IV. WATER RESOURCES

A. Major Tributaries

The study corridor is in the West Branch Susquehanna River Watershed within the areas identified by PADEP as Subbasins 9 (Central West Branch) and 10 (Lower West Branch) of the Susquehanna and Chesapeake Bay Basin. The West Branch Susquehanna River is the largest waterway in both subbasins however, it is the smaller, faster moving tributaries that carry the bulk of the sediment into the Susquehanna River and ultimately into the Chesapeake Bay (PSU, 1988).

A listing of the West Branch Susquehanna River's tributaries is compiled in Drainage List L of the Pennsylvania Code, Title 25, Chapter 93, Water Quality Standards. Chapter 93 assigns varying water quality classifications or protected use designations to streams regarding their suitable uses. High Quality waters are given more protection than Cold Water Fisheries, which in turn have more protection than Warm Water Fisheries.

There are 45 named, Order 3 tributaries that discharge directly into the West Branch within the study corridor (PADEP, 2001c). The majority of these are classified as Cold or Warm Water Fisheries (CWF, WWF) or Trout Stocked Fisheries (TSF). Cold Water Fisheries are known to support species adapted to colder mountain and limestone streams, such as brook trout, while Warm Water Fisheries support various species of warm water fish, such as bass, bluegill, carp and catfish. Only White Deer Creek, Pine Creek, Queen's Run and Lick Run are listed as High Quality (HQ) streams within the reaches located in the study corridor. The list of tributaries along with their protected uses is provided in Table B-3 of Appendix B. In addition to the larger streams, there are approximately 60 unnamed small tributaries that flow into the West Branch within the study corridor. All streams and their watershed divides can be seen on Map 1 in Appendix A.

B. Wetlands

Wetlands as defined by the United States Fish and Wildlife Service (USFWS) are those transitional lands located between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. These lands must, at least periodically, support hydrophytic vegetation, have predominantly undrained hydric soils as their substrate and be saturated with water or covered by shallow water at some time during the growing season of each year. While this definition is widely interpreted by various scientists and regulatory agencies, it includes the three parameters that define wetland areas.

Several freshwater wetlands types are found within the study corridor. Palustrine and riverine systems are the most common wetland ecosystems found in the corridor, however there are also some lacustrine wetlands ecosystems present within the dam pools of the West Branch. Palustrine wetland ecosystems are inland freshwater wetlands dominated by trees, shrubs, or emergents in non-tidal areas, commonly known as swamps and bogs. Riverine wetland ecosystems are freshwater wetlands and deepwater habitats contained within a channel, commonly defined as rivers and streams. Lacustrine wetland ecosystems are freshwater wetlands or deepwater habitats situated within a topographic depression or dammed river channel, commonly known as lakes or ponds (Mitsch and Gosselink, 1993).

The most common wetland class types in the study corridor include palustrine emergent, scrub-shrub, open water and forested wetlands; and riverine, lower and upper perennial and intermittent wetlands. There are also a few lacustrine wetlands within the dam pools of the West Branch. Because the study corridor is concentrated on the area 1-mile in either direction of the banks of the West Branch, the majority of the wetlands are fringe wetlands associated with the river or its tributaries and are located within the 100 or 500-year floodplain. The locations of National Wetland Inventory (NWI) mapped wetlands within the study corridor are outlined on Map 7 of Appendix A. Some functions of these wetlands may include flood storage capacity, wildlife habitat, plant species diversity, the establishment of riparian buffer zones, stormwater retention and pollutant filtration, aesthetic and scenic opportunities and groundwater recharge.

In past decades, wetlands were looked upon as unsightly, undevelopable lands that needed to be filled or drained to make them profitable. As a result, much of the state's wetlands were drained for agriculture or filled to accommodate development. However, in 1977 the Clean Water Act (CWA) was passed and Section 404 of this act gave the US Army Corps of Engineers (USACE) jurisdiction over all waters of the Commonwealth, including wetlands, and regulation of activities within these areas began. The act defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of hydrophytic vegetation typically adapted for life in saturated conditions" (Mitsch and Gosselink, 1993). Wetlands in Pennsylvania are regulated by the United States. Army Corps of Engineers (USACOE) under Sections 404 and 401 of the Clean Water Act and by PADEP under Section 105 of the Dam Safety and Encroachment Act.

About 1.4 percent (404,000 acres) of Pennsylvania is covered by wetlands. Deciduous and forested wetlands are the most common types, followed by open water, marshes, shrub wetlands, and others. Wetlands are most densely distributed in the glaciated northwestern and northeastern parts of the State. Wetland area in Pennsylvania has decreased by more than one-half in the last 200 years. The primary causes of wetland loss or degradation have been conversion to cropland, channelization, forestry, mining, urban development, and the construction of ponds and impoundments. Within the Lower West Branch Susquehanna Watershed, approximately 56% of wetlands in the National Wetlands Inventory database have been lost over the past two decades. However, the USEPA estimates that Pennsylvania has lost 50 to 79% of its wetlands within the past 200 years (USEPA, 1999).

As previously stated, one of the most important wetland complexes located within the study corridor is Montandon Marsh located in West Chillisquaque Township, Northumberland County. Montandon Marsh is a 44-acre wetland complex located just east of the town of Lewisburg along the West Branch Susquehanna River. The marsh is a very diverse riparian wetland ecosystem of glacial origin and contains marshes, swamps, bogs, and seasonal ponds nestled among low sand dunes. Because it is situated on the West Branch Susquehanna River, which is an ancient, glacial-oriented, braided river course, the habitat is a unique mixture of low sand dunes and wetland areas able to support a diverse population of rare plant and animal species.

Some of the plant species present in Montandon Marsh have northern bog affinities like *Chamaedaphne calyculata* (leatherleaf) and *Vaccinium corybosum* (highbush blueberry). Furthermore, Montandon Marsh is one of the few remaining areas in Pennsylvania that contains a healthy population of the state rare species *Scirpus fluvialitis* (river bulrush) and *Carex bullata* (bull sedge). The marsh is also known for its large pocket population of *Scaphiopus platifhinos* (Eastern spadefoot toads). Two bird species listed as threatened in 1985 by the Pennsylvania Game Commission, *Cistothorus palustris* (marsh wren) and *Ixobrychus exilis* (Least Bittern), have occasionally been observed and are suspected of nesting in the marsh. Montandon Marsh is also utilized as a stopover area for migratory birds flying through the region.

Many Bucknell and Susquehanna University students and faculty have completed studies and written theses describing Montandon Marsh's unique sand dune and wetland habitat and the species it supports. Although gravel mining has been proposed in the area, with the appropriate minimization and mitigation techniques, the mining should not have an adverse impact on the marsh (Hochman, et. al 1996). This wetland area is part of land owned by Central Builders Supply, Inc. of Sunbury, PA. Another 34-acre parcel of the Montandon Marsh ecosystem, known as the Belles Tract, is owned and preserved through a conservation easement by the Merrill W. Linn Land and Waterways Conservancy of Lewisburg, PA.

C. Floodplains

As seen on Map 7, the valley section of the entire 77-mile study corridor is located within either the 100 or 500-year floodplain of the West Branch Susquehanna River.

A floodplain includes those lands adjoining a river or stream that have been or may be expected to be inundated by floodwaters in a 100 or 500-year frequency flood. The alluvial soils of floodplains are typically fertile and productive soils that receive adequate hydrology, therefore agricultural areas tend to be concentrated in and around floodplain areas. During colonization, floodplains were where the settlers were able to easily travel. They could survive due to the level transportation routes and significant water sources. For these reasons, cities and towns tended to develop along the floodplains of major rivers.

With increased development however, floodplains have lost their capacity for storing floodwaters. Heavy flood damage has occurred to structures and properties within the study corridor. The Susquehanna River Basin Commission (SRBC) maintains that the Susquehanna River basin is one of the nation's most flood-prone areas. The topography of the area, specifically the narrow gorges that the otherwise wide river must pass through, result in flooding events from ice jams and the subsequent melting that cause downstream surges. In addition, areas along the river that have very shallow banks and little slope, are flood prone areas. Heavy rainfall events easily cause the river to swell and flood these banks. Although these areas are prone to flooding, nearly 30% of the population in the Susquehanna basin lives along the major rivers (SRBC, 2001b).

For these reasons, SRBC and PADEP have developed one of the most extensive flood protection programs in the nation. SRBC and PADEP are authorized to provide structural flood protection in any area of the Commonwealth that requests such protection, if it can be economically justified. The program works best when it combines structural and non-structural flood protection methods. Structural protections include dams, reservoirs, floodwalls and levees, and channel excavation and modification.

Williamsport and South Williamsport became the first communities in the study corridor to have structural flood protection when the US Army Corps of Engineers (USACE) constructed a levee system in the 1950's. Lock Haven received their flood protection levees in the early 1990's. Flood control reservoirs that also help to mitigate flooding in the study corridor include the Stevenson, Bush, Sayers and Curwensville dams, all of which are located upstream of the study corridor.

Non-structural flood protections methods include the Susquehanna Flood Forecast and Flood Warning System, flood insurance, relocation, flood training and education, floodproofing and floodplain management. In 1998, Lycoming County became part of the Pennsylvania Project Impact Partnership, which is a flood disaster resistance initiative to implement proactive, long-term strategies to reduce the risk of damage from natural and man-induced disasters. Union County was awarded a Project Impact Grant in 2001. Recorded flood stages from the National Weather Service along the West Branch are 18 feet in Lewisburg, 19 feet in Milton, 20 feet in Williamsport, 26 feet in Jersey Shore and 21 feet in Lock Haven (SRBC, 2001b). It should be noted that flood stages are representative for a whole reach of a river and indicate the point at which flood warnings are issued by the National Weather Service.

Most comprehensive flood protection projects are designed to provide protection from the 100-year flood (i.e., a flood that has a one percent chance of occurring in any given year). In some cases economic limitations, or restrictions by bridges, buildings, or other encroaching structures, make it impractical to provide this degree of protection. No local flood protection project will completely eliminate the possibility of future flooding since past flooding events cannot be presumed as the greatest that can ever occur.

Floodplain protection projects typically include acquisition and clearing of structures experiencing repetitive flooding and the removal of small dams, abandoned bridges and other man-made structures that alter the flow of floodwaters. Buyout programs could also result in opportunities to create new open space and public access greenway areas within the study corridor. Work within any floodway in Pennsylvania requires the appropriate water obstruction and encroachment permits issued under Section 105 of the Dam Safety Act from PADEP and/or the USACOE. A floodway is the channel of a watercourse and portions of the adjoining floodplains that are reasonably required to carry and discharge the 100-year frequency flood (PADEP, 1999b). Work in the 100-year floodplain is regulated or restricted by municipalities and county planning commissions.

D. Lakes and Ponds

According to the USEPA, there are 135 lakes consisting of 2,926.9 acres in the Lower West Branch Susquehanna River Watershed and 7 lakes totaling 246.2 acres in the Middle West Branch Susquehanna River Watershed. However, most of these lakes are not located directly within the study corridor.

As previously mentioned, lakes are formed within the banks of the West Branch from waters that back up and form pools behind dams. There are three dam pools or "lakes" that provide various opportunities for water recreation. The Adam Bower Dam at Sunbury (formerly known as the Fabri-Dam) is located on the main stem Susquehanna River below the confluence, but the dam pool, also known as Lake Augusta, extends up the West Branch to River Mile 6 in Northumberland County. The Hepburn Street Dam in Williamsport is located at River Mile 40 and the dam pool ends at River Mile 52. The Grant Street Dam in Lock Haven is located at River Mile 70 and the dam pool ends at River Mile 73. In addition, previous restoration, flood control and/or stormwater control efforts in the corridor have resulted in the creation of stormwater detention basins, constructed ponds, open-water wetlands and other water sources in the study corridor.

E. Water Quality

Numerous studies conducted on the Lower West Branch Susquehanna River and within the overall watershed indicate that water quality within the watershed and in the West Branch Susquehanna River is good. Sources of water quality problems include agriculture, urban and storm sewers, stormwater runoff from construction sites, atmospheric deposition, abandoned or acid mine drainage (AMD), removal of vegetation, industrial point sources, package plants, municipal point sources, surface mining, on-site sewage and sewage treatment systems. These sources of impairment for the West Branch and its tributaries are listed by waterbody in Table 2-7 of the Technical Document.

The USEPA Surf your Watershed website provides an Index of Watershed Indicators that characterizes the condition and vulnerability of aquatic systems in each of the watersheds in the United States. The overall classification for the Lower West Branch Susquehanna River Watershed is "Better Water Quality and Low Vulnerability" (USEPA, 1999). This is the highest rating in the system. "Better Water Quality" refers to watersheds where data is sufficient to assert that the State or Tribal designated uses are largely met and other indicators of watershed condition show few problems. "Low Vulnerability" refers to watersheds where data suggest pollutants or other stressors are low, and, therefore there exists a lower potential for future declines in aquatic health. Actions to prevent declines in aquatic conditions in these watersheds are appropriate but at a lower national or statewide priority than in watersheds with higher vulnerability. It should be noted however, that some water quality problems do exist in the West Branch regardless of this rating by the USEPA.

There are numerous opportunities for water quality studies and data collection throughout the 77-mile study corridor. Students at the Pennsylvania State University's Landscape Architecture Department produced a West Branch Susquehanna Scenic River Study (Lock Haven to Muncy) in 1988 and (Muncy to Sunbury) 1989. Data on surface water quality collected included pH, temperature, flow discharge, biochemical oxygen demand (BOD), dissolved oxygen and specific conductance.

The study indicated that most of the pH problems in the northern section of the study corridor are derived from abandoned coal mines to the north and west of the study corridor. Severe acid pollution exists in the Lock Haven area from AMD located upstream making the pH of the West Branch around 4.0 in that area at the time of the study. However, Bald Eagle Creek is very alkaline and once it merges and mixes with the West Branch just east of the City of Lock Haven, the river stabilizes to a near neutral pH of 7.0. The pH remains fairly stable and around neutral throughout the rest of the corridor. This is the result of the limestone fed tributaries that merge with the river, neutralizing any acid pollution picked up from AMD throughout the study corridor. High levels of specific conductance resulting from dissolved solids were detected near Lock Haven and Williamsport. The study did not find any significant water temperature changes along the northern part of the corridor (PSU, 1988). In addition, the dissolved oxygen and specific conductance were fairly stable in the southern section (Muncy to Northumberland) of the corridor (PSU, 1989).

In 1997, the USACE studied the level of federal interest in environmental restoration, streambank protection, flood control, floodplain management, flood damage reduction and stormwater management of the Lower West Branch. The USACE used the study to develop a plan for both identifying necessary feasibility studies and finding viable sponsors to fund the proposed work.

The studies revealed that the water quality was good in Buffalo, White Deer, Muncy, Loyalsock and Lycoming Creeks. There have been few groundwater pollution incidents from landfill leachate or septic systems malfunctions. However, the studies did find a variety of water related problems in other areas including flooding, streambank erosion and sedimentation, degraded environment and aquatic habitat and reduced water quality.

Development within the watershed had increased the percentage of impervious surfaces resulting in reduced infiltration rates and increased volumes of stormwater runoff and flooding. The increased flood flows have contributed to severe bank erosion along certain tributaries. This led to an increase in the amount of sediments entering the West Branch. The increased sediment can lead to other problems including alterations in the natural configuration of the channel, loss of stream meanders, decreased occurrences of pool, riffle, and run patterns and a destruction of the variety and abundance of aquatic habitat.

Much of the river is affected by non-point source pollution, which was not the focus of water quality measurements by natural resource agencies in the past. A major source of non-point source pollution in the West Branch Susquehanna River is from AMD. Nearly 200 miles of the West Branch Susquehanna River are impaired to various degrees by AMD, however most of the impaired reaches are located upstream or in the last 5 miles of the study corridor (above Lock Haven). As the river travels through the study corridor the water chemistry gradually improves once neutralized by limestone fed streams (USACE, 1997).

Although many of the streams that flow into the West Branch have good water quality, there are a few that have experienced severe pollution problems. The USEPA and PADEP use an impaired waters list (Section 303 (d)) to identify those waters where existing pollution controls are not stringent enough to achieve state water quality standards even after implementation of technology-based controls. Section 303(d) of the Federal Clean Water Act requires states to establish total maximum daily loads (TMDLs) in accordance with a priority ranking. The 303(d) list is submitted to USEPA and updated every two years (PADEP, 2000). A list of the water bodies within or drain into the study corridor on the 303(d) list in Pennsylvania is provided in Table 2-7 of the Technical Document.

In 1995, PADEP conducted a study of the West Branch from Williamsport to Lewisburg. The study, provided in Section 8 of the Technical Document (TD-8), focused on municipal sewage treatment plants that discharge directly into the river. Parameters measured or studied included benthic macroinvertebrates, fecal coliform, chlorine, pH, dissolved oxygen, BOD, suspended solids, and other chemical parameters and habitat and substrate observations. Thirteen of the 14 effluent sampling points indicated biological scores above 83% of the respective reference sites, indicating no impairment. Only the Kelly Township site recorded a score of 75% of its reference site indicating slight impairment. The impairment was attributed to an increased chlorine content of the effluent. Three of the discharges, Williamsport Central, Montgomery and Lewisburg contained high fecal coliform counts. There were a few slight increases in ammonia, nitrogen and total phosphorous at the effluent sites, but none were excessive. All other chemical parameters were unaffected and indicated good water quality. Some metal precipitates were present at all the sites but were greater toward the north end of the study corridor where coal mining has contributed to precipitates in the water (Hughey, 1996).

In July 2000, the Lycoming College Clean Water Institute started collecting water quality data from twelve different monitoring locations on the West Branch Susquehanna River throughout the length of the study corridor. These locations include Sunbury, Lewisburg Milton, Watsontown, Montgomery, Muncy, Montoursville, Williamsport, Susquehanna Campground, Jersey Shore, Great Island and Lick Run. Parameters that the Clean Water Institute monitors include ortho-phosphorous, total phosphorous, temperature, dissolved oxygen, pH, alkalinity, conductivity, total dissolved solids, nitrate and coliform. Data from these water quality monitoring events are provided in TD-8 and indicate that nitrates and coliform are higher in the river from Sunbury to Montoursville, while ortho-phosphorous and total phosphorous have been high in the Watsontown area. High nitrate and coliform concentrations suggest influence from untreated wastewater or animal manure (barnyard runoff). Higher concentrations of phosphorous and orthophosphates indicates influence form wastewater treatment plants, fertilizers and detergents. Alkalinity once again proves to be highest at the Sunbury and Lewisburg sample locations and remains fairly consistent up to the Jersey Shore sample location. This supports the fact that Bald Eagle Creek, and other smaller limestone streams, provide a large source of carbonate buffering to the river. The lack of buffering and the effects of AMD above Lock Haven are apparent from low alkalinity concentrations and higher total dissolved solids and conductivity, the latter of which can likely be attributed to high concentrations of dissolved metals.

Finally, another study involved a baseline assessment, which quantified current impairment data for the Big Bend Watershed (also known as the Lower West Branch Susquehanna River; PADEP Subbasin 10). The Big Bend watershed encompasses the Antes-Lycoming Creek (10A), Loyalsock Creek (10B), White Deer-Buffalo Creeks (10C) and the Muncy-Chillisquaque Creek watersheds. Completed by PADEP's Big Bend Project Team, the study was part of a monitoring effort conducted to determine the causes and effects of pollution within the Lower West Branch Susquehanna Watershed. The study revealed that of the 3,377.08 stream miles (within the watershed), 393.82 stream miles (11.7%) are impaired. The Muncy-Chillisquaque Creek Watershed (Subbasin 10D) was by far the most impaired, claiming nearly 83% of the total impaired River Miles (Aldenderfer, 2001). The impairment in this area is likely due to the extremely high concentration of agricultural farms and developed areas adjacent to the streams and the river in this region. A discussion of the various point and non-point sources of pollution and the methods for monitoring water quality in the study corridor are described in the sections that follow.

1. *Point Sources*

Most often, water quality is measured by the absence or presence of certain sources of pollution. Point sources of pollution to water systems are direct discharges coming from a known facility, pipe or ditch to a known location in a stream or river. Point source pollution is most often associated with industries or municipalities that discharge wastewater to natural waters through a pipe or ditch (Brooks, et. al., 1997). Point sources of pollution can be measured and treated, therefore discharges of wastewater in the United States are regulated under the provisions of the Clean Water Act and sources must obtain permits issued under the National Pollutant Discharge Elimination System (NPDES) in order to discharge wastewater into streams. An NPDES permit requires the discharger to meet certain technology-based effluent limits and perform effluent monitoring.

There are 147 facilities within the study corridor that have NPDES permits to discharge wastewater into the waterways of the Lower West Branch Susquehanna River Watershed. These facilities discharge predominantly sewage and industrial waste effluents. The majority of the facilities are concentrated in the urban centers of Northumberland, Milton, Williamsport, Jersey Shore and Lock Haven. See Table 2-8 of the Technical Document for a detailed list of the NPDES facilities within the study corridor.

The previously mentioned baseline assessment done for the Big Bend Watershed or Lower West Branch Susquehanna River showed that only a very small percentage of the pollution in the watershed comes from point sources. The study revealed that industrial point sources, package plants, municipal point sources and surface mining account for less than 1% each of the total amount of impairment in the watershed. The reason for this is likely due to our ability to measure, monitor, control and reduce the amount of point source pollution coming from any one given facility or location. In addition, there are existing laws and agencies that have the ability to regulate and enforce effluent standards to reduce the total point source pollution. Therefore, any major impacts to the Lower West Branch are due to non-point sources, which are discussed in further detail below.

2. Non-point Sources

Unlike point sources, non-point sources of pollution occur over a wide area and are usually associated with large-scale land activities such as agriculture, livestock grazing, mining, logging and development of impervious surfaces resulting in increased amounts of often polluted stormwater runoff. Non-point source pollution is difficult to measure, regulate and treat because of the nature of the activities that cause it and the large-scale area that it is derived from (Brooks, et. al., 1997).

The baseline assessment done for the Big Bend Watershed or lower West Branch Susquehanna River revealed that 9 of the top 10 sources of pollution in the watershed were caused by non-point sources. The study revealed that the largest contributor of impairment (70%) in the entire watershed was agricultural pollution. Remaining impairment sources (30%) included road runoff, atmospheric deposition, small residential runoff, abandoned mine drainage, urban runoff and storm sewers, natural sources and removal of vegetation.

In the southern section of the study corridor, agriculture and development pressures along tributaries contribute to an increase of non-point source pollution to the West Branch. Types of pollution common to agricultural areas include increased soil erosion and deposition, barnyard runoff and wastes from livestock loafing in waterways. The primary problem resulting from increased land development is the increase in stormwater runoff from impervious surfaces such as roofs, parking lots, roads and driveways. The increase in stormwater volumes and velocities results in accelerated erosion and sedimentation, while thermal and chemical pollution from roads and large parking lots further degrades water quality. The increase in impervious surfaces within the corridor also reduces infiltration and groundwater aquifer recharge.

Acid mine drainage (AMD), discharged from abandoned mines located throughout the state, is currently the largest non-point source pollution problem in Pennsylvania (SRBC, 2001a). Fortunately, tributaries flowing into the lower West Branch area do not directly contribute to AMD due to the absence of large-scale mining activities within and adjacent to the study corridor. However, as previously mentioned, AMD from bituminous coal mining upstream of the corridor is the primary non-point source pollution problem in the northern section of the study corridor. In fact, the river upstream of the corridor is devoid of aquatic life due to the impacts of AMD, such as high acidity and dissolved metal concentrations. As a result, fish populations within the study corridor upstream of Lock Haven are sparse. However, AMD impacts become buffered and reduced by limestone streams such as Bald Eagle Creek and other good quality mountain tributaries within the study corridor and the fishery progressively improves downstream. The efforts to mitigate AMD impacts on impaired tributaries upstream of the study corridor are strongly encouraged to continue even though such projects are not within this study corridor.

Methods for controlling and minimizing non-point source pollution from agriculture include the use of sound land management practices such as crop rotation, proper timber harvesting, balanced use of fertilizers, barnyard waste management, erosion control and streambank fencing. Methods for reducing non-point source pollution from land development include zoning laws to help control and restrict development to certain areas and the use of best management practices (BMP's) to treat increased runoff from impervious surfaces and help stormwater infiltrate back to the groundwater. The establishment of riparian buffers along streams and the use of passive wetland treatment systems to filter and treat stormwater runoff before it enters receiving streams can further reduce non-point pollution.

3. *Monitoring*

The water that flows through our many creeks and rivers holds the key to life. Our waters support terrestrial and aquatic life, including plants, animals, and people. Though often taken for granted, water is a precious resource that should be cherished. Good quality water is an essential component of recreational, educational, and industrial opportunities and the well-being of our civilization. The only way to assess and evaluate the quality of streams and rivers in the watershed is through consistent and accurate monitoring. Traditionally, most of the water quality sampling and monitoring in the state was done by either PADEP, the United States Geologic Survey (USGS) or some other governmental agency such as the Pennsylvania Fish and Boat Commission.

There are eight stream flow gauging stations operated by USGS located along the West Branch Susquehanna River within the study corridor. The stations are in Lewisburg, West Milton, Watsontown, Montoursville, Williamsport, Jersey Shore and Lock Haven. Although these gauging stations help to provide valuable water quality and quantity data, there has been an increasing concern and quest for more detailed data and knowledge of water quality problems throughout entire watersheds in recent years. The government agencies' staffs cannot handle comprehensive water quality monitoring for all the streams in the Commonwealth, therefore citizen-based groups are becoming educated and have begun volunteer monitoring programs across the state. Even before the formal inception of the Citizen's Volunteer Monitoring Program by PADEP, citizen volunteers have been involved in monitoring the quality of the waters in their area since the 1960's. The Citizen's Volunteer Monitoring Program now enables even more watershed groups, interested citizens, schools, clubs and others to learn about and participate in the monitoring of the water quality in their watersheds (PADEP, 2001b).

Recently formed watershed groups within the study corridor include the Chillisquaque-Limestone Creek Watershed Association, Buffalo Creek Watershed Alliance, White Deer Creek Watershed Restoration Committee, Muncy Creek Watershed Association, Loyalsock Creek Watershed Association, Lycoming Creek Watershed Association and the Nippenose Valley Watershed Association. For more information on watershed groups, visit PADEP's web site at www.dep.state.pa.us or Pennsylvania Organization for Watersheds and Rivers web site at www.pawatersheds.org.

Most importantly, the study corridor has a broad base of private and public colleges and universities, which have the professional staff and students to plan, supervise and implement water quality studies within the corridor. The Lycoming College Clean Water Institute is one such entity that plans to continue monitoring the water quality within the corridor. Other institutions that conduct biological, chemical and geological studies of the corridor's surface and groundwater resources include Bucknell University, Lock Haven University and Susquehanna University. These institutions not only have volunteers, equipment and laboratories to complete monitoring, they have the need to involve their students in meaningful curricula and projects. It is a win-win situation for everyone who partners with and uses these educational institutions as a means to monitor and solve water resource problems within the West Branch Susquehanna River corridor. Such partnerships will be key to implementing water quality management options and projects identified in Section IX, Management Options.

F. Water Supply Areas

1. Public vs. Private

Within the study corridor, there are approximately 102 municipal and private water supply sources that provide potable water from springs and wells for customers they serve or for private businesses (PADEP, 2001d). Public or private utilities provide water for 66% of the households, while 30% utilize individual residential wells (USCB, 2001). The water supply systems within the study corridor include five nontransient, noncommunity systems and 42 community systems. Of the municipal community systems, the Montgomery Borough Water and Sewer Authority, Muncy Borough Water Company, Montoursville Water Company and the Williamsport Municipal Water Company have sources located directly in the study corridor. There is only one surface water intake on the West Branch Susquehanna River. Owned by the Pennsylvania American Water Company, this intake is located along the eastern shore at River Mile 11 in the Borough of Milton. Pennsylvania American Water Company is a private water company.

According to information provided by PADEP (listed in Table 2-9 of the Technical Document), these water sources serve populations from 25 to 5,200. The Williamsport Municipal Water Authority sources include 9 wells that serve as a reserve for the Williamsport area. Pennsylvania American Water Company's single intake can serve up to 40,160 consumers. It should be noted, however, that these water supply sources are not the only sources that service the population within the study corridor. For instance, Williamsport's primary water supply source is from large reservoirs in the Mosquito Creek and Hagermans Run Watersheds outside of the corridor. Pennsylvania American Water Company also draws water from White Deer Creek and Spruce Run Reservoir (a tributary to Buffalo Creek in Union County). Other municipalities such as Jersey Shore and Lock Haven also receive their primary drinking water sources from areas outside the corridor. Map 7 shows the locations of municipal and private groundwater supply wells and the surface water intake point. These locations can be cross-referenced with the source information provided in Table 2-9 of the Technical Document. It should be noted that the data does not include individual groundwater supply wells that service private residents located in the corridor.

2. Well Head Protection Areas

Wellhead protection is defined in Section 1428 of the Federal Safe Drinking Water Act (SDWA) as a comprehensive program to protect wellhead protection areas (WHPA) from man-induced contaminants, which have an adverse effect on the health of people. The Pennsylvania Safe Drinking Water regulations, 25 PA Code Chapter 109, direct public water suppliers to find the best source available and take those measures necessary to protect that source to provide a continual and safe water supply. The SDWA regulations define wellhead protection and wellhead protection areas, set permitting requirements for ground-water sources, set operations requirement and establish elements necessary for state approval of local wellhead protection (WHP) programs. Not all, but many of the WHP management approaches for a comprehensive local WHP program would require local government action, cooperation or support. PADEP has been developing a state Wellhead Protection Program Plan for Pennsylvania since 1989. Most of these efforts have focused on encouraging voluntary local program development through education and incentive grants, formulating technical WHP area delineation strategies and the establishment of regulations and associated compliance assistance.

Public education and participation are key to local WHP program development. A series of approaches can be developed to educate and involve the public in WHP. PADEP reviews and approves local WHP programs, which meet the basic elements set-out in the state SDWA regulations. PADEP can provide data to local WHP programs on state or federally regulated potential sources of ground-water contamination and can advise them on approaches for WHPA delineation, conducting contaminant source inventories, public education programs and management approaches. Existing federal guidelines and recommendations can be utilized for the program and guidance will be developed only if a need arises. The principles of the Comprehensive State Ground Water Protection Program should be applied to coordinate point and non-point source pollution prevention programs with the local WHP programs. Funding for local wellhead protection programs is available from SDWA State Revolving Set-Aside Funds and through PADEP's Source Water Protection Grant Program. Additional PADEP field and central office staff and fixed assets can be used to support WHPA delineations, assessments and management plan development and to support public participation and public promotion of these activities (PADEP, 2001e).

Within the study corridor, there are several known wellhead protection programs in various municipalities. The Montoursville Water Company was recognized by PADEP for its voluntary efforts to develop the first state-approved wellhead protection program in the state in 1999. The Borough began developing the program in 1995. The program emphasizes technical, educational and financial assistance to encourage the development of voluntary local wellhead protection programs (PADEP, 2001d). In a similar effort, the Jersey Shore Area Joint Water Authority became a member of the Partnership for Safe Water in January 2000. The partnership is a voluntary effort involving rigorous self-assessment procedures specifically geared toward identifying weaknesses in existing plant operations, design and administration. In August 2000, Williamsport also joined the Partnership for Safe Water. Other areas in Union and Northumberland Counties were awarded grants in past years to conduct feasibility studies or develop wellhead protection programs in the study corridor (PADEP, 2001e).

Continued wellhead protection efforts are encouraged within this River Conservation Plan. Specific implementation projects to promote wellhead protection programs to protect the quality and quantity of community ground water supplies are identified in Section VIII, Management Options.