soils with a moderately fine to moderately coarse texture. The Philo series is listed as containing hydric inclusions that are comprised of Atkins silt loam. Both soil series are considered prime agricultural soils within the limits of the watershed. The erosion hazard listed for the Culleoka and Philo soil series range from slight to moderate.

The second major grouping of soils identified in the watershed consists of the Gilpin, Guernsey, Upshur, Weikert, Wharton, and Vandergrift series (Table A-2, Appendix A). This group of soils covers 80.78 square miles or 54.8 percent of the watershed. The soils have a slow rate of infiltration when thoroughly wetted and consist mainly of soils containing a layer that impedes downward movement of water with moderately fine to fine texture. The erosion hazard varies from slight to severe. Hydric inclusions have been documented in the Guernsey (wet spots), Weikert (seep spots), and Wharton (wet spots and Brinkerton) soil series. Additionally, each soil series with the exception of the Vandergrift series have been classified as prime agricultural soils within the watershed.

The Atkins, Brinkerton, and Library soil series comprise 17.54 square miles of 11.9 percent of the watershed area (Table A-2, Appendix A). These soils have a very slow rate of infiltration when wetted and consist mainly of shallow clay soils. The soils have a high swelling potential, a permanent high water table, and a claypan or clay layer at or near the surface over nearly impervious material. The erosion hazard for the soil series ranges from slight to severe. Major hydric components have been identified in the Atkins and Brinkerton soil series while the Library series is listed as having hydric inclusions. The Atkins and Library soils have also been identified as prime agricultural soils.

In addition to the native soils, the Turtle Creek watershed contains Strip Mine Soils and Urban Soils, which comprise 26.83 square miles or 18.2 percent of the watershed area (Table A-2, Appendix A). Strip Mine Soils are derived from land that has been disturbed by surface coal mining operations. The surface layer and subsoil of the original soil profile have been mixed with raw and partially weathered

rock. Urban Soils consist of materials excavated during earth moving operations. These activities have also destroyed the original soil profiles and mixed the surface layer and subsoil with raw and partially weathered rock. As a result, the characteristics of Strip Mine Soils and Urban Soils are highly variable.

1.8 WATER QUALITY

Tables B-1 and B-2 in Appendix B summarize the water quality status of Turtle Creek and its subwatersheds. Table B-3 identified the different groups that have performed water quality studies and sampling within the watershed. Two streams in the watershed, Haymaker Run and Steeles Run have a protected use of High Quality Waters-Cold Water Fishes (HQ-CWF). The rest of the watershed is classified either as Trout Stocking (TSF) or as WarmWater Fishes (WWF). The relatively rural Upper and Middle Turtle Creek and Brush Creek and all of the tributary streams to these stream segments are classified as TSF, whereas the urbanized lower Turtle Creek subwatershed and its tributaries are classified as WWF.

As a result of the pervasive extraction of the Pittsburgh Coal seam, numerous high volume, net alkaline (total alkalinity > total acidity) and net acidic (total acidity > total alkalinity) abandoned mine discharges (AMD) have evolved and contribute major pollutant loads (e.g., metals and acidity) to several streams in the Turtle Creek watershed. Depending upon the characteristics of the discharge, pollutant loads from AMD almost always results in reduced biodiversity and decreased water quality of the receiving stream. These effects have important ecological and economic repercussions considering the functions and values provided by aquatic ecosystems. For example, the high rate of pollutant loading to upper Turtle Creek by AMD is the limiting factor for stocking hatchery-reared trout in middle Turtle Creek.

AMD occurs in upper Turtle Creek from the Export, Delmont, Catranel, Ringertown, Kistler Road, and Italy Road discharges; in Lyons Run from the Heidekat North, Heidekat South, and Snyder Road West discharges; and in Brush Creek from the Irwin, Coal Run, Coal Run North, Scotch Valley, and Frog Road discharges. These discharges were identified and characterized in the 1970s during Operation Scarlift (Pullman Swindell 1977) and more recently by the Pittsburgh District of the U.S. Army Corps of Engineers (USACOE 1998a, 1998b, 1998c; Figure 4). In the three AMD reconnaissance studies conducted by the USACOE, they evaluated the five of the six major discharges in the upper Turtle Creek watershed, five major discharges in the Brush Creek watershed, and three discharges in the Lyons Run watershed. Based on their evaluation of treatment alternatives and cost

benefit analysis, the USACOE recommended remedial designs for the Delmont (i.e., Boreland Farm) discharge in the upper Turtle Creek watershed, the Irwin discharge in the Brush Creek watershed, and the north and south Heidekat discharges in the Lyons Run watershed. According to the USACOE studies, remediation of these three discharges were the most feasible to pursue and would deliver the greatest stream restoration benefit to the watersheds.

Abandoned mine discharges in other areas of the Turtle Creek watershed, such as in Thompson Run and Sawmill Run, have not been studied to the same degree. Thompson's Run and portions of the Turtle Creek mainstem have been evaluated by PADEP and are listed as impaired waters on PADEP's Section 303(d) List because of acid mine drainage, bank modifications and urban stormwater runoff. Haymaker Run, Abers Creek and Lyons Run are listed as having attained their surface water use. However, only 42 of the 315 stream miles within the watershed have been assessed by PADEP. Once the PADEP assessment is complete, then streams listed as impaired will be eligible for TMDL development and implementation of water quality improvement measures by the state.

Water quality data clearly show the effects of abandoned mine drainage on the Upper Turtle Creek subwatershed, where low pH (3.09 –6.77) and elevated acidity and dissolved aluminum and iron levels are evident (Table B-2). Elevated aluminum concentrations, which can be toxic to fish, have also been detected in the Middle Turtle Creek subwatershed and Lyons Run and in several of the smaller tributaries to the Lower Turtle Creek valley (i.e., Thompson Run and Ardmore Run). Dissolved oxygen concentrations appear to be well within the range of supporting trout and other game fish.

1.9 SPECIES AND HABITATS OF CONCERN

The PADCNR Pennsylvania Natural Diversity Inventory (PNDI), Pennsylvania Fish and Boat Commission (PAFBC), Pennsylvania Game Commission (PAGC), and U.S. Fish and Wildlife Service (USFWS) were contacted to request database searches for known records of endangered, threatened, and rare plants and animals and unique and rare habitats within the Turtle Creek watershed. The PNDI maintains a database of rare species records for the state. The PAFBC is responsible for protecting state-listed reptiles, amphibians, fish and invertebrates. The PAGC oversees state-protected birds and mammals, and the USFWS protects federally-listed plants and animals. Copies of the correspondence received from these agencies are included in Appendix C.

Table 2 lists the species of concern identified for the watershed by the above agencies and from biological inventories of Haymaker Run. The species of concern include one fish, one reptile, three insects and nine plants. The least brook lamprey and snow trillium have been found in the watershed recently. The last sighting of the Kirtland's snake was over 40 years ago and the insects and the rest of the plants have not been observed in the watershed for more than 80 years. Clearly, surveys are needed to determine the status and distributions of these and other potentially rare species in the watershed.

The Western Pennsylvania Conservancy (WPC) conducted biological inventories of natural areas in Allegheny and Westmoreland counties (WPC 1994 and 1998) and identified three areas of significant biological diversity (Biological Diversity Areas (BDAs)) within the Turtle Creek watershed. Table 3 lists the three BDAs: Simpson Run BDA and Jacks Run Valley BDA in Allegheny County and Haymaker Run BDA in Westmoreland County. All three BDAs support relatively undisturbed mixed mesophytic forest communities and the state rare snow trillium was found at the Haymaker Run BDA and the Simpson Run BDA. in Allegheny County (WPC 1994, 1998).

1.10 AQUATIC COMMUNITIES

The primary aquatic habitat in the watershed consists of perennial and intermittent streams with gravel, cobble, and sand substrates. To a lesser extent, small impoundments and excavated ponds contribute to the diversity of aquatic habitats in the watershed. Wetlands, transition areas between aquatic and terrestrial communities, provide aquatic functions within the watershed, such as habitat for aquatic organisms. Approximately 315 miles of mapped streams are present in the watershed (Table B-1). National Wetlands Inventory maps for the watershed identify only 9.8 acres of ponds and 1.7 acres of vegetated wetlands within the watershed (Figure 7 and Table B-4). This is almost certainly a gross underestimate of the actual acreage of wetlands within the watershed.

The streams provide habitat for a complex community of aquatic organisms, including: (1) algae attached to the surface of cobbles and large gravel - called periphyton; (2) bottom-dwelling aquatic insects, crustaceans, worms, and mollusks - called benthic macroinvertebrates; (3) a variety of different fish species – called the ichthyofauna; (4) aquatic and semi-aquatic reptiles (turtles, water snakes), amphibians (frogs, toads, salamanders), birds (wading birds, waterfowl), and mammals (beaver, muskrat). The most characteristic residents

TABLE 2

Species of Special Concern within the Turtle Creek Watershed

PNDI Species[1]	Pennsylvania Element Rank	Pennsylvania Protection Status	Pennsylvania Biological Survey Suggested Protection Status	Federal Protection Status	Location in Watershed Observed	Date Last Observed	Habitat Requirements
Kirtland's snake (*Clonophis kirtlandii*)	SH	PE	PE	None	Wilkinsburg, Forest Hills, and Penn Hills	1960	Snake that prefers open wet meadows, riparian areas along streams, and newly-cleared land and vacant lots in suburban areas[3].
six-banded longhorn beetle (*Dryobius sexnotatus*)	SH			None	Jeanette	19??	Beetle that employs the sugar maple (*Acer saccharum*) as a host tree[3].
brotherly clubtail (*Gomphus fraternus*)	S2S3			None		19??	Dragonfly that prefers wave-washed lake shores and turbulent areas of small to large rivers[3].
marked clubtail (*Stylurus notatus*)	SX			None	Wall	1921	Dragonfly that prefers lakes and rivers with sandy substrates[3].
tall larkspur (*Delphinium exaltatum*)	S1	PE	PE	None		1869	Herbaceous perennial that prefers rich woods on rocky slopes[4].
sunflower (*Helianthus hirsutus*)	S2	N	TU	None		1900	Herbaceous perennial that prefers shaly slopes, upland meadows, and dry roadside banks[4].
purple rocket (*Iodanthus pinnatifidus*)	S1	PE	PE	None		1891	Herbaceous perennial that prefers moist, alluvial woods and wooded slopes[4].
American gromwell (*Lithospermum latifolium*)	S3	PE	PR	None		1869	Herbaceous perennial that prefers rich, wooded, limestone slopes and hilltop woods[4].
heartleaf meehania (*Meehania cordata*)	S1	TU	PE	None		1869	Herbaceous perennial that prefers banks and wooded slopes[4].
Virginia ground-cherry (*Physalis virginiana*)	S1S2	TU	PE	None		1918	Herbaceous perennial that prefers ballast and waste ground[4].
lance-leaved sage (*Salvia reflexa*)	S2	TU	DL	None		1918	Herbaceous annual that prefers river banks, old fields, roadsides, cinders, and quarry waste[4].
showy goldenrod (*Solidago speciosa* var. *speciosa*)	SR	N	PT	None		1911	Herbaceous perennial that prefers moist meadows, rocky woods, thickets, and rocky roadside banks[4].
snow trillium (*Trillium nivale*)	S3	PR	PR	None	Haymaker Run BDA and Simpson Run BDA	1996	Herbaceous perennial that prefers rocky, wooded slopes, frequently under the eastern hemlock (*Tsuga canadensis*)[4].
Other Species[2]							
least brook lamprey (*Lampetra aepyptera*)	S3	CR	CR	None	Haymaker Run	1999	Ammocoetes (larvae) of this fish occur in pools of small, sandy or silty bottom streams. Adults inhabit clean gravel riffles and runs of high gradient streams[5].

[1]Pennsylvania Department of Conservation and Natural Resources (PADCNR). 2000. Pennsylvania Natural Diversity Inventory (PNDI) Review of Turtle Creek Watershed. Bureau of Forestry. Harrisburg, Pennsylvania.
[2]Civil & Environmental Consultants, Inc. (CEC). 1999. Unpublished Data. Pittsburgh, Pennsylvania.
[3]Genoways, H. H. and F. J. Brenner (Eds.). 1985. *Species of Special Concern in Pennsylvania*. Carnegie Museum of Natural History. Special Publication 11. Pittsburgh, Pennsylvania.
[4]Rhoads, A. F. and W. M. Klein, Jr. 1993. *The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas*. American Pilosophical Society. Philadelphia, Pennsylvania.
[5]Cooper, E. L. 1984. *Fishes of Pennsylvania and the Northeastern United States*. Pennsylvania State University Press. University Park, Pennsylvania.

LEGEND:
SX = Extirpated - Element is believed to be extirpated from the state.

SH = Historical - Element occurred historically in the state (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an Element would become SH without such a 20-

S1 = Critically Imperiled - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer occurrences or very few remaining individuals.
S2 = Imperiled - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6 to 20 occurrences or few remaining individuals.
S3 = Vulnerable - Vulnerable in the state either because rare and uncommon, or found in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences.
S#S# - Range Rank - A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the Element. Ranges cannot skip more than one rank (e.g., SU should be used rather than S1S4).
SR = Reported - Element reported in the state but without a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports.
PE = Pennsylvania Endangered - Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate.
PT = Pennsylvania Threatened - Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless that casual factors affecting the organism are abated.
PR = Pennsylvania Rare - Plant species which are uncommon within the Commonwealth.
CR = Candidate Rare - Species which exist only in one of a few restricted geographic areas or habitats within Pennsylvania, or they occur in low numbers over a relatively broad area of the Commonwealth.
DL = Delisted - Species which were once listed but are now cited for delisting.
TU = Tentatively Undetermined - A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxonomic uncertainties, limited evidence within histor
N = No current legal status exists, but is under review for future listing.

TABLE 3

Habitats of Special Concern within the Turtle Creek Watershed

Natural Heritage Area	Subwatershed location	Total Area (acres)	Area within Turtle Creek Watershed (acres)	County Significance	Significant Natural Communities	Species of Special Concern
Haymaker Run BDA[1]	Haymaker Run	306	306	High	Mesic Central Forest	snow trillium (*Trillium nivale*)
Simpson Run BDA[2]	Middle Turtle Creek	340	340	High	Mesic Central Forest	snow trillium (*Trillium nivale*)
Bullock-Pens Park OHA[2]	Thompson Run	53	53	Notable	Mesic Central Forest	
Jacks Run Valley BDA[2]	Lower Brush Creek	810	4	High	Mesic Central Forest	

[1]Western Pennsylvania Conservancy. 1998. *Westmoreland County Natural Heritage Inventory*. Pittsburgh, Pennsylvania.

[2]Western Pennsylvania Conservancy. 1994. *Allegheny County Natural Heritage Inventory*. Pittsburgh, Pennsylvania.

LEGEND:
BDA = Biologically Diverse Area.
OHA = Other Heritage Area.

High County Significance = Sites that represent vital areas of the county's biological and ecosystem resources and have not been overly disturbed by human activities. Also occasionally included are sites that have less important occurrences of state or n

Notable County Significance = Sites that harbor many of the flora, fauna, and natural community resources in the county, and although somewhat disturbed by human activities, still represent areas that provide habitat, open space, educational lands, and ge

of the streams and the ones most often studied to gage a streams health are the benthic macroinvertebrates and fish communities.

Tables C-1 through C-4 in Appendix C provide summaries of the benthic macroinvertbrates found in Turtle Creek and its tributaries during several recent water quality surveys. Performed by the U.S. Army Corps of Engineers (USACOE) and the PADEP. The greatest diversity of benthic macroinvertebrates (18 to 23 distinct types or taxa) was found in the lower reached of Lyons Run and in Haymaker Run, indicating a healthy aquatic community at these locations (Tables C-1, C-3, and C-4). In contrast, the Upper Turtle Creek Watershed and upper reaches of Lyons Run, near AMD discharges, supported fewer macroinvertebrate taxa (0 to 5 taxa). Brush Creek, Abers creek and the Middle and Lower Turtle creek subwatersheds were intermediate in the number of macroinvertebrate tax found (5 to 11 taxa). The type of macroinvertebrates also serves as an indication of a stream's quality. Haymaker Run and the downstream extent of Lyons Runs were home to stoneflies, mayflies, crustaceans, and aquatic beetles, which are indicator of good water quality and habitat conditions. Streams segments and subwatersheds more heavily impacted by AMD, such as those near the Export, Delmont, Irwin, and Heidekat discharges, or by urban runoff were dominated by more pollution tolerant macroinvertebrates, such as chironomids (midges), blackfly larvae, oligochaetes (aquatic worms), and hydropsychid caddisflies.

Fish community surveys on streams within the watershed were performed on different occasions by the USACOE, the PAFBC, and by volunteer biologists from CEC, the USACOE and other consulting firms. The results of these surveys are presented in Tables C-5 through C-7. The fish survey results mirror those of the macroinvertebrate studies. Few fish species were found in stream reaches near the Export AMD discharge (Table C-6) compared with Haymaker Run, Abers Creek and the Middle Turtle Creek mainstem. One of the most interesting findings from the fish surveys, was confirmation of an earlier discovery of a population of the rare least brook lamprey (*Lampetra aepytera*) in Haymaker Run. The least brook lamprey is state listed as a candidate rare (CR) species by the PAFBC and is classified as a pollution intolerant species. The habitat requirements of the least brook lamprey consist of pools of small, sandy or silty bottom streams for the ammocoetes (larvae) and clean gravel riffles and runs of high gradient streams for adults (Cooper 1983). Haymaker Run also supports a population of the pollution intolerant redside dace (*Clinostomus elongatus*), an uncommon species in the watershed. The presence of the least brook lamprey and redside dace further confirm the good water quality and habitat conditions in Haymaker Run.

1.11 PLANT COMMUNITIES

1.11.1 Natural Plant Communities in the Turtle Creek Watershed

A "plant community" is a term used by ecologists to describe an assemblage of plants that live in a given environment, interacting with each other, and with animals, fungi, bacteria, and physical forces to form a distinctive living system (Whittaker 1975). Ecologists use a variety of characteristics to classify plant communities, including the form and structure of the plants (i.e., trees, shrubs, herbs, etc.), the species composition and distribution of the plants, and the physical environment, such as landscape location (i.e., ridge-top, valley slope, floodplain, etc.), soil type, hydrology (i.e., terrestrial, wetland, aquatic), and degree of natural or human disturbance. While the classification of complex natural systems into discrete categories is an artificial process (Fike 1999), the identification and classification of plant communities is useful because it allows us to better manage and conserve forests, wildlife habitat, rare species, and natural resources within the watershed, while maintaining necessary economic development activities.

The plant communities in the Turtle Creek watershed include both those shaped primarily by natural forces and those modified by human activities. This brief narrative describes the plant communities and common, rare, and invasive plant species that do, *or may,* occur within the Turtle Creek watershed area. The emphasis on "*or may*" reflects the lack of detailed information on the distribution and extent of plant communities and plant species in the Turtle Creek watershed. Development of the GIS database as part of this RCP will greatly facilitate future work to develop a detailed inventory and map of plant communities within the watershed.

Plant community classification systems range from simplified general schemes to complex detailed systems. PADCNR has prepared a descriptive classification system for the natural plant community types found in Pennsylvania (Fike 1999). PADCNR's classification system broadly separates plant communities by hydrology into terrestrial (non-wetland) and palustrine (wetland) communities. It further subdivides these two categories according to the form and structure of the plants comprising the community into forest, woodland, shrublands, and herbaceous communities. Finally, individual plant communities are described based on the dominant plant species comprising the community. This classification does not include plant community types that have undergone extensive modification by humans.

Table C-8 (Appendix C) lists the PADCNR natural plant communities known to occur within the Pittsburgh Low Plateau Section ecological region, which contains the Turtle Creek watershed. Table C-8 lists 26 terrestrial and 27 palustrine communities, generally grouped into forest, shrub, and herbaceous categories. Native plant species commonly encountered in the Turtle Creek area are listed in Table C-9 (Appendix C).

Terrestrial forest community types range from mixed coniferous-hardwood communities to hardwood-dominated communities and include some fairly common plant associations (e.g., hemlock-northern hardwood forest, mixed mesophytic forest, black locust forest) and some rare forest types (e.g., pitch pine-dominated communities, scrub oak and heath-type forests and woodlands, and yellow oak-redbud woodlands). Dominant tree species in the natural terrestrial forest communities include pitch pine (*Pinus rigida*), white pine (*Pinus strobus*), hemlock (*Tsuga canadensis*), white oak (*Quercus alba*), northern red oak (*Q. rubra*), sugar maple (*Acer saccharum*), red maple (*A. rubrum*), yellow poplar or tuliptree (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), American beech (*Fagus grandifolia*), and black locust (*Robinia pseudoacacia*). Palustrine or wetland forest types potentially occurring within the watershed include a hemlock-dominated community type and several hardwood-dominated community types. These natural wetland forest communities are dominated by red maple, sycamore (*Platanus occidentalis*), box elder (*A. negundo*), silver maple (*A. saccharinum*), swamp white oak (*Q. bicolor*), black willow (*Salix nigra*), and elms (*Ulmus rubra, U. americana*). The sycamore-box elder, silver maple, and red maple-elm-willow floodplain forest types are found along Turtle Creek and its tributaries and represent the most common palustrine forest communities in the watershed.

During the 1990s, the Western Pennsylvania Conservancy (WPC) conducted biological inventories of natural areas in Allegheny and Westmoreland counties (WPC 1994 and 1998). They identified areas of significant biological diversity, termed Biological Diversity Areas (BDAs). Three BDAs were noted within the Turtle Creek watershed, including Simpson Run BDA and Jacks Run Valley BDA in Allegheny County and Haymaker Run BDA in Westmoreland County (Figure 7). WPC reports that all three BDAs support relatively undisturbed mixed mesophytic forest communities, with mature stands of white oak, sugar maple, red oak, American beech, yellow poplar, and black cherry.

The natural terrestrial shrub communities identified by PADCNR for the Pittsburgh Low Plateau Section are relatively uncommon in the Turtle Creek watershed area. These include red cedar-red bud communities and low heath and scrub oak shrublands. A low heath community consists of low-growing ericaceous

shrubs, including blueberries (*Vaccinium angustifolium, V. pallidum*), huckleberry (*Gaylussacia baccata*), sheep laurel (*Kalmia angustifolia*), and black chokeberry (*Aronia melanocarpa*; Fike 1999). Scrub oak shrublands have similar plant species as low heaths, but are dominated by scrub oak (*Quercus ilicifolia*). Palustrine shrub communities that may occur in the watershed include buttonbush (*Cephalanthus occidentalis*), smooth alder (*Alnus serrulata*), ninebark (*Physocarpus opulifolius*), highbush blueberry (*Vaccinium corymbosum*), meadow-sweet (*Spirea alba*), and black willow dominated wetlands. The black willow scrub-shrub community is the most common wetland shrub association in the watershed, and typically has black willow, silky dogwood (*Cornus amomum*), and northern arrowwood (*Viburnum recognitum*) as the dominant shrub species.

Naturally-occurring terrestrial herbaceous communities are rare, consisting of relict prairie communities or associated with rocky soils (i.e., serpentine, calcareous and sandstone outcrops, etc.), where thin soil or other conditions prevent or limit colonization by woody plants. The two community types reported for the Pittsburgh Plateau Low Plateau Section are the little bluestem-Pennsylvania sedge opening and calcareous cliff opening. Palustrine herbaceous communities are more varied and common in the watershed area. PADCNR identify fifteen herbaceous wetland community types in the ecoregion. Common community types in the watershed include bluejoint-reed canary grass marsh, cattail marsh, mixed forb marsh, wet meadow, bulrush marsh, skunk cabbage-golden saxifrage forest seep, and water willow-smartweed river bed community. These wetland types are dominated by grasses, sedges, rushes, and other herbaceous plants, including common cattail (*Typha latifolia*), rice cutgrass (*Leersia oryzoides*), reed canary grass (*Phalaris arundinacea*), bulrushes (*Scirpus validus, S. cyperinus, S. atrovirens*), carex sedges (*Carex crinita, C. lurida, C. scoparia, C. stipata, C. vulpinoidea*), manna grasses (*Glyceria striata, G. grandis*), skunk cabbage (*Symplocarpus foetidus*), and jewelweeds (*Impatiens capensis, I. pallida*).

1.11.2 Rare Plants

The PADCNR Pennsylvania Natural Diversity Inventory (PNDI) maintains a database of rare species records for the state. A PNDI review of the Turtle Creek watershed (Table 2) and the PNDI rare species lists for Allegheny and Westmoreland counties were consulted to identify rare plant species potentially occurring in the Turtle Creek watershed area (PADCNR 2000a, 2000b, 2000c). Table C-10 (Appendix C) lists the rare plant species included on the county lists. The list includes 38 plant species, of which 10 are state-listed as endangered, nine as threatened, seven as rare, one as extirpated, and nine as tentatively undetermined. Two species have no current legal state status. None of the plants

listed in Table C-10 are federally designated as endangered, threatened, or candidate species under the Endangered Species Act.

Nine of the rare plants listed in Table C-10 are known to occur or have occurred in the watershed from current and historical records. These plants include tall larkspur (*Delphinium exaltatum*), a sunflower species (*Helianthus hirsutus*), purple rocket (*Iodanthus pinnatifidus*), American gromwell (*Lithospermum latifolium*), heartleaf meehania (*Meehania cordata*), Virginia ground-cherry (*Physalis virginiana*), lance-leaved sage (*Salvia reflexa*), showy goldenrod (*Solidago speciosa* var. *speciosa*), and snow trillium (*Trillium nivale*; PADCNR 2000a; Table 2). The WPC found populations of snow trillium in two BDAs in the Turtle Creek watershed, the Haymaker Run BDA in Westmoreland County and the Simpson Run BDA in Allegheny County (WPC 1994, 1998). However, comprehensive surveys of the watershed's flora and fauna have not been performed, and our current understanding of the distribution of rare plants and animals is incomplete.

1.11.3 Non-Native Plant Communities and Invasive Plants

Human alterations and introduction of non-native plants to the natural landscape have resulted in radical changes to the composition of plant communities in the Turtle Creek watershed. Rhoads (2000) estimates that 37 percent of the plant species in Pennsylvania are not native to the state. Large-scale removal of native vegetation for urban, industrial, and agricultural land uses and the introduction of non-native vegetation for landscaping and farming have promoted the spread of many non-native invasive plant species into undeveloped areas and natural plant communities. Some of these invasive plants are so aggressive that they have almost totally replaced our native flora in some locations, forming single species stands or monocultures (e.g., Japanese knotweed (*Polygonum cuspidatum*)). The spread of non-native invasive plants is undesirable because they replace native vegetation, grow in monocultures and thus reduce biodiversity, provide poor habitat for wildlife, and, in some cases, can pose health threats to humans, domestic animals and wildlife (e.g., the recent appearance and spread of the toxic giant hogweed (*Heracleum mantegazzianum*) in western Pennsylvania, including Westmoreland County).

Invasive plants have several characteristics that enable them to invade and replace natural native flora. Most are non-native or exotic (i.e., introduced from another geographic region or country) and thus are freed from the natural population controls from their place of origin, including climate controls, disease-causing pathogens, animal grazers, and competition from other vegetation. They typically grow and mature very quickly, can spread by roots and shoots, produce high

numbers of seed that spread and germinate easily, can grow under a wide range of soil and moisture conditions, and readily colonize disturbed areas (Gresham et al. 1998). There is evidence that some of these invasive plants are alleopathic, meaning they release chemical compounds to the soil that inhibit the growth of other plant species (Rice 1984).

Once established, invasive plants are extremely difficult to control and eradicate because of these characteristics. Control measures such as digging, cutting, burning, and herbicide application are labor intensive and often require repeated treatments to successfully significantly reduce or eliminate the invasive species. Follow-up plantings with native species may also be needed to prevent the re-establishment of invasives (Gresham et al. 1998; Rhoads 2000).

Like many urban watersheds in the Pittsburgh region, the plant communities in the Turtle Creek watershed have been adversely affected by the widespread invasion of non-native plant species (PADCNR 2000). Table C-11 (Appendix C) lists exotic and invasive plant species established in the watershed. The most serious threats to native plant species comprising the watershed's natural plant communities are posed by several of these invasive plants.

The following plants appear to pose the biggest threats to terrestrial plant communities. Tree-of-heaven (*Ailanthus altissima*) is a quick-growing tree introduced from Asia that readily establishes in early-successional forests and openings in mature forests. Once established, it spreads rapidly by wind-dispersed seed and becomes a dominant tree species. Tree-of-heaven is often a co-dominant with black locust in the black locust forest community type. Two non-native shrub honeysuckles, Morrow's honeysuckle and tartarian honeysuckle, are spreading at an alarming rate and becoming the dominant understory plant in terrestrial forests and a dominant plant in terrestrial shrublands. These shrubs were originally introduced as horticultural plantings, but birds readily spread their seeds. Other problem shrubs, such as multiflora rose (*Rosa multiflora*), autumn olive (*Elaeagnus umbellata*), and Russian olive (*Elaeagnus angustifolia*), were introduced as conservation plantings by the U. S. Department of Agriculture, Soil Conservation Service and state wildlife agencies and have also been widely dispersed by birds. Japanese knotweed and garlic mustard (*Alliaria petiolata*) are herbaceous plants introduced from Japan and Europe, respectively, that now constitutes the dominant ground cover plant in many terrestrial forests in the watershed. Japanese knotweed is widely established along the banks and disturbed riparian areas along Turtle Creek and its tributary streams, where it forms dense, almost-impenetrable thickets.

In wetland plant communities, five plant species standout as invasive threats. These include the common reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), narrow-leaf cattail (*Typha angustifolia*), and hybrid cattail (*Typha glauca*). All of these species are highly aggressive and tend to replace diverse wetland plant communities with a dense monoculture. Reed canary grass is reported to be a native species in Pennsylvania (Rhoads and Klein 1993). However, varieties introduced for agricultural wet meadow hay production and waterway stabilization spread rapidly and readily out-competes other native wetland herbs and forbs. While these species often colonize wetlands where soils and/or vegetation have been disturbed, they are also apparently capable of invading undisturbed wetlands by seed dispersal.

1.12 WILDLIFE

The Turtle Creek watershed is host to a wide variety of mammals, birds, reptiles, and amphibians. Most of the suitable habitats for terrestrial wildlife exist within undeveloped, forested areas within the watershed. As areas in the Turtle Creek watershed become increasingly urbanized, wildlife species and their habitat become progressively more displaced by humans. Therefore, it is imperative to understand the relationships between the urban environment and wildlife species, such that appropriate recommendations can be made to homeowners, planners, and developers concerning wildlife conservation issues.

Mammal species that may be found within the Turtle Creek watershed include a marsupial (the Virginia opossum, *Didelphis virginiana virginiana*), insectivores (e.g., shrews and moles), chiopterans (e.g., bats), lagomorphs (e.g., rabbits), rodents (e.g., squirrels, voles, mice, and the woodchuck, *Marmota monax monax*), omnivores such as the raccoon (*Procyon lotor*) and striped skunk (*Mephitis mephitis*) carnivores (e.g., foxes, weasels, and the coyote, *Canis latrans latrans*), and an artiodactyl (the white-tailed deer, *Odocoileus virginianus borealis*; Table C-12 in Appendix C).

Numerous bird species can be found within the Turtle Creek watershed. Most of these species, including common inhabitants of the watershed as well as migrants, have been observed in undeveloped areas of the watershed including Duff Park in Murrysville, William D. Boyce Regional Park in Monroeville, and Bushy Run Battlefield State Park in Penn Township (Tables C-13 in Appendix C). Some common bird species that have been observed within the Turtle Creek watershed include wading birds (e.g., great blue heron, *Ardea herodius*), migratory waterfowl (Canada goose, *Branta canadensis*), raptors (e.g., red-tailed hawk, *Buteo jamaicensis*), gamebirds (e.g., wild turkey, *Meleagris gallopavo*), woodpeckers (e.g.,

pileated woodpecker, *Dryocopus pileatus*), plovers (e.g., killdeer, *Charadrius vociferus*), and songbirds (e.g., cedar waxwing, *Bombycilla cedrorum*) (Brauning 1992).

For many reasons, reptiles and amphibians have not received as much attention as other species of wildlife. Fortunately, this trend is changing in Pennsylvania, mostly because of the Pennsylvania Herpetological Atlas Project (PHAP). Directed by Dr. Art Hulse of the Biology Department at Indiana University of Pennsylvania, PHAP is comprised of many volunteers who perform herpetological surveys throughout Pennsylvania. Many common reptile species have been documented in the Turtle Creek watershed by PHAP volunteers, including the common snapping turtle (*Chelydra serpentina serpentina*), the eastern box turtle *(Terrapene carolina carolina*), the black rat snake (*Elaphe obsoleta obsoleta*), and three species of *Thamnophis*: (1) the shorthead garter snake (*Thamnophis brachystoma*); (2) the eastern ribbon snake (*Thamnophis sauritis sauritis*); and (3) the eastern garter snake (*Thamnophis sirtalis sirtalis*; Table C-14 in Appendix C). Common amphibian species documented by PHAP volunteers in the Turtle Creek watershed include the northern two-lined salamander (*Eurycea bislineata bislineata*), the eastern American toad (*Bufo americanus americanus*), and the northern green frog (*Rana clamitans melanota*; Table C-15 in Appendix C).

Contemporary research has documented the decline of many reptile and amphibian populations in Pennsylvania, primarily because of environmental degradation and habitat loss. Accordingly, herpetofauna can be specific bioindicators of environmental perturbation. For example, the decline of many salamander populations in Pennsylvania has been attributed to acid deposition. In the Turtle Creek watershed, the loss of the Kirtland's snake (*Clonophis kirtlandii*) is most probably because of habitat degradation. Listed as a species of special concern, the Kirtland's snake has a protection status of Pennsylvania Endangered (PADCNR 2000). This small, elusive snake has not been observed in the Turtle Creek watershed since the mid-1960s (PAFBC 2000). In Pennsylvania, mostly all of the historic records for this species have occurred within the Turtle Creek watershed (Genoways and Brenner 1985). It highly probable that the Kirtland's snake no longer exists within the Turtle Creek watershed (PAFBC 2000), and may likely be extirpated from Pennsylvania.

Wildlife habitats in a watershed are always changing because of land developments, floods, and other occurrences. Species of wildlife that adjust easily to a variety of habitats are called habitat generalists (e.g., white-tailed deer). Generalist species in urban areas adapt to living near humans and to utilizing artificial habitats.

Conditions or characteristics that enable many wildlife species to live in an urban watershed include cover, nocturnal behavior, and diet.

Many areas in urban watersheds offer suitable habitat for wildlife. Parks, greenspaces, and backyards are places where wildlife species often find cover. Some wildlife species take advantage of man-made structures, while others adapt to the existing ecosystems in urban areas. Typical characteristics of urban watersheds that influence wildlife habitats include the following:

Habitat Fragmentation

Habitat fragmentation occurs when streets and highways, shopping centers, and other large-scale developments are built. The change in land use breaks up large habitat areas into many small ones, which influences the composition and abundance of wildlife species that can live in these smaller habitats. Fragmentation creates more edge habitats along the edges of a forest but also decreases the forest's interior habitats. Such fragmentation benefits species that thrive on habitat edges (e.g., white-tailed deer) but is detrimental to wildlife species that live in interior habitats (e.g., wood turtle, *Clemmys insculpta*).

Greenways

Greenways connect nature preserves, parks, and other greenspaces in an urban watershed that wildlife species (e.g., migratory birds and mammals) utilize to move from one location to another. Natural greenways in a watershed usually exist along stream valleys and are very valuable for wildlife. Greenways also exist along man-made structures such as railroads and utility right-of-ways. However, greenways need to be wide enough to provide adequate food, water, and cover for some wildlife species. Unfortunately, land developments can disrupt greenways (e.g., when a migration route is interrupted by an interstate highway).

Disturbed Soil and Plant Communities

Most of the soil in an urban environment has been disturbed by land development practices such as grading and paving. These activities can change soil conditions, influencing the plant species that can grow there, ultimately influencing the wildlife habitat at these disturbed sites. Changes in wildlife habitat may occur when: (1) forests are cleared during land development; (2) native vegetation is removed, mixed, or replaced with exotic or undesirable species (which may impact the density and diversity of the vegetation); and (3) drainage patterns and soil conditions are changed.

Poor Water Quality
Various point and nonpoint source pollutants found in urban streams are detrimental to aquatic wildlife (e.g., benthic macroinvertebrates, fish, and amphibians). Also, the increased amount of impervious cover (e.g., roads and parking lots) found in urbanized watersheds increases stormwater runoff that may increase sedimentation and change nutrient levels in the receiving stream.

Noise Pollution
Loud noises in urban areas, such as mass transit systems, automobiles, and airplanes, can disturb wildlife. However, some wildlife species can adapt to these noises.

Human-made Structures
The urban environment is full of man-made structures used by wildlife (e.g., buildings, bridges, highway overpasses and underpasses, culverts, radio towers, utility lines, and light fixtures). These structures may provide cover and a place to reproduce for many wildlife species (e.g., some birds that nest on the roofs of buildings and amphibians that survive in artificial impoundments). Some structures (e.g., utility lines and locations near highways) can also be dangerous for wildlife species.

1.13 LAND USE

Existing land use in the Turtle Creek watershed was determined from GIS databases obtained from the Allegheny County Health Department (ACHD) and the Southwestern Pennsylvania Commission (SPC). Land use categories identified for the watershed include residential/urban, industrial/ transportation, mines/barren areas, transitional, forested/herbaceous, and agricultural planted/cultivated (Figure 8).

Several land use patterns are evident within the Turtle Creek watershed. In the Allegheny County portion of the watershed, residential/urban land is concentrated in the eastern suburbs of Pittsburgh (e.g., Penn Hills, Churchill, Wilkinsburg, Forest Hills, and North Braddock) or along transportation corridors in the outlying suburbs (e.g., S.R. 286 in Plum Borough and U.S. Route 30 in North Versailles). Commercial and industrial land use is concentrated along the transportation corridors (U.S. Route 22 in Monroeville and Wilkins Township and U.S. Route 30 in North Versailles, East McKeesport, and Forest Hills) or within the level floodplain of the lower Turtle Creek valley (e.g., Turtle Creek, Wilmerding, Wall, and Pitcairn), which was the former site of several Westinghouse Electric Corporation facilities. Greenspace in the Allegheny County portion of the watershed is found on

steep slopes of hillsides and increases in percent land cover to the east in North Versailles, Monroeville, and Plum. Approximately 1.4 percent of the Allegheny County portion of the watershed consists of publicly owned land, most of which is located in the William D. Boyce Regional Park.

In the Westmoreland County portion of the Turtle Creek watershed, the population centers are focused along U.S. Route 22 in Murrysville, S.R. 130 in Penn Township, and along U.S. Route 30 in the established communities of Irwin and Jeannette. Agricultural land use is common in Murrysville and the townships of Penn, North Huntingdon and Hempfield. Commercial and industrial land use in Westmoreland County is concentrated along U.S. Route 22 in Murrysville, S.R. 130 and S.R. 993 in Trafford Borough and Penn Township and along U.S. Route 30 in North Huntingdon Township, Irwin, and Jeannette. Greenspace in the Westmoreland County portion of the watershed is found on steep slopes of hillsides and increases in percent land cover to the west in North Huntingdon Township, Penn Township, and Murrysville. Approximately 1.9 percent of the Westmoreland County portion of the watershed consists of publicly owned land.

Impervious surfaces were modeled from the land use data, and mirror the concentration patterns in residential/urban and industrial/transportation land uses (Figure 9). Tabulations of land use and impervious cover areas and percentages for each subwatershed are presented in Tables A-4 and A-5, respectively (Appendix A).

1.14 LOCAL GOVERNMENT

Thirty-three municipalities occur entirely or partially within the Turtle Creek watershed boundary, including two cities, eight townships, and 23 boroughs (Figure 2). The municipality of Murrysville comprises the largest area of the Turtle Creek watershed, at 21.48 percent (Table E-1, Appendix E). Salem Township, the City of Greensburg, and Washington Township only comprise 0.19, 0.05, and 0.01 percent of the watershed area, respectively.

Local governments hold the key to water resource protection through land use and zoning regulations and land development ordinances and standards that include natural resource protection provisions for streams, riparian buffers, wetlands, forests, and recreational access and opportunities. Land use regulations in the form of municipal zoning ordinances, subdivision/land development ordinances, and comprehensive plans, however, vary between the municipalities in the watershed (Figure 10). Salem Township and Adamsburg Borough are the only two communities without any land use regulations; however, Adamsburg observes Westmoreland County Ordinances (Table E-2, Appendix E). Twenty-seven of the municipalities in the watershed have incorporated some type of erosion and

sedimentation control and stormwater management provisions in their ordinances (Table E-2). Twenty municipalities have even established floodplain management provisions. However, the extent and precision of these controls vary. Only three municipalities have adopted stream protection provisions and two have ordinances that protect wetlands (Table E).

1.15 SOCIOECONOMIC CHARACTERISTICS

Recent census data reports an estimated total population of approximately 188,000 residents within the 33 communities of the Turtle Creek watershed (Table E-1 and Figure 11). Population densities range from highs of 9,582 people per square mile in Wilkinsburg and 8,757 people per square mile in Manor Borough to lows of 136 people per square mile in Salem Township and 218 people per square mile in Washington Township (Table E-1).

U. S. Census Bureau data model-based income and poverty estimates were obtained for Allegheny (Census Bureau 2000a) and Westmoreland Counties (Census Bureau 2000b). This countywide data provides a general view of economic conditions in the region and can be extrapolated for communities of the Turtle Creek watershed. Median annual household income is reportedly $35,733 in Allegheny County. The poverty rate is estimated at 11.0 percent and is 18.3 percent for children under 18 years old. Corresponding numbers reported for Westmoreland County are a median annual household income of $32,189, a poverty rate of 10.6 percent, and a childhood poverty rate of 15.7 percent.

Major sources of employment along the western and southern portions of the watershed consist of light industrial, health care, professional, and commercial businesses. The northern and eastern portions of the watershed consist primarily of commercial and professional businesses with some light industrial sources of employment also offered.

1.16 CULTURAL RESOURCES

From Bushy Run Battlefield in Penn Township to KDKA Radio's original studio in Turtle Creek, the Turtle Creek watershed boasts countless sites of cultural, historical, and economic significance. The area could be considered a snapshot of the vast historical and technological changes that have shaped the culture of the industrial northeastern United States. Seventy-three known sites of historic or archaeological importance are recorded within the watershed, based on records maintained by the Pennsylvania Historical and Museum Commission. Table D-3

lists these sites and identifies their significance, ownership (i.e., public or private) and condition.

Among the many cultural resources of the Turtle Creek watershed, five important economic or historical themes emerge. In approximately chronological order, the themes are as follows:

- Prehistoric Native Americans
- Western Pennsylvania frontier
- Coal mining, gas wells, and the glass industry
- Pennsylvania Railroad and the steel industry
- George Westinghouse and the Westinghouse Electric Corporation

1.16.1 Prehistoric Native Americans

Native American influences have important, though sometimes less well known, influences on the cultural resources of the Turtle Creek watershed. Some prehistoric sites in the Turtle Creek watershed date to at least 10,000 years ago (the Paleo Indian period). More than 200 prehistoric archaeological sites are located within the Turtle Creek watershed. The sites include large villages, farmsteads, and campsites associated with the Monongahela Native American people. The Monogahelas had a farming culture, raising corn, beans, and squash on the watershed's terraces and upland environments. In the early 1600s, the Monogahela people left the area as the Iroquois displaced them in their search for new hunting territories. Turtle Creek was originally named the Turtle River, or *Tulpewisipu,* after the Turtle Clan of the Delaware Indians, who occupied the region in the early 1700s, after the Europeans took over their lands along the Eastern Seaboard.

1.16.2 Western Pennsylvania Frontier

The first recorded white settler at the mouth of the Turtle Creek was John Frazier, a trader who built a landmark trading post there, when the French still claimed the region. George Washington visited Frazier several times at his trading post and traveled through the watershed. At the confluence of Turtle Creek and the Monongahela River was the internationally famous site of General George Braddock's defeat. At this site, on July 9, 1755, the British army, under General Braddock, suffered an ignominious defeat at the hands of the French and Delaware Indians.

The opening of Western Pennsylvania to European settlement hinged on the decisive British victory over the Native Americans at Bushy Run Battlefield, in

Penn Township, in August 1763. The Bushy Run Battlefield, a National Historical Landmark, offers visitors guided and self-guided tours and other educational programs, as well as a yearly reenactment of the military encounter every August.

1.16.3 Coal Mining, Gas Wells, and the Glass Industry

The Turtle Creek watershed boasts a number of firsts in the coal mining, gas, and glass industries. In the area now known as Murrysville, for example, Obediah Haymaker drilled the first gas well in the United States, in 1878. When the drillers first hit the gas, a great explosion sent flames 100 feet into the air.

The town of Export, in the upper Turtle Creek region, had its roots as a coalmine town in 1892. By 1904, the two drift-entry mines (Export No. 1 and Export No. 2) extracted the most coal of any mine in the world—almost three-quarter million tons of bituminous coal. The mines relinquished their last chunks of coal in 1952, when the sites were closed for good.

A few miles from the Export mines, the Adams Mine in Hahntown, Westmoreland County, was a significant player in the great strike of 1911. When the Penn Gas Coal Company hired strikebreakers to thwart the strike, they housed the "scabs" on quickly constructed houses on Adams Hill. To this day, nearly a century later, the locals refer to the hill as "Scab Hill."

Nicknamed "The Glass City," the city of Jeannette, also in the Turtle Creek watershed, was founded on the glass industry. Because of the town's nearness to coal beds and gas wells, whose cheap supply of fuel is necessary for the production of glass, the city became the largest window-glass plant in the world by the late nineteenth century. Reminders of the industry's halcyon days remain in the city's historic district.

1.16.4 Pennsylvania Railroad and the Steel Industry

Few of the area's industries do not testify to the importance of the railroad in the economic development of the watershed. When the Pennsylvania Railroad traveled up the watershed in 1852, it provided transportation for the area's rich coal and other natural resources. The railroad later opened up the area for the growth of the steel industry, such as the Edgar Thompson Steel Works. On the boundary of the Turtle Creek watershed, Edgar Thompson was an economic giant of the area until the demise of the steel industry in the 1980s.

Numerous towns grew as the Pennsylvania Railroad grew. Port Perry, at the mouth of the Turtle Creek, served as a busy railroad transit center for the coal industry. The town of Pitcairn, famous for its large railroad yards, was named after Robert Pitcairn of the Pennsylvania Railroad. The town boasts several building eligible for the National Register of Historic Places. Wall is another town that grew up as railroad center.

1.16.5 George Westinghouse and the Westinghouse Electric Corporation

The most significant person in the transformation of the watershed into a major industrial force, George Westinghouse left a legacy to the Turtle Creek watershed. With his invention of the air brake in the late 1800s, Westinghouse laid the foundation for Westinghouse Air Brake Corporation. Located in Turtle Creek, WABCO employed thousands of workers during its heyday. Also in the late 1880s, George Westinghouse perfected large-scale methods of generating and transmitting electricity and founded Westinghouse Electric and Manufacturing Company, with headquarters in the watershed. By 1930, the company had 20,000 employees in the area.

The communities of the watershed enjoy several cultural attractions related to George Westinghouse. Turtle Creek is home to the KDKA Studio, famous for producing the world's first commercial radio broadcast. The George Westinghouse Memorial Bridge, near the mouth of Turtle Creek, is listed on the National Register of Historic Places. Wilmerding, a Westinghouse company town, is the site of the George Westinghouse Museum, a unique museum dedicated to the man and the industry he spawned.

1.17 RECREATION

One of the most popular recreational activities within the Turtle Creek watershed involves the angling opportunity provided by a put-and-take trout fishery on the main stem of middle Turtle Creek between the mouths of Abers Creek downstream to the mouth of Brush Creek. The TCWA has been responsible for stocking approximately 800 hatchery-reared trout in 1999 and again in 2000 in this section of middle Turtle Creek. However, in prior years, this section was a Pennsylvania Approved Trout Water (ATW) that was stocked annually by the Pennsylvania Fish and Boat Commission (PAFBC).

The PAFBC first stocked Turtle Creek with hatchery-reared trout in 1984. However, on April 13, 1989, a major fish kill occurred in the ATW section. The kill involved approximately 3,200 hatchery-reared brown trout (*Salmo trutta*), and

rainbow trout (*Oncorhynchus mykiss*), which the PAFBC had previously stocked a day earlier, and some 2,500 forage fish (PAFBC 1989). Subsequent investigations conducted by the PAFBC and the Pennsylvania Department of Environmental Resources (Stutzman 1989) found severe pH depression (pH = 4.6) in middle Turtle Creek. Dead fish examined in the field were found to have an excessive amount of mucous covering their gills, indicating mortality most likely because of acute acid/aluminum toxicity. A severe drought that had occurred in 1988 and 1989 coupled with a larger than normal acid minewater input to upper Turtle Creek was determined to be the reason for the sever pH depression and the subsequent fish kill (PAFBC 1989; Stutzman 1989). Because of improvements in water quality, Turtle Creek was stocked with trout by the PAFBC again in 1991. However, in 1993, Turtle Creek was officially taken off the Pennsylvania's stocking list by the PAFBC until water quality improvement projects could be implemented.

Additional angling opportunities that exist within the Turtle Creek watershed including the following:

- Lower Turtle Creek: Monongahela River species such as smallmouth bass, *Micropterus dolomieui*, and walleye, *Stizostedion vitreum*, have been caught as far upstream as Trafford.

- B-Y Pond: This Trafford park is the site of the TCWA's annual Funday, and many species of gamefish have been stocked by the TCWA and local sportsmen's organizations.

- Haymaker Run: SLAM (Sportsmen and Landowner Alliance of Murrysville) annually stocks hatchery-reared trout in Haymaker Run to provide angling opportunities for children. Interestingly, many trout in Haymaker Run migrate downstream into middle Turtle Creek.

- Upper Brush Creek: Manor Borough's Recreation Department annually stocks hatchery-reared trout in upper Brush Creek near Manor Park.

Numerous parks are located within the Turtle Creek watershed (Figure 12 and Table 4). These include a state park, Bushy Run Battlefield State Park in Penn Township, a county park, William D. Boyce Regional Park in Plum Borough and Monroeville, and numerous municipal parks (see also Tables D-1 and D-2, Appendix D). Municipalities typically provide and maintain neighborhood and community parks. The municipalities of Murrysville and Monroeville appear to provide most of the municipal parks within the Turtle Creek watershed, many of which offer a wide range of recreational features.

Several existing and proposed trails are located within the Turtle Creek watershed area (Figure 12). Most existing trails are located within park boundaries (e.g., Duff Park Trail located in Duff Park, Murrysville, Bear Hollow Trail in Murrysville, the Edge Hill Trail located in Bushy Run Battlefield State Park (Appendix D), and the Outer Trail located in William D. Boyce Regional Park (Appendix D)). The Westmoreland County Bureau of Parks has recently received PADCNR funding to conduct a feasibility study for the planned Saltsburg to Export to Trafford Rail Trail (Figure 12). This 17-mile proposed rail trail corridor would connect the Beaver Run Reservoir Greenway to the Conemaugh River Greenway Trail System. Other trails proposed by the Westmoreland County Bureau of Parks include the Tinkers Run Trail and the Manor to Claridge Trail (Figure 12). In Allegheny County, the proposed Monroeville Bikeway and Forbes Trail (Trafford to the Monongahela River) are under study (Figure 12).

1.18 INFRASTRUCTURE

Major transportation routes shown on Figure 12. The watershed is served by Interstate Highway I-76/I-376, U.S. Routes 22 and 30, and State Routes 66, 130, 286, and 993. A mainline of the CSX Railroad Runs along Brush Creek and the Lower Turtle Creek subwatershed, including an intermodal facility near Wall and Pitcairn. Industry along the Upper Turtle Creek subwatershed are serviced by the Turtle Creek Railroad.

Eight municipal authorities provide public water service to residents of the watershed (Figure 13; Table F-1 in Appendix F). These public water suppliers serve sixty-one percent of the entire watershed (approximately 90 square miles). The largest service area is provided by the Municipal Authority of Westmoreland County (58.7 square miles), followed by the Wilkinson-Penn Joint Water Authority (17.3 square miles) in the Allegheny County portion of the watershed. Service to subwatersheds follows predictable patterns with the most urbanized subwatersheds having almost 100% service area coverage (i.e., Sawmill Run and Ardmore Run) and one of the most rural subwatersheds, Steel's Run, with only 12% coverage (Table F-1).

Approximately fifty-five percent of the watershed (approximately 81 square miles) falls within ten designated public sewer service areas, operated by eight

TABLE 4

Parklands within the Turtle Creek Watershed

Map ReferenceNo.[1]	Park	Size (Acres)
1	Forest Hills Park	15.2
2	(Park along Dirty Camp Run)	32.5
3	Bullock-Pens Park	24.0
4	William D. Boyce Regional Park	1071.2
5	Alpin Park	37.0
6	Heritage Park	52.0
7	Beechwood Park	49.0
8	Kelvington Park	38.0
9	B-Y Pond Borough Park	3.0
10	Townsend Park and Trail	160.0
11	Veteran's/Beckwith Fields	5.0
12	Bear Hollow Park	62.0
13	Royal Highlands Field	4.0
14	Bear Hollow Trail	34.0
15	Lillian Kellman Nature Reserve	56.0
16	Duff Park	148.0
17	Murrysville Ballfield	1.3
18	Chambers Park	3.9
19	Staymates Farm	7.0
20	Level Green Community Park	11.7
21	Level Green Ballfield	1.5
22	Pedora Park	70.0
23	Kovalczik Park	28.0
24	Oak Hollow Park	52.0
25	Country Hills Park	9.7
26	Tinkers Run Park	34.9
27	Hilltop Park	1.1
28	Jack Town Park	5.3
29	Westmoreland City Park	8.2
30	Penglyn Park	0.5
31	Manor Borough Park	8.0
32	Penn Township Recreation	50.4
33	Claridge Soccer Fields	2.4
33	Bushy Run Battlefield State Park	678.7
34	Elliott Park	3.0
35	Oakford Park	46.4
36	Hempfield Township Park	60.0
	Murrysville undeveloped park	262.0
TOTAL PARKLAND		3136.8

[1]Reference numbers correspond to parks shown on Figure 12

municipal authorities, a sanitary authority, and a township (Figure 14; Table F-2 in Appendix F). The Allegheny County Sanitary Authority (ALCOSAN) has the larges service area (41.4 square miles), followed by the Western Westmoreland Municipal Authority (WWMA) (15.6 square miles) and the Franklin Township Municipal Sanitary Authority (12.8 square miles). Eighty-five percent or more of four subwatersheds (Armore Run, Sawmill Run, Thompson Run, and Middle Turtle Creek) are included in public sewer service areas. Steels Run subwatershed has only nine percent of its area currently within a sewer service area.

Three water pollution control plants (WPCPs) for treating sewage occur in the watershed (Figure 14; Table F-3, Appendix F). The Brush Creek WPCP is the largest with a permitted discharge of 4.4 million gallons per day (MGD) to Lower Brush Creek. The Meadowbrook Road WPCP is permitted a discharge of 4.2 MGD to Middle Turtle Creek. The Holiday Park Sewage Treatment Plant is permitted a discharge of 2.24 MGD to Abers Creek. Thirty-eight combined sewer overflows (CSOs) discharge to the watershed. Thirty of these belong to ALCOSAN, five belong to the City of Export, and three belong to the WWMA.

The watershed contains two municipal waste landfills owned and operated by Waste Management, Inc. of Houston, Texas. The location of each facility is shown on Figure 14. Monroeville Landfill is located immediately to the northwest of Pitcairn in the Borough of Monroeville. The landfill comprises 389.4 acres, of which 353 acres are permitted for landfill activities. The current lined footprint covers 174.5 acres and approximately 1,800 tons of waste per day is disposed on average. Valley Landfill is located along Pleasant Valley Road in Penn Township. The site consists of 327.3 acres, of which 257.4 acres are permitted for landfill operations. The lined footprint covers 107.3 acres while the gate rate is approximately 2,600 tons of waste per day on average.

1.19 SUBWATERSHED CHARACTERISTICS

A large amount of information on the character of the subwatersheds was generated by analysis of the GIS database constructed for the watershed. This information is provided in tables in the appendices and includes subwatershed acreages of: prime farmland and hydric/hydric inclusion soils (Table A-3); land use categories (Table A-4); other landscape characteristics, such as steep slopes, impervious surfaces, and abandoned mine lands (Table A-5); water quality designations and miles of assessed stream (Table B-1); and area included in public water and sewer service areas (Tables F-1 and F-2).

Table 5, in the plan, summarizes some of the subwatershed characteristics generated by the GIS analysis. Table 5 lists the drainage area, mainstem stream length, the USFWS classification of the stream taken from the National Wetland Inventory Maps, the Pennsylvania Chapter 93 protected use classification for aquatic life, the Section 303 designation, and the acreage of impervious cover and abandoned mine land within each subwatershed. The following sections provide brief description of each subwatershed's characteristics, for use in evaluating potential subwatershed issues.

1.19.1 Abers Creek

The Abers Creek subwatershed contains 24.6 miles of stream that drains a 10.6-square-mile watershed. Portions of the municipalities of Murrysville, Monroeville, and Plum comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Abers Creek as an Upper Perennial Riverine, Open Water/Unknown Bottom, Intermittently Exposed/Permanent system (R3OWZ). Abers Creek and its tributaries have a Chapter 93 aquatic life use designation of TSF. According to PADEP, 0.89 miles of Abers Creek near its mouth have reached attainment for the uses designated for this stream. To date, no streams within the Abers Creek subwatershed have been listed on the Section 303 (d) List.

Water quality data for the subwatershed have been collected by the Allegheny County Health Department and by the USACOE, Pittsburgh District (Table B-2). These data include dissolved oxygen and pH measurements, which are typical of a warmwater stream in the Pittsburgh Low Plateau Section and well within the ranges for supporting aquatic life. A qualitative benthic macroinvertebrate survey conducted by PADEP at the mouth of Abers Creek (1998;

Table C-7 in Appendix C) revealed a depauperate benthic community composed of pollution tolerant (as defined by USEPA 1999) taxa including Chironomidae (midges), Simulidae (blackflies), and Hydropsychidae (caddisflies). No fish data are available for the Abers Creek subwatershed.

Land use within the Abers Creek subwatershed is comprised of 65.8% forested/herbaceous, 21.9% residential/urban, 8.2% planted/cultivated, 2.6% industrial/transportation, 0.9% transitional, and 0.1% mines/barren areas (Figure 8 and Table A-4). The subwatershed is composed of 14.9% impervious cover (Figure 6 and Table A-5), indicating Abers Creek is an impacted stream.

TABLE 5

Characteristics of Subwatersheds within the Turtle Creek Watershed

Subwatershed	Drainage Area (sq. mi.)	Mainstem Stream Length (miles)	NWI Classification[1]	PADEP Chapter 93 Protected Use[2]	PADEP Section 303(d) List[3]	Impervious Cover		Abandoned Mine Lands	
						Area (sq. mi.)	Percent	Area (sq. mi.)	Percent
Abers Creek	10.64	24.63	R3OWZ	TSF	Attained	1.59	14.9%	0.56	5.3%
Ardmore Run	3.16	4.86	Not Designated	WWF	Unassessed	1.03	32.6%	0.48	15.2%
Brush Creek, Lower	17.43	38.77	R3OWZ	TSF	Unassessed	1.93	11.1%	2.22	12.7%
Brush Creek, Upper	26.13	56.44	R3OWZ	TSF	Unassessed	3.29	12.6%	1.11	4.2%
Bushy Run	13.94	32.73	PFO1A	TSF	Unassessed	0.70	5.0%	0.84	6.0%
Dirty Camp Run	3.23	4.70	Not Designated	WWF	Unassessed	0.46	14.2%	0.46	14.2%
Haymaker Run	10.97	29.23	R3OWZ	HQ-CWF	Attained	0.37	3.4%	0.00	0.0%
Lyons Run	8.78	17.59	PFO1A	TSF	Attained	0.43	4.9%	1.34	15.3%
Sawmill Run	2.02	2.48	Not Designated	WWF	Unassessed	0.58	28.7%	0.13	6.4%
Steels Run	4.81	10.03	PFO1A	HQ-CWF	Unassessed	0.02	0.4%	0.00	0.0%
Thompson Run	15.87	30.62	R3OWZ	WWF	Impaired	3.71	23.4%	2.48	15.6%
Turtle Creek, Lower	10.02	18.17	R3OWZ	WWF	Impaired	2.28	22.8%	1.35	13.5%
Turtle Creek, Middle	7.43	15.67	R3OWZ	TSF	Impaired	1.20	16.2%	0.00	0.0%
Turtle Creek, Upper	12.98	29.00	R3OWZ	TSF	Impaired	1.05	8.1%	1.78	13.7%
Total	**147.41**	**314.92**							

[1]U. S. Fish and Wildlife Service (USFWS). 1977. National Wetlands Inventory Maps. Braddock, Irwin, Murrysville, and Slickville, Pennsylvania Quadrangles. Classifications are as follows:

R3OWZ = Riverine, Upper Perennial, Open Water/Unknown Bottom, Intermittently Exposed/Permanent

PFO1A = Palustrine, Forested, Broad-Leaved Deciduous, Temporary

[2]Pennsylvania Department of Environmental Protection (PADEP). 2000. PA Code, Title 25, Chapter 93. Water Quality Standards. Protected Uses are as follows:

TSF = Trout Stocking

WWF = Warm Water Fishes

HQ-CWH = High Quality Waters - Cold Water Fishes

[3]Pennsylvania Department of Environmental Protection (PADEP). 2000. Draft Section 303(d) List. Bureau of

There are 0.56 square mile of abandoned mine land areas in the Abers Creek subwatershed, and 20.4% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

Municipal water authorities serve 43 percent of the Abers Creek subwatershed area. Most of the public drinking water in the subwatershed is provided by the Plum Borough Municipal Authority (Figure 13 and Table F-1). Municipal sanitary authorities, including ALCOSAN and the Plum Borough Municipal Sewer Authority, which discharges treated effluent into Abers Creek via the Holiday Park Sewage Treatment Plant, provide 77 percent of the subwatershed area with public sewer service (Figure 14 and Tables F-2 and F-3).

1.19.2 Ardmore Run

The Ardmore Run subwatershed contains only 4.86 miles of stream that drains 3.16 square miles (Table B-1). Portions of the municipalities of Wilkinsburg, Churchill, Forest Hills, Braddock Hills, Chalfant, North Braddock, Wilkins Township, and East Pittsburgh comprise the subwatershed (Figure 2 and subwatershed overlay).

Ardmore Run and its tributaries have an aquatic life use designation of WWF. To date, no streams within the Ardmore Run subwatershed have been listed on the Section 303 (d) List. Water quality data for the subwatershed have been collected by students from Woodland Hills High School's *Water Project* Gifted Program (WHHS) and by the USACOE, Pittsburgh District (Table B-2). These data include dissolved oxygen and pH data, which are typical of a warmwater stream in the Pittsburgh Low Plateau Section. The elevated conductivity value indicates a high degree of dissolved solids. Although these values are typically supportive of aquatic life, no fish or benthic macroinvertebrate data are available for the Ardmore Run subwatershed

Land use within the Ardmore Run subwatershed is comprised of 52.2% residential/urban, 40.5% forested/herbaceous, 3.2% planted/cultivated, 1.9% industrial/transportation, 0.3% mines/barren areas, and 0.3% transitional (Figure 8 and Table A-4). The subwatershed is composed of 32.6% impervious cover (the highest in the Turtle Creek watershed), classifying Ardmore Run as a non-supporting stream. There is only 0.48 square mile of abandoned mine land in the Ardmore Run subwatershed; however, 97.2% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table).

The Wilkinsburg-Penn Joint Water Authority provides 95% of the Ardmore Run subwatershed area with public drinking water (Figure 13 and Table F-1).

ALCOSAN provides 100% of the subwatershed area with public sewer service (Figure 14 and Table F-2).

1.19.3 Lower Brush Creek

The Lower Brush Creek subwatershed contains 38.8 miles of stream and a drainage area of 17.4 square miles (Table B-1). Portions of the municipalities of Trafford, North Irwin, Irwin, Adamsburg, and North Versailles, Penn, North Huntingdon, and Hempfield Townships comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Brush Creek as an Upper Perennial Riverine, Open Water/Unknown Bottom, Intermittently Exposed/Permanent system (R3OWZ). Brush Creek and its tributaries have an aquatic life use designation of TSF. To date, no streams within the Lower Brush Creek subwatershed have been listed on the Section 303 (d) List (PADEP 2000c).

Water quality data for the subwatershed have been collected by the TCWA and by the USACOE, Pittsburgh District (Table B-2). These data include dissolved oxygen and pH data, which are typically supportive of aquatic life. Because of net alkaline AMD inputs (e.g., Irwin discharge), severe pollutant loads in the form of elevated iron concentrations impact the Lower Brush Creek subwatershed. A qualitative benthic macroinvertebrate survey conducted by USACOE at several locations within the subwatershed (Table C-2) revealed depauperate benthic communities composed of pollution tolerant taxa including Oligochaeta (segmented worms), Chironomidae (midges), and Hydropsychidae (caddisflies). Likewise, a fish survey conducted by CEC (Table C-7) revealed a depauperate fish community dominated by pollution tolerant species including bluntnose minnows (*Pimephales notatus*), white suckers (*Catostomus commersoni*), and creek chubs (*Semotilus atromaculatus*).

Land use within the Lower Brush Creek subwatershed is comprised of 68.6% forested/herbaceous 16.1% residential/urban, 11.0% planted/cultivated, 2.1% industrial/transportation, 0.9% transitional, and 0.2% mines/barren areas (Figure 8 and Table A-4). The subwatershed is composed of 11.1% impervious cover (Figure 9 and Table A-5), classifying Lower Brush Creek as an impacted stream. There are 2.22 square miles of abandoned mine land areas in the Lower Brush Creek subwatershed, and 50.9% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

Municipal water authorities serve 58% of the Lower Brush Creek subwatershed area. Most of the public drinking water in the subwatershed is provided by the Municipal Authority of Westmoreland County (Figure 13 and Table F-1). Municipal sanitary authorities, including the Western Westmoreland Municipal Authority that discharges treated effluent into Lower Brush Creek via the Brush Creek Water Pollution Control Plant and untreated sewage/stormwater via a CSO regulator, serve 42% of the subwatershed area (Figure 14 and Tables F-2 and F-3). Also, ALCOSAN is responsible for two CSO regulators that discharge untreated sewage/stormwater into Lower Brush Creek.

1.19.4 Upper Brush Creek

The Upper Brush Creek subwatershed contains 56.4 miles of stream that drains an area of 26.1 square miles (Table B-1). Portions of the municipalities of Manor, Adamsburg, Irwin, North Irwin, Jeannette, Greensburg, and Penn, North Huntingdon, Hempfield, and Salem Townships comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Brush Creek as an Upper Perennial Riverine, Open Water/Unknown Bottom, Intermittently Exposed/Permanent system (R3OWZ). Brush Creek and its tributaries have an aquatic life use designation of TSF. To date, no streams within the Upper Brush Creek subwatershed have been listed on the Section 303 (d) List. Water quality and benthic macroinvertebrate community data for the subwatershed are not available. A synoptic fish survey conducted by CEC (Table C-7) revealed a depauperate fish community dominated by pollution tolerant species including bluntnose minnows, blacknose dace (*Rhinichthys atratuls*), and an interesting occurrence of a population of banded killifish (*Fundulus diaphanus*).

Land use within the Upper Brush Creek subwatershed is comprised of 48.9% forested/herbaceous, 28.0% planted/cultivated, 16.5% residential/urban, 3.8% industrial/transportation, 1.1% transitional, and 0.9% mines/barren areas (Figure 8 and Table A-4). The subwatershed is composed of 12.6% impervious cover (Figure 9 and Table A-5), classifying Upper Brush Creek as an impacted stream. There are 1.11 square miles of abandoned mine land in the Upper Brush Creek subwatershed, and 43.3% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Municipal Authority of Westmoreland County provides 78% of the Upper Brush Creek subwatershed with public drinking water (Figure 13 and Table F-1). Municipal sanitary authorities, including the City of Jeannette Municipal Authority

and the Western Westmoreland Municipal Authority, which discharge untreated sewage/stormwater to Upper Brush Creek via two CSO regulators, provide 41% of the subwatershed area with public sewer service (Figure 14 and Tables F-2 and F-3). Two flood control projects, the Bull Run Dam (located on Bull Run in Penn Township, approximately one mile upstream of Jeannette) and the Jeannette Channel Rectification Project (located on Upper Brush Creek in Jeannette) currently exist within the Upper Brush Creek subwatershed.

1.19.5 Bushy Run

The Bushy Run subwatershed contains 32.7 miles of stream that drain 13.9 square miles (Table B-1). Portions of the municipalities of Manor and Hempfield and Salem Townships comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Bushy Run as a Palustrine, Broad-Leaved Deciduous Forested, Temporary system (PFO1A). Bushy Run and its tributaries have a Chapter 93 aquatic life use designation of Trout Stocking. To date, no streams within the Bushy Run subwatershed have been listed on the Section 303 (d) List (PADEP 2000c). Water quality, benthic macroinvertebrate community, and fish community data for the subwatershed are not available.

Land use within the Bushy Run subwatershed is comprised of 53.6% planted/cultivated, 37.1% forested/herbaceous, 7.9% residential/urban, 0.7% mines/barren areas, 0.4% industrial/transportation, and 0.1% transitional (Figure 8 and Table A-4). The subwatershed is composed of only 5.0% impervious cover (Figure 9 and Table A-5), classifying Bushy Run as a relatively unimpacted sensitive stream. There are only 0.84 square miles of abandoned mine land areas in the Bushy Run subwatershed; however, 84.5% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5)

The Municipal Authority of Westmoreland County provides 71% of the Bushy Run subwatershed with public drinking water (Figure 13 and Table F-1). Municipal sanitary authorities, including the Western Westmoreland Municipal Authority, only provide 25% of the subwatershed area with public sewer service (Figure 14 and Table F-2).

1.19.6 Dirty Camp Run

The Dirty Camp Run subwatershed contains only 4.70 miles of stream and a drainage area of 3.23 square miles (Table B-1). Portions of the municipalities of

Pitcairn and Monroeville comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS has not classified the main stem of Dirty Camp Run (USFWS 1977). Dirty Camp Run and its tributaries have an aquatic life use designation of Warm Water Fishes according to Chapter 93 Water Quality Standards. To date, no streams within the Dirty Camp Run subwatershed have been listed on the Section 303 (d) List.

Water quality data for the subwatershed have been collected by the USACOE, Pittsburgh District (Table B-2). These data include dissolved oxygen and pH data, which are typical of a warmwater stream in the Pittsburgh Low Plateau Section. The elevated conductivity value indicates a high degree of dissolved solids. Although these values are typically supportive of aquatic life, no fish or benthic macroinvertebrate data are available for the Dirty Camp Run subwatershed.

Land use within the Dirty Camp Run subwatershed is comprised of 60.7% forested/herbaceous, 19.8% residential/urban, 10.8% mines/barren areas, 3.4% industrial/transportation, 3.7% planted/cultivated, and 1.5% transitional (Figure 8 and Table A-4). The subwatershed is composed of 14.2% impervious cover (Figure 9 and Table A-5), classifying Dirty Camp Run as an impacted stream. There are only 0.46 square miles of abandoned mine land areas in the Dirty Camp Run subwatershed. However, 87.3% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Monroeville Water Authority and the Wilkinsburg-Penn Joint Water Authority provide 49% of the Dirty Camp Run subwatershed area with public drinking water (Figure 13 and Table F-1). ALCOSAN provides 68% of the subwatershed area with public sewer service (Figure 14 and Table F-2).

A severe flash-flooding event occurred on July 1, 1997 in the Dirty Camp Run subwatershed because of excessive rainfall from a semi-stationary thunderstorm cell that developed over Monroeville. The stormwater runoff quickly moved downstream into Dirty Camp Run, which flows through and flooded a heavily urbanized area of Pitcairn. Unfortunately, one fatality occurred to a volunteer fireman. Ten million dollars flood damage occurred to 429 homes, 12 businesses, 2 sewer systems, 1 park, and 13 roads and bridges.

1.19.7 Haymaker Run

The Haymaker Run subwatershed contains 29.2 miles of stream that drain 11 square miles (Table B-1). Portions of the municipalities of Murrysville, Plum, and Monroeville comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Haymaker Run as an Upper Perennial Riverine, Open Water/Unknown Bottom, Intermittently Exposed/Permanent system (R3OWZ).Haymaker Run and its tributaries have a Chapter 93 aquatic life use designation of High Quality Waters, Cold Water Fishes. According to PADEP, 11.64 miles of Haymaker Run, including tributaries and the main stem, have reached attainment for the uses designated for this stream (Table B-1). To date, no streams within the Haymaker Run subwatershed have been listed on the Section 303 (d) List.

Water quality data for the subwatershed have been collected by the USACOE, Pittsburgh District (Table B-2). These data include dissolved oxygen and pH data, which are typically supportive of aquatic life. Qualitative benthic macroinvertebrate surveys conducted by PADEP and USACOE at two stations on Haymaker Run (Tables C-1 and C-4) revealed diverse benthic communities composed of pollution intolerant taxa including *Isoperla* (a stonefly), *Rhyacophila* (a caddisfly), and *Psephenus* (a water penny beetle). Fish surveys conducted by CEC (Table C-7) revealed less diverse fish communities dominated by pollution tolerant species including bluntnose minnows, blacknose dace, creek chubs, and central stonerollers (*Campostoma anomalum*). Two intolerant fish species, the redside dace (*Clinostomus elongatus*), and the (Candidate Rare) least brook lamprey, were found in Haymaker Run.

Land use within the Haymaker Run subwatershed is comprised of 75.2% forested/herbaceous, 17.8% planted/cultivated, 5.5% residential/urban, 0.5% transitional, 0.2% industrial/transportation, and 0.1% mines/barren areas (Figure 8 and Table A-4). The subwatershed is composed of only 3.4% impervious cover stream (Figure 9 and Table A-5), classifying Haymaker Run as a sensitive stream. There are no abandoned mine land areas in the Haymaker Run subwatershed, and only 0.3% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

Municipal water authorities serve 31% of the Haymaker Run subwatershed area. Most of the public drinking water in the subwatershed is provided by the Municipal Authority of Westmoreland County (Figure 13 and Table F-1). Municipal sanitary authorities, including the Franklin Township Municipal Sanitary Authority,

provide only 27% of the subwatershed area with public sewer service (Figure 14 and Table F-2).

1.19.8 Lyons Run

The Lyons Run subwatershed contains 17.6 miles of stream and a drainage area of 8.9 square miles (Table B-1). Portions of the municipalities of Murrysville and Penn Township comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Lyons Run as a Palustrine, Broad-Leaved Deciduous Forested, Temporary system (PFO1A). Lyons Run and its tributaries have an aquatic life use designation of Trout Stocking according to Chapter 93 Water Quality Standards. According to PADEP, 3.93 miles of Lyons Run, including tributaries and the main stem, have reached attainment for the uses designated for this stream (Table B-1). To date, no streams within the Lyons Run subwatershed have been listed on the Section 303 (d) List.

Water quality data for the subwatershed have been collected by the TCWA and by the USACOE, Pittsburgh District (Table B-2). These data include pH values that range from 2.9 at the headwaters (non-supporting) to 7.74 at the mouth (supporting). Because of net acidic AMD inputs from the Heidekat discharge, severe pollutant loads (i.e., elevated instream iron, aluminum, and acidity concentrations) impact the headwaters of the Lyons Run subwatershed. Qualitative benthic macroinvertebrate surveys conducted by PADEP and USACOE at several locations within the subwatershed (Tables C-3 and C-4) revealed depauperate benthic communities composed of pollution tolerant taxa (e.g., Chironomidae, midges) at the headwaters of Lyons Run and a more diverse benthic community composed of pollution intolerant taxa (e.g., *Diplectrona*, a caddisfly and *Allocapnia*, a stonefly) downstream near the mouth of Lyons Run. However, a synoptic fish survey conducted by CEC (Table C-7) revealed a depauperate fish community, dominated by pollution tolerant species including blacknose dace, creek chubs, and white suckers, near the mouth of Lyons Run.

Land use within the Lyons Run subwatershed is comprised of 74.5% forested/herbaceous, 13.4% planted/cultivated, 4.4% mines/barren areas, 3.8% residential/urban, 3.8% industrial/transportation, 0.1% transitional (Figure 8 and Table A-4). The subwatershed is composed of only 4.9% impervious cover (Figure 9 and Table A-5), classifying Lyons Run as a sensitive stream. There are 1.34 square miles of abandoned mine land areas in the Lyons Run subwatershed, and 40.7% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Municipal Authority of Westmoreland County provides 38% of the Lyons Run subwatershed area with public drinking water (Figure 13 and Table F-1). Municipal sanitary authorities, including the Western Westmoreland Municipal Authority, provide 41% of the subwatershed area with public sewer service (Figure 14 and Table F-2).

1.19.9 Sawmill Run

The Sawmill Run subwatershed contains only 2.48 miles of stream that drain an area of 2.02 square miles (Table B-1). Portions of the municipalities of Wilkinsburg, Churchill, Wilkins Township, Chalfant, Turtle Creek, and East Pittsburgh comprise the subwatershed (Figure 2 and subwatershed overlay).

The main stem of Sawmill Run is not classified on the USFWS NWI map. Sawmill Run and its tributaries have an aquatic life use designation of Warm Water Fishes. To date, no streams within the Sawmill Run subwatershed have been listed on the Section 303 (d) List. Water quality data for the subwatershed have been collected by students from Woodland Hills High School's *Water Project* Gifted Program (Table B-3). No fish or benthic macroinvertebrate data are available for the Sawmill Run subwatershed.

Land use within the Sawmill Run subwatershed is comprised of 42.6% residential/urban, 41.1% forested/herbaceous, 10.9% planted/cultivated, 4.5% industrial/transportation, 0.5% mines/barren areas, and 0.5% transitional (Figure 8 and Table A-4). The subwatershed is composed of 28.7% impervious cover (Figure 9 and Table A-5), classifying Sawmill Run as a non-supporting stream. There are only 0.13 square miles of abandoned mine land areas in the Sawmill Run subwatershed; however, 99.5% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Wilkinsburg-Penn Joint Water Authority provides 99% of the Sawmill Run subwatershed area with public drinking water (Figure 13 and Table F-1). ALCOSAN provides 99% of the subwatershed area with public sewer service (Figure 14 and Table F-2). A flood control project, the Sawmill Run Channel Improvement Project (located in lower Sawmill Run) currently exists within the Sawmill Run subwatershed.

1.19.10 Steels Run

The Steels Run subwatershed contains only 10.0 miles of stream and a drainage area of 4.8 square miles (Table B-1). Portions of the municipalities of Murrysville

and Washington Township comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Steels Run as a Palustrine, Forested, Broad-Leaved Deciduous, Temporary system (PFO1A). Steels Run and its tributaries have an aquatic life use designation of High Quality Waters, Cold Water Fishes. To date, no streams within the Steels Run subwatershed have been listed on the Section 303 (d) List. Water quality, benthic macroinvertebrate community, and fish community data for the subwatershed are not available.

Land use within the Steels Run subwatershed is comprised of 60.9% forested/herbaceous, 34.5% planted/cultivated, 2.1% mines/barren areas, 1.2% transitional 0.4% residential/urban, and 0.2% industrial/transportation (Figure 8 and Table A-4). The subwatershed is composed of only 0.4% impervious cover (the lowest in the Turtle Creek watershed), classifying Steels Run as a sensitive stream (Figure 9 and Table A-5). There is no abandoned mine land in the Steels Run subwatershed. Approximately 21.4% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Municipal Authority of Westmoreland County provides only 12% of the Steels Run subwatershed area with public drinking water (Figure 13 and Table F-1). Likewise, the Franklin Township Municipal Sanitary Authority provides only 9% of the subwatershed area with public sewer service (Figure 14 and Table F-2).

1.19.11 Thompson Run

The Thompson Run subwatershed contains 30.6 miles of stream that drains 15.9 square miles (Table B-1). Portions of the municipalities of Penn Hills, Plum, Monroeville, Wilkinsburg, Churchill, Wilkins Township, and Turtle Creek comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Thompson Run as a Riverine, Upper Perennial, Open Water/Unknown Bottom, Intermittently Exposed/Permanent system (R3OWZ). Thompson Run and its tributaries have an aquatic life use designation of Warm Water Fishes. The PADEP has included 6.85 miles of the main stem of Thompson Run on the Section 303 (d) List because of metals and pH impairment from acid mine drainage sources.

Water quality data for the Thompson Run subwatershed have been collected by students from Woodland Hills High School's *Water Project* Gifted Program and by the USACOE (Table B-2). These data include dissolved oxygen and pH data, which

are typical of a warmwater stream in the Pittsburgh Low Plateau Section. The elevated conductivity value indicates a high degree of dissolved solids. Although these values are typically supportive of aquatic life, no fish or benthic macroinvertebrate data are available for the Thompson Run subwatershed.

Land use within the Thompson Run subwatershed is comprised of 45.1% forested/herbaceous, 34.8% residential/urban, 8.6% mines/barren areas, 6.9% planted/cultivated, 3.6% industrial/transportation, and 0.2% transitional (Figure 8 and Table A-4). The subwatershed is composed of 23.4% impervious cover (Figure 9 and Table A-5), classifying Thompson Run as an impacted stream. There are 2.48 square miles of abandoned mine land areas in the Thompson Run subwatershed. Also, 100% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Wilkinsburg-Penn Joint Water Authority, the Monroeville Water Authority, and other municipal authorities provide 84% of the Thompson Run subwatershed area with public drinking water (Figure 13 and Table F-1). ALCOSAN and Penn Hills Township Municipal Authority provide 95% of the subwatershed area with public sewer service (Figure 14 and Table F-2). ALCOSAN is also responsible for a main trunk line, which runs parallel with lower Thompson Run, and two CSO regulators that discharge untreated sewage/stormwater directly into lower Thompson Run (Figure 14 and Table F-3). A flood control project, a segment of the Flood Reduction Channel, currently exists within the Thompson Run subwatershed.

1.19.12 Lower Turtle Creek

The Lower Turtle Creek subwatershed contains 18.2 miles of stream and a watershed area of 10.0 square miles (Table B-1). Portions of the municipalities of North Versailles Township, Wall, Monroeville, Pitcairn, Trafford, East McKeesport, Wilmerding, Turtle Creek, East Pittsburgh, and North Braddock comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Turtle Creek as a Riverine, Upper Perennial, Open Water/Unknown Bottom, Intermittently Exposed/Permanent system (R3OWZ). Lower Turtle Creek and its tributaries have an aquatic life use designation of Warm Water Fishes. To date, 19.24 miles of the main stem of Turtle Creek, from its source in Delmont downstream to the confluence with Thompson Run, has been listed on the Section 303 (d) List because of metals, pH, suspended solids, nutrients, and siltation impairment from acid mine drainage (15.78 miles), removal of vegetation, small residential runoff, and bank modifications (2.68 miles), and urban runoff/storm sewers (0.78 miles) sources.

Water quality data for the Lower Turtle Creek subwatershed have been collected by the USACOE, Pittsburgh District (Table B-2). These data include dissolved oxygen and pH data, which are typical of a warmwater stream in the Pittsburgh Low Plateau Section. These values are typically supportive of aquatic life. Synoptic fish surveys conducted by the USACOE (Table C-5) revealed diverse fish communities dominated by pollution tolerant species including common carp (*Cyprinus carpio*), gizzard shad (*Dorosoma cepedianum*), and bluntnose minnows; intermediate species including sand shiners (*Notropis stramineus*) and smallmouth bass (*Micropterus dolomieui*); and pollution intolerant species including the rosyface shiner (*Notropis rubellus*). There appears to be upstream migration of fish from the Monongahela River into Lower Turtle Creek, evident by the presence of "river species" (e.g., gizzard shad and quillback*, Carpiodes cyprinus*) in Lower Turtle Creek. No benthic macroinvertebrate data are available for the Lower Turtle Creek subwatershed.

Land use within the Lower Turtle Creek subwatershed is comprised of 51.5% forested/herbaceous, 26.5% residential/urban, 9.8% industrial/ transportation, 1.1% mines/barren areas, 4.7% planted/cultivated and 1.2% transitional (Figure 8 and Table A-4). The subwatershed is composed of 22.8% impervious cover, classifying Lower Turtle Creek as an impacted stream (Figure 9 and Table A-5). There are 1.35 square miles of abandoned mine land areas in the Lower Turtle Creek subwatershed, and 62.1% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Wilkinsburg-Penn Joint Water Authority, the Monroeville Water Authority, and other municipal authorities provide 49% of the Lower Turtle Creek subwatershed area with public drinking water (Figure 13 and Table F-1). ALCOSAN and McKeesport Municipal Authority provide 81% of the subwatershed area with public sewer service (Figure 14 Table F-2). ALCOSAN is also responsible for a main trunk line, which runs parallel with Lower Turtle Creek, and 23 CSO regulators that discharge untreated sewage/stormwater directly into Lower Turtle Creek (Figure 14 and Table F-3).

Two flood control projects, the Flood Reduction Channel and the Westinghouse Floodgates, currently exist within the Lower Turtle Creek subwatershed. In their *Turtle Creek Valley Strategic Action Plan, 2000-2010*, the Turtle Creek Valley Council of Governments (TCVCOG) has evaluated the cost of operating the flood control gates and determined that the operation and maintenance of this facility places an unsustainable financial burden on the host municipalities of East Pittsburgh, Turtle Creek, and Wilmerding (GAI 1999). TCVCOG recommends that the USACOE perform a reconnaissance study to determine if the flood gates are

needed after implementation and future operation of the new lock and Dam Number 2 on the Monongahela River. If the flood gates are needed, the TCVOG plan recommends that the reconnaissance study also evaluate and specify a course of action for allocating financial resources for operation of the facility.

1.19.13 Middle Turtle Creek

The Middle Turtle Creek subwatershed contains 15.7 miles of stream and a drainage area of 7.4 square miles (Table B-1). Portions of the municipalities of Trafford, Penn Township, Monroeville, and Murrysville comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Turtle Creek as a Riverine, Upper Perennial, Open Water/Unknown Bottom, Intermittently Exposed/Permanent system (R3OWZ). Middle Turtle Creek and its tributaries have an aquatic life use designation of Trout Stocking. To date, 19.24 miles of the main stem of Turtle Creek, from its source in Delmont downstream to the confluence with Thompson Run, has been listed on the Section 303 (d) List because of metals, pH, suspended solids, nutrients, and siltation impairment from acid mine drainage (15.78 miles), removal of vegetation, small residential runoff, and bank modifications (2.68 miles), and urban runoff/storm sewers (0.78 miles) sources.

Water quality data for the Lower Turtle Creek subwatershed have been collected by the ACHD, TCWA and USACOE (Table B-2). These data include dissolved oxygen and pH measurements, which are typical of a warmwater stream in the Pittsburgh Low Plateau Section. These values are typically supportive of aquatic life. Fish surveys conducted by the PAFBC (Table C-6) and by CEC (Table C-7) revealed depauperate fish communities dominated by pollution tolerant species including blacknose dace, creek chubs, white suckers, bluntnose minnows, and central stonerollers; as well as an occasional pollution intolerant species including hatchery-reared trout. The trout that inhabit Middle Turtle Creek are either migrants that swim downstream from Haymaker Run or are fish that have been stocked by the TCWA. Likewise, qualitative benthic macroinvertebrate surveys conducted by PADEP and USACOE at several locations within the subwatershed (Tables C-1 and C-4) revealed depauperate benthic communities composed of pollution tolerant taxa including Oligochaeta (segmented worms), Chironomidae (midges), Simulidae (blackflies), Tipulidae (craneflies), and Hydropsychidae (caddisflies).

Land use within the Middle Turtle Creek subwatershed is comprised of 69.4% forested/herbaceous, 20.9% residential/urban, 5.2% industrial/ transportation, 3.2%

planted/cultivated, 0.7% mines/barren areas, and 0.5% transitional (Figure 8 and Table A-4). The subwatershed is composed of 16.2% impervious cover, classifying Middle Turtle Creek as an impacted stream (Figure 9 and Table A-5). There are no abandoned mine land areas in the Middle Turtle Creek subwatershed, and only 0.1% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Wilkinsburg-Penn Joint Water Authority, the Monroeville Water Authority, and the Municipal Authority of Westmoreland County provides 48% of the Middle Turtle Creek subwatershed area with public drinking water (Figure 13 and Table F-1). ALCOSAN and the Franklin Township Municipal Sanitary Authority that discharges treated effluent into Middle Turtle Creek via the Meadowbrook Road Water Pollution Control Plant, provide 85% of the subwatershed area with public sewer service (Figure 14 and Tables F-2 and F-3). ALCOSAN is also responsible for three CSO regulators that discharge untreated sewage/stormwater to Middle Turtle Creek.

1.19.14 Upper Turtle Creek

The Upper Turtle Creek subwatershed contains 29.0 miles of stream that drains a 13-square-mile area (Table B-1). Portions of the municipalities of Delmont, Murrysville, Export, and Salem and Penn Townships comprise the subwatershed (Figure 2 and subwatershed overlay).

The USFWS classifies the main stem of Turtle Creek as a Riverine, Upper Perennial, Open Water/Unknown Bottom, Intermittently Exposed/Permanent system (R3OWZ). Upper Turtle Creek and its tributaries have an aquatic life use designation of Trout Stocking. As discussed above, 19.24 miles of the main stem of Turtle Creek, from its source in Delmont downstream to the confluence with Thompson Run, has been listed on the Section 303 (d) List because of metals, pH, suspended solids, nutrients, and siltation impairment from acid mine drainage (15.78 miles), removal of vegetation, small residential runoff, and bank modifications (2.68 miles), and urban runoff/storm sewers (0.78 miles) sources.

Water quality data for the subwatershed have been collected by the TCWA (1998) and by the USACOE (Table B-2). These data include severely depressed pH data (as low as 3.09), which, except for the most tolerant macroinvertebrate taxa, are not typically supportive of most aquatic life (including fish). Because of net acidic AMD inputs (e.g., Delmont and Export discharges), severe pollutant loads (i.e., elevated instream iron, aluminum, and acidity concentrations) impact the Upper Turtle Creek subwatershed. Qualitative benthic macroinvertebrate surveys conducted by

PADEP (1998) and USACOE (1998) at several locations within the subwatershed (Tables C-4 and C-1) revealed severely depauperate benthic communities composed of pollution tolerant taxa including Oligochaeta (segmented worms) and Chironomidae (midges). Likewise, fish surveys conducted by PAFBC (Table C-6) revealed the absence of fish in Upper Turtle Creek (because of severe pH depression), at stations above the mouth of Haymaker Run.

Land use within the Upper Turtle Creek subwatershed is comprised of 59.1% forested/herbaceous, 19.0% planted/cultivated, 11.2% residential/urban, 1.9% industrial/transportation, 0.3% mines/barren areas, and 0.2% transitional (Figure 8 and Table A-4). The subwatershed is composed of only 8.1% impervious cover, classifying Upper Turtle Creek as a sensitive stream (Figure 9 and Table A-5). There are 1.78 square miles of abandoned mine land areas in the Upper Turtle Creek subwatershed, and 56.3% of the subwatershed has been mined for the Pittsburgh Coal (Figure 4 and Table A-5).

The Municipal Authority of Westmoreland County provides 72% of the Upper Turtle Creek subwatershed area with public drinking water (Figure 14 and Table F-1). The Franklin Township Municipal Sanitary Authority provides 60% of the subwatershed area with public sewer service. There are five CSO regulators owned by the City of Export that discharge untreated sewage/stormwater into Upper Turtle Creek (Figure 14 Tables F-2 and F-3).

SECTION 2
CONSERVATION PLANNING AND WATERSHED PROTECTION

2.1 INTRODUCTION

The concept of conservation planning is not a new one. Many communities have adopted ordinances and land development regulations that try to strike a balance between promoting orderly community growth and maintaining the community's quality of life. The term "quality of life" spans a wide range of perceptions and values, including a community's ability to provide and maintain infrastructure and services (well-maintained roads and sewers, clean drinking water, parks, etc.), as well as desirable but less tangible characteristics, such as clean, safe neighborhoods; shady streets; open space and wildlife; clean streams; etc.

Local government land use decisions and land development regulations can have a great impact, both positive and negative, on the environmental quality and the quality of life for the residents of the community. This section of the RCP presents ideas, principles, conservation planning tools, and model ordinances to encourage and assist municipalities in the watershed to implement conservation planning practices when making local land use decisions, especially with regard to protecting Turtle Creek and its tributaries.

2.2 CONSERVATION PLANNING PRINCIPLES

2.2.1 Four Keys to Conservation

The Natural Lands Trust, Inc. (NLT), a non-profit regional land trust, in collaboration with the PADCNR, the Penn State Cooperative Extension, and an advisory committee, has developed a four-step set of conservation planning guidelines for local communities. These guidelines, called the "Four Keys to Conservation," are described in detail in NLT's publication *Growing Greener: Putting Conservation into Local Codes*, a copy of which is provided in the Conservation Planning Toolbox in Appendix G. The Four Keys summarize the actions that municipalities can take to use the development process "to protect interconnected networks of open space: natural areas, greenways, trails, and recreational land."

The Four Keys to Conservation are summarized below:

I. Envision the future and perform community audits

Communities need a realistic understanding of their future goal and strategies for development and conservation. The community audit helps determine long-term consequences of growth and the adequacy of existing land use policies to meet the future goals of the community. The audit has three parts: (1) to analyze past and current population and development trends and projects these trends into the future; (2) to evaluate the strengths and weaknesses of existing land use/land development regulations; and (3) construct build-out maps for rapidly developing or redeveloping areas or for areas particularly sensitive or vulnerable to development pressure. The audit allows the community to create a future vision for the community and to establish conservation as well as development goals.

II. Protect open space networks through conservation planning

Communities need to have a good understanding of their natural and cultural resources to establish reasonable goals for development and conservation. The community's comprehensive plan would be updated to document important resources such as parklands, trails, stream corridors, etc. Maps of these potential conservation lands or conservation overlay districts could then be developed to guide the location of open space on future developments. The comprehensive plan would also describe specific ordinance updates needed to implement the goals of the conservation planning.

III. Conservation zoning: a "menu of choices"

Communities wishing to maintain open space in the face of rapid development can do so by modifying their zoning regulations to encourage the reservation of open space on new developments. The zoning regulations would need to incorporate fair and legally defensible criteria that balance the community goals and private landowner interests. The *Growing Greener* publication in Appendix G gives examples of several scenarios and case histories that meet this test. For example, density-neutral development allows the same density of lots as allowed under the existing zoning, but lot sizes are reduced in favor of maintaining open space.

IV. Conservation subdivision design: a four-step process

In addition to updating the comprehensive plan and zoning ordinance to reserve open space, NLT recommends that communities include clear standards for conservation lands in the subdivision or land development regulations. NLT has found the following four-step process effective in guiding the site design process: Step 1 - identify the land that will be protected as open space; Step 2 – locate individual lots within the development area so that views of the open space are

maximized; Step 3 – connect the lots with streets; and Step 4 – draw in the lot lines. This approach is the reverse of that traditionally used in designing subdivisions, where the roads and lots are located first.

2.2.2 Model Development Principles

The Center for Watershed Protection (CWP) offers a slightly different but complimentary approach to changing traditional site development, but with similar goals as those of the NLT. In their excellent publication entitled *Better Site Design: A Handbook for Changing Development Rules in Your Community*, the CWP presents 22 detailed model development principles or recommendations for reducing impervious surfaces, minimizing stormwater run-off and pollution impacts on streams, and for conserving natural areas. The 22 principles are listed in Table G-1 (Appendix G). For each principle, the *Handbook* discusses the current design practices, recommended practices, perceptions vs. realities, case studies, and sources of additional information. This is an invaluable resource for communities who are considering updating subdivision ordinances to incorporate conservation practices.

2.3 WATERSHED CONSIDERATIONS

Several issues warrant special consideration by the municipalities in the watershed, because local land use decisions can have a significant effect on hydrology, water quality and stream biota, downstream flooding, and public access to Turtle Creek and its tributaries. These include the following:

2.3.1 Stormwater Management

Existing local stormwater management ordinances typically require that new developments attenuate the peak runoff from the developed site for one or more design storm events, so that the peak post-development discharge rate does not exceed the pre-development peak rate. Typically, stormwater runoff is directed to a stormwater pond equipped with an outfall structure that temporarily detains the stormwater before releasing it to the receiving stream. Thus, this form of stormwater management deals primarily with managing water quantity and is intended to protect downstream property from flooding and the receiving stream from highly erosive flows. This type of stormwater management does little to remove pollutants carried in the stormwater runoff.

Various technologies have been developed to remove pollutants from stormwater runoff, but they are not commonly used in western Pennsylvania. The CWP has

published a handbook entitled *Design of Stormwater Filtering Systems*, which describes the design and effectiveness of a variety of stormwater treatment technologies. While infiltration designs are often limited by the predominantly clay soils throughout the watershed, stormwater quality designs employing extended detention, wet pond, and grassy swale practices can be used for water quality improvement. Updating local stormwater ordinances to require water quality treatment design criteria for stormwater management systems would contribute to improvements in stream quality in the watershed. A model stormwater management ordinance prepared by Chester Engineers as part of the *Turtle Creek Watershed Act 167 Stormwater Management Plan* (Chester Engineers 1991) can be found in Appendix G.

2.3.2 Floodplain Management

Streams and their floodplains are dynamic and complex ecosystems that can provide important benefits, both economic and ecological. Throughout history, communities were established on floodplains because of the conveniences that waterways offer for transportation, commerce, energy, water supply, soil fertility, and waste disposal. However, floods have caused a greater loss of life and property and have disrupted more families and communities in the United States than all other natural hazards combined.

Flooding in the Turtle Creek watershed is caused both by local stream runoff during heavy rains and backwater flooding from the Monongahela River (Chester 1990) Flooding frequency and discharge estimates have been developed for several locations within the Turtle creek watershed (Chester Engineers 1991). Discharge data for the main stem of Turtle Creek at Trafford ranges 2,420 cubic feet per second (cfs) during a 2.33-year storm event to 5,700 cfs during a 100-year storm event.

Delineated flood prone areas as defined by the Federal Emergency Management Agency (FEMA) are shown on Figure 10. These areas represent an approximation of which, on average, are likely to be inundated by floodwaters at a frequency of once in 100 years (or the "100-year floodplain areas"). Approximately 6 square miles (or 3.9 percent of the watershed area) of 100-year floodplain areas exist within the Turtle Creek watershed (Figure 9 and Table A-5 in Appendix A). Lower Turtle Creek exhibits a relatively broad floodplain ranging from 1,000 to 2,000 feet wide in several locations (Figure 10). However, where steep slopes border Turtle Creek and its tributaries, the 100-year floodplain areas are generally restricted to the narrow regions of the stream valley.

Since 1888, over 25 damaging flood events have been recorded in the Turtle Creek valley. Significant flooding events in the Turtle Creek watershed have been documented in 1888, 1907, 1936, 1942, 1946, 1954 (Hurricane Hazel), 1958, 1972 (Hurricane Agnes; main stem of Turtle Creek at 16,100 cfs; USACOE 1987), and 1997 (Dirty Camp Run flash-flood). The ill effects of these floods were felt most severely by the communities of East Pittsburgh, Turtle Creek, Wilmerding, Pitcairn, and Trafford, located along lower Turtle Creek valley. However, construction of the Westinghouse Floodgates has eliminated the Monongahela River backwater from extending into lower Turtle Creek. Also, since 1967, the USACOE concrete trapezoidal Flood Reduction Channel in lower Turtle Creek and lower Thompson Run has diminished severe flooding from occurring in this section of the watershed. Now, much of the lower Turtle Creek subwatershed is undergoing re-development following the industrial decline of the 1970s and 1980s. With this re-development, local municipalities have the opportunity to regulate land use within the floodplain and to select uses that are compatible with the natural functions of floodplains.

Historically, effective floodplain management was recognized as an essential task to reduce the loss of life and property. However, floodplains are now recognized as having ecological functions and values as well as an influential role in increasing a community's quality of life. Some functions and values of a naturally functioning floodplain include providing for: (1) storage and conveyance of floodwaters; (2) recharging of groundwater; (3) maintenance of surface water quality; and (4) providing wildlife and fish habitat. Floodplains also provide diverse recreational opportunities and aesthetic values. The potential gains of transforming stream floodplains from problem areas into community assets are substantial. Municipal leaders are uniquely positioned to utilize floodplain resources for the benefits of their communities.

In their publication entitled *Protecting Floodplain Resources: A Guidebook for Communities*, the Federal Interagency Floodplain Management Task Force (FIFMTF 1996; Appendix G) presents the following six steps for effective floodplain management:

- Step 1 – Identify the Planning Area.
- Step 2 – Conduct an Inventory and an Analysis of Land use and Environmental Concerns.
- Step 3 – Conduct a Problem and Need Assessment.
- Step 4 – Define the Corridor Management Boundary.
- Step 5 – Develop an Action Plan.
- Step 6 – Implementation and Monitoring of the Action Plan.

According to the FIFMTF (1996) the best examples of floodplain management programs are those that were initiated by local government. FIFMTF's *Guidebook* in Appendix G provides case studies of municipal governments who have taken the initiative of establishing effective floodplain management programs by employing public participation to define local objectives and by utilizing available resources from state and federal programs.

2.3.3 Urbanization and Impervious Cover

Recent research has shown that streams in urbanized watersheds possess fundamentally different characteristics than streams in forested or agricultural watersheds. Because streams integrate all that occurs in their surrounding landscapes, their condition, especially their biological condition, infers much about the consequences of human activity. According to the Center for Watershed Protection (CWP 1998), the amount of impervious cover (e.g., buildings, roads, sidewalks, and parking lots) in an urbanized watershed can be used to project the current and future quality of streams in the watershed. Schueler (1995) has demonstrated that as little as 10% impervious cover in a watershed area has been linked to stream degradation, with the degradation becoming more severe as impervious cover increases. Impervious cover increases volume and flash in downstream runoff events resulting in modified stream channel structure, increased water temperatures, reduced biodiversity, and decreased water quality (Schueler 1995). These effects have important ecological and economic repercussions regarding the functions provided by aquatic ecosystems.

Land use data from the Turtle Creek watershed GIS databases was used to estimate the percent impervious cover for the Turtle Creek watershed. The sum of 60 percent of the area of residential/urban land use cover class and 70 percent of the area of the industrial/transportation land use cover class gives an approximate cover by impervious surfaces. These percentages represent conservative approximations of typical percent impervious cover of different land use cover classes in Delaware (University of Delaware 2000) and in Pennsylvania (Integrated Land Management, Inc. 1997). This calculation indicates that the Turtle Creek watershed has approximately 12.6 percent impervious cover (approximately 19 square miles; Figure 9 and Table A-5 in Appendix A).

The Center for Watershed Protection (1998) has constructed an urban stream classification model based on impervious cover. The model classifies streams into one of the following three categories:

- Sensitive Streams – Typically have a percent watershed impervious cover ranging from 0 to 10 percent. Sensitive streams are of high quality, and are typified by stable channels, excellent habitat structure, good to excellent water quality, and diverse communities of fish and benthic macroinvertebrates. The management goal for sensitive streams is to protect water quality and to conserve greenspace in the watershed.

- Impacted Streams – Typically have a percent watershed impervious cover ranging from 11 to 25 percent. Impacted streams show clear signs of degradation because of watershed urbanization. The management goal for impacted streams is to limit degradation of water quality with zoning techniques and best management practices.

- Non-Supporting Streams – Typically have a percent watershed impervious cover greater than 25 percent. Non-supporting streams essentially become a conduit for conveying stormwater flows and can no longer support a diverse stream community. The management goal for non-supporting streams is to encourage redevelopment.

According to the model, the Turtle Creek watershed would be classified as an impacted stream. However, the effect of the high percentage of impervious cover on stream quality has not been determined for the Turtle Creek watershed.

2.3.4 Stream Buffers

From the USEPA, Office of Water's Website *Model Ordinances to Protect Local Resources* (USEPA 2000; Appendix G), a stream buffer is defined as a vegetated area, including trees, shrubs, and herbaceous vegetation, that exists or is established to protect a stream system. Stream buffers serve as natural boundaries between local waterways and existing development. Stream buffers provide numerous environmental protection and resource management benefits that include the following:

- Restoring and maintaining the chemical, physical, and biological integrity of the water resources.
- Removing pollutant loads delivered from urban stormwater.
- Reducing erosion and preventing stream sedimentation.
- Stabilizing stream banks.
- Providing infiltration of stormwater runoff.
- Maintaining baseflow of streams.
- Contributing organic matter (e.g., leaves), which is the primary source of food and energy for the stream ecosystem.

- Providing tree canopy to shade streams and promote desirable aquatic organisms.
- Providing riparian wildlife habitat.
- Furnishing scenic value and recreational opportunities.

Urban stream buffer ordinances should be an integral component of any local stream protection program. Stream buffer ordinances should specify the size and management of the stream buffer, making it a specific planning tool designed to protect stream quality and aquatic habitat. According to USEPA's *Model Ordinances* (Appendix G), effective stream buffer ordinances that provide guidelines for buffer creation and maintenance must require the following provisions:

- Buffer boundaries to be clearly marked on local planning maps.
- Maintenance language that restricts vegetation and soil disturbance.
- Tables that illustrate buffer width adjustment by% slope and type of stream.
- Direction on allowable uses and public education.

By adopting some rather simple performance criteria, municipalities can make best use of stream buffers. Better design and planning also ensure that municipalities realize the full ecological and economic benefits of stream buffers.

2.3.5 Steep Slopes

The degree of slope has always a major factor in determining the suitability of land for development in the Turtle Creek watershed. Valley sides in the watershed generally possess steep slopes, with moderately sloped intermediate land. Development on and disturbance of steep slopes increases the potential for landslides, runoff, erosion, and can adversely affect water quality via sedimentation, especially if highly erodible soils are present. It is important to protect steep slopes for many reasons. Conservation of steep slopes adjacent to streams protects water quality and aquatic habitat. Preserving vegetation on steep slopes can minimize hazards such as flooding, landslides, upland slumping, erosion, and sedimentation pollution.

Steep slopes also tend to have higher biodiversity when compared with more uniform habitats. Steeply sloped lands are often comprised of numerous microhabitats to which certain plants and animals are specifically adapted. Steeply sloped areas may consist of numerous microhabitats and their associated species, and conservation of the biodiversity that characterizes these areas is an important consideration in steep slope conservation. Approximately 9 square miles (or 6.2% of the watershed area) of steep slopes (> 15 degrees) exist within the Turtle Creek

watershed (Figure 4 and Table A-5 in Appendix A). The majority of the steep slopes exist in stream valleys in the central (e.g., Haymaker Run and middle Turtle Creek) and western (e.g., Thompson Run and tributaries to lower Turtle Creek) portions of the watershed (Figure 9).

2.3.6 Recreational Opportunities

Recreational opportunities are opportunities to undertake particular recreation activities (e.g., fishing) in a particular setting (e.g., middle Turtle Creek). Each combination of *activity* and *setting* represents a different recreational *opportunity*.

Based on the available resources that exist within the Turtle Creek watershed, the most auspicious and economically feasible recreational opportunities of the watershed are outdoor-based activities. Common characteristics of outdoor recreational activities include: (1) performed outside the confines of buildings; (2) do not involve organized competition; (3) can be undertaken without the existence of any built facility or infrastructure; (4) usually require large areas of land, water and/or air (i.e., a watershed-based recreational activity); and (5) may require outdoor areas of predominantly unmodified natural landscape. Some outdoor recreational activities that can easily be performed within the Turtle creek watershed include the following:

- Nature Observation and Photography
- Walking, Hiking, and Trail Running
- Camping
- Bicycle Riding, Mountain Biking
- Skiing, Snowboarding, Sledding, and Ice Skating
- Canoeing and Kayaking
- Horseback Riding
- Fishing
- Hunting/Shooting with Firearms and Bow and Arrow
- Trapping
- Motorcycling and ATVs

The Izaak Walton League (IWL), recognized for its leadership in building a national outdoor recreation policy, has developed eight principles for outdoor recreation planning. These principles are the following (IWL 2000):

- There should be preserved, developed, and made accessible to all American people such quantity and quality of outdoor recreation as is necessary and desirable for individual enjoyment and to assure physical, cultural and spiritual benefits to the nation.

- Natural areas and areas dedicated wholly or largely to recreational use must be adequate in distribution and number to serve the entire public.
- The public interest requires that recreation and fish and wildlife values be considered fully in the planning and management of all public lands and waters.
- The League recognizes that the overall recreational objective can be achieved only through public and private cooperation in recreation planning and development. The League encourages private landowners to make recreation resources available to the public. Private owners who make their lands available for public recreation should be protected fully from legal liability. State and local agencies should make special enforcement or other arrangements for patrolling and protecting private properties that are open for public recreation.
- Public programs should be designed and conducted to protect and, where possible, enhance recreation and fish and wildlife values.
- Abandoned railroad corridors should be preserved for public recreational use through a national rails-to-trails program.
- Billboards should be banned in scenic areas and restricted in size, number and location outside of scenic areas.

By adopting some of the IWL principles, municipalities can make best use of their existing outdoor recreational opportunities, ultimately improving the quality of life for residents of the Turtle Creek watershed.

2.4 CONSERVATION PLANNING RESOURCES FOR WATERSHED PROTECTION: A TOOLBOX FOR LOCAL COMMUNITIES

Appendix G was included in this RCP as a "Conservation Planning Toolbox" for the 33 municipalities in the Turtle Creek watershed. The toolbox contains the following tools:

- *Growing Greener: Putting Conservation into Local Codes* prepared by the Natural Lands Trust, Inc. (NLT 1999).
- Model stormwater management provisions for municipal subdivision/land development ordinance prepared by Chester Engineers as part of the *Turtle Creek Watershed Act 167 Stormwater Management Plan* (Chester Engineers 1991).
- *Protecting Floodplain Resources: A Guidebook for Communities* prepared by the Federal Interagency Floodplain Management Task Force (FIFMTF 1996).
- A model stream buffer protection ordinance prepared by the USEPA Office of Water (USEPA 2000).

- The *Environmental Advisory Council Handbook: A Guide for Pennsylvania's Municipal Environmental Advisory Councils* prepared by the Pennsylvania Environmental Council (PEC 1996).

The purpose for including these planning tools in the RCP is to encourage local municipalities to evaluate their existing comprehensive plans, zoning ordinances, and subdivision/development regulations on their effectiveness in protecting Turtle Creek, its tributaries, wetlands, floodplains, and greenspace within the watershed, and to serve as a source of new ideas for implementing conservation planning practices throughout the watershed.

2.5 ADDITIONAL RESOURCES

The following is an annotated bibliography of conservation planning references, including those discussed above and others, that may be useful to citizens and government officials residing in the Turtle Creek watershed.

Allegheny County Planning Department. 1993. *Improving Local Development Regulations: A Handbook for Municipal Officials.*
This represents Allegheny County's attempt at managing growth in the urbanized county. It advocates action and careful planning to improve how developments take place and suggests to provide a more sustainable landscape. Topics listed include: Improving Community Appearance, Model Regulations, Intergovernmental Coordination, Model Intergovernmental Agreements, Flexible Development Procedures, and Model Regulations for Flexible Development.

Association of State Floodplain Managers, Inc. and Federal Interagency Floodplain Management Task Force. 1996. *Addressing Your Community's Flood Problems- A Guide For Elected Officials.*
This document is designed for public officials to help plan for and take action to protect local communities from flood damage. It documents the experience of others in coping with flood disasters and quotes many levels of government officials on floodplain management. Some of the chapters include: How Floods Can Affect You, What You Can Do Before a Flood, Success Stories, Situations You Will Face After a Flood, and Resources You Can Use to Cope with a Flood.

Federal Interagency Floodplain Management Task Force. 1996. *Protecting Floodplain Resources: A Guidebook For Communities,* Second Edition.
This guidebook was written for local officials and citizens to assist in the basic understanding of natural resources in floodplains and for encouraging wise use of

these areas. Included are ideas for planning and managing conservation projects in floodplains, use of existing governmental programs and examples of effective management practices that have been applied in floodplains.

Governor's Center For Local Government Services. 1999. *Technical Information on Floodplain Management: Administrative Guidelines for Development*. #11. First Edition.
This publication is #11 in the planning series of the Governor's Center for Local Government Services and deals with floodplain management at the local level. Topics covered include: Permits for construction, Determining the 100-year floodplain, Regulating development in the floodway, Elevation & floodproofing, Manufactured homes, Department of Community and Economic Development, and Variances. It basically is a description of the hows and whys of participating in the National Flood Insurance Program (NFIP).

Governor's Center For Local Government Services. 1999. *The Comprehensive Plan in Pennsylvania*. #3. Sixth Edition.
This publication is #3 in the planning series of the Governor's Center for Local Government Services and deals with the development of a comprehensive plan for municipalities. It encourages local governments to form a plan by providing specific guidelines. Chapters include: Responsibility of a local government to plan, Elements of a comprehensive plan, developing a comprehensive plan, and adopting a plan. The guide also provides suggested tools and techniques to accomplish this goal.

Governor's Center For Local Government Services. 1999. *Zoning*. #4. Seventh Edition.
This publication is #4 in the planning series of the Governor's Center for Local Government Services and deals with zoning issues. Some included topics are: Relationship between planning and zoning, Preparation of the ordinance, Adopting the ordinance, Amending the ordinance, Problems with zoning, Alternative approaches to zoning, and other related topics. The publication attempts to make the complicated regulations of land use management easier to understand and provides some basic introduction to the zoning process.

Governor's Center For Local Government Services. 1997. *Pennsylvania Municipalities Planning Code*. Thirteenth Edition.
This publication is simply a list of the Pennsylvania municipal codes and provisions. The articles provided for under the Act include an Official Map, Subdivision Land Development, Zoning, Comprehensive Plan, Appeals Processes, Municipal Planning Commissions, and various related topics that fall under local empowerment acts.

Natural Lands Trust, Inc. 1997. *Growing Greener: Putting Conservation into local Codes.*
This booklet summarizes how municipalities can use the development process to protect open space by incorporating conservation of green space into the design. Different than "clustering," this concept advocates 4 basic actions: Envisioning the Future – performing "community audits," Protecting open space through conservation planning, Conservation zoning – a menu of choices, and Conservation subdivision design – a 4-step process.

Pennsylvania Department of Community and Economic Development. 1998. *Meeting the Minimum Requirements of the National Flood Insurance Program and the Pennsylvania Floodplain Management Act.*
This publication contains suggested provisions to ordinances that have been prepared to help Pennsylvania municipalities meet the requirements of the National Flood Insurance Program and the Pennsylvania Floodplain Management Act. All the provisions necessary to comply with these programs are included as well as guidelines on how to administer the ordinances, ordinance appeals, identification of floodplain areas, and special permits and exceptions.

Pennsylvania Environmental Council. 1996. *The EAC Handbook – A Guide for Pennsylvania's Municipal Environmental Advisory Councils.*
This publication was written as a guide for local environmental advisory councils (EAC) to manage growth in their communities by getting involved in the zoning and planning process. Discussed is how to operate an effective EAC, suggested action projects for an EAC, compiling an environmental resource inventory (data layers), how to work with local government, how land use decisions are made in Pennsylvania, and what the local role is.

U. S. Environmental Protection Agency (USEPA), Office of Water. 2000. *Model Ordinances to Protect Local Resources.*
www.epa.gov/owow/nps/ordinance/moll.htm
This publication is a model stream buffer protection ordinance that can be adopted by a municipality. Focusing primarily on streams, it contains suggestions for background information, intent of ordinance, definition of terms, applications, plan requirements, design standards, buffer management, enforcement procedures and variance/waiver information.

Frederick County Commissioners, Frederick County Site Planning Roundtable. 2000. *Recommended Model Development Principles for Frederick County, Maryland: A Consensus of the Frederick County Site Planning Roundtable.*
The Frederick County, Maryland Site Planning Roundtable, a group of development, environmental, local government, civic, nonprofit, business, and other community professionals analyzed Frederick County's existing development codes and ordinances. Through a consensus process, the Roundtable recommended 23 model development principles designed to guide future development towards the goals of measurable reducing impervious cover, conserving natural areas, and minimizing stormwater pollution. These model development principles, which address the issues of streets and parking lots, lot development, and conservation of natural areas, are described in this publication.

Center for Watershed Protection. 1996. *Environmental Indicators to Assess Stormwater Control Programs and Practices.* Final Report.
This publication presents a series of alternate stormwater monitoring techniques that rely on indicators, or surrogates of chemical, biological, physical, social, and programmatic conditions, to assess stormwater program and practice successes. 26 environmental indicator fact sheets are presented in this publication, which describes the environmental indicator, explains advantages and disadvantages for use, reviews indicator utility, presents a case example, and cites references for further investigation. A framework for using indicators is presented, along with a potential methodology for crafting an indicator-based monitoring program for municipal and industrial site managers. Three theoretical case examples are presented applying the principles of environmental indicator-based stormwater monitoring programs.

Center for Watershed Protection. 1996. *Design of Stormwater Filtering Systems.*
This publication presents detailed engineering guidance on 11 different filtering systems employing many different stormwater treatment methods utilizing various media, such as sand, peat, grass, soil, or compost, to filter pollutants entrained in urban stormwater. These filters are typically designed solely for pollutant removal, and serve small development sites. Three broad groups presented in the publication include: (1) sand filters (e.g., surface, underground, perimeter, organic, and pocket designs); (2) bioretention; and (3) vegetated channels (e.g., grass channels, dry swales, wet swales, filter strips, and gravel wetlands).

Center for Watershed Protection. 1997. *The Economics of Stormwater Best Management Practices in the Mid-Atlantic Region.*
This publication presents current cost data for urban stormwater practices, updates Best Management Practices (BMPs) cost prediction equations, and assesses the cost-effectiveness of the BMPs most commonly used in the Mid-Atlantic region. This examination of BMP costs includes 70 stormwater BMPs in the Mid-Atlantic area; including 38 pond systems (18 dry extended detention ponds, 18 wet extended detention ponds, and two wetlands), 12 bioretention areas, nine sand filters, and five infiltration trenches. In general, the publication confirms that storage volume is a reasonably strong indicator of total construction cost for urban BMPs. Accurate cost projection equations are provided for ponds, wetlands, and bioretention areas. This publication is designed for use by engineers, planners, and municipal officials as they consider BMPs in conjunction with watershed restoration and protection efforts, stormwater management strategies, erosion and sedimentation control plans, and BMP design manuals and criteria.

Center for Watershed Protection. 1998. *Nutrient Loading from Conventional and Innovative Site Development.*
This publication presents a comparison between the pollutant export and economic benefits of conventional planning techniques versus innovative site planning techniques. This simple assessment methodology consisted of analyzing four development sites located within the Chesapeake Bay watershed. Variables such as total site disturbance, impervious cover, key natural features retained, linear footage of roads, utilities, and storm drainage, size and type of stormwater BMPs, annual pollutant loadings, and estimated construction costs were analyzed for the four conventionally designed projects. The projects were then redesigned to incorporate innovative site planning techniques (e.g., narrower streets, smaller parking lots, open space development options, shorter driveways, and open channel drainage). The spreadsheet-based loading model SUNOM (Simplified Urban Nutrient Output model) was developed to compute pollutant loads for the alternative development scenarios. This publication illustrated the results of the analysis and graphically displayed the four alternative site designs.

Center for Watershed Protection. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community.*
This publication presents 22 detailed model development principles or recommendations for reducing impervious surfaces, minimizing stormwater run-off and pollution impacts on streams, and for conserving natural areas. The 22 principles are listed in Table G-1 (Appendix G). For each principle, the *Handbook* discusses the current design practices, recommended practices, perceptions vs. realities, case studies, and sources of additional information. This is an invaluable

resource for communities who are considering updating subdivision ordinances to incorporate conservation practices.

SECTION 3
ISSUES, NEEDS, AND OPPORTUNITIES

3.1 PUBLIC MEETINGS/SURVEYS

Three public meetings have been held thus far as part of the public involvement and planning process for the RCP. The first two meetings were conducted in an interactive fashion to solicit ideas from watershed residents on the issues of importance to them and their recommendations on how these issues should be addressed. The third meeting was held to present the draft conservation plan and to demonstrate the utility of the Turtle Creek GIS database that was built to assist in preparing the RCP. Appendix H provides further information on these meetings and the other activities used to keep the public informed on the status of the plan. A fourth and final meeting will be held to present the final plan and, most importantly, to discuss the ways in which the objectives of the plan will be implemented.

During the first two information-gathering meetings, people met in informal discussion groups and contributed thoughts on what the plan should address and their recommendations on how the plan should be used to improve the watershed. The discussions were guided by the following general themes: education and public involvement, recreation, stormwater runoff, water quality; and land use and development. A visioning session was held following the group discussions, where everyone listed their thoughts and ideas on flip charts and were then asked to vote for the issues they would most like to see included in the plan.

The recommendations gathered at the public meetings were used to prepare a survey that was mailed TCWA members, resource agency personnel, watershed stakeholders, and municipalities within the watershed to obtain feedback on the plan. The survey was also placed on the TCWA website, where it could be downloaded, completed and returned to TCWA or CEC.

The results of the visioning sessions at the public meetings and from returned surveys are presented in Table 6. Regarding education and public involvement, the top recommendation from both the visioning sessions and survey was for the TCWA to develop more outreach programs for sportsmen's groups, schools colleges and other organizations. The public also felt that it was important that the TCWA develop and publicize a mission statement and a long-range plan for the organization.

TABLE 6

Issues/Action Items Rankings from the Public Meetings and Surveys

Issue: Education and Public Involvement	Survey					Public Meeting	
	High	Medium	Low	Score	% Total	Votes	% Total
	(10)	(5)	(1)				
1 Develop more TCWA outreach for sportsman's groups, schools, colleges, and other organizations	9	2	0	100	12%	15	27%
2 Develop a mission statement and a long-range plan for the TCWA (i.e., What is the objective of the TCWA?)	6	4	0	80	10%	14	25%
3 Place "Turtle Signs" around the watershed to identify watershed boundaries and create a sense of ownership	2	3	6	41	5%	9	16%
4 Utilize Boy Scouts and schools to create parental involvement and to utilize computers in schools featuring watershed-based GIS	5	3	3	68	8%	4	7%
5 Develop a program to acquire more public land in the watershed (e.g., work with conservancies)	6	4	1	81	10%	4	7%
6 Create a "Canoe Turtle Creek" event to gain public involvement	2	4	4	44	5%	4	7%
7 Develop an interactive Website to host Turtle Creek watershed GIS maps	3	5	3	58	7%	2	4%
8 Utilize Pennsylvania Cleanways and community service programs in the watershed	5	3	3	68	8%	1	2%
9 Set up the TCWA booth in schools for school functions and for municipalities on community days	2	4	5	45	6%	1	2%
10 Identify landowners in riparian areas to gain more participation in conservation programs	6	1	4	69	9%	1	2%
11 Host "TCWA Funday" on/near Turtle Creek	3	6	2	62	8%	1	2%
12 Solicit business sponsorships to promote TCWA events	1	6	3	43	5%	0	0%
13 Determine what the hydrologic impact on the watershed would be as a result of the Lower Monongahela River Project (i.e., lock and dam replacement)	3	3	4	49	6%	0	0%
				808	100%	56	100%

Issue: Recreation	Survey					Public Meeting	
	High	Medium	Low	Score	% Max.	Votes	% Total
	(10)	(5)	(1)				
1 Explore options for rails-to-trails projects in the watershed	7	3	0	85	173%	12	20%
2 Create connectivity of watershed greenspace using floodplains	7	4	0	90	184%	12	20%
3 Identify and investigate converting Brownfields in the watershed into parks	7	3	0	85	173%	11	19%
4 Identify and create access (including parking) to recreation areas for fishing, hiking, etc. in the watershed	9	2	0	100	204%	9	15%
5 For potential recreation, employ GIS to identify greenspace, property owners along the stream, floodplains, and right-of-ways in the watershed	8	3	0	95	194%	7	12%
6 Identify potential future problems in floodplain areas in the watershed	5	4	2	72	147%	5	8%
7 Explore ways to enhance fishing opportunities in the watershed (e.g., Brush Creek)	4	2	4	54	110%	1	2%
8 Identify and link important resources in the watershed	6	1	3	68	139%	1	2%
9 Create an historical inventory of the watershed	2	3	6	41	84%	1	2%
10 Consider developing a nature center in the watershed	1	5	5	40	82%	0	0%
11 Identify existing recreation assets in the watershed	0	8	3	43	88%	0	0%
12 Identify any recreation plans developed for resources in the watershed	1	6	4	44	90%	0	0%
				817	1667%	59	100%

TABLE 6

Issues/Action Items Rankings from the Public Meeting and Surveys

Issue: Stormwater Runoff	Survey					Public Meeting	
	High	Medium	Low	Score	% Total	Votes	% Total
	(10)	(5)	(1)				
1 Create erosion and sedimentation control ordinances for municipalities in the watershed	10	0	0	100	14%	16	28%
2 Develop educational programs for municipal officials and design engineers	8	1	2	87	12%	10	18%
3 Identify public lands in the watershed that could be used for conservation projects	6	5	0	85	12%	6	11%
4 Investigate stormwater management possibilities for existing PADOT roads and systems in the watershed	4	6	1	71	10%	6	11%
5 Create an inventory of existing ponds in the watershed	2	6	3	53	7%	4	7%
6 Develop streamside debris ordinances	6	4	0	80	11%	4	7%
7 Identify structures that were developed before ordinances were adopted (e.g., large paved areas and underground detention facilities)	5	4	2	72	10%	4	7%
8 Identify flood control projects for the watershed	5	6	0	80	11%	4	7%
9 Identify areas with substantial agricultural runoff in the watershed	3	4	4	54	7%	3	5%
10 Explore options for retrofitting existing storm sewer systems in the watershed	4	2	5	55	7%	0	0%
				737	100%	57	100%

Issue: Water Quality	Survey					Public Meeting	
	High	Medium	Low	Score	% Max.	Votes	% Total
	(10)	(5)	(1)				
1 Identify areas and sources of abandoned mine drainage in the watershed	11	0	0	110	15%	26	46%
2 Identify development, which may be causing erosion and sedimentation in the watershed. Create education, planning, and best management plans to alleviate these problems	11	0	0	110	15%	15	26%
3 Create linkages between siltation problems and land use in the watershed	7	4	0	90	12%	7	12%
4 Identify combined sewer overflows (CSOs) in the watershed	8	1	2	87	12%	6	11%
5 Identify flood prone areas in the watershed	8	2	0	90	12%	3	5%
6 Create more public awareness of the connection between biological resources and water quality	7	4	0	90	12%	3	5%
7 Identify aquatic habitats compatible with stream channel dredging to increase capacity	4	4	3	63	9%	3	5%
8 Investigate the levels of toxic sediment (e.g., PCBs, metals) in the watershed	5	3	3	68	9%	4	7%
9 Create an Index of Biotic Integrity (IBI) for the watershed	2	4	4	44	6%	1	2%
				752	102%	68	119%

TABLE 6

Issues/Action Items Rankings from the Public Meetings and Surveys

Issue: Land Use and Development	Survey					Public Meeting	
	High	Medium	Low	Score	% Max.	Votes	% Total
	(10)	(5)	(1)				
1 Develop improved enforcement of land use codes and ordinances	7	4	0	90	7%	10	15%
2 Utilize "Special Measures" to alleviate problems in the watershed such as streamside buffers, clus	10	1	0	105	8%	8	12%
3 Develop better coordination between municipalities in the watershed	9	2	0	100	8%	8	12%
4 Create educational opportunities for municipal officers in zoning and land use that depicts the val	9	2	0	100	8%	8	12%
5 Create an environmental inventory for all municipalities in the watershed	6	5	0	85	7%	7	11%
6 Redevelop Brownfield sites in the watershed	6	3	2	77	6%	7	11%
7 Identify areas in the watershed with an over-development of housing	5	3	3	68	5%	7	11%
8 Develop proactive zoning and land use ordinances for municipalities in the watershed	7	1	3	78	6%	3	5%
9 Remediate stormwater within older communities during new development in the watershed	3	6	2	62	5%	2	3%
10 Update zoning ordinances to protect natural resources in the watershed	5	4	1	71	6%	2	3%
11 Map all floodplains and small tributaries in the watershed	4	4	3	63	5%	2	3%
12 Implement stormwater management in new development areas in the watershed	10	0	0	100	8%	1	2%
13 Develop plans for communities to try to preserve the watershed	3	3	2	47	4%	1	2%
14 Identify characteristics of communities within the watershed	1	3	6	31	2%	0	0%
15 Identify hillsides and developments impacting groundwater in the watershed	4	1	6	51	4%	0	0%
16 Utilize sustainable forestry to reduce runoff, flooding, and property damage in the watershed	5	2	4	64	5%	0	0%
17 Investigate Transfer of Development Rights (TDRs) for protecting open space in the watershed	3	5	3	58	5%	0	0%
				1250	100%	66	100%

Under the topic of recreation, five recommendations were ranked highly by the participants, including exploring rails to trails projects in the watershed; connecting green spaces within the watershed using floodplain areas; identifying and investigating brownfield sites that could be converted into parks; creating access (including parking) to recreation areas for outdoor recreation; and use the GIS to identify potential recreation areas by comparing greenspace, property owners along streams, floodplains, and rights of way.

Two stormwater runoff issues seemed to garner the greatest interest. These were creating erosion and sediment control ordinances for municipalities within the watershed and develop educational programs on stormwater management for municipal officials and design engineers. The related topic of water quality solicited recommendations to sources of abandoned mine drainage in the watershed and to monitor developments to identify those responsible for causing erosion and sedimentation problems and to correct the problems through education, planning and best management practices.

The topic of land use and development received the greatest number of recommendations. The following six land use action items were closely ranked:

- Develop improved enforcement of land use codes and ordinances;
- Use special measures such as stream side buffers, cluster housing, restricting grading next to streams, and protecting slopes to alleviate watershed problems from development;
- Develop better coordination between municipalities in the watershed;
- Educate municipal zoning officers on the value of the watershed;
- Create an environmental inventory for all municipalities in the watershed; and
- Redevelop brownfield sites in the watershed.

Most of the recommendations made by the public have been carried through the development of the plan by the Steering Committee, Project Advisory Council, and consultant team, and are included in the action plan presented in Section 4 of the RCP.

3.2 WATERSHED-WIDE ISSUES, NEEDS, AND OPPORTUNITIES

Many issues, needs, and opportunities of the Turtle Creek watershed were identified during the three public meetings, survey, five Steering Committee meetings, five Project Advisory Council meetings, and in comments on the draft RCP. The following issues were identified as being of watershed-wide importance, even though they may affect certain subwatersheds to a greater degree than others:

1. Determine the existing quality of the unassessed stream reaches in the watershed; begin a watershed-wide water quality and biological monitoring program.

2. Prevent further water quality and stream habitat degradation, especially from AMD, urban run-off, CSOs, and new land development.

3. Increase public involvement in the TCWA and in awareness of watershed issues, in general.

4. Endorse and actively promote opportunities for outdoor recreation within the watershed, including providing access to streams for water sports; trails/rails to trails for walking, hiking, running, biking, horse, and ATVs; greenways along floodplains and riparian areas that interconnect existing and future potential parklands;

5. Educate and promote wise land use and land development practices, including enforcement of environmental controls to prevent erosion and sedimentation and protection of sensitive landscape features such as streams, riparian areas, wetlands, floodplains, and steep slopes.

6. Restore degraded stream and riparian habitats, including repairing accelerated stream bank erosion and management of non-native, invasive plants.

7. Protecting floodplains from over-development so that they can continue to provide natural flood control functions.

8. Inventory potential habitats in the watershed for species of special concern, such as the Kirtland's snake, and the rare plants and insects having historical occurrences within the watershed.

9. Promote the history of the Turtle Creek watershed, to make people aware of its role in our region's history as well as the reflection of that history in the current battle to restore the creek.

While preparing the RCP, we have found substantial gaps in the available technical data, especially in the area of stream water quality and attainment of its state mandated protected use. For some subwatersheds (e.g., Steels Run, Bushy Run), no water quality or biological data have been collected. Out of the 315 stream miles

within the Turtle Creek watershed, only about 42.6 miles (14%) have been assessed by the state (PADEP 2000c and Table B-1 in Appendix B).

PADEP is required by Section 303(d) of the Federal Clean Water Act to identify all surface waters (i.e., streams and lakes) in the State that do not meet water quality standards. Streams and lakes that do not meet State water quality standards are placed on the 303(d) impaired waters list. Section 303(d) also requires PADEP to develop a Total Maximum Daily Load (TMDL) for these impaired waters. A TMDL is an estimate of the maximum amount of point and nonpoint sources of pollution that can be assimilated by a stream without causing impairment or water quality standards to be violated.

It is highly probable that hundreds of stream miles within the Turtle Creek watershed are impaired by a variety of nonpoint source pollutants, including siltation, AMD, nutrients, metals, and organic enrichment. However, only 26 stream miles in the watershed have been designated as impaired on Pennsylvania's 2000 Section 303(d) List, making them eligible for state clean-up plans.

Given that PADEP has assigned the Turtle Creek watershed the lowest priority category (Category IV) available for watershed assessment, the TCWA should take the lead in implementing a watershed-wide monitoring program. This program should concentrate efforts in the remaining (90 percent) unassessed streams in the Turtle Creek watershed.

3.3 SUBWATERSHED ISSUES, NEEDS, AND OPPORTUNITIES

Subwatersheds have specific characteristics and problems determined by numerous factors such as population density, economics, topography, land use, and water quality. The watershed management and planning principles developed by the Center for Watershed Protection (CWP 1998) were used to evaluate the water quality status and the recommended stream management approach of the Turtle Creek subwatersheds (Table 7). Three streams. Haymaker, Steeles, and Bushy Run, are recommended for conservation management. At the other extreme, Ardmore Run and Sawmill Run are highly impaired and fall within the urban watershed management category (i.e., non-restorable). All other streams are assessed as having restoration potential, if the source of impairment can be abated. While the effects of AMD can be more severe to overcome, AMD impacted streams in a rural setting such as the Lyons Run and the Upper Turtle Creek probably stand a greater chance of fully attaining their protected use compared with the urbanized subwatersheds.

TABLE 7

Subwatershed-based Stream Quality Evaluation

Subwatershed	Impervious Cover Class	General Stream Quality	Stream Quality Impact	Available Resources	Recommended Management Category
Abers Creek	Impacted	Fair	Urbanization	None	Watershed Restoration
Ardmore Run	Non-Supporting	Fair	Urbanization	None	Urban Watershed Management
Lower Brush Creek	Impacted	Poor	AMD	None	Watershed Restoration
Upper Brush Creek	Impacted	Fair	Urbanization	Put-and-take trout fishery	Watershed Restoration
Bushy Run	Sensitive	Unknown	Unknown	Unknown	Watershed Conservation
Dirty Camp Run	Impacted	Fair	Urbanization	None	Watershed Restoration
Haymaker Run	Sensitive	Good	Urbanization	Relict least brook lamprey population; Put-and-take trout fishery	Watershed Conservation
Lyons Run	Sensitive	Fair	AMD	None	Watershed Restoration
Sawmill Run	Non-Supporting	Unknown	Unknown	Unknown	Urban Watershed Management
Steels Run	Sensitive	Unknown	Unknown	Unknown	Watershed Conservation
Thompson Run	Impacted	Poor	AMD	None	Watershed Restoration
Lower Turtle Creek	Impacted	Fair/Good	Urbanization	Warm water fishery.	Watershed Restoration
Middle Turtle Creek	Impacted	Fair	AMD	Put-and-take trout fishery.	Watershed Restoration
Upper Turtle Creek	Sensitive	Poor	AMD	None	Watershed Restoration

3.4 CURRENT AND PAST PROJECTS UNDERTAKEN AND SUPPORTED BY THE TCWA

The TCWA has an active role in watershed awareness, monitoring and improvement projects throughout its 31-year history. TCWA's ongoing and completed projects are listed in Table 8. From its annual Fun Day at BY Park in Trafford to promote public awareness to its pivotal role in sponsoring and implementing AMD treatment projects, such as the Boreland Farm Discharge Project, the TCWA has an established record of serving the watershed that is its namesake. These past accomplishments and ongoing efforts to improve the Turtle Creek watershed, along with the public input and data compilation and analysis for the Rivers Conservation Plan, serve as the basis for developing the action plan presented in Section 4.

TABLE 8

Projects Completed/Underway by the Turtle Creek Watershed Association

Project	Partners/Participants	Funding	Status
Boreland Farm Road Discharge	TCWA, PADEP, PennDot, and Skelly & Loy, Inc.	Growing Greener grant, PennDOT mitigation funds,and other sources	Phase I Begun - Remove Gob Pile, Construct ALD and One Pond Phase II (Need Funding) - Construct More Ponds
Delmont (Durabond) Discharge Study	TCWA, PADEP, and GAI Consultants, Inc.	Growing Greener grant	Underway. TCWA and GAI studing possible treatment optionsfor the Delmont discharge.
Education Grant	TWCA and PADEP	Growing Greener grant	Underway. TCWA received funding to purchase equipment.
Streambank Stablilization Project	TCWA, PADEP, Heinz Foundation, Westmoreland County Conservation District, and Municipality of Murrysville	Growing Greener grant and Heinz Foundation grant	Ongoing. Stabilization Project at Haymaker Run at Bear Hollow Park, Murrysville.
Water Quality Monitoring Grant	TCWA and PADEP	Growing Greener grant	Ms. Flavin collected water samples of all AMD discharges within Turtle Creek Watershed. TCWA has this new data.
Rivers Conservation Plan	TCWA, PADCNR, Civil & Environmental Consultants, Inc.	PADCNR grant	Underway.Draft plan completed; making final revisions to plan.
Lower Turtle Creek Flood Control Study	Turtle Creek Valley Council of Governments, U.S. Army Corps of Engineers (USACOE), TCWA	Federal, state, and local funding	Proposed.
Annual Turtle Creek Clean-up	TCWA, sportsmans groups, scout troops, students and citizen volunteers	Donated services and materials by municipalities and local businesses and volunteer services	Ongoing
Annual Trout Stocking	TCWA, PAFBC, sportsmans groups	TCWA, donations by sportsmans groups, and PAFBC funding	Ongoing
Annual TCWA Fun Day	TCWA and local business sponsors	TCWA and donations by local businesses	Ongoing
Proposed Forbes Trail Recreation Area Study	TCWA, private landowners, Municipality of Monroeville, Trafford Borough, Penn Township, PA Department of Community Affairs	State and local funding	Ongoing.
Italy Road AMD Diversion Well	TCWA and PADEP	PADEP funding	Completed.
Trout Stocking Study	TCWA, Western PA Coalition for Abandoned Mine Reclamation, and Civil & Environmental Consultants, Inc.	WPCAMR grant and donated consulting services	Completed.
Fish and Benthic Macroinvertebrate Biomonitoring Surveys of Turtle Creek, Abers Creek, Brush Creek, Haymaker Run, and Lyons Run	PAFBC, PADEP, Civil & Environmental Consultants, Inc., Pat Bonislawsky, USACOE, and Westmoreland County Conservation District	PAFBC and PADEP biologists and donated and volunteer services	Completed.
905(b) Reconnaissance Study of the Upper Turtle Creek Watershed	USACOE, Pittsburgh District and TCWA	1998 Federal Energy and Water Development Appropriations Act and TCWA matching funds	Completed.
905(b) Reconnaissance Study of the Brush Creek Watershed	USACOE, Pittsburgh District and TCWA	1998 Federal Energy and Water Development Appropriations Act and TCWA matching funds	Completed.
905(b) Reconnaissance Study of the Lyons Run Watershed	USACOE, Pittsburgh District and TCWA	1998 Federal Energy and Water Development Appropriations Act and TCWA matching funds	Completed.
Irwin Syncline Basin Mine Drainage Pollution Abatement Project (Operation Scarlift)	Pullman Swindell and PADER	State and federal funding	Completed.

SECTION 4
IMPLEMENTATION AND ACTION PLAN

This Action Plan is designed to guide the TCWA toward the goal of conserving and improving the Turtle Creek watershed. The Action Plan for the Turtle Creek is presented in the implementation matrix in Table 9. The matrix lists both watershed wide and subwatershed issues and needs and recommends specific actions and implementation strategies, possible partnerships and potential funding sources, where needed. Recommended implementation dates and priority rankings are also indicated for TCWA's consideration.

One of the key implementation strategies on which the success of this plan will likely succeed or fail is the unquestionable need for TCWA to recruit active and energetic members to undertake many of the initiatives recommended by this plan. It is true that some of the actions, such as remediation of specific abandoned mine discharges will require funding more than willing hands, but many of these objectives will not be accomplished without a groundswell of grass roots community support. Serious consideration needs to be given to implementing a successful community outreach program that will want to make people become involved with the TCWA. This is why the need to increase community involvement and TCWA membership is listed as the number one watershed-wide priority of the plan.

TABLE 9

Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
WATERSHED-WIDE	Increase community involvement in watershed projects, activities, and advocacy; recruit new members into TCWA; promote environmental education	1. Promote and increase membership of the Turtle Creek Watershed Association through active projects, involvement in TCWA committees, public relations campaigns, TCWA website, local television and radio programs (On Q, Allegheny Front, etc.)	Canaan Valley Institute Pennsylvania Environmental Council Western Pennsylvania Coalition for Abandoned Mine Reclamation Allegheny Watershed Network Pennsylvania Organization for Watersheds and Rivers local television and radio stations, and local school districts partner with other nearby watershed organizations on large projects of mutual interest	Pennsylvania Department of Enviromental Protection (PADEP) businesses/corporations, and private foundations	2002	2002	2003	H
		2. Display at Carnegie Science Center during science fair						L
		3. Form a speakers committee to promote TC and watershed activities and environmental education to local science teachers and classes, scouting groups, and service organizations;						M
		4. Develop brochures and other displays to educate the residents of the watershed on how their actions affect the watershed and its resources			2002	2002	2002	H
	Appoint TCWA Member Representatives from each portion/subbasin of the watershed	Member representatives track and report on activities in their subwatershed	Watershed residents and memebers of TCWA	Accomplish with volunteer help	2002	---	2003	H
	Stream assessments to evaluate extent of water quality degradation by AMD, urbanization, and CSOs	1. Form a water quality monitoring committee, devise a modest but flexible initial monitoring program that can grow into a comprehensive watershed-wide monitoring program	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program Pennsylvania Senior Environmental Corp TCWA member volunteers	PADEP for volunteer training, monitoring equipment, and laboratory support sevices	2002	2003	2003	H
		2. Petition PADEP to schedule the evaluations of the unasessed waters within the watershed						M
	Development pressures on sensitive areas, i.e., steep slopes, floodplains, wetlands, riparian zones and streams	1. Liason with municipal officials, engineers, and planners to promote adoption of conservation principles and natural resource protection measures in land development codes and regulations	Thirty-three Municipalities of the Turtle Creek Watershed Allegheny Conservation District Westmoreland Conservation District Pennsylvania Department of Community and Economic Development Allegheny County Department of Economic Development Westmoreland County Department of Planning and Development TCWA member volunteers needed.	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				M
		2. Offer technical assistance to municipalities to help review and revise existing codes and adopt new ordinances (e.g., model zoning ordinances, riparian protection ordinance), update comprehensive plans, prepare conservation zoning overlay districts to protect critical TC resources						L
		3. Work to establish an Environmental Advisory Council for each municipality within the watershed						M
		4. Form a TCWA local government liason committee						L
		5. Have a TCWA member serve as a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the TC watershed						L
		6. Comment on projects that are or seem to be detrimental to maintaining clean stable stream systems and recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						M
	Urban stormwater runoff	Promote local adoption government of *Turtle Creek Watershed Act 167 Stormwater Management Plan* (1991) and stormwater treatment BMPs for stormwater systems, in accordance with Phase II stormwater quality requirements.	Thirty-three Municipalities of the Turtle Creek Watershed	Accomplish with volunteer help				M
	Greenways and municipal parks: endorse outdoor recreation, greenway/trail plan linking parks	1. Form a TCWA greenways, trails and recreation committee to network with local municipal parks departments; assist with grant applications and letters of support for land acquisition for greenways/waterways trails and parks	Thirty-three municipalities of the Turtle Creek Watershed Westmoreland County Bureau of Parks and Recreation Allegheny County Department of Public Works Parks Division Local sportsmans groups (fishing access trails) Private property owners along streams PADCNR, Regional Trails Corporation, Rails To Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association	Pensylvania Deparment of Conservation and Natural Resources (PADCNR) Western Pennsylvania Conservancy land trusts	2002	---	2003	H
		2. Facilitate the use of conservation easements as tax-deductible gifts and for environmental mitigation						L
		3. Promote greenway concepts that incorporate riparian corridors and land and water trails			2002	---	2003	H
		4. Improve stream access for fishing			2003	2004	2005	H
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for listing on the national register of historic places	Owners of historical properties Pennsylvania Historical and Museum Commission (PHMC) Steel Industry Heritage Corporation Friends of The Riverfront Three Rivers Heritage Trail Council Steel Valley Trail Council Pennsylvania Heritage Society Historical Society of Western Pennsylvania Westmoreland Historical Society Lincoln Highway Heritage Corridor Thirty-three municipalities of theTurtle Creek Watershed	PHMC Pittsburgh history and landmarks foundations private foundations				L
		2. Promote main street programs that preseve and reuse historical properties						L
		3. Work with municipalities, local and state agencies, property owners, and historic societies to develop and publicize historic driving and trail routes and tours that promote historic tourism within the Turtle Creek Valley.						M
	Stream habitat degradation	Seek funding for and initiate one stream habitat restoration/improvement project each year to repare degraded stream habitat; where possible use natural stream channel design and bioengineering techniques in place of rip rap and hard structures.	Form partnerships with other nearby watershed and conservation groups, involve boy scout troops and other service-based organizations PADEP Bureau of Waterways Engineering U. S. Department of Agriculture Natural Resources Conservation Service (NRCS) U. S. Fish & Wildlife Service (USFWS) U. S. Army Corps of Engineers (USACOE) Allegheny County Conservation District (ACCD) Westmoreland County Conservation District (WCCD)	PADEP USACOE ACCD/WCCD/NRCS Wildlife Habitat Council/private corporate sponsors National Fish and Wildlife Foundation Five Star Restoration Challange Grant	2002	2003	2003	H
	Species and habitats of special concern	1. Survey potential habitat for Kirtland's snake, rare plant species, and rare insects observed in TC watershed in past	Western Pennsylvania Concervancy (WPC) PADCNR Dr. Art Hulse (PA Herptelogical Atlas Project Coordinator, IUP)	WPC Wildlife Resource Conservation Fund PA Hertelogical Atlas project volunteers				L
		2. Survey public lands for unique and special concern habitats						L
	Invasive non-native vegetation	1. Develop a watershed-wide program to control Japanese knotweed (*Polygonum cuspidatum*)	Form partnerships with private landowners along streams Federal Interagency Committee for the Management of Noxious and Exotic Weeds National Invasive Species Council Western Pennsylvania Conservancy Arbor Day Foundation U. S. and PA Departments of Agriculture Western PA Botanical Society	PADEP PADCNR WPC				L
		2. Educate riparian landowners on the threat posed by this and other invasive plants to our natural heritage and stream systems; this project could be adopted by the greenways committee when an adequate number of members is reached.						L
	Revise/update Rivers Conservation Plan	Revise and update the Turtle Creek Rivers Conservation Plan every five years; submit updates to PADCNR	PADCNR	PADCNR PADEP - Growing Greener funding	20006	20007	20008	H

TABLE 9

Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
ABERS CREEK	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of Holiday Park WWTP, Route 286, and Boyce Park AMD discharges	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program Pennsylvania Senior Environmental Corp TCWA member volunteers ACCD, WCCD, PennDOT	PADEP for volunteer training, monitoring equipment, and laboratory support sevices	2003	2004	2004	H
	Medium impervious cover	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote natural stream channel principles and floodplain protection and discourage channel widening and floodplain filling	TCWA member volunteers needed Municipalities of Murrysville, Monroeville, and Plum Private developers PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Allegheny County Conservation District (ACCD) Westmoreland County Conservation District (WCCD)	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
		2. Work with developers to restore destabilized stream channels for environmental mitigation						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Steep slopes	1. Inventory steep slopes and landslide areas within Abers Creek subwatershed and enter data in GIS	Municipalities of Murrysville, Monroeville, and Plum Developers, and private landowners	PADCNR PADEP - Growing Greener grant Municipalities of Murrysville, Monroeville, and Plum				L
		2. Provide information to local municipalities and work with municipalities to develop and enforce ordinances to protect steep slopes and landslide-prone areas						L
	Greenways, streamside trails and/or rail trails	Inventory possible trail routes along Abers Creek and develop and promote streamside trails linking Boyce Park and Abers Creek valley parks to the Turtle Creek valley	Municipalities of Murrysville, Monroeville, and Plum Westmoreland County Bureau of Parks and Recreation Allegheny County Department of Public Works Parks Division Private property owners along streams PADCNR, Regional Trails Corporation, Rails To Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association	PADCNR Western Pennsylvania Conservancy land trusts				M
	Flooding	Work with municipalities to promote/enforce floodplain ordinances and land development regulations that conserve floodplains, restrict floodplain development, and improve infrastructure	Municipalities of Murrysville, Monroeville, and Plum PADEP Bureau of Waterways Engineering Federal Emergency Management Agency and National Flood Insurance Program USACOE Private landowners	USACOE PADEP - Growing Greener grant				M
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for listing on the national register of historic places in the Abers Creek subwatershed	Owners of historical properties Pennsylvania Historical and Museum Commission (PHMC) Steel Industry Heritage Corporation Friends of The Riverfront Three Rivers Heritage Trail Council Steel Valley Trail Council Pennsylvania Heritage Society Historical Society of Western Pennsylvania Westmoreland Historical Society Municipalities Of Murrysville, Monroeville, and Plum,	PHMC Pittsburgh history and landmarks foundations and private foundations				L
		2. Promote historic tourism (e.g., Carpenter log house in Boyce Park)						L
	Abandoned mine drainage	Endorse and support WPCAMR's evaluation of Boyce Park AMD discharges for remediation priorities and feasibility; remediate if warranted and feasible	PADEP Bureau of Abandoned Mine Reclamation And Bureau of Watershed Conservation Western Pennsylvania Coalition For Abandoned Mine Reclamation (WPCAMR)	PADEP WPCAMR Private foundations	2002	2003	2004	H
ARDMORE RUN	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of Route 30 and urban stormwater runoff and AMD discharges	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program Pennsylvania Senior Environmental Corp TCWA member volunteers ACCD, PennDOT	PADEP for volunteer training, monitoring equipment, and laboratory support sevices				L
	Species of Special Concern	Survey potential habitat for Kirtland's snake	Western Pennsylvania Conservancy, PADCNR, and Pennsylvania Fish and Boat Commission	Pennsylvania Deparment of Conservation and Natural Resources				M
	High impervious cover, long culverted stream reaches	Host workshops for municipalities and developers to promote improving existing stormwater infrastructure during redevelopment, including daylighting culverted streams, correcting CSO problems, restoring riparian vegetation, installing green stormwater systems, etc.	Municipalities of Wilkinsburg, Churchill, Forest Hills, Braddock Hills, Chalfant, North Braddock, Wilkins Township, and East Pittsburgh, ACCD ALCOSAN Rocky Mountain Institute	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
	Brownfield sites	Provide support to the Turtle Creek Valley Council of Governments (TCVCOG), municipalities, and other redevelopment authorities in promoting brownfield redevelopment based on sound conservation design principles.	TCVCOG The Brownfields Center (Carnegie Mellon University and the University of Pittsburgh) Urban Redevelopment Authority of Pittsburgh PADEP Land Recycling Program (Act 2) Pittsburgh High Technology Council Regional Industrial Development Corporation	PADEP and Private Foundations				M
	Abandoned mine drainage	Identify and evaluate AMD discharges along Ardmore Run for remediation priorities and feasibility; remediate if warranted and feasible	PADEP Bureau of Abandoned Mine Reclamation And Bureau of Watershed Conservation Western Pennsylvania Coalition For Abandoned Mine Reclamation (WPCAMR)	PADEP WPCAMR Private foundations				L

TABLE 9

Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
LOWER BRUSH CREEK	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of stormwater runoff from Routes 130 and 993 and urban sources, two identified CSOs and the Irwin and other AMD discharges	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program Pennsylvania Senior Environmental Corp TCWA member volunteers ACCD, WCCD, PennDOT	PADEP for volunteer training, monitoring equipment, and laboratory support sevices	2002	2002	2002	H
	Medium impervious cover	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote natural stream channel principles and floodplain protection and discourage channel widening and floodplain filling	TCWA member volunteers Municipalities of Trafford, North Irwin, Irwin, Adamsburg, North Versailles, Penn Township, North Huntingdon Township, and Hempfield Township Private developers PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Allegheny County Conservation District (ACCD) Westmoreland County Conservation District (WCCD)	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
		2. Work with developers to restore destabilized stream channels for environmental mitigation						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	CSO discharges	Advocate for and support efforts to eliminate two documented CSOs in the Lower Brush Creek subwatershed	PADEP, Western Westmoreland Municipal Authority and North Huntingdon Township	USEPA, PADEP, Western Westmoreland Municipal Authority				M
	Abandoned mine drainage	1. Evaluate Irwin and Coal Run Discharges and identify other discharges for remediation priorities; perform feasibility studies and remediate major discharges.	PADEP Bureau of Abandoned Mine Reclamation and Bureau of Watershed Conservation Western Pennsylvania Coalition for Abandoned Mine Reclamation Municipalities of Irwin and North Huntington	PADEP WPCAMR Private foundations	2002	2005	2007	H
		2. Coordinate with local planning and zoning departments to pursue opportunities to purchase approporiate properties for remediation projects			2002	2005	2007	H
	Outdoor recreation and fishing opportunities	Promote warmwater fishery and fishing, improve stream access for fishing, initiate stream habitat improvement projects	Pennsylvania Fish and Boat Commission (PAFBC) and Local Sportsmen's Groups	PAFBC and Local Sportsmen's Groups	2005	2007	2009	H
	Streamside trail and/or rail trail	Inventory possible trail routes along lower Brush Creek and develop and promote streamside trails linking the proposed Tinkers Run Trail and Manor to Claridge Trail to the planned Export to Trafford Trail and proposed Forbes Trail	Municipalities of Trafford, North Irwin, Irwin, Adamsburg, North Versailles, Penn Township, North Huntingdon Township, and Hempfield Township Westmoreland County Bureau of Parks and Recreation Allegheny County Department of Public Works Parks Division Private property owners along streams PADCNR, Regional Trails Corporation, Rails To Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association	PADCNR Western Pennsylvania Conservancy land trusts	2004	2006	2008	H
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for Listing on the National Register of Historic Places	Owners of historical properties Municipalities of Trafford, North Irwin, Irwin, Adamsburg, North Versailles, Penn Township, North Huntingdon Township, and Hempfield Township Pennsylvania Historical and Museum Commission (PHMC) Steel Industry Heritage Corporation Steel Valley Trail Council Friends of The Riverfront Three Rivers Heritage Trail Council Pennsylvania Heritage Society Historical Society of Western Pennsylvania Westmoreland Historical Society	PHMC Pittsburgh history and landmarks foundations and private foundations				L
		2. Assist municipalities in implementing main street programs						L
		3. Promote historic tourism (e.g., Carnegie Coal Company's Ardara Mine and Larimer Coke Works, Penn Gas Coal Company's Number 2 Mine (Adams Mine), Adams Hill (Scab Hill), and Pennsylvania Railroad)						M
	Flooding	Work with municipalities to promote/enforce floodplain ordinances and land development regulations that conserve floodplains, restrict floodplain development, and improve infrastructure	Municipalities of Trafford, North Irwin, Irwin, Adamsburg, North Versailles, Penn Township, North Huntingdon Township, and Hempfield Township PADEP Bureau of Waterways Engineering Federal Emergency Management Agency and National Flood Insurance Program United States Army Corps of Engineers Private Landowners	USACOE, PADEP				L
	Steep slopes	1. Inventory steep slopes and landslide areas within lower Brush Run subwatershed and enter data in GIS	Municipalities of Trafford, North Irwin, Irwin, Adamsburg, North Versailles, Penn Township, North Huntingdon Township, and Hempfield Township	PADCNR PADEP - Growing Greener grant Municipalities of Trafford, North Irwin, Irwin, Adamsburg, North Versailles, Penn Township, North Huntingdon Township, and Hempfield Township				L
		2. Provide information to local municipalities and work with municipalities to develop and enforce ordinances to protect steep slopes and landslide-prone areas						L
	Brownfield sites	1. Complete an inventory of available brownfield sites for re-development, including available acreage, ownership and known limitiations	Municipality redevelopment authorities The Brownfields Center (Carnegie Mellon University and the University of Pittsburgh) Urban Redevelopment Authority of Pittsburgh PADEP Land Recycling Program (Act 2) Pittsburgh High Technology Council Regional Industrial Development Corporation Redevelopment Authority of Westmoreland County Westmoreland County Industrial Development Corporation	Redevelopment authorities PADEP Private foundations				M
		2. Provide support to municipalities and redevelopment authorities in promoting brownfield redevelopment based on sound conservation design principles						M

TABLE 9

Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
UPPER BRUSH CREEK	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of stormwater runoff from Routes 130 and 993, and urban and agricultural sources, and one identified CSO	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program Pennsylvania Senior Environmental Corp TCWA member volunteers WCCD, PennDOT	PADEP for volunteer training, monitoring equipment, and laboratory support sevices				M
	Medium impervious cover	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote natural stream channel principles and floodplain protection and discourage channel widening and floodplain filling	TCWA member volunteers Municipalities of Manor, Adamsburg, Irwin, North Irwin, Jeannette, Penn, North Huntingdon Township, and Hempfield Township Private developers PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Westmoreland County Conservation District (WCCD)	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
		2. Work with developers to restore destabilized stream channels for environmental mitigation						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	CSO discharges	Advocate for and support efforts to eliminate the documented CSOs in the Upper Brush Creek subwatershed	Western Westmoreland Municipal Authority and Municipality of Manor	Western Westmoreland Municipal Authority				M
	Put-and-take trout fishery	Endorse put-and-take trout fishing and stock trout, improve stream access for fishing, initiate stream habitat improvement projects	Pennsylvania Fish and Boat Commission and local sportsmen's groups	PAFBC and local sportsmen's groups	2003	2004	2004	H
	Streamside trail and/or rail trail	Inventory possible trail routes along upper Brush Creek and develop and promote streamside trails along upper Brush Creek that are linked with the proposed Tinkers Run Trail and Manor to Claridge Trail	Municipalities of Manor, Adamsburg, Irwin, North Irwin, Jeannette, Penn, North Huntingdon Township, and Hempfield Township Private property owners along upper Brush Creek Westmoreland County Bureau of Parks and Recreation PADCNR, Regional Trails Corporation, Rails To Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association	PADCNR Westmoreland County Bureau of Parks And Recreation Western Pennsylvania Conservancy land trusts	2004	2005	2006	H
	Brownfield sites	1. Complete an inventory of available brownfield sites for re-development, including available acreage, ownership and known limitiations	Municipality redevelopment authorities The Brownfields Center (Carnegie Mellon University and the University of Pittsburgh) Urban Redevelopment Authority of Pittsburgh PADEP Land Recycling Program (Act 2) Pittsburgh High Technology Council Regional Industrial Development Corporation Redevelopment Authority of Westmoreland County Westmoreland County Industrial Development Corporation	Redevelopment authorities PADEP Private foundations				L
		2. Provide support to municipalities and redevelopment authorities in promoting brownfield redevelopment based on sound conservation design principles						M
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for Listing on the National Register of Historic Places	Owners of historical properties Municipalities of Manor, Adamsburg, Irwin, North Irwin, Jeannette, Penn, North Huntingdon Township, and Hempfield Township Pennsylvania Historical and Museum Commission (PHMC) Steel Industry Heritage Corporation Friends of The Riverfront Three Rivers Heritage Trail Council Steel Valley Trail Council Pennsylvania Heritage Society Historical Society of Western Pennsylvania Westmoreland Historical Society	PHMC Pittsburgh history and landmarks foundations and private foundations				L
		2. Assist municipalities in implementing main street programs						M
		3. Promote historic tourism (e.g., Jeannette's Glass Companies and Pennsylvania Railroad)						L
	Flooding	Work with municipalities to promote/enforce floodplain ordinances and land development regulations that conserve floodplains, restrict floodplain development, and improve infrastructure	Municipalities of Manor, Adamsburg, Irwin, North Irwin, Jeannette, Penn, North Huntingdon Township, and Hempfield Township PADEP Bureau of Waterways Engineering Federal Emergency Management Agency and National Flood Insurance Program United States Army Corps of Engineers Private Landowners	USACOE, PADEP				M

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Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
BUSHY RUN	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of agricultural runoff	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program Pennsylvania Senior Environmental Corp TCWA member volunteers WCCD, PennDOT	PADEP for volunteer training, monitoring equipment, and laboratory support sevices				M
	Low Impervious Cover (Sensitive)	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote green development principles, riparian buffers, preservation of streams, wetlands and floodplains, and stormwater treatment	TCWA member volunteers Municipalities of Manor and Penn Township Private developers PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Westmoreland County Conservation District (WCCD)	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
		2. Work with developers to restore destabilized stream channels for environmental mitigation.						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Put-and-take trout fishery	Endorse put-and-take trout fishing and stock trout	Pennsylvania Fish and Boat Commission and local sportsmen's groups	PAFBC and local sportsmen's groups				M
	Greenspace	Promote land use practices that conserve greenspace, identify desirable parcels for greenspace protection, and purchase land for greenways	Municipalities of Manor and Penn Township PADCNR Western Pennsylvania Conservancy land trusts	PADCNR Western Pennsylvania Conservancy land trusts				M
	Streamside trail and/or rail trail	Endorse and support development of the proposed Manor to Claridge Trail	Municipalities of Manor and Penn Township Private property owners along Bushy Run Regional Trails Corporation Rails To Trails Conservancy Allegheny Trail Alliance Keystone Trails Association PADCNR Westmoreland County Bureau of Parks And Recreation	PADCNR	2002	2003	2004	H
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for Listing on the National Register of Historic Places	Owners of historical properties Municipalities of Manor, Adamsburg, Irwin, North Irwin, Jeannette, Penn, North Huntingdon Township, and Hempfield Township Pennsylvania Historical and Museum Commission (PHMC) Steel Industry Heritage Corporation Friends of The Riverfront Three Rivers Heritage Trail Council Steel Valley Trail Council Pennsylvania Heritage Society Historical Society of Western Pennsylvania Westmoreland Historical Society	PHMC Pittsburgh history and landmarks foundations and private foundations				L
		2. Assist municipalities in implementing main street programs						L
		3. Promote historic tourism (e.g., Bushy Run Battlefield State Park)						M
DIRTY CAMP RUN	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of urban stormwater runoff to Dirty Camp Run	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program Pennsylvania Senior Environmental Corp TCWA member volunteers aCCD, PennDOT	PADEP for volunteer training, monitoring equipment, and laboratory support sevices				L
	Medium impervious cover	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote natural stream channel principles and floodplain protection and discourage channel widening and floodplain filling	TCWA member volunteers Municipalities of Pitcairn and Monroeville Private developers PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Allegheny County Conservation District	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				M
		2. Work with developers to restore destabilized stream channels for environmental mitigation						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Flooding	Work with municipalities to promote/enforce floodplain ordinances and land development regulations that conserve floodplains, restrict floodplain development, and improve infrastructure	Municipalities of Pitcairn and Monroeville PADEP Bureau of Waterways Engineering Federal Emergency Management Agency and National Flood Insurance Program United States Army Corps of Engineers Private Landowners	USACOE, PADEP	2002	2002	2002	H
	Steep slopes	1. Inventory steep slopes and landslide areas within the subwatershed and enter data in GIS	Municipalities of Pitcairn and Monroeville Developers and private landowners	PADCNR PADEP - Growing Greener grant Municipalities of Pitcairn and Monroeville				M
		2. Provide information to local municipalities and work with municipalities to develop and enforce ordinances to protect steep slopes and landslide-prone areas						M

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Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
HAYMAKER RUN	Species and habitats of special concern	1. Conduct least brook lamprey population study in Haymaker Run and develop plan to enhance and protect habitat for this species	Western Pennsylvania Conservancy PADCNR Pennsylvania Fish and Boat Commission USACOE Westmoreland Conservancy Municipalities of Murrysville, Plum, and Monroeville	PADEP - Growing Greener grant PADCNR Pennsylvania Fish and Boat Commission				M
		2. Study and document biodiversity of Haymaker Run Biologically Diverse Area, including surveys for rare plant species						M
	Put-and-take trout fishery	Endorse put-and-take trout fishing and stock trout, improve stream access for fishing, initiate stream habitat improvement projects	Pennsylvania Fish and Boat Commission Sportsmen And Landowner Alliance of Murrysville	Pennsylvania Fish and Boat Commission Sportsmen And Landowner Alliance of Murrysville	2002	2003	2003	H
	Low impervious cover (sensitive)	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote green development principles, riparian buffers, preservation of streams, wetlands and	TCWA member volunteers Municipalities of Murrysville, Plum, and Monroeville Private developers PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Westmoreland County Conservation District (WCCD)	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
		2. Work with developers to restore destabilized stream channels for environmental mitigation.						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Greenspace	Promote land use practices that conserve greenspace, identify desirable parcels for greenspace protection, and purchase land for greenways	Municipalities of Murrysville, Plum, and Monroeville PADCNR Western Pennsylvania Conservancy, land trusts	PADCNR Western Pennsylvania Conservancy land trusts				L
	Steep slopes	1. Inventory steep slopes and landslide areas within the subwatershed and enter data in GIS	Municipalities of Murrysville, Plum, and Monroeville Developers and private landowners	PADCNR PADEP - Growing Greener grant Municipalities of Murrysville, Plum, and Monroeville				L
		2. Provide information to local municipalities and work with municipalities to develop and enforce ordinances to protect steep slopes and landslide-prone areas						L
	Streamside trail and/or rail trail	Inventory possible trail routes along Haymaker Run and promote streamside trail development	Municipalities of Murrysville, Plum, and Monroeville Private property owners along Bushy Run Westmoreland County Bureau of Parks And Recreation PADCNR, Regional Trails Corporation, Rails To Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association	PADCNR Westmoreland County Bureau of Parks And Recreation Western Pennsylvania Conservancy land trusts				L
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for Listing on the National Register of Historic Places.	Owners of historical properties Municipalities of Murrysville, Plum, and Monroeville Pennsylvania Historical and Museum Commission (PHMC) Steel Industry Heritage Corporation, Friends of The Riverfront, Three Rivers Heritage Trail Council, Steel Valley Trail Council, Pennsylvania Heritage Society, Historical Society of Western Pennsylvania, Westmoreland Historical Society	PHMC Pittsburgh history and landmarks foundations and private foundations Municipalities of Murrysville, Plum, and Monroeville				L
		2. Assist municipalities in implementing main street programs.						L
		3. Promote historic tourism (e.g., Haymaker Gas Well and Pucketa Path).						L
LYONS RUN	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of stormwater runoff from PA Turnpike and AMD from Heidekat discharges	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management TCWA member volunteers Citizen's Volunteer Monitoring Program, Pennsylvania Senior Environmental Corp WCCD, PennDOT, PA Turnpike Authority (PATA)	PADEP for volunteer training, monitoring equipment, and laboratory support sevices	2003	2003	2004	H
	Low impervious cover (sensitive)	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote green development principles, riparian buffers, preservation of streams, wetlands and floodplains, and stormwater treatment	TCWA member volunteers Municipalities of Murrysville and Penn Township Private developers PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Westmoreland County Conservation District (WCCD)	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
		2. Work with developers to restore destabilized stream channels for environmental mitigation.						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Abandoned mine drainage (e.g., Heidekat discharges)	Prioritize Heidekat discharge along with basin-wide assessment of AMD discharges; based on this re-assessment and USACOE reconnaissance studies evaluate feasibility of remediating Heidekat discharge and remediate if feasible.	PADEP Bureau of Abandoned Mine Reclamation and Bureau of Watershed Conservation and Western Pennsylvania Coalition for Abandoned Mine Reclamation	PADEP and Private Foundations	2004	2006	2008	H
	Greenspace	Promote land use practices that conserve greenspace, identify desirable parcels for greenspace protection, and purchase land for greenways	Municipalities of Murrysville and Penn Township PADCNR Western Pennsylvania Conservancy, land trusts	PADCNR Western Pennsylvania Conservancy land trusts				M
	Steep slopes	1. Inventory steep slopes and landslide areas within the subwatershed and enter data in GIS	Municipalities of Murrysville and Penn Township Developers and private landowners	PADCNR PADEP - Growing Greener grant Municipalities of Murrysvilleand Penn Township				L
		2. Provide information to local municipalities and work with municipalities to develop and enforce ordinances to protect steep slopes and landslide-prone areas						M
	Streamside trail and/or rail trail	Inventory possible trail routes along Lyons Run and promote streamside trail development	Municipalities of Murrysville and Penn Township Private property owners along Lyons Run Westmoreland County Bureau of Parks And Recreation PADCNR, Regional Trails Corporation, Rails To Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association	PADCNR PADEP - Growing Greener grant Municipalities of Murrysville and Penn Township				M

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Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
SAWMILL RUN	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of urban stormwater runoff and AMD discharges	TCWA member volunteers , PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program and Pennsylvania Senior Environmental Corp ACCD	PADEP for volunteer training, monitoring equipment, and laboratory support sevices				L
	High impervious cover, long culverted stream reaches	Host workshops for municipalities and developers to promote improving existing stormwater infrastructure during redevelopment, including daylighting culverted streams, correcting CSO problems, restoring riparian vegetation, installing green stormwater systems, etc.	Municipalities of Wilkinsburg, Churchill, Wilkins Township, Chalfant, Turtle Creek, and East Pittsburgh, ACCD ALCOSAN Rocky Mountain Institute	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
	Brownfield sites	Provide technical assitance to the Turtle Creek Valley Council of Governments (TCVCOG), municipalities, and other redevelopment authorities in promoting brownfield redevelopment based on sound conservation design principles.	TCVCOG The Brownfields Center (Carnegie Mellon University and the University of Pittsburgh) Urban Redevelopment Authority of Pittsburgh, PADEP Land Recycling Program (Act 2) Pittsburgh High Technology Council , Regional Industrial Development Corporation Redevelopment Authority of Westmoreland County Westmoreland County Industrial Development Corporation	PADEP and Private Foundations				M
	Abandoned mine drainage (e.g., unidentified discharges)	Identify and evaluate AMD discharges along Sawmill Run for remediation priorities and feasibility; remediate if warranted and feasible	PADEP Bureau of Abandoned Mine Reclamation and Bureau of Watershed Conservation	PADEP and Private Foundations				M
STEELS RUN	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of agricultural runoff	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program and Pennsylvania Senior Environmental Corp TCWA member volunteers, WCCD, NRCS	PADEP for volunteer training, monitoring equipment, and laboratory support sevices	2003	2003	2003	H
	Low impervious cover (sensitive)	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote green development principles, riparian buffers, preservation of streams, wetlands and floodplains, and stormwater treatment	Municipality of Murrysville and Westmoreland Conservation District TCWA member volunteers Private developers	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
		2. Work with developers to restore destabilized stream channels for environmental mitigation.	PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Westmoreland County Conservation District (WCCD)					M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Greenspace	Promote land use practices that conserve greenspace, identify desirable parcels for greenspace protection, and purchase land for greenways	Municipality of Murrysville PADCNR Western Pennsylvania Conservancy land trusts	PADCNR Western Pennsylvania Conservancy land trusts	2002	---	2003	H
THOMPSON RUN	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of urban and Route 22 stormwater runoff and AMD discharges	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program and Pennsylvania Senior Environmental Corp TCWA member volunteers, ACCD, PennDOT	PADEP for volunteer training, monitoring equipment, and laboratory support sevices	2002	2002	2002	H
	Species and Habitats of Special Concern	Conduct Rare Plant Survey and Kirtland's Snake Inventory, Protect these Species, and Enhance and Protect their Habitats and Bullock-Pens Park	Western Pennsylvania Conservancy, PADCNR, and Pennsylvania Fish and Boat Commission	PADCNR				L
	Medium impervious cover	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote natural stream channel principles and floodplain protection and discourage channel widening and floodplain filling	TCWA member volunteers needed Municipalities of Penn Hills, Plum, Monroeville, Wilkinsburg, Churchill, Wilkins Township, and Turtle Creek and Allegheny Conservation DistrictPrivate developers	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				M
		2. Work with developers to restore destabilized stream channels for environmental mitigation	PADEP Soils and Waterways Section		2004	---	2010	H
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream	Private developers U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Allegheny County Conservation District					L
	CSO Discharges	Advocate for and support efforts to eliminate the documented CSOs in the Thompson Run subwatershed	Allegheny County Sanitary Authority and Municipality of Turtle Creek	Allegheny County Sanitary Authority				M
	Abandoned mine drainage (e.g., Blue Lagoon discharge)	Prioritize Blue Lagoon discharge and other discharges in the Thompson Run subwatershed along with basin-wide assessment of AMD discharges; based on this re-assessment and USACOE reconnaissance studies evaluate feasibility of remediating Blue Lagoon and other discharges discharge and remediate if feasible.	PADEP Bureau of Abandoned Mine Reclamation and Bureau of Watershed Conservation and Western Pennsylvania Coalition for Abandoned Mine Reclamation PA Turnpike Authority (Mon-Fayette Expressway)	PADEP and Private Foundations	2004	2006	2010	H
	Brownfield sites	Provide technical assitance to the Turtle Creek Valley Council of Governments (TCVCOG), municipalities, and other redevelopment authorities in promoting brownfield redevelopment based on sound conservation design principles.	TCVCOG, municipalities, The Brownfields Center (Carnegie Mellon University and the University of Pittsburgh), Urban Redevelopment Authority of Pittsburgh, PADEP Land Recycling Program (Act 2), Pittsburgh High Technology Council, Regional Industrial Development Corporation	PADEP and Private Foundations				M
	Streamside trail and/or rail trail	Develop and Promote Streamside Trails and/or Rail Trails	Rails to Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association, PADCNR, Allegheny County Department of Public Works Parks Division, and Municipalities of Penn Hills, Plum, Monroeville, Wilkinsburg, Churchill, Wilkins Township, and Turtle Creek	PADCNR Westmoreland Co. Bureau of Parks and Rec. Western Pennsylvania Conservancy land trusts	2004	2006	2010	H
	Steep slopes	1. Inventory steep slopes and landslide areas within the subwatershed and enter data in GIS	Municipalities of Penn Hills, Plum, Monroeville, Wilkinsburg, Churchill, Wilkins Township, and Turtle Creek Developers and private landowners	PADCNR PADEP - Growing Greener grant local municipalities				L
		2. Provide information to local municipalities and work with municipalities to develop and enforce ordinances to protect steep slopes and landslide-prone areas						L
	Flooding	Work with municipalities to promote/enforce floodplain ordinances and land development regulations that conserve floodplains, restrict floodplain development, and improve infrastructure	Municipalities of Penn Hills, Plum, Monroeville, Wilkinsburg, Churchill, Wilkins Township, and Turtle Creek, PADEP Bureau of Waterways Engineering, Federal Emergency Management Agency, National Flood Insurance Program, United States Army Corps of Engineers, and Private Landowners	USACOE, PADEP				M

TABLE 9

Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
LOWER TURTLE CREEK	Stream assessment needs	Develop a comprehensive TCWA volunteer monitoring program to eventually monitor all subwatersheds; design monitoring program to assess impacts of urban stormwater runoff and CSOs	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program and Pennsylvania Senior Environmental Corp TCWA member volunteers , ACCD	PADEP for volunteer training, monitoring equipment, and laboratory support sevices				M
	CSO discharges	Advocate for and support efforts to eliminate the documented CSOs in the Lower Turtle Creek subwatershed	Allegheny County Sanitary Authority and Municipalities of North Braddock, East Pittsburgh, North Versailles, Turtle Creek, Wilmerding, East McKeesport, and Wall	Allegheny County Sanitary Authority				M
	Medium impervious cover	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote natural stream channel principles and floodplain protection and discourage channel widening and floodplain filling	TCWA member volunteers needed Municipalities of North Versailles, Wall, Monroeville, Pitcairn, Trafford, East McKeesport, Wilmerding, Turtle Creek, East Pittsburgh, and North Braddock PADEP Soils and Waterways Section Private developers U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS) Allegheny County Conservation District	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				L
		2. Work with developers to restore destabilized stream channels for environmental mitigation						L
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Brownfield sites	Provide technical assitance to the Turtle Creek Valley Council of Governments (TCVCOG), municipalities, and other redevelopment authorities in promoting brownfield redevelopment based on sound conservation design principles.	TCVCOG, municipalities, The Brownfields Center (Carnegie Mellon University and the University of Pittsburgh), Urban Redevelopment Authority of Pittsburgh, PADEP Land Recycling Program (Act 2), Pittsburgh High Technology Council, Regional Industrial Development Corporation Trafford Economic and Community Development Corporation	PADEP and Private Foundations				M
	Streamside trail and/or rail trail	1. Study feasibility of Trafford to Mon River Trail (Forbes Trail), linking the planned Saltsburg to Trafford trail with Steel Valley Trail	Rails to Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association, Friends of the Riverfront, Three Rivers Heritage Trail Council, Steel Valley Trail Council, PADCNR, Allegheny County Department of Public Works Parks Division, and Municipalities of North Versailles, Wall, Monroeville, Pitcairn, Trafford, East McKeesport, Wilmerding, Turtle Creek, East Pittsburgh, and North Braddock	PADCNR Western Pennsylvania Conservancy land trusts	2003	2005	2006	H
		2. If Trafford to Mon Trail is feasible, seek/propomote funfding for design, acquisition, and construction of trail			2006	2007	2008	H
	Improve outdoor/stream recreation opportunities	1. Promote warmwater fishery and fishing, improve stream access for fishing, initiate stream habitat improvement projects	PAFBC and PADCNR Local Sportsmen's Groups (e.g., Braddock District Sportsmen's Association) Three Rivers Paddling Club Boy Scouts of America Municipalities of North Versailles, Wall, Monroeville, Pitcairn, Trafford, East McKeesport, Wilmerding, Turtle Creek, East Pittsburgh, and North Braddock	PAFBC and PADCNR Local Sportsmen's Groups (e.g., Braddock District Sportsmen's Association)				M
		2. Promote and publicize canoe/kayak trail, improve access points						M
	Steep slopes	1. Inventory steep slopes and landslide areas within the subwatershed and enter data in GIS	Municipalities of North Versailles, Wall, Monroeville, Pitcairn, Trafford, East McKeesport, Wilmerding, Turtle Creek, East Pittsburgh, and North Braddock Developers and private landowners	PADCNR PADEP - Growing Greener grant local municipalities				L
		2. Provide information to local municipalities and work with municipalities to develop and enforce ordinances to protect steep slopes and landslide-prone areas						L
	Flooding	Work with TCVCOG and individual municipalities to promote/enforce floodplain ordinances and land development regulations that conserve floodplains, restrict floodplain development, and improve infrastructure; petition for operation of flood control gates by government agency.	TCVCOG, Municipalities of North Versailles, Wall, Monroeville, Pitcairn, Trafford, East McKeesport, Wilmerding, Turtle Creek, East Pittsburgh, and North Braddock, PADEP Bureau of Waterways Engineering, Federal Emergency Management Agency, National Flood Insurance Program, United States Army Corps of Engineers, and Private Landowners	USACOE, PADEP	2004	2008	2010	H
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for Listing on the National Register of Historic Places	Owners of historical properties Pennsylvania Historical and Museum Commission (PHMC) Steel Industry Heritage Corporation Friends of The Riverfront Three Rivers Heritage Trail Council, Steel Valley Trail Council Pennsylvania Heritage Society , Historical Society of Western Pennsylvania Westmoreland Historical Society Municipalities of North Versailles, Wall, Monroeville, Pitcairn, Trafford, East McKeesport, Wilmerding, Turtle Creek, East Pittsburgh, and North Braddock	Pittsburgh History and Landmarks Foundations and Private Foundations				L
		2. Assist municipalities in implementing main street programs.						M
		3. Promote historic tourism (e.g., Westinghouse Air Brake, George Westinghouse Museum, George Westinghouse Memorial Bridge, Pennsylvania Railroad, Braddock's Field, Whiskey Insurrection, and Port Perry)						M

TABLE 9

Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
MIDDLE TURTLE CREEK	Species and habitats of special concern	1. Conduct rare plant surveys of Simpson Run Biologically Diverse Area and parklands within watershed	Western Pennsylvania Conservancy PADCNR, PAFBC, PADEP Municipalities of Trafford, Penn Township, Murrysville, and Monroeville private landowners	WPC PADCNR PADEP - Growing Greener Grant PAFBC				M
		2. Promote conservation/protection of species and habitats of of special concern on public and private lands						M
		3. Study the effects of uncontrolled stormwater runoff impacts on Simpson Run watershed			2003	2004	2005	H
	Improve outdoor/stream recreation opportunities	1. Promote warmwater fishery and fishing, improve stream access for fishing, initiate stream habitat improvement projects (e.g., removal of low head dam at Trafford, other barriers to fish passage)	PAFBC and PADCNR Local Sportsmen's Groups (e.g., Pitcairn-Monroeville Sportsmen's Club) Three Rivers Paddling Club Boy Scouts of America Municipalities of Murrysville, Monroeville, and Trafford American Rivers	PAFBC and PADCNR Local Sportsmen's Groups (e.g., Pitcairn-Monroeville Sportsmen's Club)	2003	2005	2007	H
		2. Endorse put-and-take trout fishing and stock trout			2002	2002	2002	H
		3. Promote and publicize Turtle Creek canoe/kayak trail, improve access points			2003	2004	2004	H
	CSO discharges	Advocate for and support efforts to eliminate the documented CSOs in the Middle Turtle Creek subwatershed	Allegheny County Sanitary Authority and Municipality of Trafford	Allegheny County Sanitary Authority				L
	Medium impervious cover	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote natural stream channel principles and floodplain protection and discourage channel widening and floodplain filling	TCWA member volunteers needed Municipalities of Trafford, Penn Township, Murrysville, and Monroeville Allegheny and Westmoreland Conservation Districts PADEP Soils and Waterways Section Private developers U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS)	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				M
		2. Work with developers to restore destabilized stream channels for environmental mitigation						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Streamside trail and/or rail trail	Support and promote development of Saltsburg to Trafford Trail	Rails to Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association, Regional Trails Corp., PADCNR, Dura-Bond Industries, Inc., and other private landowners Westmoreland County Bureau of Parks and Recreation, Allegheny County Department of Public Works Parks Division, Municipalities of Trafford, Penn Township, Murrysville, and Monroeville	PADCNR Western Pennsylvania Conservancy land trusts	2002	2003	2004	H
	Steep slopes	1. Inventory steep slopes and landslide areas within the subwatershed and enter data in GIS	Municipalities of Trafford, Penn Township, Murrysville, and Monroeville Developers and private landowners	PADCNR PADEP - Growing Greener grant local municipalities				M
		2. Provide information to local municipalities and work with municipalities to develop and enforce ordinances to protect steep slopes and landslide-prone areas						M
	Flooding	Work with municipalities to promote/enforce floodplain ordinances and land development regulations that conserve floodplains, restrict floodplain development, and improve infrastructure	Municipalities of Trafford, Penn Township, Murrysville, and Monroeville, PADEP Bureau of Waterways Engineering, Federal Emergency Management Agency, National Flood Insurance Program, United States Army Corps of Engineers, and Private Landowners	USACOE, PADEP	2003	---	2003	H
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for Listing on the National Register of Historic Places.	Owners of historical properties Pennsylvania Historical and Museum Commission (PHMC) Steel Industry Heritage Corporation Friends of The Riverfront Three Rivers Heritage Trail Council, Steel Valley Trail Council Pennsylvania Heritage Society , Historical Society of Western Pennsylvania Westmoreland Historical Society Municipalities of Trafford, Penn Township, Murrysville, and Monroeville	Pittsburgh History and Landmarks Foundations and Private Foundations				L
		2. Assist municipalities in implementing main street programs.						M
		3. Promote historic tourism (e.g., Pennsylvania Railroad)						L

TABLE 9

Action Plan for the Turtle Creek Watershed

Planning Unit	Issues, Needs, and Opportunities	Actions and Implementation Strategies	Potential Partnerships	Potential Funding Sources	Target Date(s)			Priority Ranking
					Planning	Funding	Implementation	
UPPER TURTLE CREEK	Low Impervious Cover (Sensitive)	1. Provide technical assistance to municipalities to develop stream protection ordinances and land development regulations that promote green development principles, riparian buffers, preservation of streams, wetlands and floodplains, and stormwater treatment	PADEP Bureau of Watershed Conservation and Bureau of Watershed Management Citizen's Volunteer Monitoring Program and Pennsylvania Senior Environmental Corp TCWA member volunteers, Municipalities of Delmont, Murrysville, Export, and Penn Township Westmoreland Conservation District and NRCS Private developers PADEP Soils and Waterways Section U. S. Army Corps of Engineers (USACOE) U. S. Fish & Wildlife Service (USFWS)	Accomplish with volunteer help; some agency assistance would be beneficial for workshops				M
		2. Work with developers to restore destabilized stream channels for environmental mitigation.						M
		3. Have a TCWA member be a contact person to receive and review public notices for Section 404 and Chapter 105 permit applications for projects within the subwatershed; comment on projects that may be detrimental to maintaining clean stable stream systems; recommend alternatives that allow developers to fulfill their project while minimizing harm to the stream						L
	Abandoned Mine Drainage (e.g., Borland Farms, Delmont, Catranel, Ringertown, Kistler Road, and Italy Road Discharges)	1. In accordance with the USACOE reconnaissance studies, continue to pursue land acquisition and funding to remediate the Borland Farm AMD discharge	PADEP Bureau of Abandoned Mine Reclamation and Bureau of Watershed Conservation Western Pennsylvania Coalition for Abandoned Mine Reclamation PennDOT Municipality of Export Dura-Bond Industries, Inc.	PADEP, PennDOT, and Private Foundations	2001	2002	2003	H
		2. Continue operating and monitoring the effectiveness of the Italy Road discharge diversion well						M
		3. Evaluate results of the Growing Greener study to divert the Delmont discharge to the Irwin discharge as a treatment soulution			2002	2004	2006	H
		4. Re-prioritize other discharges identified in the COE study along with basin-wide assessment of AMD discharges; based on this re-assessment and USACOE reconnaissance studies and Growing Greener study, evaluate feasibility of remediating other discharges and remediate if feasible.			2003	2004	2005	H
	CSO discharges	Advocate for and support efforts to eliminate the documented CSOs in the Upper Turtle Creek subwatershed	Franklin Township Municipal Sanitary Authority and Municipalities of Murrysville and Export	Franklin Township Municipal Sanitary Authority				M
	Flooding	Work with municipalities to promote/enforce floodplain ordinances and land development regulations that conserve floodplains, restrict floodplain development, and improve infrastructure	Municipalities of Delmont, Murrysville, Export, and Penn Township, PADEP Bureau of Waterways Engineering, Federal Emergency Management Agency, National Flood Insurance Program, United States Army Corps of Engineers, and Private Landowners	USACOE, PADEP				M
	Streamside trail and/or rail trail	Support and promote development of Saltsburg to Trafford Trail; tie trail into Borland Farm AMD treatment facility (install educational display, information kiosk, etc.)	Rails to Trails Conservancy, Allegheny Trail Alliance, Keystone Trails Association, Regional Trails Corporation Dura-Bond Industries, Inc. and other privatel landowners PADCNR Westmoreland County Bureau of Parks and Recreation Municipalities of Delmont, Murrysville, Export, and Penn Township PennDOT	PADCNR	2002	2003	2004	H
	Cultural heritage	1. Complete an inventory of known and potential archaeological sites, historical properties and districts for Listing on the National Register of Historic Places	Pennsylvania Historical and Museum Commission, Steel Industry Heritage Corporation, Friends of the Riverfront, Three Rivers Heritage Trail Council, Steel Valley Trail Council, Pennsylvania Heritage Society, Historical Society of Western Pennsylvania, and Westmoreland Historical Society	Pittsburgh History and Landmarks Foundations and Private Foundations				L
		2. Assist municipalities in implementing main street programs						M
		3. Promote historic tourism (e.g., Westmoreland Coal Company's Export Number 1 and Export Number 2 Mines and Pennsylvania Railroad)						M
	Greenspace	Promote land use practices that conserve greenspace, identify desirable parcels for greenspace protection, and purchase land for greenways	Municipalities of Delmont, Murrysville, Export, and Penn Township PADCNR Western Pennsylvania Conservancy land trusts	PADCNR Western Pennsylvania Conservancy land trusts				M
	Brownfield sites	1. Complete an inventory of available brownfield sites for re-development, including available acreage, ownership and known limitiations.	Municipalities, redevelopment authorities, the Brownfields Center (Carnegie Mellon University and the University of Pittsburgh), PADEP Land Recycling Program (Act 2), Pittsburgh High Technology Council, Regional Industrial Development Corporation, Redevelopment Authority of Westmoreland County, Westmoreland County Industrial Development Corporation	PADEP and Private Foundations				L
		2. Provide technical assitance to municipalities and redevelopment authorities in promoting brownfield redevelopment based on sound conservation design principles.						L

SECTION 5
LITERATURE CITED

Brauning, D., ed. 1992. *Atlas of Breeding Birds in Pennsylvania.* University of Pittsburgh Press. Pittsburgh, Pennsylvania.

Center for Watershed Protection (CWP). 1998. *Rapid Watershed Planning Handbook: A Comprehensive Guide for Managing Urbanizing Watersheds.* Center for Watershed Protection. Ellicott City, Maryland.

Chester Engineers, Inc. (Chester). 1991. Model stormwater management provisions for municipal subdivision/land development ordinance. prepared by Chester Engineers as part of the *Turtle Creek Watershed Act 167 Stormwater Management Plan* .

Civil & Environmental Consultants, Inc. 1999. *Survivorship of Hatchery-Reared Rainbow, Brook, and Brown Trout Stocked in Turtle Creek, Pennsylvania.* Final Report for Western Pennsylvania Coalition for Abandoned Mine Reclamation.

Cooper, E. L. 1983. *Fishes of Pennsylvania and Northeastern United States.* Pennsylvania State University Press, University Park, Pennsylvania.

Federal Interagency Floodplain Management Task Force (FIFMTF). 1996. *Protecting Floodplain Resources: A Guidebook for Communities.*

Fike, J. 1999. *Terrestrial and Palustrine Plant Communities of Pennsylvania.* Pennsylvania Department of Conservation and Natural Resources, The Nature Conservancy, and The Western Pennsylvania Conservancy. 86 pp.

GAI Consultants, Inc. (GAI). 1999. *Turtle Creek Valley Strategic Action Plan.* Prepared for the Turtle Creek Council of Governments and Turtle Creek Valley Economic Development Task Force.

Genoways, H. H., and F.J. Brenner. 1985. *Species of Special Concern in Pennsylvania.* Special Publication of Carnegie Museum of Natural History, Pittsburgh, Pennsylvania.

Gordon, N. D., T. A. MacMahon, and B. L. Finlayson. 1992. *Stream Hydrology: An Introduction for Ecologists. John Wiley and Sons, Ltd. West Sussex, England.*

Gresham, C., A. Rhoads, and J. Lotte. 1998. *Invasive Plants in Pennsylvania*. Brochure prepared for Pennsylvania Department of Conservation and Natural Resources (PADCNR). Harrisburg, Pennsylvania.

Natural Lands Trust, Inc. (NLT). 1999. *Growing Greener: Putting Conservation into Local Codes.*

Pennsylvania Department of Conservation and Natural Resources (PADCNR). 1999. *River/Watershed Conservation Planning*. Fact Sheet.

Pennsylvania Department of Conservation and Natural Resources (PADCNR). 2000a. Pennsylvania Natural Diversity Inventory (PNDI) Review of Turtle Creek Watershed. Harrisburg, Pennsylvania.

Pennsylvania Department of Conservation and Natural Resources (PADCNR). 2000b. Pennsylvania Natural Diversity Inventory (PNDI) List of Species of Special Concern for Allegheny County. Harrisburg, Pennsylvania. 1 p.

Pennsylvania Department of Conservation and Natural Resources (PADCNR).2000c. Pennsylvania Natural Diversity Inventory (PNDI) List of Species of Special Concern for Westmoreland County. Harrisburg, Pennsylvania. 1 p.

Pennsylvania Environmental Council (PEC). 1996. The *Environmental Advisory Council Handbook: A Guide for Pennsylvania's Municipal Environmental Advisory Councils.*

Pennsylvania Fish and Boat Commission (PAFBC). 2000. Turtle Creek, Sections 01, 02, and 03 (819A) Management Report. Prepared by Rick Lorson, Gary Smith, and Jason Wisniewski.

Pullman Swindell. 1977. Irwin Syncline Basin Mine Drainage Pollution Abatement Project: Operation Scarlift Project SL 103-5. Pullman Swindell. Pittsburgh, Pennsylvania.

Rhoads, A.F. 2000. *Invasive Exotic Plant Species in the Pennsylvania Flora*. http://tncweeds.ucdavis.edu/paconf/conf14.html.

Rhoads, A.F., and W.M. Klein, Jr. 1993. *The Vascular Flora of Pennsylvania. Annotated Checklist and Atlas*. American Philosophical Society, Philadelphia, PA. 636 pp.

Rice, E.L. 1984. *Alleopathy*. Academic Press, Orlando, Florida. 422 pp.

Schueler, T. 1995. "Crafting Better Urban Watershed Protection Plans." *Watershed Protection Techniques*. Vol. 2, no. 2.

Strahler, A.N N. 1964. "Quantitative Geomorphology of Drainage Basins and Channel Networks." In *Handbook of Applied Hydrology,* ed. V. T. Chow. McGraw-Hill. New York.

U.S. Army Corps of Engineers (USACOE). 1987. *Reconnaissance Report on Water and Sediment Quality and Aquatic Life Resources Pertinent to major Rehabilitation of the Flood Reduction Channel*. Turtle Creek Local Protection Project, Allegheny County, Pennsylvania.

U.S. Army Corps of Engineers (USACOE). 1998a. *905(b) Reconnaissance Study of Upper Turtle Creek Watershed*. Turtle Creek Watershed Ecosystem Restoration of Acid Mine Discharge.

U.S. Army Corps of Engineers (USACOE). 1998b. *905(b) Reconnaissance Study of Brush Creek Watershed*. Turtle Creek Watershed Ecosystem Restoration of Acid Mine Discharge.

U.S. Army Corps of Engineers (USACOE). 1998c. *905(b) Reconnaissance Study of Lyons Run Watershed*. Turtle Creek Watershed Ecosystem Restoration of Acid Mine Discharge.

U.S. Environmental Protection Agency Office of Water (USEPA). 1999. R*apid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish.* 2nd ed. Office of Water. Washington, D.C. EPA 841-B-99-002.

U.S. Environmental Protection Agency Office of Water (USEPA). 2000. *A Model Stream Buffer Protection Ordinance*.

Western Pennsylvania Conservancy (WPC). 1998. *Westmoreland County Natural Heritage Inventory*. Prepared for the Westmoreland County Department of Planning and Development, Greensburg, Pennsylvania.

Western Pennsylvania Conservancy (WPC). 1994. *Allegheny County Natural Heritage Inventory*. Prepared for the Allegheny County Board of Commissioners. Allegheny County, Pennsylvania.

Whittaker, R. H. 1975. *Communities and Ecosystems.* 2nd ed. Macmillan, New York.

SECTION 6

GLOSSARY

abandoned mine drainage (AMD) – Polluted water discharged from inactive or abandoned mines, usually referring to coal mines. AMD can be acid or alkaline and may contain elevated levels of acidity or alkalinity, aluminum, iron, manganese, sulfate, and other chemicals.

anticline – A fold in rock layers that is convex upward.

alkalinity - Refers to the quantity and kinds of compounds present (usually bicarbonates, carbonates, and hydroxides) that collectively shift the pH above 7.

ambient conditions - Refers to environmental conditions experienced prior to disturbance.

AMD – see "abandoned mine drainage".

anthropogenic - Effects or processes that are derived from human activity.

approved trout waters (AWT) – Streams and lakes that meet the criteria qualifying them to be stocked with trout by the Pennsylvania Fish and Boat Commission.

aquifer - An underground layer of rock or soil containing ground water.

areal – The horizontal extent of a feature or an attribute on the earth's surface, usually expressed on unit area basis (i.e., square meter, acre, square mile, etc.).

assessed surface waters – Streams and other surface waters that have been assessed by the Pennsylvania Department of Environmental Protection to determine compliance with state water quality standards.

ATW - see "Approved Trout Waters".

BDA – see "biological diversity area"

beneficial use - The uses of a water resource that are protected by state laws called water quality standards. Uses include aquatic life, recreation, human consumption, and habitat.

benthic - Living in or on the bottom of a body of water.

benthos - Collectively, all organisms living in, on, or near the bottom substrate in aquatic habitats (examples are oysters, clams, burrowing worms).

best management practices (BMPs) - Management practices (such as nutrient management) or structural practices (such as terraces) designed to reduce the quantities of pollutants-- such as sediment, nitrogen, phosphorus, and animal wastes -- that are washed by rain and snow melt from farms into nearby receiving waters, such as lakes, creeks, streams, rivers, estuaries, and ground water.

biochemical oxygen demand (BOD) - The quantity of largely organic, materials present in a water sample as measured by a specific test. Although BOD is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

biological diversity area (BDA) – A natural area exhibiting one or more of the following characteristics: (1) harbors one or more plants or animals recognized as state or national species of concern; (2) possesses a high diversity of plants and animals native to the county; and (3) supports a rare or exemplary natural community, including the highest quality and least disturbed examples of relatively common community types (WPC 1998).

biological integrity - The capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition and functional organization comparable to that of the natural habitat in a region.

bioindicators - Organisms that are used to detect changes in environmental pollutant levels.

biota - The animals, plants, and microbes that live in a particular location ecoregion.

BMP - see "best management practices".

buffer strip - A barrier of permanent vegetation, either forest or other vegetation, between waterways and land uses such as agriculture or urban development, designed to intercept and filter out pollution before it reaches the surface water resource.

Chapter 93 Water Quality Standards – Chapter 93 of Title 25 of the Pennsylvania Code, which lists the water quality standards and protected uses for surface waters in the Commonwealth of Pennsylvania.

chemical oxygen demand (COD) - Quantitative measure of the strength of contamination by organic and inorganic carbon materials.

clear cutting - A silvicultural system in which all merchantable trees are harvested over a specified area in one operation.

coldwater fish - Fish such as trout and salmon; preferred water temperature ranges between 7-18 degrees C (45-65 degrees F); coolwater fish, such as striped bass, northern pike, and walleye, have a range between that of coldwater and warmwater fish.

Cold Water Fishes (CWF) – An aquatic life protected use designation for surface waters under Pennsylvania's Chapter 93 Water Quality Standards; Streams and other surface waters assigned this designation must support the maintenance or propagation, or both, of fish species (including Salmonids) and other flora and fauna indigenous to a cold water habitat.

combined sewer overflow (CSO) - A pipe that discharges water during storms from a sewer system that carries both sanitary wastewater and stormwater. The overflow occurs because the system does not have the capacity to transport, store, or treat the increased flow caused by stormwater runoff.

conductivity - A measure of the ability of an aqueous solution to transmit electrical current.

conservation tillage - Any tillage and planting system that maintains at least 30% of the soil surface covered by residue after planting for the purpose of reducing soil erosion by water.

contour - An imaginary line on the surface of the earth connecting points of the same elevation. A line drawn on a map connecting points of the same elevation.

critical habitat - Areas, which are essential to the conservation of an officially listed, endangered or threatened species and which may require special management considerations or protection.

CSO – see "combined sewer overflow".

culvert - A metal, concrete, or plastic pipe, or a constructed box-type conduit, through which water is carried under roads, railroads, or other fills in a stream.

demonstration project - A project designed to install or implement pollution control practices primarily for educational or promotional purposes.

designated use - A beneficial use type established by a state for each water resource and specified in water quality standards, whether or not it is being attained.

detention - The process of collecting and holding back stormwater for delayed release to receiving waters.

discharge permit - Legal contract negotiated between federal and state regulators and an industry or sewage treatment plant that sets limits on many water pollutants or polluting effects from the discharges of its pipes to public waters.

dissolved oxygen - The amount of oxygen present in the water column. More than 5 parts oxygen per million is considered healthy; below 3 is generally stressful to aquatic organisms.

drainage area - An area of land that drains to one point; watershed.

ecological integrity - A measure of the health of the entire area or community based on how much of the original physical, biological, and chemical components of the area remain intact.

ecoregion - A geographic region that is characterized by reoccurring ecosystems and is defined by ecological factors, such as climate, topography, plant and animal communities, landscape position, and soils.

ecosystem - Interrelated and interdependent parts of a biological system.

effluent - Treated or untreated liquid waste material that is discharged into the environment from a point source, such as a wastewater treatment plant or an industrial facility.

erosion - Wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical, chemical, or biological forces.

fault - A fracture or fracture zone along which there has been displacement of rock parallel to the fracture.

fecal coliform - Bacteria from the colons of warm-blooded animals, which are released in fecal material. Specifically, this group comprises all of the aerobic and facultative anaerobic, gram-negative, non-spore-forming, rod-shaped bacteria that ferment lactose with gas formation within 48 hours at 35 degrees Celsius.

floodplain – The low-lying, flat lands bordering a river or stream subject to flooding; typically applied to the 100-year floodplain, which is subject to a one percent chance of flooding in a given year (i.e., a 100-year frequency flood).

geographic information systems (GIS) - Computer programs linking features commonly seen on maps (such as roads, town boundaries, water bodies) with related information not usually presented on maps, such as type of road surface,

population, type of agriculture, type of vegetation, or water quality information. A GIS is a unique information system in which individual observations can be spatially referenced to each other.

ground water - The water that occurs beneath the earth's surface between saturated soil and rock and that supplies wells and springs.

habitat - A specific area in which a particular type of plant or animal lives.

hazardous waste - Any solid, liquid, or gaseous substance which, because of its source or measurable characteristics, is classified under state or federal law as hazardous and is subject to special handling, shipping, storage, and disposal requirements.

hectare - 10,000 square meters, .405 acres

High Quality Waters (HQ) - An aquatic life protected use designation for surface waters under Pennsylvania's Chapter 93 Water Quality Standards; Surface waters having quality that exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water by satisfying the provisions of Section 93.4(a) of Chapter 93.

invasive species - A non-native or introduced plant, animal, fungus, or bacterium that spreads aggressively into new areas and environments, most often to the detriment of native species.

impaired water - Surface and ground waters that are negatively impacted by pollution resulting in decreased water quality and that do not meet state water quality standards. Such waters are placed on the Section 303(d) list.

impervious cover or impervious surface – Any surface in urban landscapes, such as pavement, that cannot effectively absorb or infiltrate water.

intermittent stream - A watercourse that flows only at certain times of the year, conveying water from springs or surface sources; also, a watercourse that does not flow continuously, when water losses from evaporation or seepage exceed available stream flow.

land use - The way land is developed and used in terms of the types of activities allowed (agriculture, residences, industries, etc.) and the size of buildings and structures permitted. Certain types of pollution problems are often associated with particular land uses, such as sedimentation from construction activities.

loading - The influx of pollutants to a selected water body.

macroinvertebrate - Invertebrates visible to the naked eye, such as insect larvae and crayfish; in aquatic systems often used in conjunction with benthos, as in benthic macroinvertebrates, or the macroinvertebrates living on the bottom of a stream or other waterbody.

mitigation - Actions taken with the goal of reducing the negative impacts of a particular land use or activity.

mitigation bank - Habitat protection or improvement actions taken expressly for the purpose of compensating for unavoidable, necessary losses from specific future development actions.

model ordinance - A sample regulation that contains elements and language necessary to achieve a desired effect.

monitor - To systematically and repeatedly measure conditions in order to track changes.

National Pollutant Discharge Elimination System (NPDES) - Established by Section 402 of the federal Clean Water Act, this federally mandated system is used for regulating pollutants in point-source and stormwater discharges to waters.

native plant or animal – A plant or animal species that occurred in the state before settlement by Europeans. For example, Pennsylvania has over 2,100 native plant species (PADCNR 2000).

natural community - A distinct and reoccurring assemblage of populations of plants, animals, bacteria, fungi, and viruses naturally associated with each other and their physical environment.

non-native or introduced plant or animal – A plant or animal that has been brought into the state since European settlement and has become established. For example, by 1998, Pennsylvania had over 1,300 introduced plant species (PADCNR 2000).

nonpoint source controls - General phrase used to refer to all methods employed to control or reduce nonpoint source pollution.

nonpoint source pollution (NPS) - Pollution originating from runoff from diffuse areas (land surface or atmosphere) having no well-defined source.

nutrient management - A BMP designed to minimize the contamination of surface and ground water by limiting the amount of nutrients (usually nitrogen) applied to the soil to no more than the crop is expected to use. This may involve

changing fertilizer application techniques, placement, rate, or timing. The term fertilizer includes both commercial fertilizers and manure.

nutrients - Chemicals that are needed by plants and animals for growth (e.g., nitrogen, phosphorus). In water resources, if other physical and chemical conditions are optimal, excessive amounts of nutrients can lead to degradation of water quality by promoting excessive growth, accumulation, and subsequent decay of plants, especially algae. Some nutrients can be toxic to animals at high concentrations.

parameter - Information used as input to a water quality model or estimated by a water quality model. Examples of parameters include - slope from a statistical relationship between two variables, mean annual value or standard deviation of a variable, and number of observations for a particular variable.

particulate matter - Very small, separate particles composed of organic or inorganic matter.

parts per million (ppm) - A volume unit of measurement; the number of parts of a substance in a million parts of another substance. For example, 10-ppm nitrate in water means 10 parts of nitrate in a million parts of water.

perennial stream - A watercourse that flows throughout the year or most of the year (90%), in a well-defined channel. Same as a live stream.

pH - The negative log of the hydrogen ion concentration (-log10 [H+]); a measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The scale is 0-14.

plant community - An assemblage of plants that live in a given environment, interacting with each other, and with animals, fungi, bacteria, and physical forces to form a distinctive living system.

point source - Any confined and discrete conveyance from which pollutants are or may be discharged. These include pipes, ditches, channels, tunnels, conduits, wells, containers, and concentrated animal feeding operations.

point source pollution - Water pollution that is discharged from a discrete location such as a pipe, tank, pit, or ditch.

pollutant - A contaminant that adversely alters the physical, chemical, or biological properties of the environment. The term includes nutrients, sediment, pathogens, toxic metals, carcinogens, oxygen-demanding materials, and all other harmful substances. With reference to nonpoint sources, the term is sometimes used

to apply to contaminants released in low concentrations from many activities, which collectively degrade water quality. As defined in the federal Clean Water Act, pollutant means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.

priority pollutant - Chemical designated by the U.S. Environmental Protection Agency as having high priority for control or removal from waste discharges because of its toxicity or potential to cause cancer or mutations.

restoration - The renewing or repairing of a natural system so that its functions and qualities are comparable to its original, unaltered state.

revetment - Facing of stone or other material either permanent or temporary, placed along the edge of a body of water to stabilize the bank and/or protect it from erosion.

riffle - Area of a stream or river characterized by a rocky substrate and turbulent, fast-moving, shallow water.

riparian - Relating to the bank or shoreline of a body of water.

river - A watercourse that flows at all times, receiving water from ground or surface water, for example, from other streams or rivers. The terms "river" and "stream" are often used interchangeably, depending on the size of the water resources and the region in which it is located.

runoff - Water that is not absorbed by soil and drains off the land into bodies of water, either in surface or subsurface flows.

Section 303(d) list of impaired waters - Named after Section 303(d) of the federal Clean Water Act, which requires states to assess the quality of surface and ground waters for compliance with state water quality standards; waters that do not meet state standards are classified as impaired and placed on the Section 303(d) list. The state is required to develop objectives (TMDLs) to correct the water pollution problems of waters on the Section 303(d) list.

sediment - Particles and/or clumps of particles of sand, clay, silt, and plant or animal matter carried in water.

sedimentation - Deposition of sediment.

siltation - The deposition or accumulation of fine soil particles.

species - A class of individuals having common attributes and designated by a common name; a particular kind of atomic nucleus, atom, molecule, or ion.

stakeholders - Anyone who lives in the watershed or has land management responsibilities in it. Individuals who represent the major land uses in the watershed. Stakeholders include government agencies, businesses, private individuals and special interest groups.

steep slope - Slope greater than fifteen percent (15%).

storm drain - A system of gutters, pipes, or ditches used to carry stormwater from surrounding lands to streams or lakes. In practice storm drains carry a variety of substances such as sediments, metals, bacteria, oil, and antifreeze, which enter the system through runoff, deliberate dumping, or spills. This term also refers to the end of the pipe where the stormwater is discharged.

stormwater - Rainwater that runs off the land, usually paved or compacted surfaces in urban or suburban areas, and is often routed into drain systems in order to prevent flooding.

stream - A watercourse that flows at all times, receiving water from groundwater and/or surface water supplies, such as other streams or rivers. The terms "river" and "stream" are often used interchangeably, depending on the size of the water body and the region in which it is located.

stream order – A number system given to streams based on the number and size of tributaries. First order streams are the smallest un-branched tributaries; second order streams are initiated by the confluence of two first order streams; third order streams are initiated by the confluence of two second order streams; etc.

structural BMPs - BMPs that require the construction or use of a structure such as a terrace, lagoon, or waste storage facility.

subbasins - One of several basins that form a watershed.

substrate - The surface with which an organism is associated; often refers to the type of material making-up lake or streambeds; e.g., bedrock, boulder, cobble, gravel, sand, or silt.

subwatershed - A drainage area within a watershed.

suspended solids - Organic and inorganic particles, such as solids from wastewater, sand, clay, and mud that are suspended and carried in water.

sustainable use - Conserved use of a resource such that it may be used in the present and by future generations.

syncline – A fold in rock layers in which the layers dip inward from both sides of the axis.

thermal pollution - A temperature rise in a body of water sufficient to be harmful to the aquatic life in the water.

TMDL - see "total daily maximum load".

total alkalinity - A measure of the titratable bases, primarily carbonate, bicarbonate, and hydroxide

total Kjeldahl nitrogen (TKN) - An oxidative procedure that converts organic nitrogen forms to ammonia by digestion with an acid, catalyst, and heat.

total Kjeldahl phosphorus (TKP) - An oxidative procedure that converts organic phosphorus forms to phosphate by digestion with an acid, catalyst, and heat.

Total Maximum Daily Load (TMDL) - The loading capacity is the maximum amount of pollution that a water body can receive without violating water quality standards. Total Maximum Daily Loads are the sum of point and nonpoint source loads.

total suspended solids (TSS) - The weight of particles that are suspended in water. Suspended solids in water reduce light penetration in the water column, can clog the gills of fish and invertebrates, and are often associated with toxic contaminants because organics and metals tend to bind to particles. Differentiated from Total dissolved solids by a standardized filtration process, the dissolved portion passing through the filter.

transitional land use – A land use that is intermediate between two different land uses; for example, rural residential land use is a transitional land use between suburban residential areas and rural agricultural areas.

transport - The movement of a soil particle, nutrient, or pesticide from its original position. This movement may occur in water or air currents. Nutrients and pesticides can be attached to soil particles or dissolved in water as they move.

tributary - A stream or river that flows into a larger stream or river.

Trout Stocking (TSF) – An aquatic life protected use designation for surface waters under Pennsylvania's Chapter 93 Water Quality Standards; Streams and other surface waters assigned this designation must support the maintenance of

stocked trout from February 15 to July 31 and maintenance and propagation of fish species and other flora and fauna indigenous to a warm water habitat.

turbidity - A measure of the amount of light intercepted by a given volume of water because of the presence of suspended and dissolved matter and microscopic biota. Increasing the turbidity of the water decreases the amount of light that penetrates the water column. High levels of turbidity are harmful to aquatic life.

unassessed surface waters – Streams and other surface waters that have not yet been assessed by the Pennsylvania Department of Environmental Protection to determine compliance with state water quality standards.

variable - A water quality constituent (for example, total phosphorus pollutant concentration) or other measured factors (such as streamflow, rainfall).

warmwater fish - Prefer water temperatures ranging between 18-29 degrees C (65-85 degrees F); includes fish such as smallmouth bass, largemouth bass, and bluegill.

Warm Water Fishes (WWF) – An aquatic life protected use designation for surface waters under Pennsylvania's Chapter 93 Water Quality Standards; Streams and other surface waters assigned this designation must support the maintenance and propagation of fish species and other flora and fauna indigenous to a warm water habitat.

water quality standards - Established limits of certain chemical, physical, and biological parameters in a water body; water quality standards are established for the different designated uses of a water body.

water table - The depth or level below which the ground is saturated with water.

watershed - The area of land from which rainfall (and/or snow melt) drains into a single point. Watersheds are also sometimes referred to as drainage basins or drainage areas. Ridges of higher ground generally form the boundaries between watersheds. At these boundaries, rain falling on one side flows toward the low point of one watershed, while rain falling on the other side of the boundary flows toward the low point of a different watershed.

watershed project - A group of activities undertaken in a geographic area to restore or protect the beneficial uses of a water resource.

wetland construction - A subset of wetland creation; creation of wetlands specifically for water quality improvement purposes, typically involving controlled outflow and a design that maximizes chosen treatment functions. Creation of an

engineered system to simulate the water purification functional value of natural wetlands for human use and benefits.

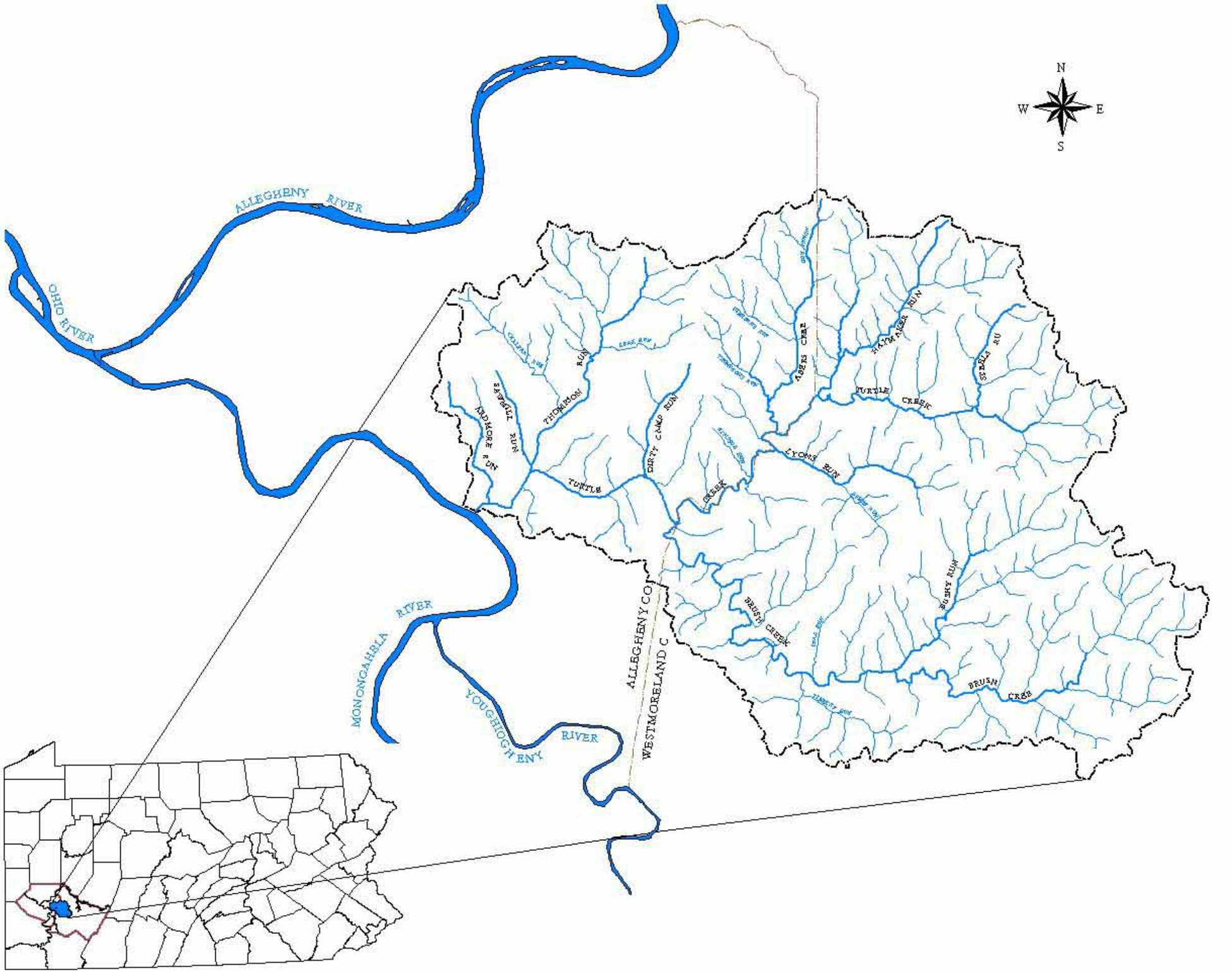
wetland creation - The bringing into existence of a wetland, whether by accident or intentionally, where none existed previously, for purposes including mitigation, habitat provision, and water quality improvement.

wetland enhancement - Modification of a natural or created wetland to increase the level of one or more functions, typically to the detriment of other functions.

wetland restoration - Rehabilitation of previously existing wetland functions, from a more impaired to a less impaired or unimpaired state of overall function.

wetlands - Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (40 CFR 232.2(r)).

zoning - Designating by ordinances areas of land reserved and regulated for different land uses.



TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 1

GENERAL LOCATION

WATERSHED BOUNDARY

COUNTY BOUNDARY

HYDROLOGY

MAJOR RIVERS

1 0 1 2 Miles

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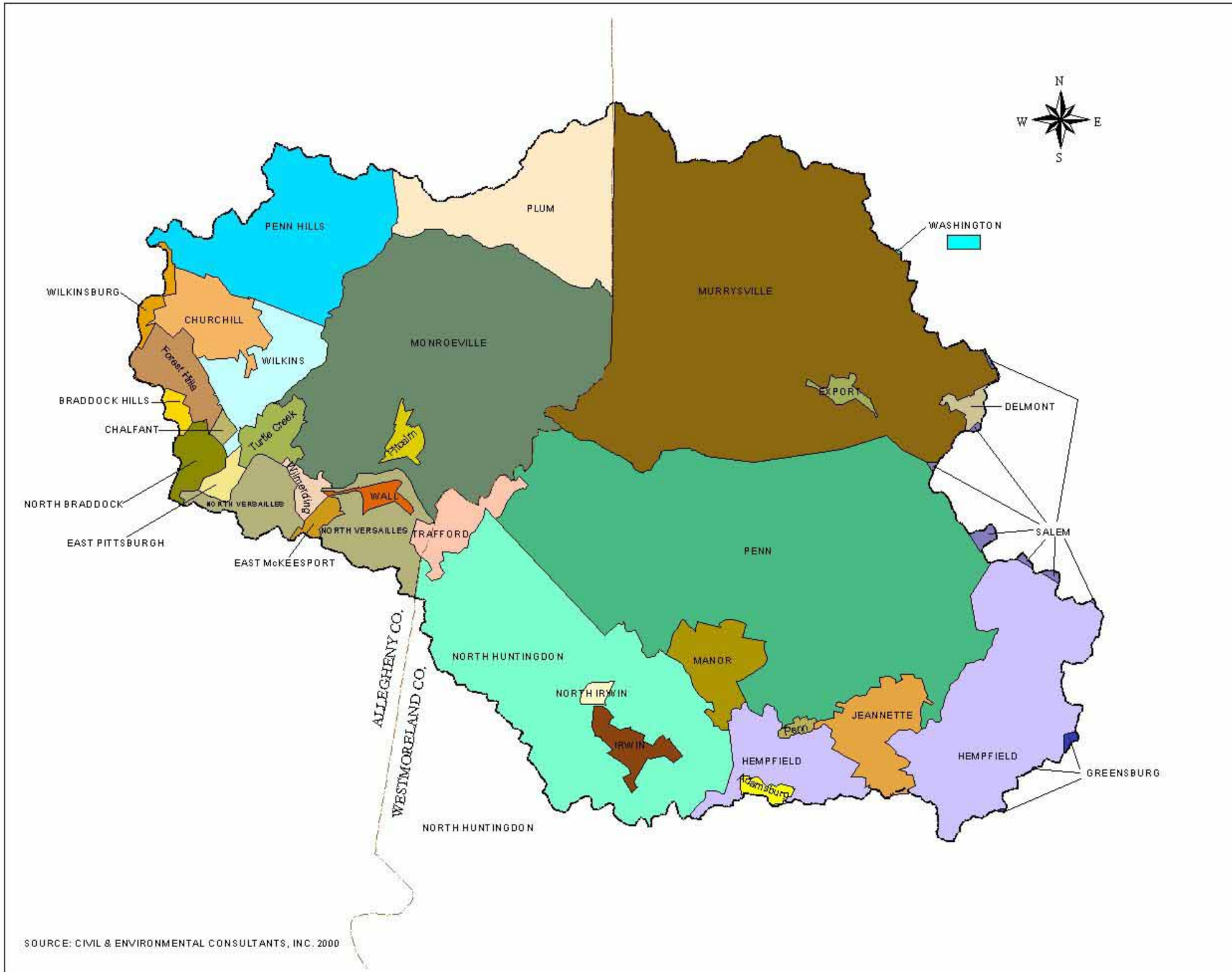

SOURCE: CIVIL & ENVIRONMENTAL CONSULTANTS, INC. 2000

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 2

MUNICIPAL BOUNDARIES

Turtle Creek Watershed Boundary
County Boundary

Cities
- JEANNETTE
- GREENSBURG

Townships
- HEMPFIELD
- NORTH HUNTINGDON
- NORTH VERSAILLES
- PENN
- PENN HILLS
- SALEM
- WASHINGTON
- WILKINS

Boroughs
- ADAMSBURG
- BRADDOCK HILLS
- CHALFANT
- NORTH IRWIN
- PENN
- PITCAIRN
- PLUM
- TRAFFORD
- TURTLE CREEK
- WALL
- WILKINSBURG
- WILMERDING
- CHURCHILL
- DELMONT
- EAST MCKEESPORT
- EAST PITTSBURGH
- EXPORT
- FOREST HILLS
- IRWIN
- MANOR
- MONROEVILLE
- MURRYSVILLE
- NORTH BRADDOCK

1 0 1 2 Miles

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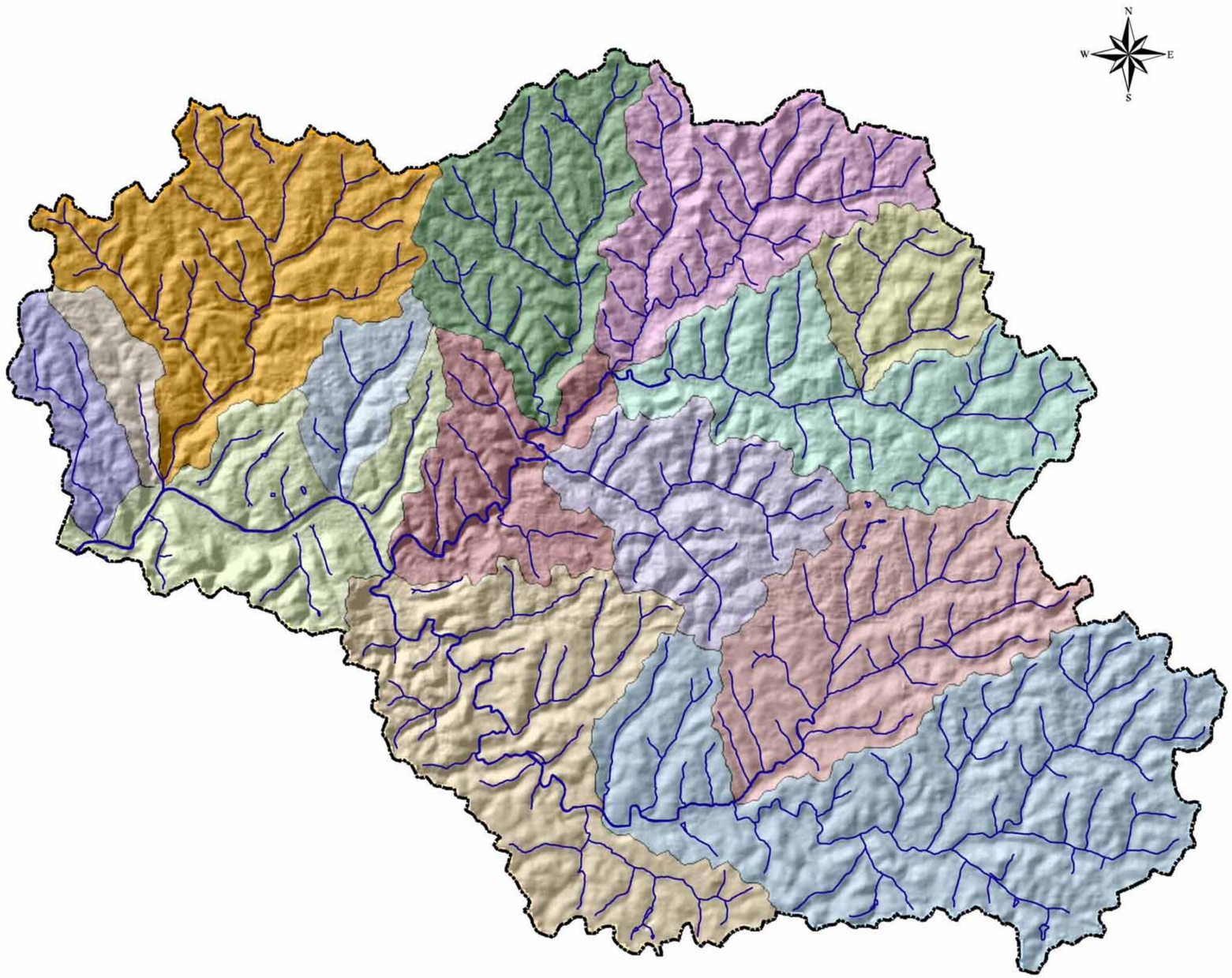

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 3

SUBWATERSHED ENVIRONMENTAL PLANNING UNITS

WATERSHED BOUNDARY

SUBWATERSHED BOUNDARY

HYDROLOGY

2 1 0 2 Miles

SOURCE: CIVIL & ENVIRONMENTAL CONSULTANTS, INC. 2000

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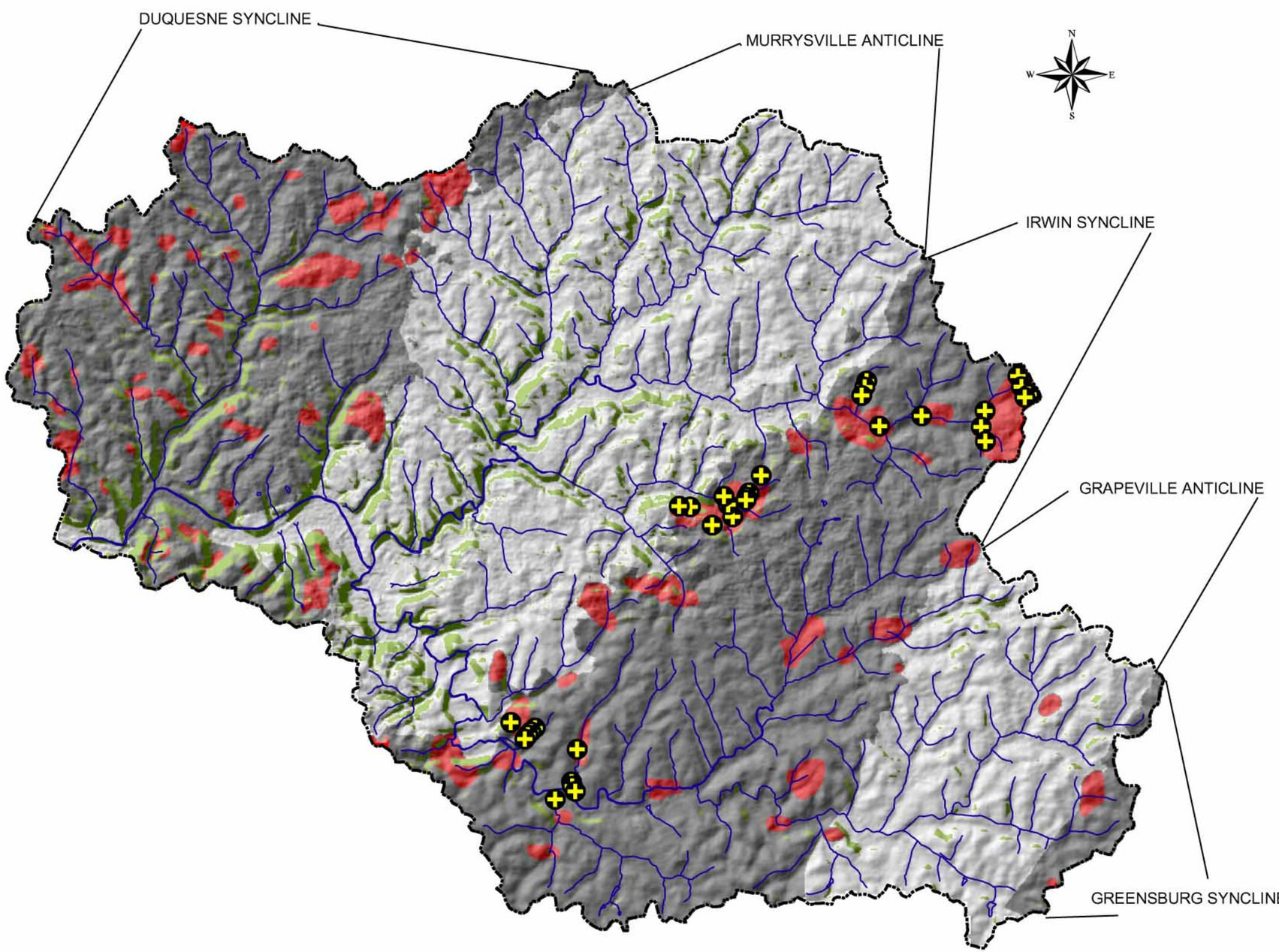

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 4

ABANDONED MINE AREAS
&
STEEP SLOPES

- WATERSHED BOUNDARY
- HYDROLOGY
- SLOPES GREATER THAN 15 DEGREES
- ABANDONED MINE LAND AREAS
- MINED AREAS OF THE PITTSBURGH COAL SEAM
- ABANDONED MINE DRAINAGE DISCHARGES

2 1 0 2 Miles

SOURCES: Mined Areas - ENVIRONMENTAL RESEARCH INSTITUTE 1996
AMLs and Drainage Discharges - PADEP 1999

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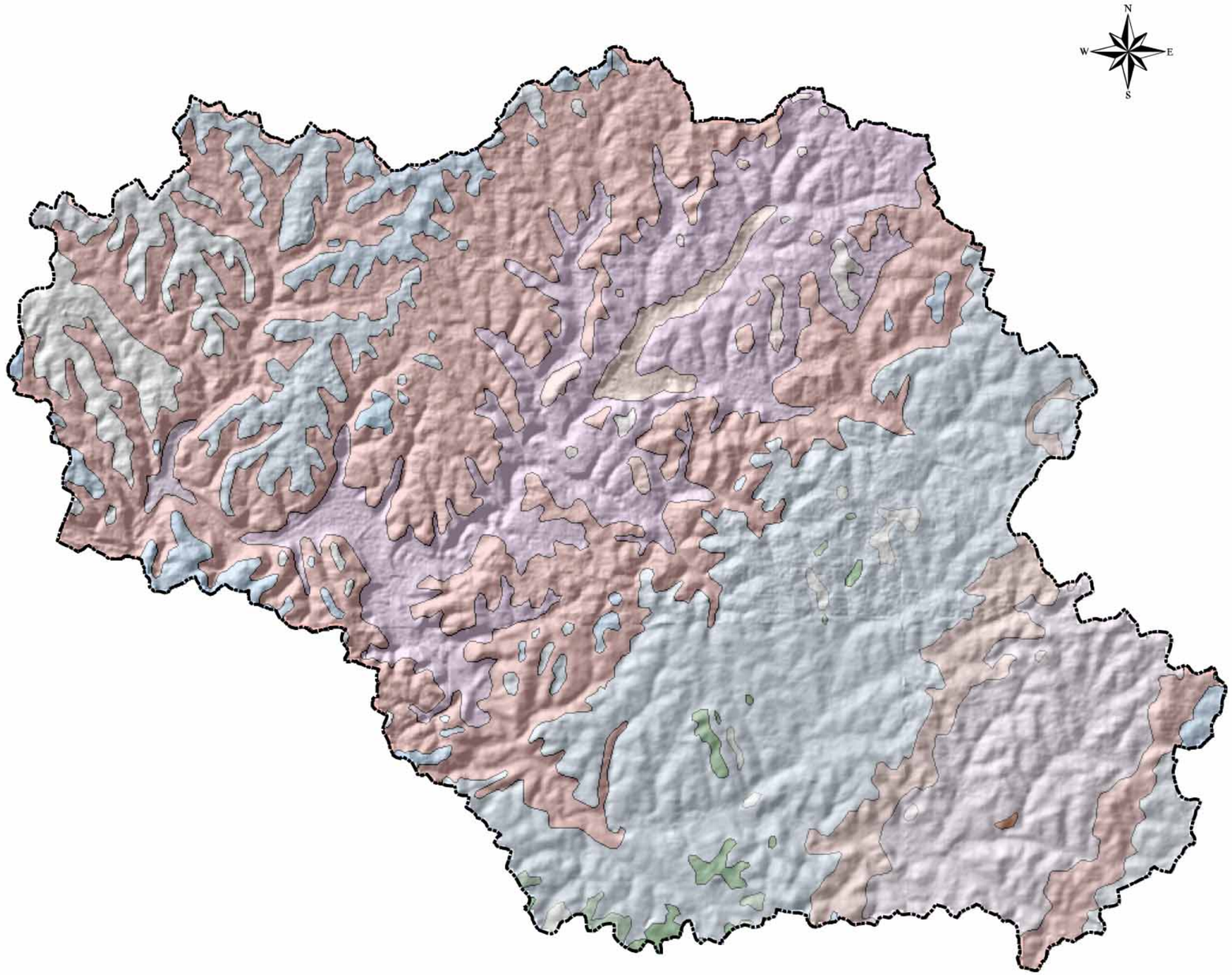

SOURCE: ENVIRONMENTAL RESEARCH INSTITUTE 1994

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 5

TOPOGRAPHY & GEOLOGY

WATERSHED BOUNDARY

DUNKARD GROUP:

WAYNESBURG FORMATION

MONONGAHELA GROUP

ALLEGHENY GROUP

CONEMAUGH GROUP:

CASSELMANFORMATION

GLENSHAW FORMATION

2 1 0 2 Miles

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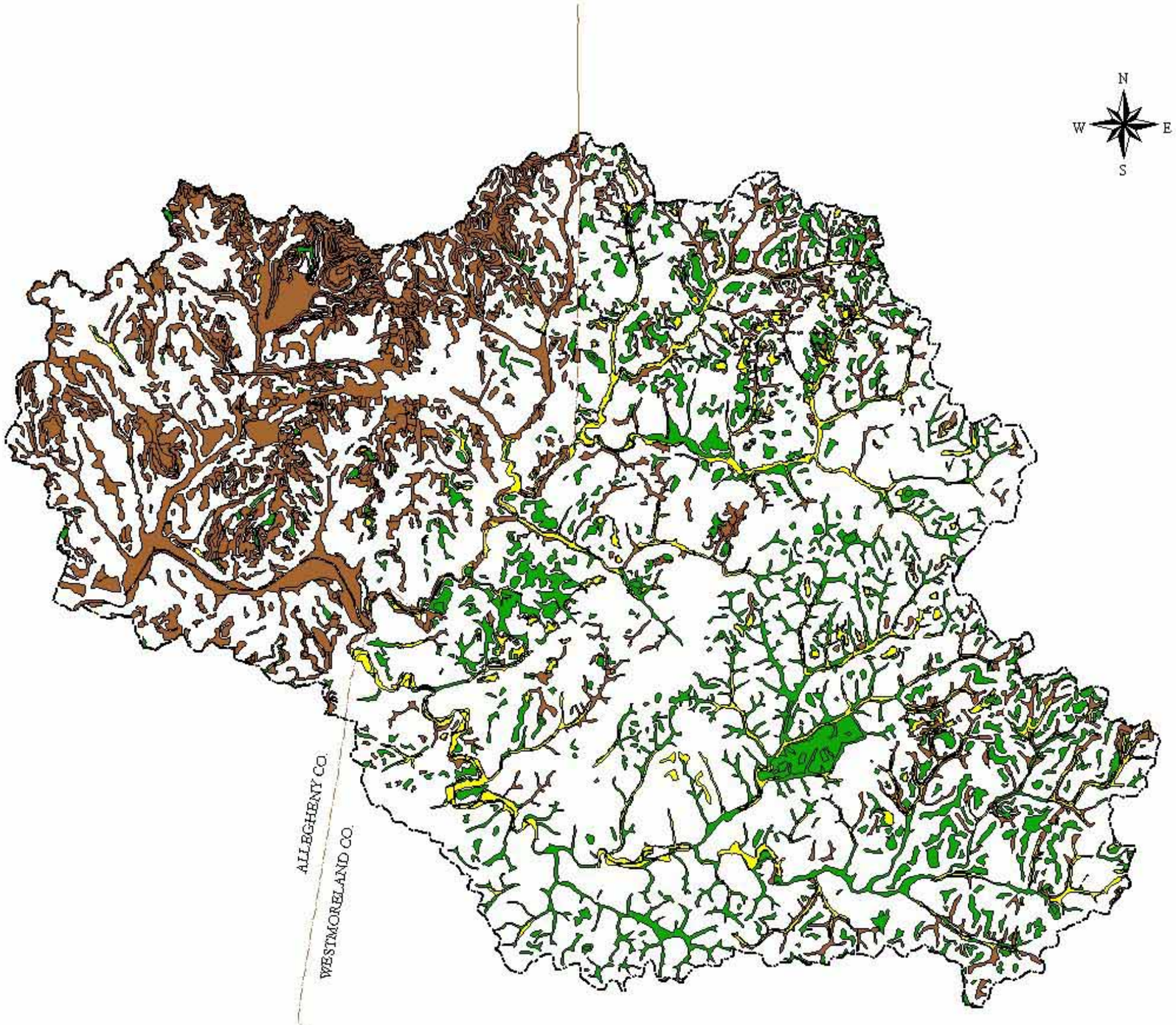

SOURCE: USDA NATURAL RESOURCES CONSERVATION SERVICE 2000

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 6

SOILS OF INTEREST

WATERSHED BOUNDARY

COUNTY BOUNDARY

HYDRIC & PRIME AGRICULTURAL SOILS

HYDRIC SOILS

PRIME AGRICULTURAL SOILS

1 0 1 2 Miles

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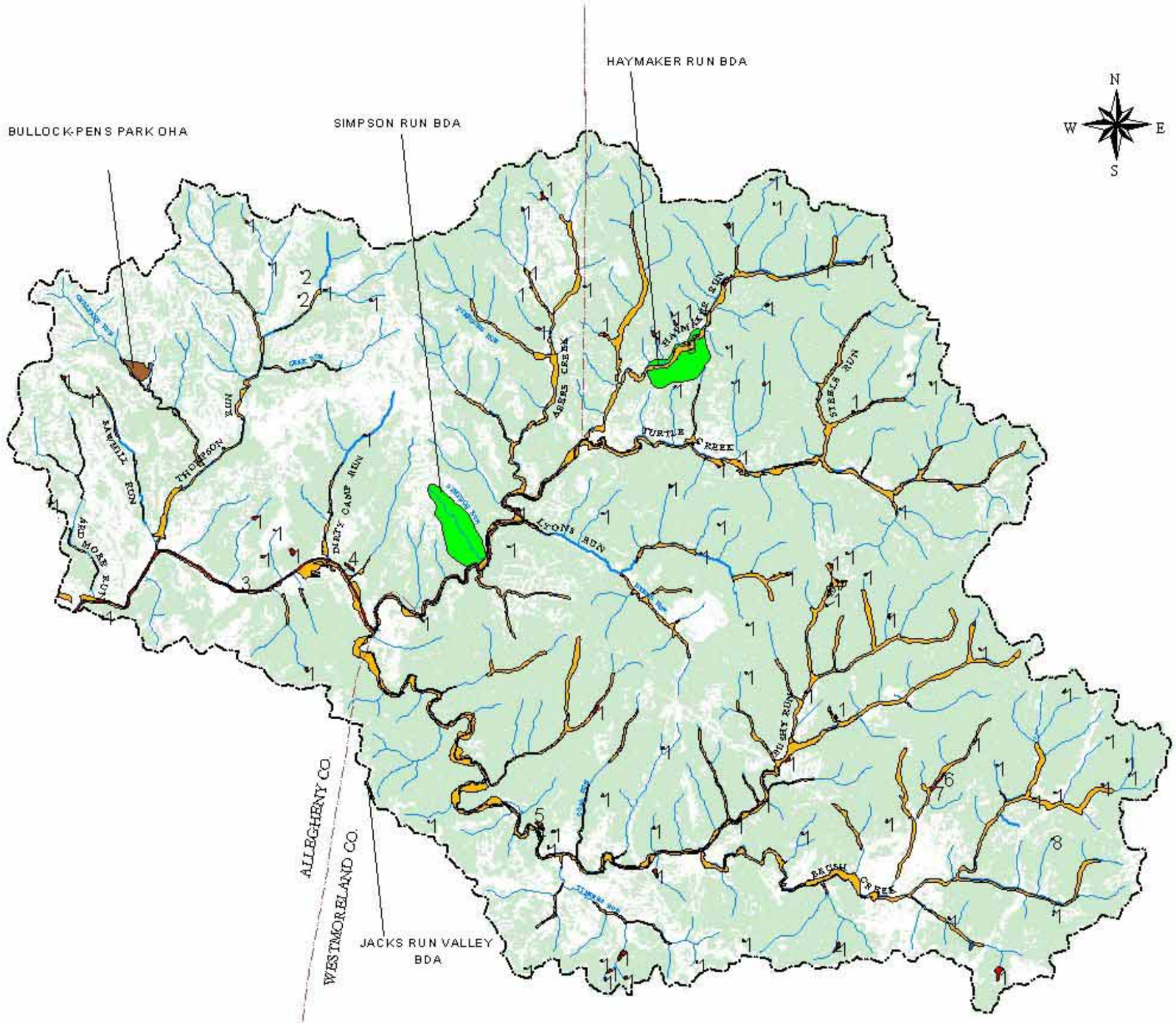

SOURCES: 100 Year Floodplain - FEMA (FEDERAL EMERGENCY MANAGEMENT AGENCY) 1995
Greenspace - LANDSAT THERMATIC MAPPER 1992
BDA & OHA - ENVIRONMENTAL RESEARCH INSTITUTE 1998
Wetlands - US FISH & WILDLIFE CENTER, NATIONAL WETLAND INVENTORY 2000

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 7

NATURAL RESOURCES

- WATERSHED BOUNDARY
- COUNTY BOUNDARY
- POND/RESERVOIR
- NWI WETLANDS
- 100-YEAR FLOOD PLAIN AREAS
- BIOLOGICAL DIVERSITY AREAS (BDA)
- OTHER HERITAGE AREAS (OHA)
- GREENSPACE
- HYDROLOGY

WETLAND I.D.	NWI CLASSIFICATION
1	PUBZ
2	PUBZx
3	R3UBZ
4	PSS1Y
5	PEMY
6	PFO1Y
7	PSS1/EM
8	PSS1/EMY
9	PFO1/SS1Y

1 0 1 2 Miles

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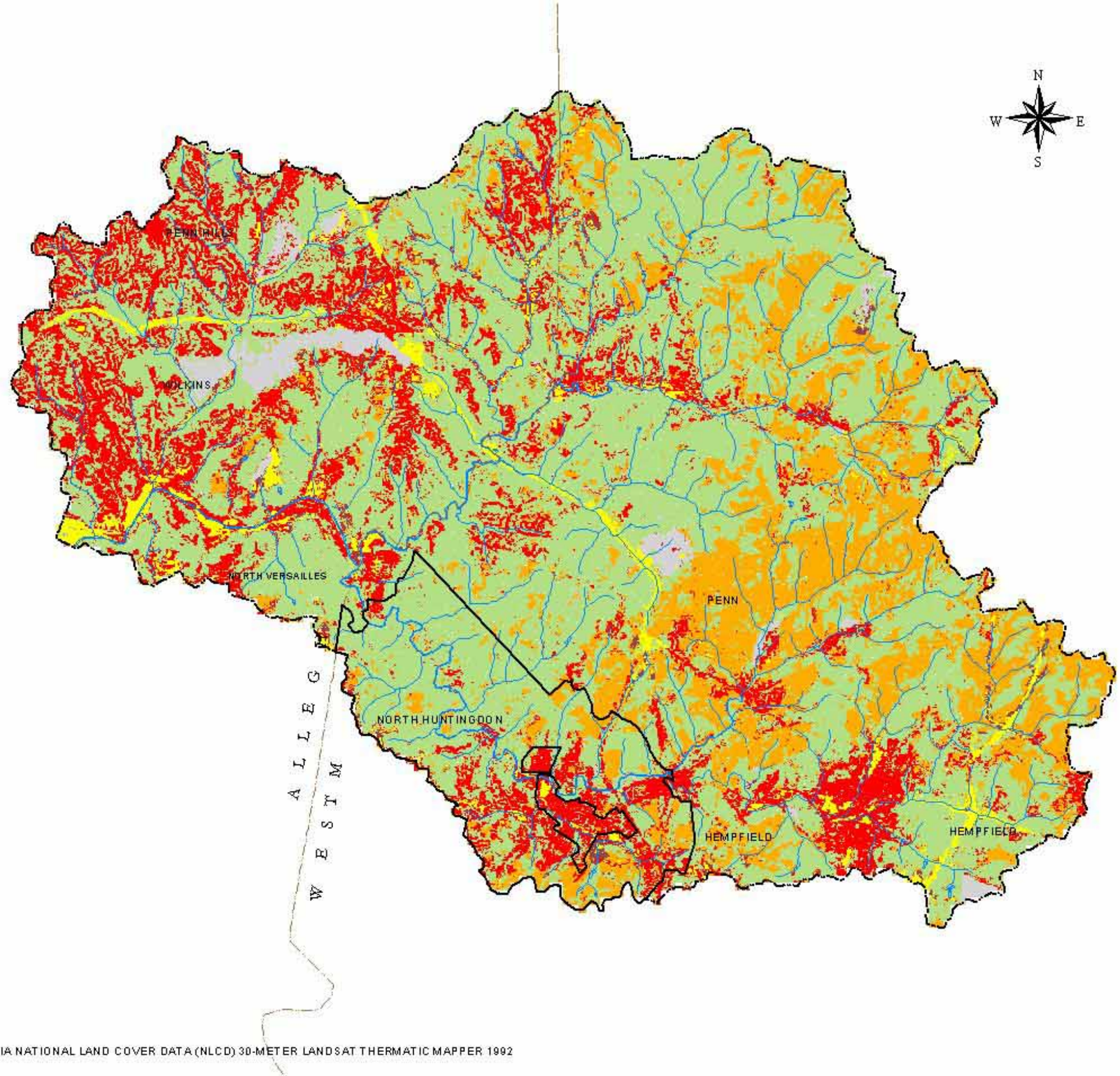

SOURCE: PENNSYLVANIA NATIONAL LAND COVER DATA (NLCD) 30-METER LANDSAT THERMATIC MAPPER 1992

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 8

LANDUSE / TYPE

- WATERSHED BOUNDARY
- COUNTY BOUNDARY
- HYDROLOGY
- WATER
- RESIDENTIAL/URBAN
- INDUSTRIAL/TRANSPORTATION
- MINES/BARREN AREAS
- TRANSITIONAL
- FORESTED/HERBACEOUS
- PLANTED/CULTIVATED

1 0 1 2 Miles

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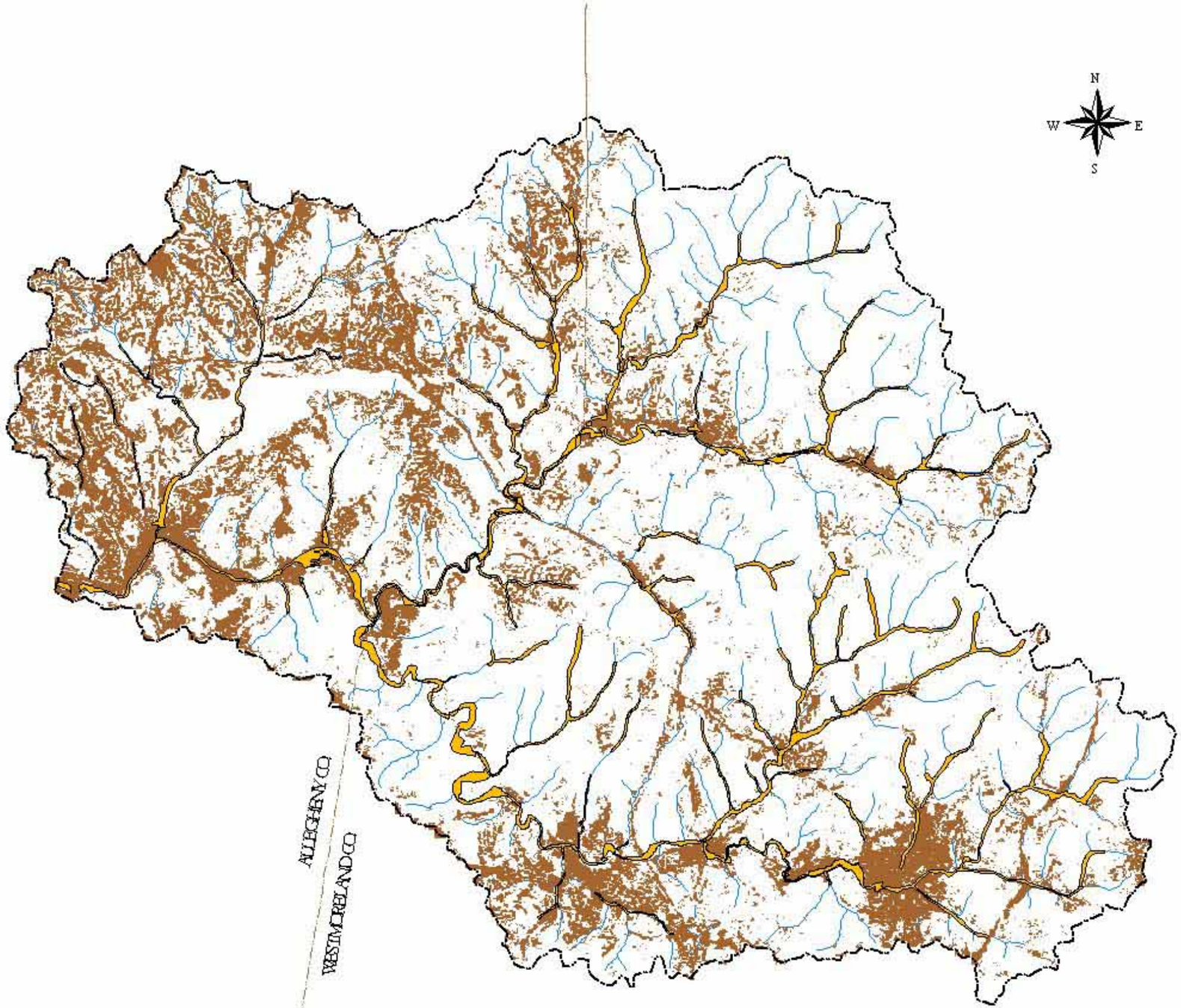

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 9
FLOOD PRONE AREAS

WATERSHED BOUNDARY

COUNTY BOUNDARY

HYDROLOGY

100-YEAR FLOOD PLAIN AREAS

IMPERVIOUS SURFACES

1 0 1 2 Miles

SOURCES: 100 Year Floodplain - FEMA (FEDERAL EMERGENCY MANAGEMENT AGENCY) 1995
Impervious Surfaces - LANDSAT THERMATIC MAPPER 1992

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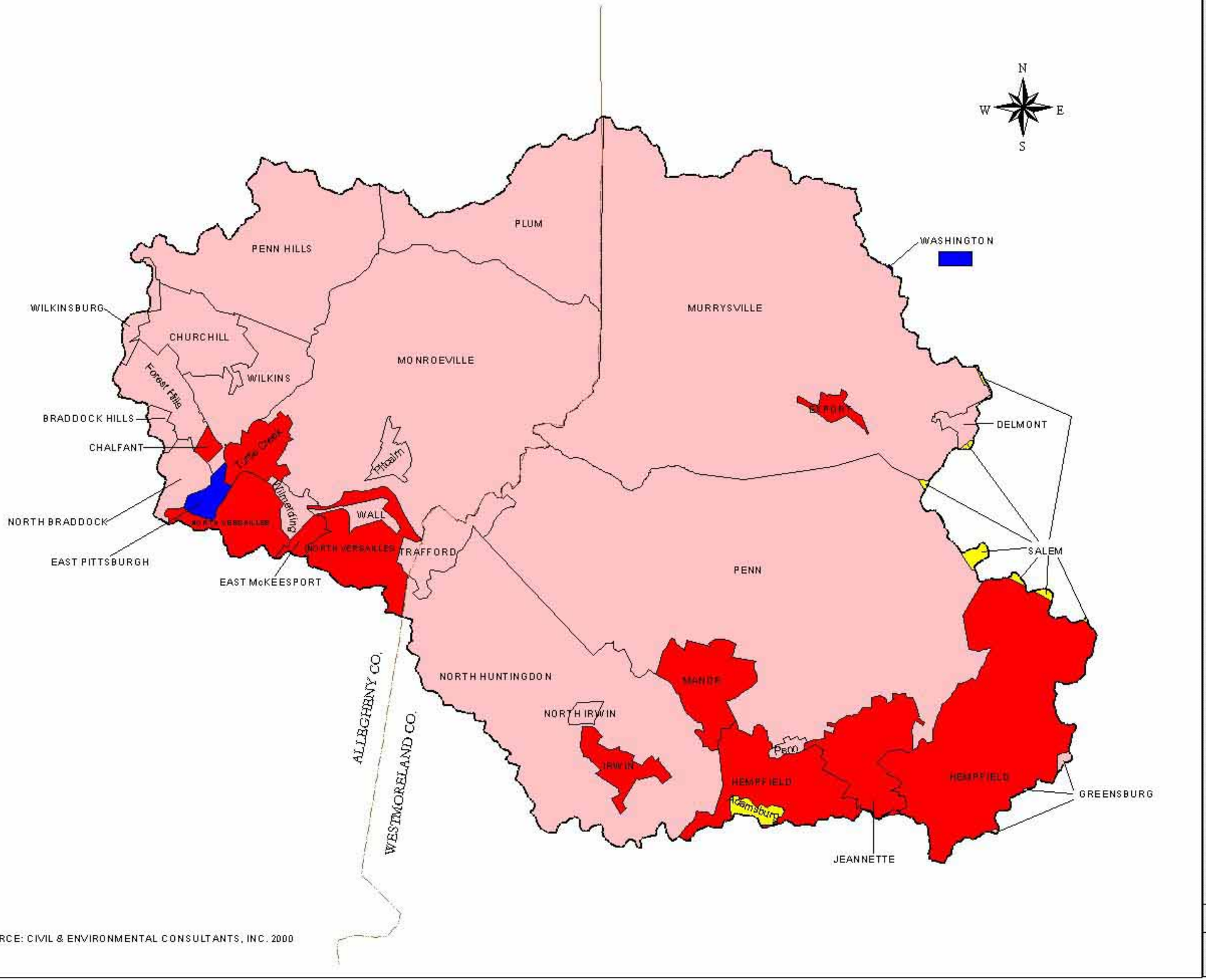

SOURCE: CIVIL & ENVIRONMENTAL CONSULTANTS, INC. 2000

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 10

COUNTY & MUNICIPAL PLANNING AND ZONING

- WATERSHED BOUNDARY
- COUNTY BOUNDARY
- NO ZONING ORDINANCE
- ZONING ORDINANCE
- COMPREHENSIVE PLAN & ZONING ORDINANCE
- COMPREHENSIVE PLAN ONLY

1 0 1 2 Miles

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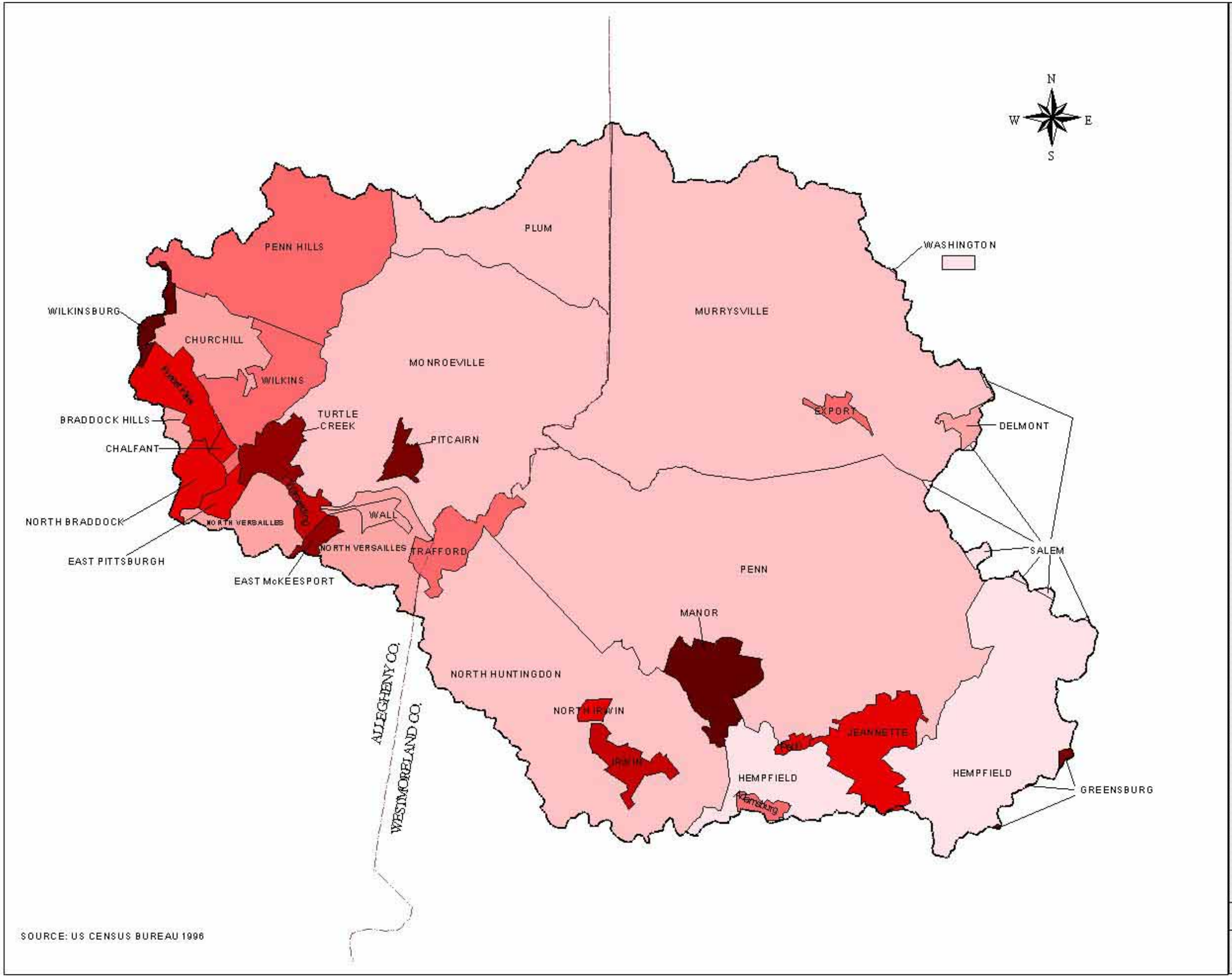

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 11

POPULATION DENSITY BY MUNICIPALITY

Turtle Creek Watershed Boundary

County Boundary

Population Density per Square Mile

- 100 - 400
- 400 - 1400
- 1400 - 2400
- 2400 - 3400
- 3400 - 4400
- 4400 - 5400
- 5400 - 6400
- 6400 - 7400
- 7400 - 8400
- 8400 - 9400

1 0 1 2 Miles

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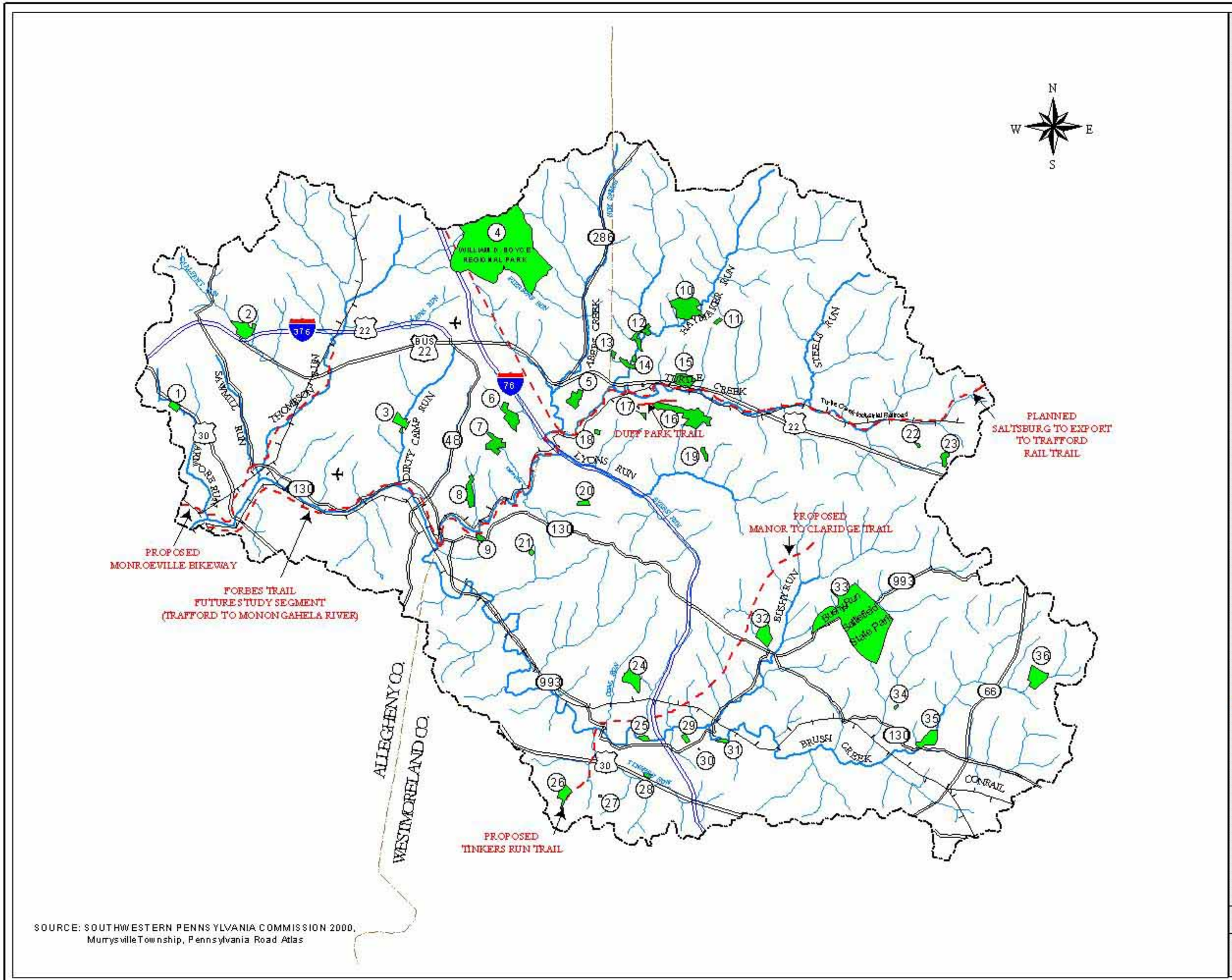

SOURCE: SOUTHWESTERN PENNSYLVANIA COMMISSION 2000, Murrysville Township, Pennsylvania Road Atlas

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 12

TRANSPORTATION & RECREATION

WATERSHED BOUNDARY
COUNTY BOUNDARY
HYDROLOGY
RAILROAD LINES
ESTABLISHED TRAILS
PROPOSED TRAILS
COUNTY & STATE PARKS
AIRPORT

ROAD TYPES

INTERSTATE HYWAYS
STATE HYWAYS
US HYWAYS

1 0 1 2 Miles

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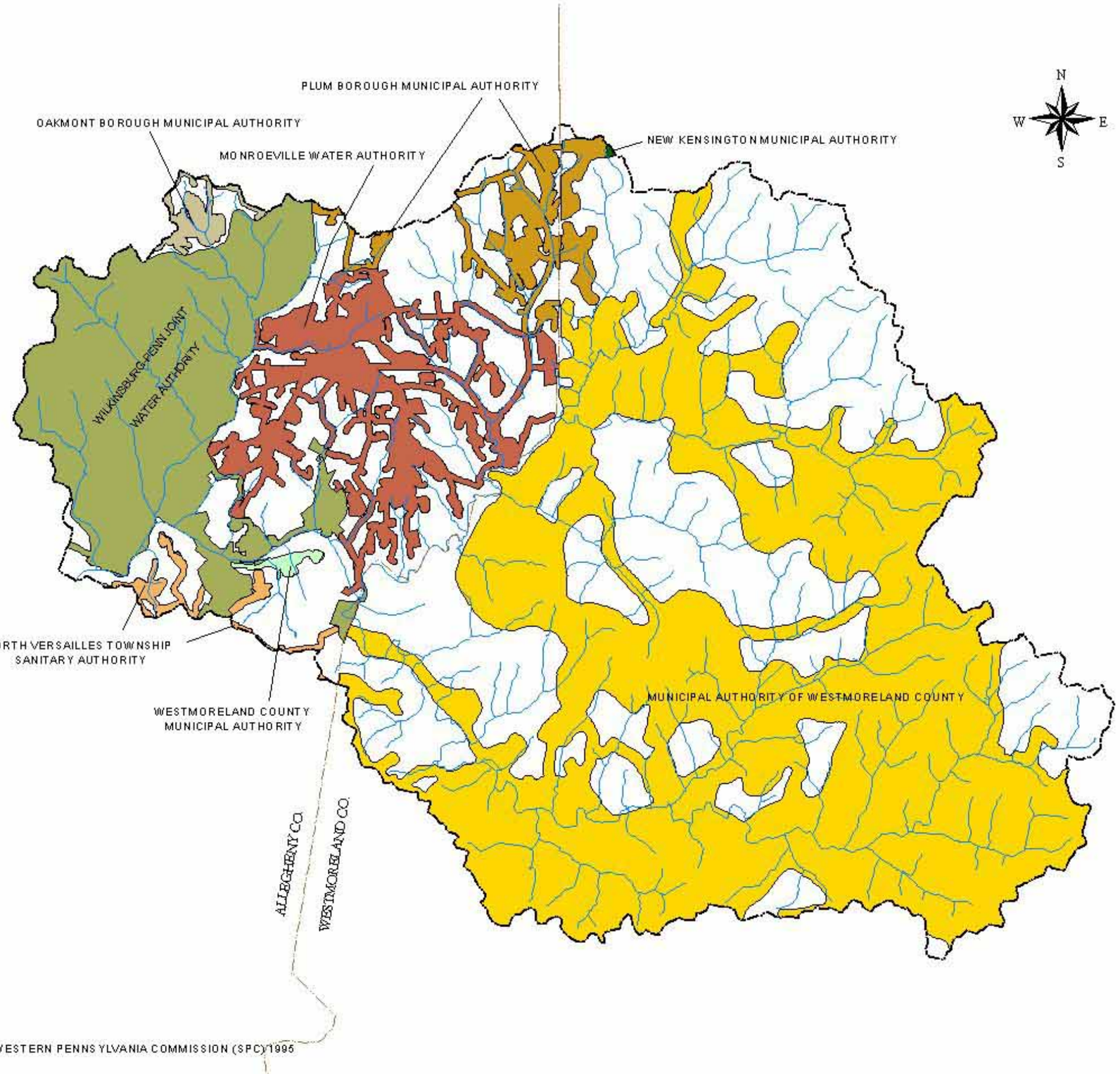

SOURCE: SOUTHWESTERN PENNSYLVANIA COMMISSION (SPC) 1995

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 13

PUBLIC WATER SERVICE AREAS

WATERSHED BOUNDARY
COUNTY BOUNDARY
HYDROLOGY

WATER SERVICE PROVIDERS

NOT SERVED
MONROEVILLE WATER AUTHORITY
MUNICIPAL AUTHORITY OF WESTMORELAND COUNTY
NEW KENSINGTON MUNICIPAL AUTHORITY
NORTH VERSAILLES TOWNSHIP SANITARY AUTHORITY
OAKMONT BOROUGH MUNICIPAL AUTHORITY
PLUM BOROUGH MUNICIPAL AUTHORITY
WESTMORELAND COUNTY MUNICIPAL AUTHORITY
WILKINSBURG-PENN JOINT WATER AUTHORITY

1 0 1 2 Miles

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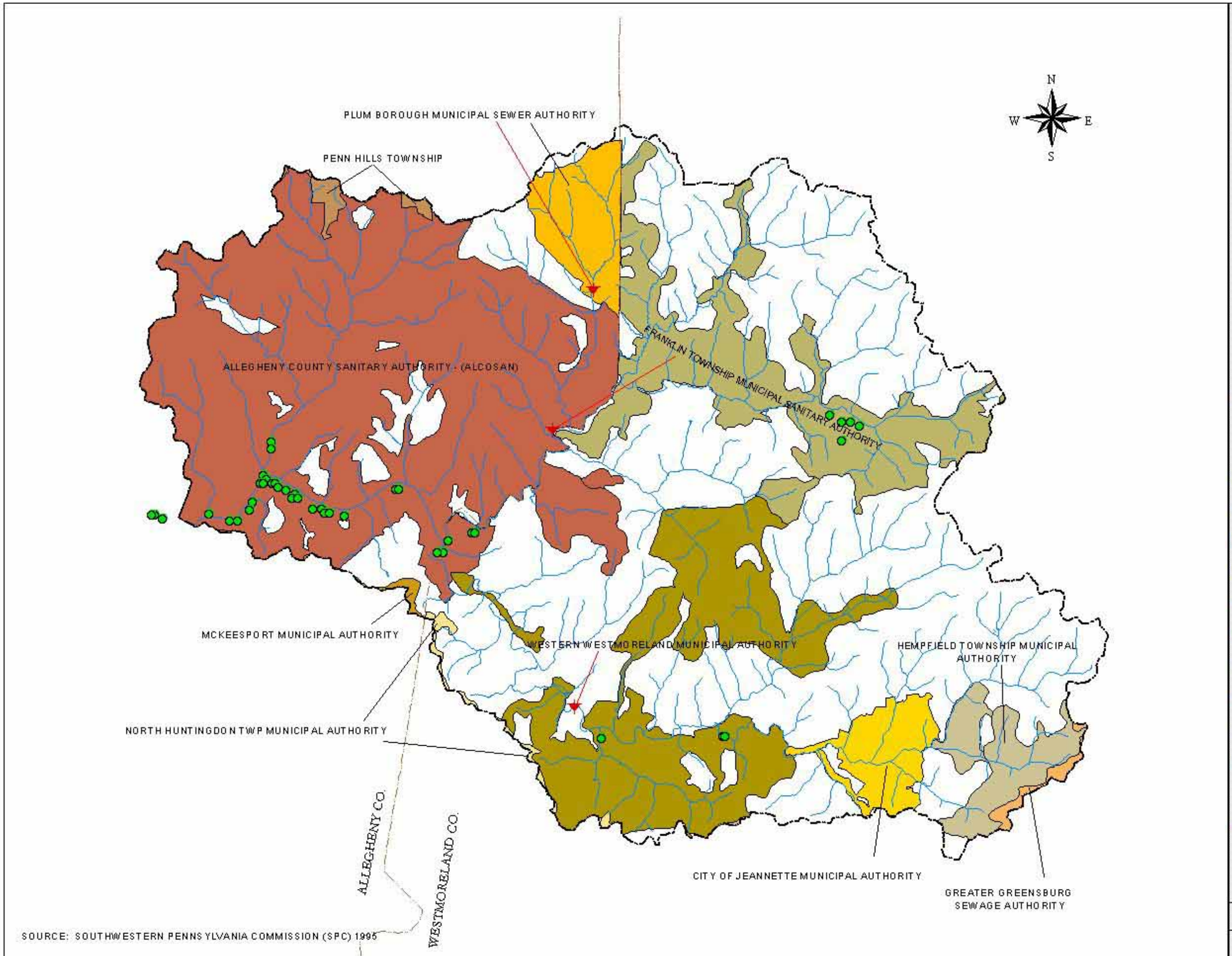

SOURCE: SOUTHWESTERN PENNSYLVANIA COMMISSION (SPC) 1995

TURTLE CREEK WATERSHED ASSOCIATION

FIGURE 14

PUBLIC SEWER SERVICE AREAS

WATERSHED BOUNDARY
COUNTY BOUNDARY
HYDROLOGY

SEWER SERVICE PROVIDERS

NOT SERVED
NORTH HUNTINGDON TWP MUNICIPAL AUTHORITY
PENN HILLS TOWNSHIP
PLUM BOROUGH MUNICIPAL SEWER AUTHORITY
WESTERN WESTMORELAND MUNICIPAL AUTHORITY
ALLEGHENY COUNTY SANITARY AUTHORITY - (ALCOSAN)
CITY OF JEANNETTE MUNICIPAL AUTHORITY
FRANKLIN TOWNSHIP MUNICIPAL SANITARY AUTHORITY
GREATER GREENSBURG SEWAGE AUTHORITY
HEMPFIELD TOWNSHIP MUNICIPAL AUTHORITY
MCKEESPORT MUNICIPAL AUTHORITY
COMBINED AND OR SEPARATE SEWER OVERFLOW
WATER POLLUTION CONTROL PLANT DISCHARGE

1 0 1 2 Miles

CEC
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