ADAMS COUNTY
PENNSYLVANIA

Water Supply and
Wellhead Protection Plan

Adams County Office of Planning and Development
19 Baltimore Street, Suite 101
Gettysburg, PA 17325

Prepared By

Science Applications International Corporation
6310 Allentown Boulevard
Harrisburg, PA 17112

Gehringer-Roth Associates
600-I Eden Road
Lancaster, PA 17601

June 2001
Final

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APPENDICES

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The Adams County Water Supply and Wellhead Protection Plan has been prepared as part of an ongoing effort by the Adams County Commissioners and Adams County Office of Planning and Development to develop a Countywide framework for water resources planning. Valuable assistance in the development of the plan was provided by the County's Water Advisory Committee, the United States Geological Survey and the Pennsylvania Rural Water Association. Funding for this project was provided through a grant from the Small Systems Alternatives Evaluation Section, Division of Technical Assistance and Outreach, Bureau of Water Supply Management, PA Department of Environmental Protection.

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Dedication

The Adams County Commissioners and the Office of Planning and Development dedicate the *Adams County Water Supply and Wellhead Protection Plan, 2000*, to Marguerite Kurth (1920-), Althea Schildknecht (1924-1993), and Harry Biesecker (1918-1999). Mrs. Kurth and Ms. Schildknecht were founding members and past Presidents of the League of Women Voters of Adams County, an organization that has spearheaded an ongoing community education effort on the conservation and preservation of surface and groundwater resources. Mr. Biesecker was County Commissioner from 1967-1978 and devoted a great deal of his political and personal life to ensuring that Adams County citizens, present and future, would have abundant, clean drinking water.

LIST OF ABBREVIATIONS

ACCD	Adams County Conservation District
ACCP	Adams County Comprehensive Plan
ACOPD	Adams County Office of Planning and Development
AL	Action Level
ASA	Agricultural Security Area
AWSR	Annual Water Supply Report
AWWA	American Water Works Association
BMP	Best Management Practice
CWS	Community Water System
DEP	PA Department of Environmental Protection
EOP	Emergency Operations Plan
ERP	Emergency Response Plan
Extension	PA State Cooperative Extension Service
FEMA	Federal Emergency Management Agency
G-ACACC	Gettysburg-Adams County Area Chamber of Commerce
gal	gallon
gpd	gallons per day
GIS	Geographic Information System
MCL	maximum contaminant level
mgd	million gallons per day
mg/l	milligrams per liter
MHP	mobile home park
mi2	square mile
NA	not applicable
NPDES	National Pollution Discharge Elimination System
NRCS	US National Resources Conservation Service
O&M	Operation and Maintenance
PADWIS	PA Drinking Water Information System
pCi/l	picocuries per liter
PENNVEST	PA Infrastructure Investment Authority
psi	pounds per square inch
PUC	PA Public Utility Commission
PWS ID	PA Water System Identification
Q	pumping rate
SDWA	Safe Drinking Water Act
SRBC	Susquehanna River Basin Commission
swm	storm water management
SY	Safe Yield
U	unknown value
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WHP	wellhead protection
WHPA	wellhead protection area

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EXECUTIVE SUMMARY

Water is an ongoing concern in Adams County. The Adams County Commissioners authorized this County Water Supply/Wellhead Protection Plan, funded in part by a grant from the Pennsylvania Department of Environmental Protection. In 1991, the County completed an updated Comprehensive Plan that made recommendations for projected future growth areas as guidance to local municipalities in the updating of local comprehensive plans and zoning ordinances. Local Act 537 sewage facilities plans similarly provide guidance for future sewer service throughout the County. To facilitate managed growth objectives and to protect environmental resources, a comprehensive Countywide framework specifically for water facilities planning is also needed.

The primary purposes of the Water Supply component of this plan are to: 1) evaluate existing community water system capabilities; 2) project future water needs; 3) identify service deficiencies; 4) evaluate alternative solutions and 5) make recommendations to promote coordination and consistency with County and municipal planning efforts. The primary purposes of the Wellhead Protection component of this plan are to: 1) provide assistance to four selected community water systems in developing wellhead protection plans and 2) develop model approaches that can be used by other systems in Adams County to protect groundwater resources. This plan primarily addresses the need for safe and adequate drinking water supplies and does not touch on recreational, wildlife, energy, or other similar issues.

During 1997, estimated water use in Adams County for all purposes was 11.26 million gallons per day (mgd). This includes approximately 4.06 mgd provided by community water systems, 1.13+ mgd provided by noncommunity water systems, 3.15 mgd in other industrial, commercial and agricultural withdrawals and 2.92 mgd from on-lot water wells. The bulk of the analysis in this plan is devoted to community water systems as they provide the majority of potable water within the County.

Adams County contains 36 community water systems, which serve populations ranging from 26 to over 10,000. The total population served by these systems is 36,452. The County's community water systems provide water for residential, commercial, industrial, institutional and other water uses. They include one large system, one medium-sized system, and 33 small systems. Fifteen are municipal systems or authorities, 13 serve mobile home parks, five are investor-owned, two serve institutional uses, and one is a water association. These systems obtain their water primarily from wells; only a few obtain water from springs or streams. Average daily residential water use is 61 gallons per day (gpd), while average peak daily water use is 96 gpd.

System improvements to enhance water supply should be accompanied by wellhead protection programs to protect water quality. This plan provides a five-step process that communities can use to protect public water supply wells from potential contaminant sources. A variety of voluntary as well as regulatory tools and techniques that can be employed by water systems and municipalities is described. Four pilot project communities were chosen to illustrate how wellhead protection programs can be developed and to provide models for other Adams County communities. The pilot project municipalities were Abbottstown, Fairfield, Gettysburg, and Littlestown. Finally, a contaminant source inventory for the county was completed, providing locational information on major federal and state-identified contaminant sources that will assist community water systems in avoiding the siting of new groundwater sources in proximity to these sites.

Six systems have demonstrated inadequate safe yields to meet current peak needs, meaning that in times of drought, these water supplies may be inadequate. Nine other systems have unknown safe yields, and may also have unreliable supplies. During the summer of 1999, at least nine systems experienced difficulty obtaining sufficient yields. Many of these are the same systems as those with unknown safe yields. Twenty-seven systems are reliant on relatively few sources of water and would have inadequate safe yields if their best water source went out of service for any reason. Thirteen systems lack an emergency response plan and many others are inadequate or out-of-date, 27 systems lack an emergency power generator, and all but three systems lack any contractual arrangement for water in times of emergency.

Many systems exhibit deficiencies or limitations, which could, considering Adams County's growing population, become serious. All systems provide, at a minimum, disinfection, while two provide full filtration. Between two and five additional systems may require filtration because their groundwater sources are influenced by surface water. Four systems provide no treated water storage, while 14 more provide inadequate current water storage.

Many systems are in need of upgraded distribution systems. Only three systems have adequate piping diameter to permit interconnection with another system, and only four have adequate piping diameter for fire-fighting purposes. Thirteen systems have unknown or inadequate pressure for fire-fighting. At least eight systems lack both hydrants and blow-off valves, which means that these systems cannot be effectively flushed. Thirteen systems may lack cross-connection control programs to prevent contamination of water.

Many systems are in need of management improvements. Twenty-two systems lack certified secondary operators and 13 lack approved Operation and Maintenance Plans. Seven systems do not meet minimal financial management standards.

By 2010, the need for system enhancements will be even greater than it is today. It is estimated that needed system improvements will cost between two and three and one-half million dollars. This plan makes recommendations for both stand-alone improvements to community water systems and, in some instances, to create regional solutions to achieve economies of scale and increased coordination. Regional solutions may, out of necessity, rely on the capabilities of viable systems. The most efficient and effectively managed systems should be encouraged to assume responsibility for expanded service and, in some instances, to incorporate non-viable systems. If regional solutions cannot be found, Adams County should implement an alternative approach, such as a County Authority to assume operation and management responsibility for non-viable systems.

The following charts summarize the major recommendations of this plan, including implementation measures and a proposed time-frame for enhancement of systems. Actions suggested for short-term implementation should be initiated within a year. Recommendations with a mid-term status should be initiated within three years, while those suggested for long-term implementation should be undertaken within five years. Recommendations are also set forth for continuing actions.

<u>Local Planning</u> - "Local planning" recommendations refer to those for which water systems and municipalities are responsible. These recommendations focus on local water supply and wellhead protection planning:

- Local Planning -

Recommendation	Responsible Party	Timeframe
1. Evaluate stand-alone & regional solutions to system problems	Water systems, municipalities & ACOPD	Short-Term
2. Undertake system structural, management & financial improvements	Water systems	Mid-Term
3. Coordinate future water service areas with local planning & zoning	Water systems, municipalities & ACOPD	On-going
4. Evaluate & revise local planning & zoning to direct growth towards areas with infrastructure capability	Municipalities & ACOPD	Short-Term
5. Evaluate &, where appropriate, revise water rate structure	Water systems	Short-Term
6. Update emergency response & emergency operations plans	Water systems & Municipalities	Mid-Term
7. Develop, adopt & implement wellhead protection plans	Water systems, municipalities & ACOPD	Long-Term
8. Purchase land or easements for all Zone I wellhead protection areas	Water systems, municipalities & ACOPD	Long-Term

Technical Assistance - These recommendations are intended to support local planning efforts by providing technical assistance, guidance and funding to water systems and municipalities. These recommendations would be undertaken by various County departments.

- Technical Assistance –

Recommendation	Responsible Party	Time Frame
1. Assist water systems in pursuing funding from DEP for system improvements & wellhead protection	ACOPD	On-going
2. Digitize all available coverages of potential contaminant sources	Adams County GIS Department	Short-Term
3. Digitize wellhead protection areas as they are professionally delineated	Adams County GIS Department	On-going
4. Assist municipalities in setting up hazardous waste collection days	Adams County Solid Waste Department	Mid-Term
5. Assist municipalities in developing OLDS management programs	ACOPD	Mid-Term
6. Assist municipalities in adopting & implementing on-lot well ordinances	ACOPD	Mid-Term
7. Assist municipalities & systems in developing wellhead protection plans	ACOPD	On-going
8. Continue to develop stormwater plans & integrate at local level	ACOPD	Mid-Term

Community Support - These recommendations are intended to support local planning efforts by helping to implement water supply and wellhead protection programs. They would be undertaken by a wide variety of public and private groups working cooperatively with one another.

- Community Support -

Recommendation	Responsible Party	Time Frame
1. Continue to assist farm community with conservation plans, nutrient management plans, integrated pest management plans & other BMPs	Adams County Conservation District & Penn State Cooperative Extension	On-going
2. Assist municipalities in developing educational programs to protect water resources	PA Rural Water Association, Chesapeake Bay Foundation, Alliance for the Chesapeake Bay, League of Women Voters	On-going
3. Appoint & involve municipal Environmental Advisory Councils to assist in water planning efforts	Municipalities	Short-Term

Major Challenges - Finally, a few recommendations involve bold new programs supporting enhanced protection of water quality and quantity that require the initiative of the Adams County Commissioners.

- Major Challenges -

Recommendation	Responsible Party	Time Frame
1. Evaluate a range of options for County coordination of critical water supply and quality issues, including: • A County Water Resources Dept. • A County Health Department • A County Water Authority • Expanded Planning Department responsibilities	Adams County Commissioners & ACOPD	Mid-Term
2. Undertake a surface water protection plan to safeguard water quality & potential new surface & groundwater sources; to be coordinated with developing watershed & stormwater plans	Adams County Commissioners & ACOPD	Long-Term

I. COUNTY WATER SUPPLY PLANNING INFORMATION

A. INTRODUCTION

Over the last several decades, Adams County has experienced rapid population growth and development, which is expected to continue well into the next century. New technologies and low energy costs are resulting in a dispersed population pattern. The visual attractiveness of the County together with surrounding development pressures and new and expanding employment centers in Maryland and the Harrisburg, York and Hanover areas combine to draw new residents and businesses to the County. The County's growth has begun to impact its natural resources, including the quantity and quality of its water resources. Existing and new development poses threats of surface and groundwater source contamination at the same time that water demands from those sources are growing. Accommodating future growth and development while protecting the County's water resources will be a continuing challenge over the next 10 to 20 years and beyond.

A key element in planning for the future of Adams County will be the availability and quality of the County's water supply. To ensure that Adams County residents continue to enjoy a plentiful, clean water supply, the County has embarked on the development of a Water Supply and Wellhead Protection Plan. In the spring of 1998, Adams County received a grant from the Pennsylvania Department of Environmental Protection (DEP) for this purpose. A countywide advisory committee, consisting of a wide variety of individuals with expertise and interest or responsibility for water issues, was organized to guide the development of the Water Supply and Wellhead Protection Plan under the guidance of the Adams County Office of Planning and Development.

The primary objectives of the Water Supply component are to:

- Provide an evaluation, based on technical, managerial, and financial considerations, of the ability of the County's community water systems to meet projected future water demands,

- Help ensure that all systems have the long-term capacity to meet Safe Drinking Water requirements,

- Recommend a variety of approaches to improve the ability of existing and potential new systems to deliver water to existing and future residents in the most effective, economical and environmentally appropriate ways possible,

- Help implement the Utilities Plan portion of the County's Comprehensive Plan,
- Propose future water service areas coordinated and consistent with the recommended growth areas of the County's Comprehensive Plan, and
- Recommend effective approaches for the provision of water service outside community water system service areas

The primary purposes of the Wellhead Protection component are to:

- Provide assistance to four selected community water systems in the delineation of wellhead protection areas and the development of wellhead protection measures to safeguard groundwater resources, and
- Create models for other community water systems across the County to utilize in the protection of their vital but vulnerable groundwater resources.

Public participation and citizen involvement are essential components in the County's water planning process. A series of public forums designed to raise public awareness and solicit public input is a necessary component of the water planning process and will help assure its successful implementation. A final major objective of the Water Supply and Wellhead Protection Plan is enhanced communication and coordination between municipalities and community water systems, which will facilitate continued effective water planning into the future.

B. GEOLOGIC OVERVIEW

Groundwater is the primary source of water for the County's community, as well as individual water systems. Only three community systems use surface water sources, all three of which rely primarily or solely upon these sources. Over the last several years, one system has abandoned its primary surface source and another has abandoned its reserve surface source.

An understanding of the physical geographic factors that influence groundwater availability and quality is important. Geology is a prime determinant of groundwater quality and quantity. Certain rock types and structures convey water better and yield more abundant water sources. The chemical composition of rock can contribute to the chemical properties of groundwater, and rock types and structure can affect the transport rates of groundwater and the vulnerability of groundwater to potential contamination.

Adams County consists of five hydrogeologic units. The **Gettysburg Lowland** covers more than half of Adams County, occupying 347 square miles and cutting a wide swath from the northeast to the southwest through the central part of the County, including the Route 15 corridor and Gettysburg area. This area is underlain by Triassic-Jurassic age sedimentary rocks (shales, siltstones, sandstones, minor limestone, and conglomerate) and igneous rocks (diabase). Rolling lowlands and isolated hills and highlands are representative of the topography in this area. The principle geologic units consist of the Gettysburg Formation, New Oxford Formation, and diabase.

The **Piedmont Lowland** is located in the southeastern part of the County in an arc extending from the Maryland line to north of McSherrystown and occupies about 22 square miles. Bedrock consists of Cambrian and Ordovician age limestones and dolomites, with some shale and marble. The geologic formations include: Conestoga, Ledger, Kinzers, and Vintage.

The **Piedmont Upland** lies to the north and south of the Piedmont Lowland, primarily south of Littlestown, but also north of McSherrystown, covering an area of about 17 square miles. The major rock type is composed of graywacke (with siltstone and quartz intervals) from the Harpers Formation. The Marburg Schist and Metabasalt make up the remaining geologic units of the Piedmont Upland. Collectively, these rock types are relatively resistant to erosion and form broad, gently rolling hills and valleys.

The **Blue Ridge** unit is located in the western part of the County in the South Mountain area, covering an area of about 135 square miles. This area is underlain by Precambrian age metavolcanic rocks that consist of metabasalt, metarhyolite, and greenstone schist. Collectively, these rocks are part of the Catoctin Formation. Pronounced ridges and deep valleys are characteristic of the erosional patterns and topographic relief of this hydrogeologic unit.

The **Valley and Ridge Province** of the Appalachian Mountains extends into the northern corner of Adams County, but represents only a small fraction (0.2 square mile) of the County's physiography. The Valley and Ridge is characterized by folded and faulted Cambrian-Age to Pennsylvanian-Age rock sequences that are best exposed on the ridge tops and valley walls. Groundwater resources available to Adams County from this Physiographic Province are extremely limited based on the small available land area where these rock types occur. Therefore, the Valley and Ridge Province was not considered in this plan for Adams County (Low and Dugas, 1999).

A more detailed discussion of the County's geology is presented in Chapter V as part of an evaluation of potential future water sources.

C. WATER OVERVIEW

Adams County is located in two major drainage basins which drain into Chesapeake Bay. The northeastern half of the County lies within the Susquehanna River Drainage Basin and is drained by the Conewago Creek and its tributaries, the South Branch of the Conewago Creek and Bermudian Creek. The southwestern half of the County lies within the Potomac River Drainage Basin and is drained by tributaries of the Monocacy River in Maryland, including Toms Creek, Middle Creek, Marsh Creek, Rock Creek, Alloway Creek, Piney Creek, Flat Run, and several smaller streams. A small area in western Adams County drains into the Potomac River Basin via the Antietam Creek. The headwaters for all County streams are located within Adams County, which has important implications for water supply and quality.

1. QUANTITY OF AVAILABLE WATER

Hydrologic Cycle - Normal annual precipitation averages 39 inches for most parts of Adams County, with as much as 44 inches in the South Mountain area. While about 62% of this precipitation evaporates or transpires back into the atmosphere, another 20% runs into streams as surface runoff, and approximately 18% infiltrates into the soil as groundwater. Different characteristics of localities can create wide variances in amounts of run-off and infiltration. Groundwater which is not withdrawn returns to the surface as stream discharge or "baseflow", and flows from the County to other adjacent counties and states (ACOPD, 1991).

Surface Water Availability - Average stream flow within the County in years of average rainfall is about 376 mgd, considerably higher than the surface runoff to streams, due to "baseflow" recharge from groundwater sources. Surface water use for all purposes was estimated in 1991 to be about 3.5 mgd, approximately 1% of average stream flow. However, in an average dry year, surface runoff can drop to less than 10% of the average, and in a drought year to even less (ACOPD, 1991).

Groundwater Availability - Groundwater recharge occurs at rates dependent on the texture and composition of the soil and underlying strata, the slope of the land, the amount of vegetative cover, and the impervious surface area. Impervious surface area is incapable of absorbing precipitation because of the use of materials, such as concrete and macadam, which block infiltration, or because of soil compaction. Recharge is enhanced in the sedimentary geology of the Gettysburg Plain and the Piedmont Lowland, particularly in the unconsolidated geology of stream valleys. Some of these areas have seasonally high water tables. Of the estimated County-wide 175 mgd groundwater recharge rate, roughly 110 mgd is available in areas underlain by Triassic or carbonate rocks in these formations that can yield well water with adequate quantity and quality. The Triassic rocks of the mid-County part of the plain provide low-to-moderate groundwater yields of from 1 to 630 gpm, with a median for residential wells of 12 gpm and for commercial wells of 69 gpm. Diabase dikes on the plain have poor water yields. Triassic rocks of the eastern part of the plain provide generally low groundwater yields of from 1 to 100 gpm, with a median for residential wells of 6 gpm and 30 gpm for commercial wells. The limestone rocks of the Piedmont Lowland in the McSherrystown/Littlestown valley yield an average of 26 gpm for residential wells and 28 gpm for commercial wells (ACOPD, 1991).

Across Adams County, groundwater use for all purposes was estimated in 1991 to be about 6.5 mgd, or 6% of available groundwater County-wide. In dry or drought years, groundwater availability is reduced, particularly in shallow wells, aquifers and springs. While there is generally adequate water available within the County, some community water systems and individuals report difficulty in meeting water demands during periods of drought. In part, this may be due to the shallow nature of many of the County's wells (ACOPD, 1991 and System Survey, 1999).

Regulation of Water Use - In that portion of the County within the Susquehanna River Watershed, groundwater withdrawals of 100,000 gpd or greater are regulated by the Susquehanna River Basin Commission (SRBC). In addition, SRBC's Agricultural Water Use Program requires agricultural water use to be reported. However, reported agricultural water use is estimated to be only about 10% of that actually used (Extension, 1999).

Groundwater withdrawals in the area of the County within the Potomac River Watershed are not regulated. Streamflow withdrawals in both watersheds are regulated by the DEP.

2. WATER QUALITY

The Pennsylvania Department of Environmental Protection (DEP) has developed water quality standards for all surface waters in the Commonwealth. These standards, which are designed to safeguard streams, rivers and lakes throughout Pennsylvania, include use designations (e.g., "cold water fishery," "warm water fishery," "swimmable") and the water quality criteria necessary to protect these uses. Special protection is provided for streams designated as "high quality" or "exceptional value" waters. Several streams in Adams County are classified as "high quality waters." These include (western) Conewago Creek, Birch Run, Carbaugh Run (lower), East Branch Antietam Creek, Hosack Run, Middle Creek, Mountain Creek, Stillhouse Run, and Toms Creek. Wastewater treatment plant effluent and any other discharges to streams classified as "high quality" are permitted only if the discharge is the result of necessary social and economic development, water quality standards are maintained, and all existing uses of the stream are protected. This would have the effect of requiring any wastewater treatment plants in these areas to provide "tertiary" treatment to meet discharge criteria. Adams County possesses one stream designated "exceptional value waters", which is the upper reaches of Carbaugh Run in Franklin and Hamiltonban Townships. Any stream classified by the Department as "exceptional value waters" must be maintained at existing quality and may not be degraded, essentially precluding any discharge to the stream.

Only limited water quality data on the County's surface water streams is available. To address this shortcoming, the County Conservation District established the Adams County Citizens Water Monitoring Program, intended to train citizens to collect base line water quality throughout the County. This program is being reorganized under the Adams County Watershed Alliance. Groundwater quality in Adams County is generally good in most areas. It ranges from very soft in the volcanic geology of the mountains to very hard in the sedimentary and particularly limestone geology of the Gettysburg Plain. Some water sources in the plain may have iron and manganese. Some areas of the County experience elevated groundwater fecal coliform bacteria levels caused by failing on-lot septic systems and/or elevated nitrate levels from over-application of fertilizers and manure. There have also been several serious incidences of industrial contamination of groundwater, particularly in the Gettysburg area. More detailed discussion of water quality issues is provided throughout this plan, particularly in Chapter VI.

3. STORMWATER PLANNING

On October 4, 1978, the Pennsylvania General Assembly approved the Stormwater Management Act, P.L. 864, No. 167. Act 167 was adopted based on the Statewide recognition of the adverse effects of inadequate management of excessive rates and volumes of stormwater resulting from development. Act 167 requires all Pennsylvania counties to prepare and adopt stormwater management plans for each watershed located in the county. The plans are to provide for uniform standards and criteria throughout a watershed for the management of stormwater volumes and flow rates from development sites through implementation of local municipal ordinances.

Adams County is currently in the Phase II process of developing an Act 167 Stormwater Management Plan for the Monocacy Watershed in the Potomac River Drainage Basin. This Plan is being coordinated with the County's Comprehensive Plan and recommended growth areas. A stormwater management plan for that portion of the County that lies within the Susquehanna River Drainage Basin will be completed in the future.

D. LAND USE IMPACTS ON WATER QUANTITY

The availability of water to meet future needs will be greatly influenced by existing and potential future land uses throughout the County. In general, open land uses including wetlands, water bodies, forest, open space, and non-intensive agriculture provide large pervious areas capable of absorbing enormous quantities of precipitation. Developed land uses, on the other hand, are frequently characterized by impervious surfaces made of macadam or concrete, such as buildings, streets, parking lots, and sidewalks. Some agricultural practices such as soil compaction by heavy equipment and construction of agribusinesses (poultry houses, feedlots, etc.) can also reduce pervious surface area. Such uses create runoff into surface waters and reduce recharge to area aquifers.

1. EXISTING LAND USE

Adams County has a total land area of 336,640 acres, or 526 square miles, sizable parts of which are held in large parcels and remain open. The County possesses a wide diversity of landscapes, including extensive, fertile agricultural lands occupying the central Gettysburg Plain, the forested South Mountain area and Buchanan Valley to the west, the Fruitbelt on South Mountain's eastern flank, the Fairfield Valley to the southwest and the Littlestown/McSherrystown Valley to the southeast. Developed areas include Gettysburg, the County's boroughs, and their surrounding residential, commercial and industrial areas.

Rapid growth in the last few decades has led to changes in land use across the County. In the 1990s, about 80% of all new units in the County were located in large, fairly compact developments close to boroughs. While the largest-sized residential developments have been occurring in the eastern portions of the County, around Gettysburg, and at Lake Meade and Carroll Valley, the distribution of small-sized developments has been widely dispersed. Commercial development has been focused along US Routes 30 and 15, while recent industrial development has been limited and has tended to locate at the County-line area near Hanover.

The conversion of farm, forest, open space and wetlands to development reduces the acreage of pervious soils through which precipitation infiltrates to reach groundwater aquifers below. The loss of pervious soils additionally increases surface water runoff, which can contribute to downstream flooding and nonpoint source pollution of both surface and groundwater resources. Following are descriptions of the County's major land use categories.

2. SURFACE WATERS AND WETLANDS

Adams County has numerous streams; many of them originate in the South Mountain area of the County and flow southeast onto the Gettysburg Plain. The only lakes within the County are man-made - Lake Meade and Lake Heritage. However, hundreds of farm ponds dot the landscape. Surface water areas, including streams, lakes and ponds, act as water storage areas during floods and storms and replenish groundwater aquifers.

Wetlands provide particular hydrologic benefits, doing more to safeguard both water quality and quantity than any other land feature on an acre-for-acre basis. Wetlands, which include swamps, marshes, bogs, and similar areas, act as natural catchment basins during floods and storms by retaining excess waters and gradually releasing them into the ground or nearby surface waterways. During dry seasons, wetlands also release waters to ground and surface sources, thus helping to maintain relatively stable flows during low flow periods. In addition, wetlands purify the quality of water by filtering and biodegrading pollutants.

Generally, a wetland must possess three components, including hydric soils, wetland vegetation and standing water, during at least some part of the year. The National Wetlands Inventory, published by the U.S. Fish and Wildlife Service, identifies the County's major wetlands, including streams. Hydric soils identified in the Adams County Soil Survey provide a good indication of additional wetland locations in the County.

The proposed filling or encroachment of wetlands requires proper State and Federal permits. The Natural Resources Conservation Service (NRCS) administers the voluntary Federal Wetland Reserve Program, which provides incentives for the permanent protection of wetlands on private lands and will shortly be administering the Wildlife Habitat Incentive Program, which will assist landowners in protecting wetlands as well as other wildlife habitats. The Fish and Wildlife Service together with the NRCS and the State Game Commission additionally work with landowners on a voluntary basis to restore wetland habitat through its Partners for Wildlife Program. Each of these established programs has several participating landowners within the County. The County's municipalities are empowered to adopt other wetland protection measures to direct development away from these important areas.

Floodplains are defined as those areas that are subject to periodic innundation by floodwaters. These areas must be kept free of encroachments that avoid an increase in flood heights. The County's most extensive floodplains occur along the South Branch of Conewago Creek and in lowland areas on the Gettysburg Plain. The downstream occurrence of flooding can be frequent. Many headwater streams have no delineated floodplains. One Hundred-Year Floodplain areas in Adams County have been identified by the Federal Emergency Management Agency (FEMA) under the National Flood Insurance Program.

Identified floodplain areas are typically protected from fill and encroachment activities through municipal floodplain zoning and/or land development regulations. However, several municipalities, including Littlestown Borough and Franklin and Highland Townships apparently lack any measures to protect floodplain areas. Two other townships, Hamilton and Hamiltonban, have provisions that protect some areas prone to flooding, but not necessarily all floodplain areas. In addition, the seven municipalities that regulate development within floodplains through their subdivision and land development ordinances do not appear to regulate residential development and fill on pre-existing lots. These municipalities should incorporate their floodplain protection measures into their zoning ordinancesl. Alluvial soils as identified in the County's Soil Survey may be used as a supplementary means of identifying areas subject to periodic innundation. Municipalities may choose to extend their areas of floodplain protection to include alluvial soils.

3. AGRICULTURAL LAND

As of 1997, 178,780 acres of land in the County were reported to be in farm use, representing about 53% of the County's total land area. The extensive areas of land in farm use enable large quantities of precipitation to infiltrate and recharge local groundwater supplies. Fruit orchards predominate in the foothills of the South Mountain area, while dairy, livestock, poultry, and field crops are located on the Gettysburg Plain. Twenty-nine percent of the County's soils are classified as prime, another 42% are defined as Unique Farmland or Farmland of Statewide Importance, and 15% of the County's soils are of Local Importance. Thus Adams County has a high proportion of productive farm soils. These soils produce high crop yields with minimal inputs of energy and economic resources. The County's most fertile soils are dispersed across the Gettysburg Plain, with the largest concentrations in the eastern, southern and northwestern portions of the County.

Since the mid-1950s, the County has experienced the idling or conversion of an average of nearly 2000 acres of agricultural land each year to other, primarily residential, uses, losing 30% of its active farmland base over this time period (ACOPD, 1991 and USDC, 1997). A number of strategies have been developed within the County in recent years to attempt to stem the conversion of farmland to other uses. First, the County's 1991 Comprehensive Plan includes a Growth Management Plan and Land Use Plan with recommended growth areas that center around existing boroughs, unincorporated villages, highway interchanges, and other settings where development can be accommodated. The identification of these areas is intended to promote compact growth patterns and discourage non-agricultural development in the County's rural and farm areas.

Second, five of the County's townships utilize effective agricultural zoning, which may be defined as a district which uses fixed area or sliding scale provisions to restrict the number of non-agricultural uses that can be developed, and that also substantially minimizes the amount of land that can be converted from agricultural uses through the use of maximum lot size requirements and/or requirements for the retention of the best agricultural land on a parcel. A sixth township is in the process of developing an effective agricultural zoning district. Three other townships include an agricultural zoning district which contributes to the protection of agricultural lands, but which does not meet the definition of an effective agricultural zone. Effective agricultural zoning can greatly reduce the potential for conflicting adjacent uses in farm areas and can provide farmers with the peace of mind required to make them willing to continue to make long-term investments in their farm operations.

Third, farmers have enrolled over 86,000 acres of land in all 21 townships in Agricultural Security Areas (ASAs) through the County's Agricultural Preservation Program. This voluntary, County-State program is intended to provide incentives to farmers to stay in farming. An ASA is an area of at least 250 acres of farmland identified by farm owners and township supervisors as being important to the future of local farming. Enrollment in an ASA provides three benefits: township supervisors agree not to pass laws that restrict normal farming operations; any condemnation proposal must be reviewed and approved by the PA Agricultural Lands Condemnation Approval Board; and enrolled farmers become eligible to apply to sell the development rights on their farms to the County, leading to the permanent preservation of the farm. In return, farmers commit to staying in ASAs for seven years. ASAs encourage the continued farm use of properties by identifying and benefitting areas where farmers envision a long-term future for themselves. To date, 7,687 acres comprising 48 farms, have been preserved in perpetuity through purchases of development rights that are funded through the State but administered by the County. In addition, the newly established Land Conservancy of Adams County has preserved another 316 acres of farmland and will continue to be an additional avenue for farmland preservation.

Finally, the State's Clean and Green tax reduction program, which applies to forest and open space land as well as farm land, has a high participation rate among farmers within the County. This program allows landowners to apply for differential taxation of their property at use rather than assessed value in exchange for committing to not develop while receiving tax relief. While this program does not, by itself, prevent land conversion and, while it allows mini-farms over 10 acres as well as commercial farms to participate, it is nevertheless necessary to a successful farmland protection program. The State also sponsors a Farm Link Program, designed to help match farmers planning for retirement with young farmers wanting to farm, and a Beginning Farmer Program.

4. FOREST AND OPEN SPACE LANDS

Approximately 25% of the land area within Adams County is covered with forest. Much of it within the Michaux and Mont Alto State Forests or State Gamelands in the South Mountain area. This land is either protected from, or unlikely to be converted to, other uses. The Gettysburg National Military Park is another large public open space holding that is permanently protected. A couple of major forest holdings managed for commercial timber use exist within the County. Most of the remainder of the County's forest and open space lands are in small private holdings.

Forest and open space lands act to protect ground and surface water yields by providing large areas of pervious soils that readily absorb precipitation with minimal erosion and runoff and no significant degradation of water quality.

The State's Clean and Green tax reduction program, which assists in discouraging conversion of resource lands, is actively used by forest and open space landowners in the County. Municipalities may adopt open space or conservation zoning to help protect privately-held forest and open land. Six of the County's townships have enacted open space or conservation zoning, and a seventh township is in the process of developing such zoning. Specific woodland protection standards to require the conservation or replacement of a fixed proportion of on-site trees on development sites is another municipal option, but one which is not yet utilized within the County.

5. BUILT LANDS

Built lands include residential, commercial, industrial, agribusiness, and institutional uses, as well as roads and parking lots. These uses create impervious surfaces, which reduce the infiltration of water into the ground after storm events. This in turn creates runoff and soil erosion, leading to the sedimentation and pollution of surface waters, downstream flooding, and reduced groundwater recharge. Where development occurs in steep-sloped areas or on lands where vegetation has been removed, groundwater recharge is especially adversely impacted.

Recharge in developed and developing areas can be encouraged by limiting permitted lot coverage, promoting the use of pervious cover, requiring vegetative cover, and calling for the use of Best Management Practices in stormwater management. Currently, all of the County's municipalities have stormwater management regulations included within local subdivision and land development ordinances. However, the effectiveness of these provisions ranges widely, and few include standards that apply to the development of homes on pre-existing lots. As regional stormwater management plans are completed for each of the County's major watersheds, each municipality will be required to reassess the adequacy of its own stormwater regulations in light of new watershed recommendations and to make revisions where needed.

E. LAND USE IMPACTS ON WATER QUALITY

Water quality is affected in many ways by land use patterns and land development practices within the County. Direct sources of pollution can enter the County's waters from specific points, such as industrial spills and leaks, underground storage tank leaks, sewage treatment plant discharge points, construction sites, surface mining, landfills, junkyards, and dumps. This type of pollution can often be monitored and controlled where identified.

In contrast, indirect, or non-point source pollution comes from many diverse sources and is more difficult to control. These sources include on-lot septic systems, certain agricultural practices, various earth disturbance activities, runoff from streets, improper disposal of household chemicals, use of lawn and garden products, and salts from winter road treatment. Studies report that between 70 - 90% of all water pollution comes from non-point source pollutants.

Both point and non-point sources of water pollution contribute sediment, heavy metals, excess nutrients, bacterial pathogens, and organic chemical contaminants to ground and surface waters. Nutrient pollution, bacterial pathogens, heavy metals, and chemical contaminants have obvious direct human health implications, while sediment pollution and discharge of organic detritus jeopardize water quality for municipal water treatment, fishing and recreational purposes. The following discussion analyzes the three major types of water pollution – physical, biological, and chemical.

1. SEDIMENT POLLUTION

When precipitation falls to the earth's surface and infiltrates the soil, a portion of it is taken up by plant roots, used for photosynthesis, and passed through the pores of plant leaves, in a process called evapotranspiration, back into the atmosphere. In this manner, vegetative cover effectively intercepts and holds water, both facilitating groundwater recharge and preventing soil from washing away. The removal of plant cover and various earth disturbance activities results in decreased infiltration and increased runoff of rainfall, which carries with it sediment from soil erosion. The primary contributors to sedimentation within the County include agriculture and construction. Soil loss is greatest in areas with steep slopes, no vegetative cover and along streambanks.

Cropland and streambank erosion together account for most soil loss in Adams County. The plowing of steep slopes, certain cultivation techniques, and an increasing tendency toward monoculture all increase soil loss through erosion. Streambank erosion occurs in the absence of riparian vegetation and where livestock are allowed constant access to the stream. Finally, overgrazing can contribute to the problem by removing protective vegetation.

The Adams County Conservation District administers a number of programs designed to reduce erosion, including reviewing and approving the Conservation Plans required of all farms; most Adams County farms have such plans. The District further provides assistance to landowners interested in streambank stabilization and other soil-saving measures through the long-standing Chesapeake Bay Program. In 1997, the DEP selected Adams County to participate in its Stream Bank Fencing Pilot Project to assist farmers interested in controlling livestock access to streams. The District also administers the State's Erosion and Sedimentation Control program by reviewing and approving plans for earth-disturbing activities to assure minimal loss of soils.

The Natural Resources Conservation Service additionally administers the federal Environmental Quality Incentives Program within Adams County, another conservation program with several participating County landowners. Finally, the Adams County Farm Service Agency administers the federal Conservation Reserve Program with 17 County participants. This program compensates farmers who take highly erodable cropland out of production. Municipalities can also significantly reduce the potential for sedimentation through the adoption and enforcement of effective stormwater management ordinances and the adoption of provisions to encourage the maintenance or establishment of vegetative cover along streams and on steep slopes.

2. BIOLOGICAL POLLUTION

On-lot septic systems are a significant source of fecal coliform and fecal staphylococcus bacterial contamination of groundwater within the County (ACOPD, 1991). On-lot septic system malfunctions may or may not be noticeable to property owners. Many on-lot septic systems and cesspools were either improperly sited, have outlived their useful lives, are improperly utilized, or are not properly maintained. Even new, properly functioning systems contribute pollutants to the groundwater. Few municipalities require on-lot septic systems to be pumped out and maintained on a regular basis, and many older systems are located quite close to private, and sometimes, public wells. Land application of manure, septage, and sludge can also contribute to bacterial contamination of groundwater.

3. NUTRIENT POLLUTION

Nutrients are organically derived chemicals that derive from human and animal wastes, such as nitrates, phosphates, and potassium. While nutrients are necessary for successful plant growth, an excess of them, particularly of nitrates and phosphates, contributes seriously to water pollution within the County. Sources of nutrient pollution within Adams County include on-lot septic systems, sanitary sewage and package treatment plants, combined sanitary and storm sewer systems, water treatment plants, inadequate barnyard drainage, inadequately constructed or maintained manure storage, unrestricted livestock access to streams, and the over-application of fertilizer, manure, sludge, and septage to land.

There are 21 municipal centralized sewage collection and treatment systems currently operating in Adams County. These systems serve about half of the County's population.

Twenty of these systems discharge their treated effluent water into a creek or stream, while one uses spray irrigation. Each of these systems discharging to a creek or stream must meet the conditions of its National Pollution Discharge Elimination System (NPDES) permit. However, several systems are effectively at capacity and storm events, infiltration and inflow from leaking pipes or low stream flows can result in water quality in creeks and streams falling below state standards. Excess nutrients in streams can lead to algal growth and low dissolved oxygen levels, adversely affecting fish and other aquatic wildlife, and posing health hazards for humans.

Recent increases in the number of confined animal operations in the County raise concerns about potential high levels of point and nonpoint source runoff from livestock manure, particularly where such operations are near surface streams or vulnerable groundwater sources. Such runoff can result in serious pollution and human health hazards. Storm events and flooding can worsen the potential adverse impacts of such runoff.

The application of manure to farm fields is an effective and cost-efficient means of fertilizing farm fields. However, often confined animal operations occupy parcels that are smaller than that needed to fully utilize the nutrients in the manure. Nutrients that are applied in excess of what can be taken up by plants either run off over the land surface to nearby streams or infiltrate through soil and rocks to underlying groundwater, where they can accumulate in unacceptably high concentrations. Nitrates in groundwater are a particular problem; concentrations of over 10 milligrams per liter are a potential health hazard to unborn children, causing oxygen deprivation and resultant mental retardation. High levels of nitrates are also a potential health hazard for livestock, causing bovine infertility and low milk yields. The recent passage of the Pennsylvania Nutrient Management Act requires that farmers with more than 2000 pounds of animal weight per acre available for manure application develop a plan for managing nutrients to assure that only as much manure is land-applied as can be utilized by crops. A small percentage of Adams County farmers, mostly intensive poultry operations, are required to develop such plans. The County Conservation District is responsible for administering this program in the County.

Phosphates are not as readily transmissible to groundwater because they are apt to bind with soil. For this reason, they tend to either remain in the soil or, where there is erosion and subsequent sedimentation in streams, contribute to the pollution of surface waters.

The Conservation District publishes a newsletter that addresses proper nutrient spreading, storage, and handling techniques. In addition, the Cooperative Extension has a Water Quality Agent who provides educational, demonstration and other services promoting water quality protection to farmers as well as to the general public. This agent, along with a multi-county resource/environmental agent, also offers programs related to septic system management. Finally the Cooperative Extension has adopted the "Farm A-Syst" program to enable farmers to self-evaluate and improve their operations to protect water quality. The County Conservation District also has a number of educational and outreach programs and events promoting water quality in addition to soil conservation measures.

4. OTHER POLLUTANTS

Commercial, industrial and institutional activities can be sources of leaks, spills, outfalls and dumps, which can contribute contaminants to streams and groundwater. Spills occur primarily when vehicles in transit are involved in accidents and release hazardous substances. A major potential source of groundwater contamination is leaking underground storage tanks, which often go unnoticed until nearby wells are contaminated. Older gasoline tanks are a primary source of such leakage. Federal standards now require the approval of new and inspection of existing underground storage tanks.

Only a few properties within Adams County currently accept sludge or septage for land application. Historically, fewer than 10 properties have land-applied sludge (Extension, 1998). However, the County has been receiving increasing numbers of applications for land-applied sludge and septage. While sludge and septage can, to a certain extent, replace commercial fertilizers, thus saving costs for farmers, they may also contain pathogens and heavy metals, raising concerns about potential contamination of nearby surface and vulnerable groundwater sources.

Pesticides (including insecticides, herbicides and fungicides), even in small concentrations, can be a public health concern when they enter groundwater and streams. Pesticides, like phosphates, tend to bind with soil and are more likely to find their way into streams and lakes through sediment transport and erosion than they are likely to enter groundwater. Pesticides are used by homeowners, businesses, institutions, and farmers. A particularly heavy user of pesticides is golf courses, which typically uses far greater amounts of pesticides per acre than any other user. In response to growing concerns, the U.S. Golf Association has recently adopted a number of initiatives to reduce pesticide use and the impact it may have on surface and groundwater. Another user of pesticides is the orchard industry, a major component of Adams County's agriculture. Landowners interested in utilizing an Integrated Pest Management approach to reducing the use of pesticides can receive assistance from the County's Conservation District and the Cooperative Extension.

Ungrouted, unsealed or abandoned wells can be a direct conduit for surface contaminants to reach groundwater. Polluted urban and suburban runoff is created when stormwater in developed areas washes contaminants off roads and lawns into streams and lakes. Such contaminants include oil, gasoline, volatile organic compounds, and antifreeze; lawn garden fertilizers and pesticides; road salts and other pollutants. Water quality problems caused by urban-suburban runoff are difficult to control after development has occurred. Stormwater management regulations that apply to new development can greatly reduce stormwater flows, thereby reducing water quality problems caused by urban and suburban runoff.

In conclusion, water quality is affected by land uses and land use practices. Contaminated surface or groundwater can reduce available water supplies or make it very expensive to treat. A discussion of specific contaminant problem areas in the County is provided in Chapter VI.

F. ECONOMIC CONDITIONS

Historically, Adams County's economy has centered on agriculture, which generated over $150 million in revenues in 1997 for the County. A leading producer of fruit, poultry and other products, the County also supports a number of important and related food processors. In recent decades, tourism, centered largely on the Gettysburg National Military Park, has become a second mainstay of the local economy, supporting a healthy service industry, and earning the County about $55 million annually (G-ACACC, 1998). These industries are supplemented by other sectors, which provide diversity and stability to the local economy.

1. ECONOMIC SECTORS

The table below identifies the County's major economic sectors, number of establishments, number of employees and payroll for 1994. Over one-third of the County's workforce is engaged in the provision of services. Other prominent sectors include manufacturing, retail, construction, and agriculture.

TABLE 1
ADAMS COUNTY EMPLOYEES BY MAJOR INDUSTRY: 1994

Major Industry	Number of Establishments [1]	Number of Employees [2]	Payroll ($1,000) [1]
Agriculture*, Forestry, and Fishing	26	2,739	18,477
Mining	3	64	2,135
Construction	242	2,658	73,471
Manufacturing	117	8,591	239,257
Transportation and Public Utilities	72	1,392	39,624
Wholesale Trade	112	1,013	24,515
Retail Trade	444	7,289	102,705
Finance, Insurance and Real Estate	112	1,600	20,463
Services	569	13,687 [3]	301,506
Unclassified	10	-	-
TOTAL	**1,707**	**39,853**	**849,988**

[1] 1994 Pennsylvania County Business Patterns
[2] U.S. Bureau of Economic Analysis, Regional Economic Information System (includes full & part-time employees)
[3] Includes 4,601 government employees

* Note: Because the above figures do not include the self-employed, those individuals involved in agriculture are undercounted.

2. EMPLOYMENT TRENDS

Water for Adams County's industrial, commercial and institutional uses is provided by a combination of public and private sources. Most recent growth in employment within the County has been in the service sector, paralleling State and national trends. Growth in this sector is expected to continue based on these trends and the presence of the Gettysburg National Military Park as a major tourist destination. Reliance on tourism and agricultural-based economies typically results in unemployment rates that fluctuate seasonally and, in some cases, wages that are lower than other non-service based occupations. This is counter-balanced by the fact that a higher proportion of the County's work force is employed in the manufacturing sector than is true for the State as a whole.

3. EXISTING AND FUTURE WATER NEEDS

Current high water users within Adams County include food processors, confined animal operations, electronic equipment manufacture, miscellaneous manufacture (brick and tile), golf courses, hospitals, and hotel/restaurant complexes. It is projected that the demand for water by existing and new businesses will continue to grow. Potential future businesses likely to locate in Adams County include those which are similar to existing uses, including spin-off businesses and expansions of existing businesses. Some of these uses are highly water-consumptive, while others are less so.

The availability of public water together with other public utilities and services can have a significant impact on the willingness of industry and business to locate within an area. Industry is often reluctant to utilize groundwater because of its variability in quality – particularly where food processing or pharmaceutical manufacture is involved – and potential fluctuations in supply at certain times of the year. Public water supplies a more consistent source of reliable water quality and quantity. In Adams County, the lack or insufficiency of a public water supply has at times been a constraint to potential incoming industry, particularly when coupled with lack of public sewer service and/or rail. Industries which were unable to access public water at desired locations within the County have been forced to site elsewhere. The availability of public water for future industrial and business uses is an issue that needs to be addressed.

G. POPULATION ANALYSIS

An analysis of historic growth trends and projected population growth is essential to planning for future land uses and determining the types and levels of community services that will be needed. A knowledge of likely future growth areas and growth levels will enable both municipalities and existing and prospective community water suppliers to be prepared to meet future water needs.

1. HISTORIC POPULATION GROWTH

Adams County's population has grown at an average rate of 14.8% each decade since 1960, with the highest rate of growth occurring between 1970 and 1980. Most of the growth in the 1960s, 1970s, and early 1980s occurred in townships adjacent to Gettysburg in the central part of the County. More recently, municipalities closer to the County's eastern boundary within easy commuting distance of Harrisburg, York, and Baltimore have experienced rapid population growth. Population levels within the County's boroughs have remained fairly static, or have increased slowly, with the exception of Littlestown Borough to the southeast and two newly incorporated municipalities – Bonneauville Borough, incorporated from a village in 1961, and the rapidly-growing Carroll Valley Borough, incorporated in 1974. An increasing proportion of the County's growth in recent years has been among retired persons.

2. POPULATION PROJECTIONS

Adams County's population has grown from 78,274 persons in 1990 to an estimated 90,111 persons by the end of 1997 (see Table 2). Because of the high quality of life, the attractive visual environment, a stable economy, proximity to job centers, the creation of significant new commercial and industrial employment centers, and a low-tax environment for retirees, Adams County is expected to continue to attract new residents well into the future. In addition, increased visitation is expected due to the creation of additional attractions, including a new visitor's center at the Gettysburg National Military Park. Three alternative population projection techniques have been used to illustrate different, year 2010 growth possibilities for each of Adams County's 34 municipalities.

Technique #1 (Unadjusted Mid-range Projection) extrapolates the average 1960-1990 per-decade growth rate for each municipality from each estimated 1997 municipal population. County-wide, this growth rate averaged 14.8%. While the average County-wide rate of growth for the single decade 1980-1990 was a slightly lower 14.6%, this probably reflects the nationwide downturn in the housing industry during the recession of the early 1980s. In contrast, building permit activity from 1990 through 1997 shows a marked upswing, with a resultant average County-wide growth rate of approximately 17.7% for this eight-year period (or 20.5% for a 10-year period). 1997 population estimates for each municipality were based on approved building permits from 1990 through 1997, average municipal household sizes for 1990, and an assumption that five percent of building permits do not result in dwellings being built, or result in temporarily unoccupied dwellings.

Technique #2 (Low Projection) assumes that a recession or other events could result in lower-than-expected population growth to the year 2010. This technique projects that growth would be 75% of that anticipated under Technique #1 for each municipality.

Technique #3 (Adjusted Mid-Range Projection) makes individual assumptions for each Adams County municipality to determine the projected municipal population by 2010. These assumptions were based on a variety of factors including but not limited to (a) recent trends in building permit activity, (b) known projects either currently under construction or known to be in the pipeline, (c) regional growth trends, both current and likely future, (d) planned capacity expansions in municipality-operated sewer and/or water systems, (e) amount of development-prone land in a given setting, and (f) presence or lack of development regulations, including a general assessment regarding overall growth management effectiveness where such regulations exist. Table 3 identifies potential development pressure (high, medium or low) for each municipality. With regard to individual municipalities, the assumptions were made as set forth in the inset on the next two pages.

For the purpose of projecting future water need, technique #3 was chosen as the population projection that most realistically projects Adams County's likely future growth to the year 2010. Using this approach, the County's population is projected to increase from an estimated 90,111 persons in 1997 to 114,895 persons by 2010 (see Table 3). This amounts to a 27.5% increase over 12 years, or 22.9% per decade. Municipal population projections are used in Chapter III as the primary basis for future water need projections.

Table 2
Population Profile
Adams County Water Supply Plan
Adams County Office of Planning and Development

Municipality	1960 Population	1970 Population	1980 Population	1990 Population	Average Growth Rate Per Decade (1960-1990)	Average Growth Rate 1980-1990 Only	1990-1997 Building Permits	1990 Average Household Size	Estimated 1990-1997 New Residents (1)	Estimated 1997 Population (2)	1990-1997 Growth Rate
Boroughs											
Abbottstown	561	552	689	539	0.5%	-21.8%	76	2.43	175	714	32.5%
Arendtsville	588	589	600	693	5.8%	15.5%	18	2.35	40	733	5.8%
Bendersville	484	528	533	560	5.0%	5.1%	5	2.69	13	573	2.3%
Biglerville	923	977	991	993	2.5%	0.2%	24	2.48	57	1050	5.7%
Bonneauville	0	819	920	1282	25.8%(3)	39.3%	58	2.96	163	1445	12.7%
Carroll Valley	0	0	817	1457	78.3%(4)	78.3%	443	2.74	1153	2100*	44.1%
East Berlin	1037	1086	1054	1175	4.4%	11.5%	72	2.49	170	1345	14.5%
Fairfield	519	547	591	524	0.7%	-11.3%	3	2.41	6	530	1.1%
Gettysburg	7960	7275	7194	7025	-4.0%	-2.3%	48	2.17	99	7124	1.4%
Littlestown	2756	3026	2870	2974	2.8%	3.6%	293	2.46	685	3659	23.0%
McSherrystown	2839	2773	2764	2769	-0.8%	0.2%	62	2.51	147	2916	5.3%
New Oxford	1407	1495	1921	1617	6.3%	-15.8%	48	2.51	114	1731	7.1%
York Springs	384	467	556	547	13.0%	-1.6%	3	2.56	7	554	1.3%
Borough Totals	19,458	20,134	21,500	22,155	4.4%	3.0%	1153	2.52	2829	24,474	12.8%
Townships											
Berwick	1102	1379	1492	1831	18.7%	22.7%	99	2.74	257	2088	14.0%
Butler	1504	1757	2166	2514	18.7%	16.1%	90	2.83	242	2756	9.6%
Conewago	3004	3431	3405	4532	15.5%	33.1%	379	2.79	1004	5536	22.2%
Cumberland	2925	3497	4637	5431	23.1%	17.1%	244	2.58	599	6030	11.0%
Franklin	2483	2744	3692	4126	18.9%	11.8%	270	2.81	721	4847	17.5%
Freedom	470	555	650	692	13.9%	6.5%	49	2.7	125	817	18.1%
Germany	1151	1308	1652	1949	19.3%	18.0%	92	2.96	258	2207	13.2%
Hamilton	763	1048	1692	1760	34.3%	4.0%	83	3.02	238	1998	13.5%
Hamiltonban	1779	1686	1835	1872	1.9%	2.0%	119	2.77	314	2100*	16.8%
Highland	546	662	717	815	14.4%	13.7%	34	2.82	91	906	11.2%
Huntington	1491	1484	1557	1989	10.7%	27.7%	92	2.86	250	2239	12.6%
Latimore	1092	1105	1369	2209	28.8%	61.4%	132	2.89	362	2420*	16.4%
Liberty	724	1075	823	938	13.0%	14.0%	55	2.88	150	1088	16.0%
Menallen	1827	1937	2354	2700	14.1%	14.7%	123	2.78	325	3025	12.0%
Mount Joy	1380	1795	2564	2848	28.0%	11.1%	171	2.86	465	3313	16.3%
Mount Pleasant	2531	1817	3473	4076	26.8%	17.4%	241	2.92	669	4745	16.4%
Oxford	1581	1808	2302	3437	30.3%	49.3%	544	2.68	1385	4822	40.3%
Reading	1352	1724	2660	3828	41.9%	43.9%	409	2.86	1112	4700*	29.0%
Straban	2387	3221	4240	4565	24.7%	7.7%	130	2.64	326	4891	7.1%
Tyrone	1186	1291	1534	1829	15.6%	19.2%	133	3.01	380	2209	20.8%
Union	1170	1479	1978	2178	23.4%	10.1%	241	2.88	659	2900*	30.3%
Township Totals	32,448	36,803	46,792	56,119	20.2%	19.9%	3730	2.82	9932	65,637	17.7%
County Totals	51,906	56,937	68,292	78,274	14.8%	14.6%	4883	2.68	12,761	90,111	16.3%

Sources: U.S. Census Bureau & ACOPD (1)1990-97 Building Permits x 1990 AHS x .95 (2)1990 Population + Estimated 1990-97 New Residents (3)1970-90 (4)1980-90 *adjusted based on specific ACOPD knowledge

Municipal Growth Assumptions

1. *Abbottstown Borough:* Build-out of project currently under development will occur. "Infill" development and perhaps another small residential project may also occur.

2. *Arendtsville Borough:* "Infill" development will likely occur.

3. *Bendersville Borough:* "Infill" development will likely occur.

4. *Biglerville Borough:* "Infill" development will likely occur.

5. *Bonneauville Borough:* Development in accordance with recently submitted residential projects will occur over the next decade.

6. *Carroll Valley Borough:* Continued development of existing Carroll Valley Borough lots will continue over the next decade.

7. *East Berlin Borough:* Build-out of residential projects currently under development or recently proposed will occur within the Borough. Some "infill" development will also occur.

8. *Fairfield Borough:* The Borough may experience new residential development on current farmland in eastern portion of the Borough. Some "infill" development and "adaptive reuse" residential development may also occur.

9. *Gettysburg Borough:* Limited "infill" development will likely occur. Some additional commercial conversion is possible.

10. *Littlestown Borough:* The build-out of currently submitted and approved residential development plans will occur. Limited "infill" development will likely occur.

11. *McSherrystown Borough:* The relatively small residential project currently under development will build-out during the next decade. Limited "infill" development will also occur.

12. *New Oxford Borough:* The relatively small residential projects recently proposed will build-out during the next decade. Limited "infill" development will also occur.

13. *York Springs Borough:* Small residential projects, in addition to limited "infill" development, will occur during the next decade.

14. *Berwick Township:* The construction of two significant projects, a single family community on Route 194 and a new mobile home park, currently either approved or moving through the review process, will occur. The construction of additional residential projects not yet officially proposed will also likely occur near Abbottstown.

15. *Butler Township:* Some additional residential development near Biglerville and Arendtsville Boroughs is likely during the next decade. Because of lack of a municipal zoning ordinance in place in the Township, there is strong potential for the development of a residential community using a privately developed water system.

16. *Conewago Township:* The build-out of currently approved residential projects within the Township will occur. The development of additional significant projects (at least two are currently proposed) will also likely occur over the next decade resulting in significant population growth for the Township.

17. *Cumberland Township:* Several smaller residential projects will likely build out over the next decade. Given the Township's proximity to Gettysburg, and the likely dramatic increase in the level of commercial and institutional development in the Gettysburg region over the next decade, increased demand for new residential opportunities will likely result in substantial new housing developments in the Township.

18. *Franklin Township:* Some small projects may occur within the Township over the next several years, particularly in the Cashtown area. Other scattered residential development will likely occur.

19. *Freedom Township:* A major development is likely to occur near the Route 15/ Emittsburg Road Interchange. Even if it is assumed that half of the project is built within the planning horizon, a dramatic increase in Township population will occur. Additional scattered residential development will likely occur in other areas of the Township

20. *Germany Township:* Because of the lack of water and sewer infrastructure in this Township, dramatic population increase is unlikely. Some small to moderate scale residential projects may be proposed in close proximity to Littlestown Borough, and may request Littlestown Borough water and sewer capacity. In addition, the development of a mobile home park, or similar residential project, using privately developed water and sewer infrastructure is possible due to the lack of zoning protection in the Township.

21. *Hamilton Township:* Continued population growth around the Abbottstown area is possible within the Township. In addition, since the Township is considering options to provide public sewer infrastructure to the area north of Cross Keys, additional population growth in this area is also likely. Population growth near East Berlin Borough is possible, as development plans for a project using privately developed water and sewer infrastructure have been submitted to the Township.

22. *Hamiltonban Township:* Dramatic population increase in this Township is unlikely. Scattered residential lots may develop.

23. *Highland Township:* Dramatic population increase in this Township is unlikely. Scattered residential lots may develop.

24. *Huntington Township:* Residential development near York Springs Borough is possible. Without municipal zoning, the development of a mobile home park or similar residential community, using privately developed water and sewer infrastructure, is possible (a large project is currently being reviewed).

25. *Latimore Township:* Residential development near York Springs Borough is possible. Continued residential construction in the Lake Meade community is also likely.

26. *Liberty Township:* Dramatic population increase in this Township is unlikely. Scattered residential lots may develop.

27. *Menallen Township:* Dramatic population increase in this Township is unlikely. Scattered residential lots may develop. Some additional development near Bendersville Borough may occur.

28. *Mount Joy Township:* Residential construction will likely continue within the Lake Heritage community, and some smaller residential projects may be proposed in the area near the Route 15 / Route 97 interchange. Scattered residential development in rural areas of the Township will also likely occur.

29. *Mt. Pleasant Township:* Residential construction will likely continue within the Lake Heritage community, and other residential projects may be proposed in the Bonneauville Borough setting. In addition, discussions are taking place regarding the potential provision of water and sewer infrastructure in the Centennial Village area, which may result in residential development in this setting as well.

30. *Oxford Township:* Additional residential development is likely near New Oxford Borough using New Oxford Municipal Authority water and sewer capacity. Additional development within the Brethren Home community is expected. Without municipal zoning, the development of a mobile home park or similar residential community, using privately developed water and sewer infrastructure, is possible and may occur.

31. *Reading Township:* Residential development near the East Berlin and Hampton Village settings is likely. A large project is currently under consideration adjacent to Hampton Village. Continued residential construction in the Lake Meade community is also likely.

32. *Straban Township:* Build-out of existing residential projects in the Township will occur. In addition, future residential developments, served by public water and sewer infrastructure, will likely be proposed near the new Gettysburg High School, and may be proposed in conjunction, or in support of, significant commercial or business developments at the Route 15 / Route 30 interchange.

33. *Tyrone Township:* Sporadic residential development may occur within the more rural areas of the Township. Smaller scale residential projects may be proposed in the Heidlersburg Village or Gardners Village areas.

34. *Union Township:* The Township will likely be faced with residential development proposals in the Littlestown Borough area. These projects will likely request connection to Littlestown Borough water and sewer capacity. Conceptual plans for at least one significant project have already been reviewed. Scattered residential development will likely occur in other portions of the Township.

Table 3 **Population Projection Alternatives** **Adams County Water Supply Plan** **Adams County Office of Planning and Development**							
Municipalities	**Estimated 1997 Population (1)**	**Average Growth Rate per Decade (1960-1990)**	**Low Projection (2)**	**Unadjusted Mid-range Projection (3)**	**In Path of Reg. Growth (4)**	**On Major Transport. Corridor (4)**	**Adjusted Mid-range Projection (5)**
Boroughs							
Abbottstown	714	0.5%	717	718	H	H	850
Arendtsville	733	5.8%	771	784	L	L	785
Bendersville	573	5.0%	599	607	L	L	620
Biglerville	1,050	2.5%	1,074	1,082	M	L	1,100
Bonneauville	1,445	25.8%	1,781	1,892	H	M	1,900
Carroll Valley	2,200	78.3%	3,580	4,073	H	M	4,500
East Berlin	1,345	4.4%	1,398	1,416	H	M	1,700
Fairfield	530	0.7%	533	534	H	M	850
Gettysburg	7,124	-4.0%	6,868	6,782	H	H	7,100
Littlestown	3,659	2.8%	3,751	3,782	H	M	4,500
McSherrystown	2,916	-0.8%	2,895	2,888	H	M	3,050
New Oxford	1,731	6.3%	1,829	1,862	H	H	1,850
York Springs	554	13.0%	619	640	M	H	640
Borough Totals	22,374	4.4%	26,415	27,060			29,445
Townships							
Berwick	2,088	18.7%	2,439	2,557	H	H	3,200
Butler	2,756	18.7%	3,220	3,374	L	L	3,200
Conewago	5,536	15.5%	6,308	6,566	H	M	7,750
Cumberland	6,030	23.1%	7,284	7,702	M	H	7,500
Franklin	4,847	18.9%	5,671	5,946	M	H	5,300
Freedom	817	13.9%	919	953	H	H	2,700
Germany	2,207	19.3%	2,590	2,718	H	M	2,700
Hamilton	1,998	34.3%	2,615	2,820	H	H	2,800
Hamiltonban	2,100	1.9%	2,136	2,148	M	M	2,250
Highland	906	14.4%	1,023	1,063	L	M	1,050
Huntington	2,239	10.7%	2,455	2,526	M	H	3,000
Latimore	2,420	28.8%	3,030	3,256	M	H	3,200
Liberty	1,088	13.0%	1,215	1,258	M	M	1,200
Menallen	3,025	14.1%	3,409	3,537	L	L	3,300
Mount Joy	3,313	28.0%	4,148	4,426	M	H	3,900
Mount Pleasant	4,745	26.8%	5,889	6,271	M	H	6,000
Oxford	4,822	30.3%	6,137	6,575	H	H	6,600
Reading	4,700	41.9%	6,472	7,063	H	M	7,000
Straban	4,891	24.7%	5,978	6,341	H	H	6,500
Tyrone	2,209	15.6%	2,519	2,623	L	H	2,600
Union	2,900	23.4%	3,511	3,714	L	M	3,700
Township Totals	65,637	20.2%	78,968	83,437			85,450
County Totals	90,111	14.8%	105,383	110,497			114,895

(1) based on 1990 Population + approved building permits (1990-1997) x average household size
(2) based on 75% of Unadjusted Mid-range Growth
(3) based on extrapolation of Estimated 1997 Populations using Average Growth Rate per Decade (1960-1990)
(4) potential development pressure: high (H), medium (M) and low (L)
(5) based on individual assumptions made for each municipality, including (4) above

II. COMMUNITY WATER SYSTEM INVENTORY

A. INTRODUCTION

Water is provided to Adams County residents and businesses by community, noncommunity and on-lot water systems. Public water systems, including both community and noncommunity systems, are systems that provide water to the public for human consumption and have at least 15 service connections or regularly serve an average of at least 25 individuals daily at least 60 days out of the year. A community water system (CWS) is a system that regularly serves at least 15 connections used by year-round residents or regularly serves at least 25 year-round residents. Normally, community water systems serve entire communities, as well as larger residential developments, mobile home parks and resident institutional uses.

Noncommunity water systems serve commercial, industrial, institutional, and seasonal residential uses with 25 or more individuals, while on-lot water systems serve individual residences and other uses with fewer than 25 persons.

This chapter provides detailed inventory information for each of the County's community water systems, while presenting more general data on noncommunity and individual on-lot water systems to contribute to a clearer picture of Countywide water use. Summary sheets for each of the County's community water systems relaying information about each system's primary components, existing capabilities, and future needs are included in Appendix A of this report. Community water system locations are shown on Plate 1.

B. COMMUNITY WATER SYSTEMS

Thirty-six community water systems currently provide water to Adams County residents. All of these systems own and operate their own sources of supply and treatment and distribution facilities, providing water directly to users. One additional system serving Fort Detrick, U.S. Department of the Army, will not be analyzed as part of this study because it has classified status. One other system providing water service within Adams County, Hanover Municipal Waterworks, is located in adjacent York County and will be addressed only as it impacts existing and potential future water users within Adams County.

The Hanover system serves all of McSherrystown Borough and nearly all of Conewago Township, for a total of 2,796 residential connections, and 161 commercial, industrial, institutional, and other connections within Adams County.

Approximately 20% of the Hanover system's current average daily water production of 5.145 mgd goes to Adams County. Water comes primarily from two surface sources – the south branch of Conewago Creek and Slagels Run (both in Adams County), with the supplemental use of a well also located in Adams County. Permitted allocations and safe yields of these water sources total 10.2 mgd. The Hanover system uses a filtration plant with a permitted capacity of 11.6 mgd and has 13.77 million gallons of finished storage capacity in two reservoirs in York County.

The data presented in this section are drawn primarily from the PA Drinking Water Information System (PADWIS) database, which is based largely on Community Water System Inventories updated regularly by the DEP. Also utilized are the 1997 Annual Water Supply Reports (AWSRs) and some 1996 reports, where current reports were lacking, provided by water suppliers to the DEP and responses to a water system survey (Appendix B) developed for this study and distributed to each community water system. Twenty-eight of the 36 inventories distributed were returned by the County's community water systems, for a 72% response rate.

1. WATER SOURCES

The County's community water systems utilize a total of 101 wells. Thirty-one systems use only wells, while three systems use wells and a total of six springs, and one system uses wells and a surface water source. One other system relies on surface water alone. Table 4 summarizes the number and type of water sources in use for each system, as well as safe yield where reported. Safe yield is used as a conservative estimate of year-round groundwater availability. Safe yield is defined by the DEP as the maximum quantity of water that can be drawn from surface or groundwater sources without ultimate depletion of the source during a drought interval of 50 years. While some safe yield data is based on recent testing, other data is based on estimates or older figures. While more recent safe yield data tends to account for the cumulative interactions and drawdown of multiple, adjacent water sources, older safe yield data does not. Hence, safe yield data is approximate and not exact. Reported safe yields for the County's community water systems total approximately 5.1 mgd; safe yields for nine community water systems, mostly small systems, are unknown. Where source pumping data are available for these systems, they have been used as approximations of safe yield, except where water production limitations during the drought of 1999 indicate that these rates are too high. In these instances, and others where safe yields are in doubt, 1999 summer production levels, together with other relevant operator-provided information, are used as the bases for safe yield figures. This applies to the Bendersville, East Berlin, Gettysburg, Littlestown, and New Oxford Manor MHV systems.

2. WATER USE

Table 4 reveals that in 1997, Adams County community water systems provided approximately 4.06 mgd in average daily water use to County residents as compared with total estimated peak daily water use of 5.89 mgd (three systems report unknown peak daily flows). The County's community water systems serve a reported population of 36,452, approximately 40% of the County's estimated 1997 population. However, the actual proportion served is probably higher – at least

47%. This is because some of the reported 11,563 residential connections served house multi-family units, not all of which are reported as such, and because some systems may otherwise have underreported (see section E – On-lot Water Wells).

Community water systems also provide water to 835 commercial connections, 33 industrial connections, 54 institutional connections, one bulk sales connection, and 96 other connections Countywide. Five community water systems, including three municipal systems, do not report water use by type because they are not yet metered or are in the process of being metered; therefore average daily water use cannot be disaggregated by type for these systems. Average daily water use for residential purposes is no more than 2.48 mgd, and probably about half of average daily water use for all purposes Countywide. Average daily water use for commercial purposes is at least 0.68 mgd, while that for industrial uses is a minimum of 0.34 mgd, and institutional water uses consume at least 0.23 mgd. Bulk water use is responsible for at least 3016 gpd, other uses use a minimum of 0.31 mgd, and unaccounted for water is at least 0.46 mgd. "Other" water uses typically include plant flushing and municipal use, while "unaccounted for water" includes primarily leakage and occasional fire fighting.

Only nine systems noted unaccounted for water, eight of them municipal systems or authorities. Of these, four have water losses exceeding 20%, including Biglerville (31%), Bonneauville (31%), Lake Meade (30%), and York Springs (23%). These systems are using a variety of active methods to identify leaks. Water loss should be accurately determined before systems make any costly decisions regarding additional source and treatment. By reducing water loss, the need for additional costly sources and treatment can sometimes be avoided, and user costs can be reduced. Under a contract with the Pennsylvania Rural Water Association, water loss audits can be completed at no cost to the water supplier.

The final column of Table 4 calculates peak daily 1997 water use per person for residential purposes for each system. These figures range from a low of 49 gpd in a mobile home park to a high of 457 gpd in a small residential development (reflecting a major leak). Average peak daily residential water use per person Countywide is 111 gpd or 300 gpd per household, using 1990 average household size; however, if the figure of 457 from the leaking system is not considered, the average peak daily rate per person becomes 96 gpd or 259 gpd per household. Most of the County's other high water users are mobile home parks, while most of the low per person water users are municipal systems or mobile home parks. Some of the lower water use figures may be unreliable because some systems lack individual meters or do not take daily meter readings, resulting in inaccurate water estimates. Some of the higher water use figures may be due in part to unreported system leakage, breaks, fires, and other unaccounted for water use.

Table 4
Community Water System Inventory
Adams County Water Supply Plan
Adams County Office of Planning and Development

Community Water System	PWS ID (1)	Area Served	Water Source Type	Safe Yield (gpd)	Water Use (gpd) Average Daily	Peak Daily (2)	Treatment Process (3)	Finished Storage (gal)	Population Served	Connections		Water Use Per Person	
										Residential (3)	Other (4)	Average Daily Residential (gpd) (5)	Peak Daily Residential (gpd) (6)
Abbottstown Municipal Authority	31	Abbottstown B., Berwick T.	1 well	162,000	53,221	Unknown	D	10,000	624	218	20	45	unknown
Anchor MHP Association	17	Butler T.	2 wells	50,000p	15,890	23,000	D,M	5,420	170	90	-	93	135
Arendtsville Municipal Water Co.	1	Arendtsville B., Butler T., Franklin T.	3 wells	172,000	73,937	114,900	D,C	300,000	846	304	27	48	76
Beaver Creek MHP	43	Abbottstown B., Berwick T.	2 wells	50,000	32,093	52,000	D	5,500	500	167	-	64	104
Bendersville Water Co.	2	Bendersville B., Menallen T.	3 wells, 3 springs**	81,473*	82,739	104,700	D,C	0	617	218	17	Unknown	unknown
Biglerville Water Co.	20	Biglerville B., Butler T.	3 wells	316,000	186,323	302,000	D	512,726	1,200	409	75	53	86
Bonneauville Municipal Authority	12	Bonneauville B., Mt. Pleasant T.	5 wells	115,200	127,512	176,000	D	100,000	2,031	531	20	40	87
Castle Hill MHP	14	Straban T.	1 well	21,600p	6,109	7,880	D	440	51	21	-	120	155
Cavalry Heights MHP	39	Mt. Pleasant T.	2 wells	8000	4,000	7,000	D	8,000	80	45	-	50	88
Chesapeake Estates MHP	41	Mt. Pleasant T.	5 wells	194,520p	19,532	22,876	D	7,000	470	175	-	42	49
Childrens Development Center	51	Berwick T.	2 wells	Unknown	2,851	Unknown	D	120	64	_	2	NA	NA
Citizens Utilities Water Co.	35	Mt. Pleasant T., Straban T., Mt. Joy T.	2 wells	360,000	105,082	187,100	D	60,000	1,889	665	4	51	113
East Berlin Boro Water	3	East Berlin B.	4 wells	113,816*	110,753	151,300	D	388,000	1,345	541	75	Unknown	unknown
Fairfield Municipal Authority	5	Fairfield B., Carroll Valley B., Hamiltonban T.	2 wells	140,000	66,740	108,000	D	240,000	761	287	36	46	74
Franklin Twp. Municipal Authority	32	Franklin T.	1 well	72,000	16,882	44,500	D	0	403	109	7	26	110
Gettysburg Municipal Authority	19	Gettysburg B., Straban T., Cumberland T.	8 wells, 1 surface	2.13 mgd*	1,515,236	1,838,000	D,P,T,S,C,I 1.008 mgd capacity	3,025,000	10,469	2,785	679	42	51
Hillside Rest Home	6	Hamiltonban T.	2 wells	4000+	2,827	3,800	D,C	200	45	_	1	NA	NA
Hoffman Homes for Youth	21	Mt. Joy T.	2 wells	20,000	13,857	33,100	D,S	75,000	256	_	1	NA	NA
Lake Meade Municipal Authority	36	Latimore T., Reading T.	3 wells	712,400	233,670	553,000	D,R	424,000	2,419	891	33	63	149
Lincoln Estates MHP	38	Cumberland T.	2 wells	87,000	43,000	49,000	D,S	54,000	450	185	_	96	109
Littlestown Municipal Authority	22	Littlestown B., Germany T., Union T.	10 wells	353,596	346,103	420,320	D	900,000	4,179	1,563	77	Unknown	unknown
Meadows Property Owners Assn.	44	Cumberland T.	1 well	65,000	6,402	9,500	D,S	1,200	90	40	-	71	106
Mountainview MHP	29	Reading T.	1 well	21,600	6,703	11,321	D	1,220	177	63	-	38	64
New Oxford Manor MHV	23	Mt. Pleasant T.	4 wells	23,000	18,000	23,000	D	33,500	350	110	_	51	66

Table 4
Community Water System Inventory
Adams County Water Supply Plan
Adams County Office of Planning and Development

Community Water System	PWS ID (1)	Area Served	Water Source Type	Safe Yield (gpd)	Water Use (gpd) Average Daily	Peak Daily (2)	Treatment Process (3)	Finished Storage (gal)	Population Served	Connections: Residential (3)	Connections: Other (4)	Water Use Per Person: Average Daily Residential (gpd) (5)	Water Use Per Person: Peak Daily Residential (gpd) (6)
New Oxford Municipal Authority	25	New Oxford B., Oxford T.	1 surface	1.2 mgd	742,310	1,184,000	D,T,P,O,C, 1.2mgd capacity	1,700,000	4,384	1,232	102	42	86
Oak Village MHP	11	Straban T.	2 wells	56,160	8,939	12,500	D	35,000	182	52	-	49	69
Panorama MHP	28	Oxford T.	2 wells	19,760	4,034	5,483	D	2,000	70	29	-	58	78
Pine Run Inc.	52	Hamilton T.	1 well	43,000p	1,800	11,891h	D,P	50,000	26	14	-	69	457h
Piney Mountain Home Est.	7	Franklin T.	2 wells	158,000	18,591	47,900	D,C	125,000	124	_	1	NA	NA
Possum Valley Municipal Authority	34	Menallen T.	2 wells, 2 springs**	76,000	24,600	54,000	D,C	0	303	109	11	58	128
Round Top MHP & Camp	46	Cumberland T.	2 wells	57,600p	21,114	42,400	D	18,000	200	58	1	Unknown	unknown
Section A Water Corp.	33	Carroll Valley B.	2 wells	100,000	32,038	42,000	D	50,000	254	93	-	126	165
Stockham's Village (MHP)	24	Reading T.	4 wells	39,800p	12,105	17,000	D	4,000	200	83	-	61	85
Timeless Towns of America	48	Cumberland T.	8 wells	43,920	25,835	34,000	D	150,000	300	71	2	Unknown	unknown
Walnut Grove MHP	53	Tyrone T.	1 well	58,000	13,000	19,000	D,S	161,000	234	83	-	56	81
York Springs Municipal Authority	30	York Springs B., Latimore T., Huntington T.	4 wells, 1 spring	367,000+	62,112	Unknown	D	0	689	322	-	90	unknown
County Totals	_	_	101 wells 6 springs, 2 surface	5,092,445	4,055,940	5,885,020e	36D,7C,5S 3P,2T,1M, 1I,1O,1R	8,446,306	36,452	11,563	1,191	61	111

(1) Last two digits of Public Water System identification number
(2) Total includes average daily water use values for three unknown peak daily water use values
(3) D = disinfection, M = manganese removal, C = corrosion control, P = particulates removal, T = taste/odor control, S = softening, I = inorganics removal, R = radionuclides removal
(4) Commercial, industrial, institutional, bulk, and other uses
(5) Average daily residential water use/ population served
(6) Peak daily residential water use/population served; where nonresidential water use exists, peak daily residential water use estimated as total peak daily water use x average daily residential water use/total average daily water use
*based on average per day summer 1999 production rates
e= estimated based on total peak daily water use + average daily water use x 1.46 (ratio of average to peak daily water use Countywide for systems with known values for both) for systems with unknown peak values
p = pumping capacity of source where safe yield is unknown
h = high number due to leakage
unknown = value unknown either because peak daily water use unknown or because AWSR does not disaggregate residential from other uses
**= springs have since been converted to infiltration galleries

3. Water Treatment

A summary of water treatment processes is provided in Table 4. Two of the County's community water systems provide full water filtration. All 36 systems utilize disinfection, seven provide corrosion control, five provide for softening, three provide particulate removal, two provide taste or odor control, and one system each treats for removal of organics, inorganics, manganese, and radionuclides. Water treatment and Safe Drinking Water Act requirements will be further discussed in Chapter III.

4. Finished Water Storage

Finished, or treated, water storage within Adams County, identified in Table 4, is provided primarily by ground level storage facilities, but also by several standpipes, several elevated tanks, and a few hydropneumatic tanks. Storage facilities are constructed primarily of steel, but also concrete, with a few wood facilities. All finished storage facilities are completely enclosed, according to regional DEP staff. Thirty-two of the County's community water systems provide some type of finished storage, while four provide none. Total finished water storage capacity for the County is 8.45 million gallons, which is well over peak daily water use of 5.89 mgd. As most systems are not interconnected, however, this excess capacity may or may not be available where projected needs exist. This will be further evaluated in Chapter III.

5. Transmissions and Distribution

Transmission and distribution lines in the County utilize a wide variety of materials, including polyvinyl/chloride plastic (PVC), cast iron (CI), ductile iron (DI), asbestos cement (AC), and others. The County's oldest water systems, dating from 1910 and 1912, are the Bendersville and Gettysburg systems, respectively. Most other municipal systems were constructed between 1930 and 1960, while the majority of non-municipal systems date from the 1970s and 1980s. Transmission line sizes range from 1.25 inches in diameter in two mobile home parks to 36 inches in the Fairfield system, with most others in the two-to-four-inch range, and several in the six-to-eight-inch range. Distribution line sizes range from .75 of an inch in diameter in a mobile home park and a small institutional use to 10 inches in the East Berlin and Littlestown systems. Most other distribution lines range from two to six inches. Transmission and distribution data are presented in Chapter IV.

6. Organizational Structure

The organizational structure of each water system is set forth in Table 5. There are a variety of ownership types within the County, including four municipal systems, 11 authorities, one water association, 5 investor-owned systems, 2 private systems, and 2 other-owned systems. State law requires that the Pennsylvania Public Utilities Commission (PUC) regulate all investor-owned systems; only 2 of the 5 investor-owned systems indicate on their AWSRs that they are regulated by the PUC.

Table 5
Community Water System Organization
Adams County Water Supply Plan
Adams County Office of Planning and Development

Community Water System	PWS ID (1)	Ownership: Municipal	Authority	Water Association	Investor	MHP	Other	Structure: Inter-connection	Purpose	Joint Cooperation (1)
Abbottstown Municipal Authority	31		X							
Anchor MHP Association	17					X				
Arendtsville Municipal Water Co.	1	X								
Beaver Creek MHP	43					X				
Bendersville Water Co.	2	X								34
Biglerville Water Co.	20	X								
Bonneauville Municipal Authority	12		X							
Castle Hill MHP	14					X				
Cavalry Heights MHP	39					X				
Chesapeake Estates MHP	41					X				
Childrens Development Center	51				X					
Citizens Utilities Water Co.	35				X					
East Berlin Boro Water	3	X								
Fairfield Municipal Authority	5		X					Ft. Det.	E	
Franklin Twp. Municipal Authority	32		X							
Gettysburg Municipal Authority	19		X							
Hillside Rest Home	6				X					
Hoffman Homes for Youth	21						X			
Lake Meade Municipal Authority	36		X							
Lincoln Estates MHP	38					X				
Littlestown Municipal Authority	22		X							
Meadows Property Owners Assn.	44		X							
Mountainview MHP	29					X				
New Oxford Manor MHV	23					X				
New Oxford Municipal Authority	25		X							
Oak Village MHP	11					X				
Panorama MHP	28					X				
Pine Run Inc.	52				X					
Piney Mountain Home Est.	7						X			
Possum Valley Municipal Authority	34		X							2
Round Top MHP & Camp	46					X				
Section A Water Corp.	33			X						
Stockham's Village (MHP)	24					X				
Timeless Towns of America	48				X					
Walnut Grove MHP	53					X				
York Springs Municipal Authority	30		X							
County Totals	_	4	11	1	5	13	2	1	E	2

(1) Last two digits of Public Water System identification number
E = emergency

Of the County's 36 community water systems, only the Fairfield Municipal Authority is interconnected with another system – the Department of the Army's Fort Detrick and only for emergency purposes. The Bendersville Water Company indicates on the survey that it has a contract for joint cooperation with the Possum Valley Municipal Authority. Otherwise, no other systems indicate that they employ any type of informal cooperation, contractual arrangement or joint or regional procurement, management or cooperation with any other systems.

7. WATER RATES

A summary of water system rates is presented in Table 6. Twenty of the County's community water systems, or 56%, have full metering, 12 of which charge based on water use levels. One additional unmetered system charges a flat quarterly fee. Nineteen systems report that they include water charges in their monthly rent or other dues; therefore, no rate or charge information is available for them. Four systems provide no information on their rate structures. Of the 13 systems which report that they charge specifically for water service, one of these has an inclining rate structure, with higher charges for each increment of water used, five have declining rate structures, with lower charges for each increment of water used, and seven charge for water use based on flat rates. Inclining rate structures are thought to promote conservation of water through higher per unit charges as more water is consumed, while declining rate structures discourage water conservation because per unit charges decrease as more water is consumed.

Using rate schedules, a typical quarterly charge for residential use is estimated based on a usage level of 5,000 gallons per month, or 15,000 gallons per quarter. The resulting average charge ranges from $24 to $147 per quarter, with an average quarterly charge of $75.29. This represents a very large range in rates. A number of possible factors could account for the wide disparity in rates. The systems with the lowest rates either have no reported long-term debt, and/or have significant reported equity/fixed assets or contingency funds. The systems with the highest rates tend to have moderate long-term debt but no other discernable factors that might result in higher rates, except for a high water leakage rate in one system with a somewhat high quarterly rate. High quarterly rates in some instances do and in some instances do not cover production costs as well as debt service; such high rates can present a financial hardship to some households. Rates which are too low may also not cover production costs or permit adequate investment in the system for maintenance and water quality protection (again, see Financial Summary discussion). Further evaluation will be provided in Chapter IV of this Plan.

Table 6
Community Water System Rate Summary
Adams County Water Supply Plan
Adams County Office of Planning and Development

Community Water System	Metering			Rate Structure			Billing Period		Rate Schedule			
	Yes	No	Mixed	Declining	Flat	Inclining	Quarterly	Other	Quarterly Base Rate	Rate $/ 1000 gal	Block (gal) (1)	Quarterly Charge ($) (2)
Abbottstown Municipal Authority	X			X			X		20	4.75	>3000	77
Anchor MHP Association	X			included in charges			NA	NA	NA	NA	NA	NA
Arendtsville Municipal Water Co.	X			X			X		46	2.7	>7000	67.6
Beaver Creek MHP		X		included in charges			NA	NA	NA	NA	NA	NA
Bendersville Water Co.	X				X		X		75	4.25	1000	104.75
Biglerville Water Co.	X				X		X		18.75	5	1000	93.75
Bonneauville Municipal Authority	X			X			X	mo	16.25	0.9	>5000	57.75
Castle Hill MHP		X		included in charges			NA	NA	NA	NA	NA	NA
Cavalry Heights MHP		X		included in charges			NA	NA	NA	NA	NA	NA
Chesapeake Estates MHP		X		included in charges			NA	NA	NA	NA	NA	NA
Childrens Development Center	X			included in charges			NA	NA	NA	NA	NA	NA
Citizens Utilities Water Co.	X				X		X		49.5	3.98	1000	109.2
East Berlin Boro Water	X				X		X		15	5	>3000	75
Fairfield Municipal Authority	X					X	X		20.58	5.15	>8000	61.78
Franklin Twp. Municipal Authority	X											
Gettysburg Municipal Authority	X											
Hillside Rest Home	X			included in charges			NA	NA	NA	NA	NA	NA
Hoffman Homes for Youth	X			included in charges			NA	NA	NA	NA	NA	NA
Lake Meade Municipal Authority			X		X		X		45			45
Lincoln Estates MHP		X		included in charges			NA	NA	NA	NA	NA	NA
Littlestown Municipal Authority	X											
Meadows Property Owners Assn.		X			X		X		24	_	_	24
Mountainview MHP		X		included in charges			NA	NA	NA	NA	NA	NA
New Oxford Manor MHV		X		included in charges			NA	NA	NA	NA	NA	NA
New Oxford Municipal Authority	X			X				bi-mo	19.50*	0.19	>10,000	30.95
Oak Village MHP		X		included in charges			NA	NA	NA	NA	NA	NA
Panorama MHP		X		included in charges			NA	NA	NA	NA	NA	NA
Pine Run Inc.	X			included in charges			NA	NA	NA	NA	NA	NA
Piney Mountain Home Est.	X			included in charges			NA	NA	NA	NA	NA	NA
Possum Valley Municipal Authority	X				X		X		42	7	1000	147
Round Top MHP & Camp		X		included in charges			NA	NA	NA	NA	NA	NA
Section A Water Corp.		X										
Stockham's Village (MHP)		X		included in charges			NA	NA	NA	NA	NA	NA
Timeless Towns of America		X		included in charges			NA	NA	NA	NA	NA	NA
Walnut Grove MHP		X		included in charges			NA	NA	NA	NA	NA	NA
York Springs Municipal Authority	X			X			X		40	5	>6000	85
County Totals	20	15	1	5	7	1	12	1	_	_	_	_
Countywide	56%	42%	3%	14%	19%	3%	33%	3%	_	_	_	75.29avg.

(1) in addition to the base rate, most systems charge a rate per 1000 gallons of water used over the indicated block amount
(2) based on 5,000 gallons water use per household per month
NA = not applicable as water charges included in other dues/rent
* inside Borough; outside Borough is $23.50

8. FINANCIAL SUMMARY

A summary of financial data is presented in Table 7. This data is drawn primarily from survey responses and Annual Reports of Municipal Authorities. Financial data is available for only about half of the systems. The lack of financial data is largely because the water fees for many smaller systems are included in other dues or rent and separate financial records for water operations are not maintained. These systems are indicated by the use of NA. Blank spaces indicate systems that did not return surveys, while spaces with dashes indicate systems that did not answer financial questions on the survey. Only five systems indicate the existence of a specific contingency fund, although a number of additional systems maintain significant cash reserves. The data that is available indicates that at least three systems are operating at a loss, two apparently because of debt service on long-term debt and despite the high quarterly water rates they are charging, as indicated in Table 6.

There is a very large range among systems in revenues received per 1,000 gallons of water sold, from a low of 38 cents per 1,000 gallons to a high of $10.49 per 1,000 gallons sold, with an average of $4.51 per 1,000 gallons sold. Similarly, expenses incurred per 1,000 gallons sold range from $.89 per 1,000 gallons to $11.56 per 1,000 gallons sold, with an average of $3.69 per 1000 gallons sold. The systems selling the largest volumes of water tend to have lower per unit costs and revenues than systems selling smaller volumes of water, undoubtedly because of the economies of scale involved. Further evaluation will be provided in Chapter IV of this Plan.

C. NONCOMMUNITY WATER SYSTEMS

Noncommunity water systems are public water systems serving primarily commercial, industrial, institutional, agricultural, and seasonal residential uses. Non-transient noncommunity (NN) water systems are those that regularly serve at least 25 of the same persons for at least six months every year, while transient noncommunity (TN) water systems provide service to at least 25 persons who are not the same for at least six months every year. There are 133 noncommunity water systems within Adams County, most of them commercial. The combined average daily water use for the 73 noncommunity water systems for which data is available is estimated at approximately 1.13 mgd (DEP 1998 PADWIS files and regional DEP staff); actual average daily water use for all 133 systems is higher, including water for two additional golf courses and numerous commercial uses. The water for the great majority of the County’s noncommunity water systems is drawn from wells, while the water for three comes from springs, and none comes from surface water sources.

The County's major noncommunity water systems using an average of 20,000 gpd or more are identified in Table 8. These 15 systems serve a variety of primarily food processors and recreational uses, using up to 82% of the total water used by noncommunity systems countywide.

Table 7
Financial Summary
Adams County Water Supply Plan
Adams County Office of Planning and Development

Community Water System	Million Gallons	Revenue			Expenses					Net Profit/ (Deficit) $	Contingency Fund $ (1)	Equity/ Fixed Assets	Long-Term Debt
		Operating $	Other $	Total $	$/ 1000 gal	Operating $	Other $	Total $	$/1000 gal				
Abbottstown Municipal Authority	19.43	117,787	0	117,787	6.06	65,351	25,140	90,491	4.66	27,296	100,304	655,428	228,676
Anchor MHP Association	5.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arendtsville Municipal Water Co.	26.99	107,510	_	107,510	3.98	52,528	19,062	71,590	2.65	35,920	_	_	185,595
Beaver Creek MHP	11.71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bendersville Water Co.	30.2	105,000	1400	106,400	3.52	100,000	400	100,400	3.32	6000	_	_	200,000
Biglerville Water Co.	68.01	226,552	11,609	238,161	3.5	89,184	156,085	245,269	3.61	(-7108)	_	_	1,221,880
Bonneauville Municipal Authority	46.54	193,014	0	193,014	4.15	9145	169,536	178,681	3.84	14,333	362,350	0	2,290,000
Castle Hill MHP	2.23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cavalry Heights MHP	1.46	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chesapeake Estates MHP	7.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Childrens Development Center	1.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Citizens Utilities Water Co.	38.35	292,219*	_	292,219	7.62	_	_	_	_	_	_	_	_
East Berlin Boro Water	40.42	174,500	_	174,500	4.32	174,500	_	174,500	4.32	0	_	_	0
Fairfield Municipal Authority	24.36	94,000	5000	99,000	4.06	85,000	_	85,000	3.49	14,000	50,000	_	124,000
Franklin Twp. Municipal Authority	6.16	64,611	_	64,611	10.49	38,643	_	38,643	6.27	25,968	_	139,143	_
Gettysurg Municipal Authority	553.06	1,473,409	_	1,473,409	2.66	915,727	126,876	1,042,603	1.89	430,806	1,183,103	6,429,131	2,380,000
Hillside Rest Home	1.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hoffman Homes for Youth	5.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lake Meade Municipal Authority	85.29	216,075	_	216,075	2.53	166,954	_	166,954	1.96	49,121	_	4,723,619	_
Lincoln Estates MHP	15.7	NA	NA	NA	NA	12,000	2000	14,000	0.89	NA	NA	NA	NA
Littlestown Municipal Authority	126.33	48,096	_	48,096	0.38	1800	144,401	146,401	1.16	(-98,305)	_	_	1,985,000
Meadows Property Owners Assn.	2.34	12.096	_	12,096	5.17	8000	_	8000	3.42	4096	_	_	_
Mountainview MHP	2.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Oxford Manor MHV	6.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 7 Financial Summary Adams County Water Supply Plan Adams County Office of Planning and Development													
Community Water System	Million Gallons	Revenue				Expenses				Net Profit/ (Deficit) $	Contingency Fund $ (1)	Equity/ Fixed Assets	Long-Term Debt
		Operating $	Other $	Total $	$/ 1000 gal	Operating $	Other $	Total $	$/1000 gal				
New Oxford Municipal Authority	270.94	489,111	613,358	1,102,469	4.07	548,419	70,991	619,410	2.29	483,059	2,914,588	5,532,994	3,900,000
Oak Village MHP	3.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Panorama MHP	1.47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pine Run Inc.	0.66	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Piney Mountain Home Est.	6.79	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Possum Valley Municipal Authority	8.98	26,488	24,603	51,091	5.69	85,384	18,382	103,766	11.56	(-52,675)	_	99,605	308,036
Round Top MHP & Camp	7.71	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Section A Water Corp.	11.69												
Stockham's Village (MHP)	4.42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Timeless Towns of America	9.43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walnut Grove MHP	4.75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
York Springs Municipal Authority	22.67	90,000	_	90,000	3.97	85,000	_	85,000	3.75	5000	0	_	400,000

*estimated based on rates and number of connections
_ = no response given
NA = not applicable as water charges included in other dues/rent
blank = survey not returned
(1) special purpose fund for contingencies or emergencies

Table 8

MAJOR NONCOMMUNITY SYSTEMS			
User	**Municipality**	**Type**	**GPD**
Knouse Foods, Inc.	Hamilton Twp.	NN	125,000
Knouse Foods, Inc.	Tyrone Twp.	NN	55,000
Knouse Foods, Inc.	Tyrone Twp.	NN	150,000
Hillandale Farms	Tyrone Twp.	NN	110,000
Hollabaugh Bros. Orchards	Butler Twp.	TN	22,356
Mason Dixon Farms	Freedom Twp.	NN	92,000
Bermudian Springs School	Huntington Twp.	NN	20,000+
Granite Hill Campground	Highland Twp.	TN	90,000
Gettysburg Campground	Highland Twp.	TN	25,000
Battlefield Camp Resort	Cumberland Twp.	TN	30,000
Ski Liberty	Liberty Twp.	NN	20,000
Carroll Valley Country Club	Liberty Twp.	TN	54,463
Cedar Ridge Golf Course	Mt. Joy Twp.	TN	24,663
Flatbush Golf Course	Union Twp.	TN	41,453
Mountainview Golf Course	Hamiltonban Twp.	TN	67,153
Totals	-	-	927,088

D. OTHER WATER WITHDRAWALS

Water is also withdrawn from the County's ground and surface water sources for industrial and agricultural purposes by self-suppliers serving fewer than 25 persons. The DEP estimates that approximately 0.91 mgd is withdrawn by self-suppliers for various industrial and manufacturing purposes (Division of Water Use Planning, 1999). Historically, irrigation and other farm use of water within the County has been limited. However, in recent years, agricultural water use has been growing. Penn State Cooperative Extension has estimated the County's agricultural water use to be in the vicinity of 2.49 mgd, including approximately 1.13 mgd for irrigation and 1.36 mgd for livestock. Approximately 0.28 mgd of this is provided by noncommunity water systems (see above), while 2.21 mgd is provided by self-suppliers. Adams County farmers currently use streams, groundwater and hundreds of farm ponds to meet their water needs.

E. ON-LOT WATER WELLS

In 1990, 53% of all dwelling units in Adams County, or approximately 15,975 residences utilized on-lot water sources (U.S. Census, 1990). The vast majority of these units was served by on-lot wells, while a very small, but unknown, number utilized on-lot springs or surface water sources. A more current estimate of dwelling units utilizing on-lot water sources might be made by deducting the reported dwelling units served by community water systems in 1997 from the estimated 33,624 dwelling units that existed in the County in the same year, including approximately 400 units without plumbing. However, only 12,765 residential units were reported by community water systems or can be estimated using Census and building permit data to have been served by community water systems in 1997, as compared with a reported 13,714 units in 1990 (U.S. Census, 1990). While some units previously without plumbing may now have on-lot water, it is unlikely that residences previously using community water would have switched to on-lot water. Further, County records indicate that most new residences are being served by community water. Therefore, it must be assumed that community water systems have significantly underreported the number of residential units served in 1997. Assuming that in 1997 the same ratio of dwelling units are served by on-lot water systems as was true in 1990, then at most 17,688 dwellings may be estimated to be served by on-lot water wells in 1997.

Average daily water use for the estimated 17,688 dwelling units served by on-lot water can be estimated based on average household residential water use for community water systems of 165 gpd. This yields a figure of about 2.92 mgd in water use.

F. SUMMARY ANNUAL WATER USE

The County's 1991 Comprehensive Plan estimates that 1990 water use for residential, commercial, industrial, and institutional use was approximately 10 mgd. Table 9 estimates average daily water use within the County for community and noncommunity water systems, other withdrawals by self-suppliers, and individual on-lot water systems in 1997. More than one-third of all water used was provided by community water systems, while a little more than one-quarter was withdrawn by self-suppliers and one-quarter was withdrawn by individual on-lot wells. At least 10% came from noncommunity water systems. Countywide water use for 1997 is estimated to be over 11.26 mgd.

Table 9

1997 ESTIMATED ANNUAL WATER USE

Supplier	Average Day MGD
Community Water Systems	4.06 (36%)
Noncommunity Water Systems	1.13+ (10%)
Withdrawals by Self-suppliers	3.15 (28%)
On-lot Water Wells	2.92 (26%)
Totals	**11. 2 6 + (100%)**

III. COMMUNITY WATER SYSTEM ANALYSIS

A. INTRODUCTION

This chapter projects future water needs, evaluates the capabilities of the County's water systems to meet those needs, describes and reviews compliance with federal Safe Drinking Water Act requirements, and identifies specific system problem areas.

B. COMMUNITY WATER SYSTEMS

1. FUTURE WATER NEEDS

Projected future water needs are based on municipal population projections, designated growth areas, anticipated development infill, remedial water needs, and projected average and peak daily water use for each of the County's community water systems (CWSs). According to Annual Water Supply Reports (AWSRs) and county population estimates, during 1997, approximately 50% of Adams County's households were served by community water systems. The Adams County Comprehensive Plan recommends that an increased proportion of households be served by such systems. The County's boroughs are projected to provide public water to virtually 100% of future households, while townships will provide water to a lower proportion of new households.

Tables 10A through 10D summarize projected future community water needs for all of the County's municipalities, including water needs which must be met by existing community water systems as well as potential new community water systems. With three exceptions, community water systems serve portions of most County municipalities. The tables reflect the existing "served" population. They also indicate the 1997–2010 population increase anticipated for each municipality. For Adams County as a whole, the projected population increase is anticipated to be 24,784 persons, of which approximately 84% will use community water. By the year 2010, approximately 56% of the county's total population is expected to be served by community water systems.

Population Projections by Municipality and Community Water System – Tables 10A and 10B identify projected 2010 population to be served within municipalities and by community water systems, respectively. Sixteen of the County's existing community water systems serve two or more municipalities. Assumptions were made to estimate current population served as well as in projecting the distribution of new residents to be served by systems across municipal lines. These assumptions are as follows:

- For all boroughs, except those noted below, it is assumed that the municipal system currently provides 100% coverage of the Borough population and that it will continue to serve 100% of all new development. Thus, for the boroughs, the served population equals the 1997 population estimate. Population growth anticipated for the boroughs reflects the remaining "build-out" capabilities of the land base within each community.

- Two community water systems currently operate within Abbottstown Borough. The Abbottstown municipal system provides water to a majority of the Borough's residents. However, the Beaver Creek Mobile Home Park also operates partially within Abbottstown Borough, and serves a small portion of its population. Thus, the number of Abbottstown Borough residents served by the Abbottstown system is estimated by subtracting the estimated number of Borough residents who are believed to reside in the mobile home park.

- 1997 Community water system Annual Water Supply Reports (AWSRs) provide data on population served for each system and on the number of residential and other connections within each municipality. The population served within each municipality by multi-municipal systems is not calculated. However, the system-wide estimates often do not correspond exactly with the number of residential connections when the average household size is considered for various townships. Thus, system figures tend to underestimate population served. For this reason, within the County's townships as well as for Carroll Valley Borough, estimates of population currently served by each of the municipal systems (including the Lake Meade and Citizens systems) are based on the number of reported residential connections and average household size.

- For privately operated community water systems, including those serving mobile home parks, retirement communities, and group homes or counseling centers, the 1997 population estimate was taken directly from the 1997 AWSR completed for that system.

Community Water System Growth Assumptions

1. *Abbottstown Municipal Authority:* Substantial residential development in Hamilton Township is already served by the Abbottstown sewer system. Some new residential development in Berwick Township is likely, which should be provided water service by the Abbottstown water system.

2. *Arendtsville Municipal Water Company:* A small-scale extension of the water service area may be necessary over the next decade. Projections suggest that service may be extended to several properties in Butler Township that the Company has identified as potentially requiring service. Additional small-scale extensions into Butler and Franklin Townships are also likely.

3 *Bendersville Water Company:* Small-scale extension of the water service area into Menallen Township may be possible over the next decade.

4. *Biglerville Water Company:* Some extension of the water service area is possible into Butler Township over the next decade.

5. *Bonneauville Municipal Authority:* The service projections assume that a significant amount of residential development will occur within the Borough itself. In addition, it is likely that some residential development that may use Bonneauville water will be proposed in Mt. Pleasant Township.

6. *Citizens Utilities Water Company:* The service projections assume that new residences will continue to be built within the Lake Heritage community in Mount Joy, Mount Pleasant, and Straban townships. Some residential development may also occur near the Route 15 / Route 97 interchange.

7. *East Berlin Borough Water Company:* The service projections assume that existing projects within the Borough will be completed by 2010, but that the Company does not plan to serve development adjacent to the Borough. However, East Berlin and Hamilton Township should consider extending service to proposed development in the Township.

8. *Fairfield Water Company:* Service projections assume that fairly significant residential development may occur within the Borough, and that an existing project in the Borough will be completed. The projections also assume moderate extensions of service to potential development in Hamiltonban Township and Carroll Valley Borough.

9. *Franklin Township Municipal Authority:* The service projections assume that some small-scale residential development will occur in the Cashtown area.

10. *Gettysburg Municipal Authority:* The service projections assume that developments currently under construction, as well as additional new residential developments in both Cumberland and Straban townships will be served. Service levels in Straban Township may be relatively high if development near the new Gettysburg High School or adjacent to likely commercial or business development sites near the Route 15 / Route 30 interchange is proposed.

11. *Hanover Municipal Authority:* The service projections assume significant continuing residential development and activity in Conewago Township. The service projections also assume that a moderate service extension into southern Berwick Township may be possible over the next decade.

12. *Lake Meade Municipal Authority:* The service projections assume that residential development will continue on currently vacant lots in both the Reading Township and Latimore Township portions of the Lake Meade community.

13. *Littlestown Municipal Authority:* The Littlestown area continues to be one of the fastest growing residential areas of Adams County. The service projections assume that this trend will continue over the next decade. The service projections account for the build-out of projects currently under development within the Borough, which will generate significant new demand for water. The projections assume that at least one significant project will be proposed in Union Township that will require water service. In addition, some properties in Germany Township may require Borough water service.

14. *New Oxford Municipal Authority:* The New Oxford area also continues to be one of the fastest growing residential areas of Adams County. The service projections account for the completion of projects currently under development in both New Oxford Borough and Oxford Township. New residential projects in Oxford Township are also likely. In addition, extension of water service to the area north of Cross Keys in Hamilton Township may be provided in conjunction with extending sewer infrastructure along Route 94.

15. *Possum Valley Municipal Authority:* The service projections assume that the system will gradually expand to provide water service to a small number of potential new houses.

16. *Section A Water Company:* The service projections assume that the system will gradually expand in the coming years to provide water service to potential new construction, in Section A of Carroll Valley. This assumption acknowledges the Carroll Valley Comprehensive Plan, which recommends that efforts be made toward the provision of community water and sewer systems in the Borough.

17. *York Springs Municipal Authority:* The service projection assumes the gradual extension of York Springs water to potential development sites in Huntington Township. Much of the increase in Huntington Township will be accounted for by a development already under construction.

Assumptions similar to those used in compiling the 2010 population projections for each municipality presented in Chapter I were used to project future population growth by service area. For publicly operated community water systems, assumptions were made as set forth in the opposite inset.

For privately operated community water systems, including those serving mobile home parks, retirement homes, and group homes or counseling centers, it was assumed that the population served by each system would remain static through 2010. The only exceptions were those systems that have already submitted development plans. While several of the private systems, particularly the mobile home parks, indicate that they may expand by 2010, given the number of newer mobile home parks "in the pipeline," it is assumed that the demand for additional mobile home pads in existing mobile home parks will be minimal. It is anticipated that people entering the mobile home park market will gravitate toward new mobile home park facilities rather than to older parks. The four mobile home parks which are likeliest to expand are as follows:

1. *Castle Hill Mobile Home Park:* The owners of this park had submitted development plans within the last couple years to Straban Township for review. While the park owners have currently withdrawn the plans from consideration, it is assumed that the expansion will take place by 2010.

2. *Oak Village Mobile Home Park.* The owners of this park have also submitted development plans within the last couple years to Straban Township. In this case, the development plans have been approved by Straban Township, and the park expansion is underway.

3. *Pine Run Mobile Home Park:* The owner of this mobile home park has been slowly finishing Phase I of the park for the last several years. Earlier this year, final plans for Phase II of the park were submitted to Hamilton Township for review. At this time, the Phase II plans have been approved by the Township. However, the owner of the park has not initiated Phase II construction.

4. *Walnut Grove Mobile Home Park:* This relatively recent mobile home park has been under construction for the last several years, and is now nearing completion.

***Non-Residential Projections* –** The 1997 AWSRs include information on a number of non-residential connections, types of uses, and amount of water consumed by each type of use. Non-residential water use includes water for commercial, industrial, institutional, and other purposes. Using this information as baseline data, together with anticipated non-residential growth and development projections for the number of non-residential connections as well as the amount of water likely to be used have been assigned to each publicly operated community water system. In compiling these projections, the same general assumptions were applied as were used in the 2010 projections by municipality and by community water system service area. In addition, system-specific assumptions were applied as noted in the opposite inset.

Non-Residential Growth Assumptions

1. *Abbottstown Municipal Authority*: The projections assume a moderate rate of non-residential growth in both Abbottstown Borough and in Berwick Township.

2. *Arendtsville Municipal Water Company*: The projections assumed a slow rate of non-residential growth in Arendtsville Borough.

3. *Bendersville Water Company*: The projections assumed a reduction in water demand due to the anticipated down-sizing of some water users.

   Biglerville Water Company: The projections assumed a slow to moderate rate of non-residential growth in Biglerville Borough and in Butler Township. Some commercial connections are anticipated, as well as some additional industrial connections (likely supportive in nature to the fruit processing industry).

5. *Bonneauville Municipal Authority*: The projections assume a moderate to high rate of non-residential growth in Bonneauville Borough. The projections take into account new non-residential development either currently under construction or in the development review stage, as well as municipal zoning which allows for commercial development along some existing, undeveloped road frontages.

6. *Citizens Utilities Water Company:* The projections assume a high rate of non-residential growth with service provided in the Lake Heritage area in Mount Joy Township. The increase in the number of connections is primarily attributed to the proposed outlet store development in the southeast quadrant of the U.S. Route 15 / Route 97 interchange. Some additional "spin-off" commercial development in the area is also likely.

7. *East Berlin Borough Water Company:* The projections assume a slow to moderate rate of growth of non-residential development in East Berlin Borough. Some new commercial connections are likely, but moderate to high levels of non-residential growth are unlikely unless East Berlin water service would be extended into adjacent townships.

8. *Fairfield Water Company:* The projections assume a slow to moderate rate of non-residential development in Fairfield Borough and Hamiltonban Township. However, new commercial development is possible between Fairfield Borough and Carroll Valley Borough along Route 116 in Hamiltonban Township, particularly if regional population continues to increase.

9. *Franklin Township Municipal Authority:* Non-residential development served by the Franklin Township system is not envisioned, with the exception of, perhaps, a fruit-processing "spin-off" industry.

10. *Gettysburg Municipal Authority:* The projections assume moderate to high rates of non-residential development in Gettysburg Borough and Straban and Cumberland Townships. Some commercial "infill" and/or conversions of residential properties to commercial uses is anticipated. Substantial commercial development is anticipated in Straban Township, particularly if any of the four quadrants of the U.S. Route 15 / Route 30 Interchange develop. The assumption includes the probable extension of water and sewer service to the east of the Interchange, and also assumes that the Adams County Commerce Center, located in the southeast quadrant of the Interchange, will begin to be developed.

11. *Hanover Municipal Authority:* The projections assume a moderate rate of non-residential growth in McSherrystown Borough and Conewago Township. More commercial development is anticipated in the Township versus the Borough due to the presence of larger tracts of development-prone land. However, the overall rate of non-residential development may be stemmed, to some degree, by the proximity of large commercial centers in Hanover Borough, most notably Eisenhower Drive.

12. *Lake Meade Municipal Authority:* Substantial non-residential development served by the Lake Meade system is not envisioned.

13. *Littlestown Municipal Authority:* The projections assume that a moderate rate of non-residential development will occur in this service area, with the majority of the new connections remaining in Littlestown Borough, likely along West King Street. The development of additional commercial or business facilities in this area will likely be due to the area's continuing residential population growth.

14. *New Oxford Municipal Authority:* The projections assume that a moderate to high rate of non-residential development will occur in this service area. Some commercial projects are envisioned in the current service area covering portions of Oxford Township Service area extensions are envisioned in portions of Hamilton Township and Berwick Township. Commercial development in these townships is likely, given that the townships are likely to develop municipal sewer systems.

15. *Possum Valley Municipal Authority:* The projections assume some non-residential development in Menallen Township.

16. *Section A Water Company:* The projections assume that the Section A Water Company may be able to extend water service to potential, smaller-scale commercial projects that could be developed in accordance with the Carroll Valley Zoning Ordinance. Although it is acknowledged that the Section A system was conceived to address residential water needs, there may be some benefits to expanding the service beyond residential customers. If commercial uses are proposed, and if the Section A system is able to provide service, the uses themselves will likely be smaller-scale uses designed to provide neighborhood-level services.

17. *York Springs Municipal Authority:* The York Springs Municipal Authority registers a connection as commercial only if the water use exceeds a specific volume. This volume is roughly 500 gpd, a consumption rate which exceeds most, if not all, of the commercial uses in existence in the Borough. A small number of connections that would meet the Municipal Authority's criteria for "commercial connections" are possible. No non-residential development is anticipated in adjoining Huntington Township or Latimore Township that would utilize York Springs water.

Tables 10A and 10B go on to identify four categories of new water needs as follows:

Infill **–** Table 10 identifies the numbers of additional persons anticipated to be served by existing community water systems through infill development within existing service areas in boroughs and in private water systems.

Extension - Table 10 identifies the number of persons who could be served by existing community water systems whose service area could be extended to serve an adjacent area, regardless of whether the area is currently developed or likely to develop. This Plan identifies 22 existing systems - mostly municipal - that are capable of providing such service. Several areas of the County with problem on-lot water systems would benefit from such extensions. Where these areas are within approximately one mile of existing community water systems, they are proposed to be served by extensions from these systems. Extensions are also intended to serve areas planned by the County for future growth and development.

Remedial - The number of persons in existing developments who could be provided with remedial water by anticipated new water systems is also set forth in Table 10. These water needs are in areas not within proximity of existing community water systems. Recommendations for new remedial community water systems are made in Table 10.

New Private **–** Table 10 also identifies the number of persons in projected new developments who would need to be served by new private systems because of the distance of these areas from existing community water systems. Recommendations for new private water systems are made in Table 10.

Tables 10C and 10D use data from Tables 10A and 10B as well as Table 4 to project 2010 water needs by municipality and by community water system, respectively.

Projected Average/Peak Daily New Residential Water Needs **–** Projected average daily new residential water use for existing systems is based on existing average daily per person residential water use for each system. Projected peak daily new residential water use for existing systems is based on existing peak daily per person residential water use for each system, except for systems where this value is less than the County average of 111 gpd, in which case the more conservative County average is used. For new systems, projected average and peak daily new residential water use is estimated at 76 gpd and 111 gpd, respectively, reflecting the existing Countywide ratio of average-to-peak daily water use of 1:1.46. Projected 2010 average daily new residential water needs for all systems, both new and existing, are 1.39 mgd, while peak needs are projected at 2.40 mgd, reflecting a ratio of 1:1.73 for future average to peak daily water use. The difference in ratios is due to a number of existing systems with peak daily water use levels of greater than 111 gpd, which increases demand.

Projected New Non-residential Water Needs **–** Year 2010, County-wide need for commercial, industrial, institutional, and other water needs to be served by community water systems is estimated to be .426 mgd. This does not include water needs for agricultural uses or for industrial, commercial or institutional uses provided by noncommunity systems or self-suppliers.

Projected Average/Peak Daily New Total Water Needs **–** New residential and non-residential water needs are added together and multiplied by a conservation factor of five percent, reflecting the growing number of public and private water conservation efforts.

Total Average/Peak Daily Water Needs – Projected average and peak daily new total water needs are added to existing average/ peak daily water use figures to yield 2010 total water demand for each system. County-wide, average daily demand is estimated to be 6.32 mgd, while peak daily demand is approximately 9.33 mgd.

Table 10A
Projected 2010 Population to be Served by Municipality
Adams County Water Supply Plan
Adams County Office of Planning and Development

Municipality	System	1997 Pop.	2010 Pop.	1997 Served	2010 Served	Distribution of Additional Service				Total Additional 2010 Pers. Served	Total 2010 Pers. Served	% 2010 Municipal Pop. Served
						New Private	Infill	Extended	Remedial			
Boros:												
Abbottstown		**714**	**850**	**714**	**850**		**136**			**136**	**850**	**100**
	Abbottstown			589	725		136			136	725	
	Beaver Creek			125	125						125	
Arendtsville		**733**	**785**									**100**
	Arendtsville			733	785		52			52	785	
Bendersville		**573**	**620**									**100**
	Bendersville			573	620		47			47	620	
Biglerville		**1050**	**1100**									**100**
	Biglerville			1050	1100		50			50	1100	
Bonneauville		**1445**	**1900**									**100**
	Bonneauville			1445	1900		455			455	1900	
Carroll Valley		**2100**	**4500**	**267**	**650**		**291**	**92**		**383**	**650**	**14**
	Fairfield			13	50			37		37	50	
	Section A			254	600		291	55		346	600	
East Berlin		**1345**	**1700**									**100**
	East Berlin			1345	1700		355			355	1700	
Fairfield		**530**	**850**									**100**
	Fairfield			530	850		320			320	850	
Gettysburg		**7124**	**7100**									**100**
	Gettysburg			7124	7100		24			24	7100	
Littlestown		**3659**	**4500**									**100**
	Littlestown			3659	4500		841			841	4500	
McSherrystown		**2916**	**3050**									**100**
	Hanover			2916	3050		134			134	3050	
New Oxford		**1731**	**1850**									**100**
	New Oxford MA			1731	1850		119			119	1850	
York Springs		**554**	**640**									**100**
	York Springs			554	640		86			86	640	
TOTAL		24474	29445	22641	25595		2962	92		2954	25595	87

Table 10A Projected 2010 Population to be Served by Municipality Adams County Water Supply Plan Adams County Office of Planning and Development												
Municipality	System	1997 Pop.	2010 Pop.	1997 Served	2010 Served	Distribution of Additional Service				Total Additional 2010 Pers. Served	Total 2010 Pers. Served	% 2010 Municipal Pop. Served
						New Private	Infill	Extended	Remedial			
Townships:												
Berwick		**2088**	**3200**	**474**	**1775**			**1104**	**197**	**1301**	**1775**	**55**
	Abbottstown			35	200			165		165	200	
	Beaver Creek			375	375						375	
	Childrens Dvpt.			64	64						64	
	Green Springs			0	786			589	197	786	786	
	New Oxford MA			0	100			100		100	100	
	Hanover			0	250			250		250	250	
Butler		**2756**	**3200**	**419**	**900**	**230**		**251**		**481**	**900**	**28**
	Anchor			170	170						170	
	Arendtsville			99	200			101		101	200	
	Biglerville			150	300			150		150	300	
	Private			0	230	230				230	230	
Conewago		**5536**	**7750**	**5201**	**7400**			**2199**		**2199**	**7400**	**95**
	Hanover			5201	7400			2199		2199	7400	
Cumberland		**6030**	**7500**	**3221**	**3740**			**519**		**519**	**3740**	**50**
	Gettysburg			2181	2700			519		519	2700	
	Lincoln			450	450						450	
	Meadows			90	90						90	
	Round Top			200	200						200	
	Timeless Towns			300	300						300	
Franklin		**4847**	**5300**	**541**	**900**		**45**	**133**	**181**	**359**	**900**	**17**
	Arendtsville			14	50			36		36	50	
	Franklin			403	500			97		97	500	
	Orrtanna			0	226		45		181	226	226	
	Piney Mountain			124	124						124	
Freedom		**817**	**2700**	**0**	**1600**	**1500**			**100**	**1600**	**1600**	**59**
	Fairplay			0	100				100	100	100	
	Private			0	1500	1500				1500	1500	
Germany		**2207**	**2700**	**65**	**800**	**300**		**435**		**735**	**800**	**30**
	Littlestown			65	500			435		435	500	
	Private			0	300	300				300	300	
Hamilton		**1998**	**2800**	**26**	**1800**	**525**	**99**	**1150**		**1774**	**1800**	**64**
	Abbottstown			0	650			650		650	650	
	New Oxford MA			0	500			500		500	500	

Table 10A Projected 2010 Population to be Served by Municipality Adams County Water Supply Plan Adams County Office of Planning and Development												
Municipality	System	1997 Pop.	2010 Pop.	1997 Served	2010 Served	Distribution of Additional Service				Total Additional 2010 Pers. Served	Total 2010 Pers. Served	% 2010 Municipal Pop. Served
						New Private	Infill	Extended	Remedial			
	Pine Run			26	125		99			99	125	
	Private			0	525	525				525	525	
Hamiltonban		**2100**	**2250**	**263**	**570**		**31**	**152**	**124**	**307**	**570**	**25**
	Fairfield			218	370			152		152	370	
	Hillside			45	45						45	
	Orrtanna			0	155		31		124	155	155	
Highland		**906**	**1050**	**0**	**0**							
	none			0	0							
Huntington		**2239**	**3000**	**17**	**700**	**300**		**383**		**683**	**700**	**23**
	York Springs			17	400			383		383	400	
	Private			0	300	300				300	300	
Latimore		**2420**	**3200**	**783**	**1100**		**235**	**82**		**317**	**1100**	**34**
	Lake Meade			665	900		235			235	900	
	York Springs			118	200			82		82	200	
Liberty		**1088**	**1200**	**0**	**0**							
	none			0	0							
Menallen		**3025**	**3300**	**347**	**600**			**253**		**253**	**600**	**18**
	Bendersville			44	200			156		156	200	
	Possum Valley			303	400			97		97	400	
Mount Joy		**3313**	**3900**	**1352**	**1506**		**136**	**18**		**154**	**1506**	**39**
	Citizens Utilities			1096	1250		136	18		154	1250	
	Hoffman Homes			256	256						256	
Mt. Pleasant		**4745**	**6000**	**2023**	**3100**		**488**	**214**	**375**	**1077**	**3100**	**52**
	Bonneauville			586	800			214		214	800	
	Cavalry Heights			80	80						80	
	Centennial			0	750		375		375	750	750	
	Chesapeake			470	470						470	
	Citizens Utilities			537	650		113			113	650	
	New Oxford MHV			350	350						350	
Oxford		**4822**	**6600**	**2723**	**4523**	**300**		**1500**		**1800**	**4523**	**69**
	New Oxford MA			2653	4153			1500		1500	4153	
	Panorama			70	70						70	
	Private			0	300	300				300	300	
Reading		**4700**	**7000**	**2131**	**3477**		**646**		**700**	**1346**	**3477**	**50**
	Hampton			0	1000		300		700	1000	1000	
	Lake Meade			1754	2100		346			346	2100	
	Mountainview			177	177						177	

Table 10A
Projected 2010 Population to be Served by Municipality
Adams County Water Supply Plan
Adams County Office of Planning and Development

Municipality	System	1997 Pop.	2010 Pop.	1997 Served	2010 Served	Distribution of Additional Service				Total Additional 2010 Pers. Served	Total 2010 Pers. Served	% 2010 Municipal Pop. Served
						New Private	Infill	Extended	Remedial			
	Stockham's			200	200						200	
Straban		**4891**	**6500**	**1771**	**3470**		**263**	**1036**	**400**	**1699**	**3470**	**53**
	Castle Hill			51	120		69			69	120	
	Citizens Utilities			256	350		94			94	350	
	Gettysburg			1164	2200			1036		1036	2200	
	Hunterstown			0	500		100		400	500	500	
	Oak Village			300	300						300	
Tyrone		**2209**	**2600**	**234**	**735**		**101**		**400**	**501**	**735**	**28**
	Gardners			0	200				200	200	200	
	Heidlersburg			0	200				200	200	200	
	Walnut Grove			234	335		101			101	335	
Union		**2900**	**3700**	**455**	**1200**			**745**		**745**	**1200**	**32**
	Littlestown			455	1200			745		745	1200	
TOTAL		**65637**	**85450**	**22046**	**39896**	**3155**	**2044**	**10174**	**2477**	**17850**	**39896**	**47**
COUNTY TOTAL		**90111**	**114895**	**44687**	**65491**	**3155**	**6006**	**10266**	**2477**	**20804**	**65491**	**57**

Table 10B
Projected 2010 Population to be Served By Community Water System
Adams County Water Supply Plan
Adams County Office of Planning and Development

System	Municipality	1997 Served	2010 Served	Distribution of Additional Service				Total Additional 2010 Pers. Served	Total 2010 Pers. Served
				New Private	Infill	Extended	Remedial		
Abbottstown	*Abbottstown*	589	725		136			136	725
"	Berwick	35	200			165		165	200
"	Hamilton	0	650			650		650	650
TOTAL		**624**	**1575**		**136**	**815**		**951**	**1575**
Anchor	Butler	170	170						170
TOTAL		**170**	**170**						**170**
Arendtsville	*Arendtsville*	733	785		52			52	785
"	Butler	99	200			101		101	200
"	Franklin	14	50			36		36	50
TOTAL		**846**	**1035**		**52**	**137**		**189**	**1035**
Beaver Creek	*Abbottstown*	125	125						125
"	Berwick	375	375						375
TOTAL		**500**	**500**						**500**
Biglerville	*Biglerville*	1050	1100		50			50	1100
"	Butler	150	300			150		150	300
TOTAL		**1200**	**1400**		**50**	**150**		**200**	**1400**
Bonneauville	*Bonneauville*	1445	1900		455			455	1900
"	Mt. Pleasant	586	800			214		214	800
TOTAL		**2031**	**2700**		**455**	**214**		**669**	**2700**
Bendersville	*Bendersville*	573	620		47			47	620
"	Menallen	44	200			156		156	200
TOTAL		**617**	**820**		**47**	**156**		**203**	**820**
Childrens Dvpt.	Berwick	64	64						64
TOTAL		**64**	**64**						**64**
Chesapeake	Mt. Pleasant	470	470						470
TOTAL		**470**	**470**						**470**
Centennial	Mt. Pleasant	0	750		375		375	750	750
TOTAL		**0**	**750**		**375**		**375**	**750**	**750**
Cavalry Heights	Mt. Pleasant	80	80						80
TOTAL		80	80						80
Castle Hill	Straban	51	120		69			69	120
TOTAL		**51**	**120**		**69**			**69**	**120**
Citizens Uts.	Mount Joy	1096	1250		136	18		154	1250
"	Mt. Pleasant	537	650		113			113	650
"	Straban	256	350		94			94	350
TOTAL		**1889**	**2250**		**343**	**18**		**361**	**2250**
East Berlin	*East Berlin*	1345	1700		355			355	1700
TOTAL		**1345**	**1700**		**355**			**355**	**1700**
Fairplay	Freedom	0	100				100	100	100
TOTAL		**0**	**100**				**100**	**100**	**100**
Fairfield	*Carroll Valley*	13	50			37		37	50
"	*Fairfield*	530	850		320			320	850
"	Hamiltonban	218	370			152		152	370
TOTAL		**761**	**1270**		**320**	**189**		**509**	**1270**
Franklin	Franklin	403	500			97		97	500
TOTAL		**403**	**500**			**97**		**97**	**500**
Gardners	Tyrone	0	200				200	200	200
TOTAL		**0**	**200**				**200**	**200**	**200**
Gettysburg	Cumberland	2181	2700			519		519	2700
"	*Gettysburg*	7124	7100		24			24	7100
"	Straban	1164	2200			1036		1036	2200
TOTAL		**10469**	**12000**		**24**	**1555**		**1531**	**12000**
Green Springs	Berwick	0	786			589	197	786	786

Table 10B Projected 2010 Population to be Served By Community Water System Adams County Water Supply Plan Adams County Office of Planning and Development									
System	Municipality	1997 Served	2010 Served	Distribution of Additional Service				Total Additional 2010 Pers. Served	Total 2010 Pers. Served
				New Private	Infill	Extended	Remedial		
TOTAL		**0**	**786**			**589**	**197**	**786**	**786**
Hampton	Reading	0	1000		300		700	1000	1000
TOTAL		**0**	**1000**		**300**		**700**	**1000**	**1000**
Heidlersburg	Tyrone	0	200				200	200	200
TOTAL		**0**	**200**				**200**	**200**	**200**
Hoffman Homes	Mount Joy	256	256						256
TOTAL		**256**	**256**						**256**
Hanover	Berwick	0	250			250		250	250
"	Conewago	5201	7400			2199		2199	7400
"	*McSherrystown*	2916	3050		134			134	3050
TOTAL		**8117**	**10700**		**134**	**2449**		**2583**	**10700**
Hillside Rest	Hamiltonban	45	45						45
TOTAL		**45**	**45**						**45**
Hunterstown	Straban	0	500		100		400	500	500
TOTAL		**0**	**500**		**100**		**400**	**500**	**500**
Lincoln Estates	Cumberland	450	450						450
TOTAL		**450**	**450**						**450**
Littlestown	Germany	65	500			435		435	500
"	*Littlestown*	3659	4500		841			841	4500
"	Union	455	1200			745		745	1200
TOTAL		**4179**	**6200**		**841**	**1180**		**2021**	**6200**
Lake Meade	Latimore	665	900		235			235	900
"	Reading	1754	2100		346			346	2100
TOTAL		**2419**	**3000**		**581**			**581**	**3000**
Mountainview	Reading	177	177						177
TOTAL		**177**	**177**						**177**
Meadows	Cumberland	90	90						90
TOTAL		**90**	**90**						**90**
New Oxford MA	Berwick	0	100			100		100	100
"	Hamilton	0	500			500		500	500
"	*New Oxford*	1731	1850		119			119	1850
"	Oxford	2653	4153			1500		1500	4153
TOTAL		**4384**	**6603**		**119**	**2100**		**2219**	**6603**
New Oxford MHV	Mt. Pleasant	350	350						350
TOTAL		350							
Orrtanna	Franklin	0	226		45		181	226	226
Orrtanna	Hamiltonban	0	155		31		124	155	155
TOTAL		**0**	**381**		**76**		**305**	**381**	**381**
Oak Village	Straban	182	300		118			118	300
TOTAL		**182**	**300**		**118**			**118**	**300**
Piney Mountain	Franklin	124	124						124
TOTAL		**124**	**124**						**124**
Panorama	Oxford	70	70						70
TOTAL		**70**	**70**						**70**
Pine Run	Hamilton	26	125		99			99	125
TOTAL		**26**	**125**		**99**			**99**	**125**
Private	Butler	0	230	230				230	230
Private	Freedom	0	1500	1500				1500	1500
Private	Germany	0	300	300				300	300
Private	Hamilton	0	525	525				525	525
Private	Huntington	0	300	300				300	300
Private	Oxford	0	300	300				300	300
TOTAL		**0**	**3155**	**3155**				**3155**	**3155**

Table 10B Projected 2010 Population to be Served By Community Water System Adams County Water Supply Plan Adams County Office of Planning and Development									
System	Municipality	1997 Served	2010 Served	Distribution of Additional Service				Total Additional 2010 Pers. Served	Total 2010 Pers. Served
				New Private	Infill	Extended	Remedial		
Possum Valley	Menallen	303	400			97		97	400
TOTAL		**303**	**400**			**97**		**97**	**400**
Round Top	Cumberland	200	200						200
TOTAL		**200**	**200**						**200**
Section A	*Carroll Valley*	254	600		291	55		346	600
TOTAL		**254**	**600**		**291**	**55**		**346**	**600**
Stockham's	Reading	200	200						200
TOTAL		**200**	**200**						**200**
Timeless Towns	Cumberland	300	300						300
TOTAL		**300**	**300**						**300**
Walnut Grove	Tyrone	234	335		101			101	335
TOTAL		**234**	**335**		**101**			**101**	**335**
York Springs	Huntington	17	400			383		383	400
"	Latimore	118	200			82		82	200
"	*York Springs*	554	640		86			86	640
TOTAL		**689**	**1240**		**86**	**465**		**551**	**1240**

Table 10C
Projected 2010 Water Needs by Municipality
Adams County Water Supply Plan
Adams County Office of Planning and Development

Municipality	System	1997 Served	2010 Served	Total Addit. 2010 Pers. Served	Total 2010 Persons Served	Avg. Daily/ Person (gpd) 1	Peak Daily/ Person (gpd) 2	Avg. Daily New Resid. (gpd)	Peak Daily New Resid. (gpd)	1997 Peak Daily Total (gpd)	1997 Non resid. (gpd)	New Non-resid. (gpd)	Avg. Daily New Total (gpd) 3	Peak Daily New Total (gpd) 3	Total Avg. Daily (gpd) 4	Total Peak Daily (gpd) 5
Boroughs:																
Abbottstown		714	850	136	850											
	Abbottstown	589	725	136	725	45	111	6120	15096	77703	25141	3064	8725	17252	60371	94955
	Beaver Cr.	125	125		125	64	104	0	0			0	0	0	8000	0
Arendtsville																
	Arendtsville	733	785	52	785	48	111	2496	5772	114900	33329	1032	3352	6464	71865	121364
Bendersville																
	Bendersville	573	620	47	620	76	111	3572	5217	104700	35847	-20509	-16090	-14527	63305	90173
Biglerville																
	Biglerville	1050	1100	50	1100	53	111	2650	5550	302000	122723	4244	6549	9304	184922	311304
Bonneauville																
	Bonneauville	1445	1900	455	1900	40	111	18200	50505	176000	46272	4691	21746	52436	125818	228436
Carroll Valley		267	650	383	650											
	Fairfield	13	50	37	50	46	111	1702	4107				1617	3902	2215	3902
	Section A	254	600	346	600	126	165	43596	57090	42000		2000	43316	56136	75320	98136
East Berlin																
	East Berlin	1345	1700	355	1700	76	111	26980	39405	151300	8533	8770	33963	45766	144716	197066
Fairfield																
	Fairfield	530	850	320	850	46	111	14720	35520	108000	31734	2775	16620	36380	72734	144380
Gettysburg																
	Gettysburg	7124	7100	24	7100	42	111	1008	2664	1838000	1075538	76749	71954	70381	1446700	1908381
Littlestown																
	Littlestown	3659	4500	841	4500	76	111	63916	93351	420320	28499	17870	77697	105660	384280	525980
McSherrystown																
	Hanover	2916	3050	134	3050	76	111	10184	14874	1292000	807686	3076	12597	17053	1041899	1309053
New Oxford																
	New Oxford MA	1731	1850	119	1850	51	111	6069	13209	1184000	558182	-2685	3215	9998	649678	1193998
York Springs																
	York Springs	554	640	86	640	90	111	7740	9546	90684		1108	8406	10121	58266	100805
TOTAL		22641	25595	2954	25595											
Townships:																
Berwick		474	1775	1301	1775											
	Abbottstown	35	200	165	200	45	111	7425	18315			4200	11044	21389	12619	21389
	Beaver Cr.	375	375		375	64	104	0	0	52000			0	0	24000	52000
	Childrens Dvpt.	64	64		64	45	111	0	0	4162			0	0	2880	4162
	Green Springs	0	786	786	786	76	111	59736	87246			1300	57984	84119	57984	84119
	New Oxford MA	0	100	100	100	51	111	5100	11100			38500	41420	47120	41420	47120
	Hanover	0	250	250	250	76	111	19000	27750			1440	19418	27731	19418	27731
Butler		419	900	481	900											
	Anchor MHP	170	170		170	93	135	0	0	23000			0	0	15810	23000
	Arendtsville	99	200	101	200	48	111	4848	11211			440	5024	11068	9776	11068
	Biglerville	150	300	150	300	53	111	7950	16650			7057	14257	22522	22207	22522
	Private	0	230	230	230	76	111	17480	25530				16606	24254	16606	24254
Conewago		5201	7400	2199	7400											
	Hanover	5201	7400	2199	7400	76	111	167124	244089			19810	177587	250704	572863	250704
Cumberland		3221	3740	519	3740											
	Gettysburg	2181	2700	519	2700	42	111	21798	57609			19605	39333	73353	130935	73353
	Lincoln Est.	450	450		450	96	109	0	0	49000			0	0	43200	49000

Table 10C
Projected 2010 Water Needs by Municipality
Adams County Water Supply Plan
Adams County Office of Planning and Development

Municipality	System	1997 Served	2010 Served	Total Addit. 2010 Pers. Served	Total 2010 Persons Served	Avg. Daily/ Person (gpd) 1	Peak Daily/ Person (gpd) 2	Avg. Daily New Resid. (gpd)	Peak Daily New Resid. (gpd)	1997 Peak Daily Total (gpd)	1997 Non resid. (gpd)	New Non-resid. (gpd)	Avg. Daily New Total (gpd) 3	Peak Daily New Total (gpd) 3	Total Avg. Daily (gpd) 4	Total Peak Daily (gpd) 5
	Meadows	90	90		90	71	106	0	0	9500			0	0	6390	9500
	Round Top	200	200		200	76	182	0	0	42400	5914		0	0	21114	42400
	Timeless	300	300		300	76	113	0	0	34000	3035		0	0	25835	34000
Franklin		541	900	359	900											
	Arendtsville	14	50	36	50	48	111	1728	3996				1642	3796	2314	3796
	Franklin	403	500	97	500	26	111	2522	10767	44500	6404	1119	3459	11292	20341	55792
	Orrtanna	0	226	226	226	76	111	17176	25086			5200	21257	28772	21257	28772
	Piney Mountain	124	124		124	150	386	0	0	47900			0	0	18600	47900
Freedom		0	1600	1600	1600											
	Fairplay	0	100	100	100	76	111	7600	11100			3200	10260	13585	10260	13585
	Private	0	1500	1500	1500	76	111	114000	166500				108300	158175	108300	158175
Germany		65	800	735	800											
	Littlestown	65	500	435	500	76	111	33060	48285				31407	45871	36347	45871
	Private	0	300	300	300	76	111	22800	33300				21660	31635	21660	31635
Hamilton		26	1800	1774	1800											
	Abbottstown	0	650	650	650	45	111	29250	72150				27788	68543	27788	68543
	New Oxford MA	0	500	500	500	51	111	25500	55500			4000	28025	56525	28025	56525
	Pine Run	26	125	99	125	69	111	6831	10989	2886			6489	10440	8283	13326
	Private	0	525	525	525	76	111	39900	58275				37905	55361	37905	55361
Hamiltonban		263	570	307	570											
	Fairfield	218	370	152	370	46	111	6992	16872			3180	9663	19049	19691	19049
	Hillside Rest	45	45	0	45	63	84	0	0	3800			0	0	2835	3800
	Orrtanna	0	155	155	155	76	111	11780	17205				11191	16345	11191	16345
Highland		0	0	0	0											
	none	0	0	0	0			0	0				0	0		
Huntington		17	700	683	700											
	York Springs	17	400	383	400	90	111	34470	42513				32747	40387	34277	40387
	Private	0	300	300	300	76	111	22800	33300				21660	31635	21660	31635
Latimore		783	1100	317	1100											
	Lake Meade	665	900	235	900	63	149	14805	35015				14065	33264	55960	33264
	York Springs	118	200	82	200	90	111	7380	9102				7011	8647	17631	8647
Liberty		0	0	0	0											
	none	0	0	0	0			0	0				0	0	0	
Menallen		347	600	253	600											
	Bendersville	44	200	156	200	76	111	11856	17316			30500	40238	45425	43582	45425
	Possum Valley	303	400	97	400	58	128	5626	12416	54000	7026	4600	9715	16165	34315	70165
Mount Joy		1352	1506	154	1506											
	Citizen Utilities	1096	1250	154	1250	51	111	7854	17094	187100	8743	60800	65221	73999	129860	261099
	Hoffman	256	256	0	256	54	129	0	0	33100			0	0	13824	33100
Mt. Pleasant		2023	3100	1077	3100											
	Bonneauville	586	800	214	800	40	111	8560	23754			750	8845	23279	32285	23279
	Cavalry	80	80	0	80	50	88	0	0	7000			0	0	4000	7000
	Centennial	0	750	750	750	76	111	57000	83250			8750	62463	87400	62463	87400
	Chesapeake	470	470	0	470	42	49	0	0	22876			0	0	19740	22876
	Citizen Utilities	537	650	113	650	51	111	5763	12543			200	5665	12106	33052	12106
	New Oxford MHV	350	350	0	350	51	66	0	0	23000			0	0	17850	23000
Oxford		2723	4523	1800	4523											

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	New Oxford MA	2653	4153	1500	4153	51	111	76500	166500			14257	86219	171719	221522	171719
	Panorama	70	70	0	70	58	78	0	0	5483			0	0	4060	5483
	Private	0	300	300	300	76	111	22800	33300				21660	31635	21660	31635
Reading		2131	3477	1346	3477											
	Hampton	0	1000	1000	1000	76	111	76000	111000			8450	80228	113478	80228	113478
	Lake Meade	1754	2100	346	2100	63	149	21798	51554	553000	81273	1300	21943	50211	213718	603211
	Mountainview	177	177	0	177	38	64	0	0	11321			0	0	6726	11321
	Stockham's	200	200	0	200	61	85	0	0	17000			0	0	12200	17000
Straban		1771	3470	1699	3470											
	Castle Hill	51	120	69	120	120	136	8280	9384	7880			7866	8915	13986	16795
	Citizen Utilities	256	350	94	350	51	111	4794	10434				4554	9912	17610	9912
	Gettysburg	1164	2200	1036	2200	42	111	43512	114996			75937	113477	181386	162365	181386
	Hunterstown	0	500	500	500	76	111	38000	55500			2000	38000	54625	38000	54625
	Oak Village	300	300	0	300	49	69	0	0				0	0	14700	0
Tyrone		234	735	501	735											
	Gardners	0	200	200	200	76	111	15200	22200			2000	16340	22990	16340	22990
	Heidlersburg	0	200	200	200	76	111	15200	22200			3700	17955	24605	17955	24605
	Walnut Grove	234	335	101	335	56	111	5656	11211	19000			5373	10650	18477	29650
Union		455	1200	745	1200											
	Littlestown	455	1200	745	1200	76	111	56620	82695			1122	54855	79626	89435	79626
TOTAL		22046	39896	17850	39896											
COUNTY TOTAL		44687	65491	20804	65491											

1 Based on existing system average daily water use
2 Based on DEP recommended peak daily water use per household of 300 gpd/2.7 average Adams Co. household size (+111 gpd), except for systems with higher peak use; proposed new systems & systems with unknown average daily residential water use are assumed to use County-wide ratio of average to peak daily water use of 1:1.46
3 Average & peak daily new residential & non-residential water needs x .95 as a conservation factor
4 Average daily new water needs plus existing average daily water needs
5 Peak daily new water needs plus existing peak daily water needs (latter reflected in major system municipality)
bolded = under peak columns, total for all municipalities served by system

Table 10D
Projected 2010 Water Needs by Community Water System
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Adams County Office of Planning and Development

System	Municipality	1997 Served	2010 Served	Total Addit. 2010 Pers. Served	Total 2010 Pers. Served	Avg. Daily/ Person (gpd)[1]	Peak Daily/ Person (gpd)[2]	Avg. Daily New Resid. (gpd)	Peak Daily New Resid. (gpd)	1997 Peak Daily Total (gpd)	1997 Non-Resid. (gpd)	New Non-Resid. (gpd)	Avg. Daily New Total (gpd) 3	Peak Daily New Total (gpd) [3]	Total Avg. Daily (gpd)[4]	Total Peak Daily (gpd)[5]
Abbottstown	*Abbottstown*	589	725	136	725	45	111	6120	15096	**77703**	25141	3064	8725	17252	60371	94955
"	Berwick	35	200	165	200	45	111	7425	18315			4200	11044	21389	12619	21389
"	Hamilton	0	650	650	650	45	111	29250	72150				27788	68543	27788	68543
TOTAL		624	1575	951	1575	135	333	42795	105561	77703	25141	7264	47556	107184	100777	184887
Anchor	Butler	170	170		170	93	135	0	0	23000			0	0	15810	23000
TOTAL		170	170	0	170	93	135	0	0	23000	0	0	0	0	15810	23000
Arendtsville	*Arendtsville*	733	785	52	785	48	111	2496	5772	**114900**	33329	1032	3352	6464	71865	121364
"	Butler	99	200	101	200	48	111	4848	11211			440	5024	11068	9776	11068
"	Franklin	14	50	36	50	48	111	1728	3996				1642	3796	2314	3796
TOTAL		846	1035	189	1035	144	333	9072	20979	114900	33329	1472	10017	21328	83954	136228
Beaver Cr.	*Abbottstown*	125	125		125	64	104	0	0			0	0	0	8000	0
"	Berwick	375	375		375	64	104	0	0	**52000**			0	0	24000	52000
TOTAL		500	500	0	500	128	208	0	0	52000	0	0	0	0	32000	52000
Biglerville	*Biglerville*	1050	1100	50	1100	53	111	2650	5550	**302000**	122723	4244	6549	9304	184922	311304
"	Butler	150	300	150	300	53	111	7950	16650			7057	14257	22522	22207	22522
TOTAL		1200	1400	200	1400	106	222	10600	22200	302000	122723	11301	20806	31826	207129	333826
Bonneauville	*Bonneauvill e*	1445	1900	455	1900	40	111	18200	50505	**176000**	46272	4691	21746	52436	125818	228436
"	Mt. Pleasant	586	800	214	800	40	111	8560	23754			750	8845	23279	32285	23279
TOTAL		2031	2700	669	2700	80	222	26760	74259	176000	46272	5441	30591	75715	158103	251715
Bendersville	*Bendersville*	573	620	47	620	76	111	3572	5217	**104700**	35847	-20509	-16090	-14527	63305	90173
"	Menallen	44	200	156	200	76	111	11856	17316			30500	40238	45425	43582	45425
TOTAL		617	820	203	820	152	222	15428	22533	104700	35847	9991	24148	30898	106887	135598
Childrens	Berwick	64	64		64	45	111	0	0	**4162**			0	0	2880	4162
TOTAL		64	64	0	64	45	111	0	0	4162	0	0	0	0	2880	4162
Chesapeake	Mt. Pleasant	470	470	0	470	42	49	0	0	22876			0	0	19740	22876
TOTAL		470	470	0	470	42	49	0	0	22876	0	0	0	0	19740	22876

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Centennial	Mt. Pleasant	0	750	750	750	76	111	57000	83250			8750	62463	87400	62463	87400
TOTAL		0	750	750	750	76	111	57000	83250	0	0	8750	62463	87400	62463	87400
Cavalry Heights	Mt. Pleasant	80	80	0	80	50	88	0	0	7000			0	0	4000	7000
"	Straban	51	120	69	120	120	136	8280	9384	7880			7866	8915	13986	16795
TOTAL		131	200	69	200	170	224	8280	9384	14880	0	0	7866	8915	17986	23795
Citizens Uts.	Mount Joy	1096	1250	154	1250	51	111	7854	17094	**187100**	8743	60800	65221	73999	129860	261099
"	Mt. Pleasant	537	650	113	650	51	111	5763	12543			200	5665	12106	33052	12106
"	Straban	256	350	94	350	51	111	4794	10434				4554	9912	17610	9912
TOTAL		1889	2250	361	2250	153	333	18411	40071	187100	8743	61000	75440	96017	180522	283117
East Berlin	*East Berlin*	1345	1700	355	1700	76	111	26980	39405	151300	8533	8770	33963	45766	144716	197066
TOTAL		1345	1700	355	1700	76	111	26980	39405	151300	8533	8770	33963	45766	144716	197066
Fairplay	Freedom	0	100	100	100	76	111	7600	11100			3200	10260	13585	10260	13585
TOTAL		0	100	100	100	76	111	7600	11100	0	0	3200	10260	13585	10260	13585
Fairfield	*Carroll Valley*	13	50	37	50	46	111	1702	4107				1617	3902	2215	3902
"	*Fairfield*	530	850	320	850	46	111	14720	35520	**108000**	31734	2775	16620	36380	72734	144380
"	Hamiltonban	218	370	152	370	46	111	6992	16872			3180	9663	19049	19691	19049
TOTAL		761	1270	509	1270	138	333	23414	56499	108000	31734	5955	27901	59331	94641	167331
Franklin	Franklin	403	500	97	500	26	111	2522	10767	44500	6404	1119	3459	11292	20341	55792
TOTAL		403	500	97	500	26	111	2522	10767	44500	6404	1119	3459	11292	20341	55792
Gardners	Tyrone	0	200	200	200	76	111	15200	22200			2000	16340	22990	16340	22990
TOTAL		0	200	200	200	76	111	15200	22200	0	0	2000	16340	22990	16340	22990

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Gettysburg	*Gettysburg*	7124	7100	24	7100	42	111	1008	2664	**1838000**	1075538	76749	71954	70381	1446700	1908381
"	Cumberland	2181	2700	519	2700	42	111	21798	57609			19605	39333	73353	130935	73353
"	Straban	1164	2200	1036	2200	42	111	43512	114996			75937	113477	181386	162365	181386
TOTAL		10469	12000	1531	12000	126	333	64302	169941	1838000	1075538	172291	224764	325120	1740000	2163120
Green Springs	Berwick	0	786	786	786	76	111	59736	87246			1300	57984	84119	57984	84119
TOTAL		0	786	786	786	76	111	59736	87246	0	0	1300	57984	84119	57984	84119
Hampton	Reading	0	1000	1000	1000	76	111	76000	111000			8450	80228	113478	80228	113478
TOTAL		0	1000	1000	1000	76	111	76000	111000	0	0	8450	80228	113478	80228	113478
Heidlersburg	Tyrone	0	200	200	200	76	111	15200	22200			3700	17955	24605	17955	24605
TOTAL		0	200	200	200	76	111	15200	22200	0	0	3700	17955	24605	17955	24605
Hoffman Homes	Mount Joy	256	256	0	256	54	129	0	0	33100			0	0	13824	33100
TOTAL		256	256	0	256	54	129	0	0	33100	0	0	0	0	13824	33100
Hanover	*McSherrystown*	2916	3050	134	3050	76	111	10184	14874	**1292000**	807686	3076	12597	17053	1041899	1309053
"	Berwick	0	250	250	250	76	111	19000	27750			1440	19418	27731	19418	27731
"	Conewago	5201	7400	2199	7400	76	111	167124	244089			19810	177587	250704	572863	250704
TOTAL		8117	10700	2583	10700	228	333	196308	286713	1292000	807686	24326	209602	295487	1634180	1587487
Hillside Rest	Hamiltonban	45	45	0	45	63	84	0	0	3800			0	0	2835	3800
TOTAL		45	45	0	45	63	84	0	0	3800	0	0	0	0	2835	3800
Hunterstown	Straban	0	500	500	500	76	111	38000	55500			2000	38000	54625	38000	54625
TOTAL		0	500	500	500	76	111	38000	55500	0	0	2000	38000	54625	38000	54625
Lincoln Est.	Cumberland	450	450		450	96	109	0	0	49000			0	0	43200	49000
TOTAL		450	450	0	450	96	109	0	0	49000	0	0	0	0	43200	49000

Table 10D Projected 2010 Water Needs by Community Water System Adams County Water Supply Plan Adams County Office of Planning and Development																
System	**Municipality**	**1997 Served**	**2010 Served**	**Total Addit. 2010 Pers. Served**	**Total 2010 Pers. Served**	**Avg. Daily/ Person (gpd)[1]**	**Peak Daily/ Person (gpd)[2]**	**Avg. Daily New Resid. (gpd)**	**Peak Daily New Resid. (gpd)**	**1997 Peak Daily Total (gpd)**	**1997 Non-Resid. (gpd)**	**New Non-Resid. (gpd)**	**Avg. Daily New Total (gpd) 3**	**Peak Daily New Total (gpd) [3]**	**Total Avg. Daily (gpd)[4]**	**Total Peak Daily (gpd)[5]**
Littlestown	*Littlestown*	3659	4500	841	4500	76	111	63916	93351	**420320**	28499	17870	77697	105660	384280	525980
"	Germany	65	500	435	500	76	111	33060	48285				31407	45871	36347	45871
"	Union	455	1200	745	1200	76	111	56620	82695			1122	54855	79626	89435	79626
TOTAL		4179	6200	2021	6200	228	333	153596	224331	420320	28499	18992	163959	231157	510062	651477
Lake Meade	Latimore	665	900	235	900	63	149	14805	35015				14065	33264	55960	33264
"	Reading	1754	2100	346	2100	63	149	21798	51554	**553000**	81273	1300	21943	50211	213718	603211
TOTAL		2419	3000	581	3000	126	298	36603	86569	553000	81273	1300	36008	83476	269678	636476
Mountainview	Reading	177	177	0	177	38	64	0	0	11321			0	0	6726	11321
TOTAL		177	177	0	177	38	64	0	0	11321	0	0	0	0	6726	11321
Meadows	Cumberland	90	90		90	71	106	0	0	9500			0	0	6390	9500
TOTAL		90	90	0	90	71	106	0	0	9500	0	0	0	0	6390	9500
New Oxford MA	*New Oxford*	1731	1850	119	1850	51	111	6069	13209	**1184000**	558182	-2685	3215	9998	649678	1193998
"	Berwick	0	100	100	100	51	111	5100	11100			38500	41420	47120	41420	47120
"	Hamilton	0	500	500	500	51	111	25500	55500			4000	28025	56525	28025	56525
"	Oxford	2653	4153	1500	4153	51	111	76500	166500			14257	86219	171719	221522	171719
TOTAL		4384	6603	2219	6603	204	444	113169	246309	1184000	558182	54072	158879	285362	940645	1469362
New Oxford MHV	Mt. Pleasant	350	350	0	350	51	66	0	0	23000			0	0	17850	23000
TOTAL		350	350	0	350	51	66	0	0	23000	0	0	0	0	17850	23000
Orrtanna	Franklin	0	226	226	226	76	111	17176	25086			5200	21257	28772	21257	28772
"	Hamiltonba n	0	155	155	155	76	111	11780	17205				11191	16345	11191	16345
TOTAL		0	381	381	381	152	222	28956	42291	0	0	5200	32448	45116	32448	45116
Oak Village	Straban	300	300	0	300	49	69	0	0				0	0	14700	0
TOTAL		300	300	0	300	49	69	0	0	0	0	0	0	0	14700	0
Piney Mountain	Franklin	124	124		124	150	386	0	0	47900			0	0	18600	47900
TOTAL		124	124	0	124	150	386	0	0	47900	0	0	0	0	18600	47900

Table 10D Projected 2010 Water Needs by Community Water System Adams County Water Supply Plan Adams County Office of Planning and Development																
System	Municipality	1997 Served	2010 Served	Total Addit. 2010 Pers. Served	Total 2010 Pers. Served	Avg. Daily/ Person (gpd)[1]	Peak Daily/ Person (gpd)[2]	Avg. Daily New Resid. (gpd)	Peak Daily New Resid. (gpd)	1997 Peak Daily Total (gpd)	1997 Non-Resid. (gpd)	New Non-Resid. (gpd)	Avg. Daily New Total (gpd) 3	Peak Daily New Total (gpd)[3]	Total Avg. Daily (gpd)[4]	Total Peak Daily (gpd)[5]
Panorama	Oxford	70	70	0	70	58	78	0	0	5483			0	0	4060	5483
TOTAL		70	70	0	70	58	78	0	0	5483	0	0	0	0	4060	5483
Pine Run	Hamilton	26	125	99	125	69	111	6831	10989	2886			6489	10440	8283	13326
TOTAL		26	125	99	125	69	111	6831	10989	2886	0	0	6489	10440	8283	13326
Private	Butler	0	230	230	230	76	111	17480	25530				16606	24254	16606	24254
Private	Freedom	0	1500	1500	1500	76	111	114000	166500				108300	158175	108300	158175
Private	Germany	0	300	300	300	76	111	22800	33300				21660	31635	21660	31635
Private	Hamilton	0	525	525	525	76	111	39900	58275				37905	55361	37905	55361
Private	Huntington	0	300	300	300	76	111	22800	33300				21660	31635	21660	31635
Private	Oxford	0	300	300	300	76	111	22800	33300				21660	31635	21660	31635
TOTAL		0	3155	3155	3155	456	666	239780	350205	0	0	0	227791	332695	227791	332695
Possum Valley	Menallen	303	400	97	400	58	128	5626	12416	54000	7026	4600	9715	16165	34315	70165
TOTAL		303	400	97	400	58	128	5626	12416	54000	7026	4600	9715	16165	34315	70165
Round Top	Cumberland	200	200		200	76	182	0	0	42400	5914		0	0	21114	42400
TOTAL		200	200	0	200	76	182	0	0	42400	5914	0	0	0	21114	42400
Section A	*Carroll Valley*	254	600	346	600	126	165	43596	57090	42000		2000	43316	56136	75320	98136
TOTAL		254	600	346	600	126	165	43596	57090	42000	0	2000	43316	56136	75320	98136
Stockham's	Reading	200	200	0	200	61	85	0	0	17000			0	0	12200	17000
TOTAL		200	200	0	200	61	85	0	0	17000	0	0	0	0	12200	17000
Timeless Towns	Cumberland	300	300		300	76	113	0	0	34000	3035		0	0	25835	34000
TOTAL		300	300	0	300	76	113	0	0	34000	3035	0	0	0	25835	34000
Walnut Grove	Tyrone	234	335	101	335	56	111	5656	11211	19000			5373	10650	18477	29650
TOTAL		234	335	101	335	56	111	5656	11211	19000	0	0	5373	10650	18477	29650

Table 10D
Projected 2010 Water Needs by Community Water System
Adams County Water Supply Plan
Adams County Office of Planning and Development

System	Municipality	1997 Served	2010 Served	Total Addit. 2010 Pers. Served	Total 2010 Pers. Served	Avg. Daily/ Person (gpd)[1]	Peak Daily/ Person (gpd)[2]	Avg. Daily New Resid. (gpd)	Peak Daily New Resid. (gpd)	1997 Peak Daily Total (gpd)	1997 Non-Resid. (gpd)	New Non-Resid. (gpd)	Avg. Daily New Total (gpd) 3	Peak Daily New Total (gpd) [3]	Total Avg. Daily (gpd)[4]	Total Peak Daily (gpd)[5]
York Springs	*York Springs*	554	640	86	640	90	111	7740	9546	**90684**		1108	8406	10121	58266	100805
"	Huntington	17	400	383	400	90	111	34470	42513				32747	40387	34277	40387
"	Latimore	118	200	82	200	90	111	7380	9102				7011	8647	17631	8647
TOTAL		689	1240	551	1240	270	333	49590	61161	90684	0	1108	48163	59156	110173	149840

1 Based on existing system average daily water use
2 Based on DEP recommended peak daily water use per household of 300 gpd/2.7 average Adams Co. household size (=111 gpd), except for systems with higher peak use; proposed new systems & systems with unknown average or peak daily water use are assumed to use County-wide ratio of average to peak daily water use of 1:1.46
3 Average & peak daily new residential & non-residential water needs x .95 as a conservation factor
4 Average daily new water needs plus existing average daily water needs
5 Peak daily new water needs plus existing peak daily water needs (latter reflected in major system municipality only)
bolded = under peak columns, total for all municipalities served by system

2. ADEQUACY OF WATER SOURCE

The adequacy of water sources is evaluated in Table 11. In this table, "safe yield" is used to determine the ability of each system to meet peak daily water needs in 1997 and for the year 2010. Water deficits or surpluses are noted for 1997 and 2010. Peak daily water needs may also be met through provision of adequate storage, as discussed in section 4, which follows. In addition, each system is evaluated with respect to its ability to supply adequate water in the event that its single best source should go out of service. For this reason, the availability of more than one water supply source with the ability to meet 2010 average daily needs is evaluated. System operators were also asked whether there is a DEP-approved Emergency Response Plan, an on-site emergency power generator, and a contractual arrangement for an alternate water source in an emergency, available for use. Emergency Response Plans address much more than adequacy of source. Such plans should be reviewed regularly for consistency with DEP's Public Water Supply Manual – Part VI Emergency Response. Finally, Table 11 notes systems that could potentially be interconnected with other systems (located within approximately one mile of each other), providing for emergency if not supplemental water needs.

Of the 36 community water systems serving Adams County, 29, or 81% of the total, are considered to have safe yields which are adequate to meet current peak water needs. Five of these have more than 100,000 gpd in residual water availability. Several systems have unknown safe yields; therefore, the adequacy of these water sources cannot be determined. Historic source pumping data is available for most of these systems, which shows adequate pumping capacity to meet projected year 2010 peak water needs. However, pumping capacity very often exceeds safe yield and is not a good substitute for safe yield data. These systems are noted with an "a", which means "approximated" in the Deficit/Surplus column (see inset on next page). As noted in Chapter II, where water production limitations during the drought of 1999 indicate that source pumping data is not reflective of safe yield, system operators were contacted for summer 1999 production records and other pertinent data to devise more accurate estimates for safe yields. Six systems have inadequate safe yields to meet current peak water needs. Four additional DEP-identified drought-affected systems that show surplus water for 1997 (and two for 2010) may also have inadequate safe yields, despite apparent surpluses. This discrepancy can be explained in part by the two different time periods involved; the surpluses were calculated for 1996/1997 while drought shortfalls were noted in 1999, when demand was likely higher. Beyond this, any remaining discrepancies should alert system operators to the need to re-evaluate safe yields. Projected year 2010 peak water needs are anticipated to be able to be met by all but 10 of water systems. Again, the future adequacy of the systems with unknown safe yields cannot be fully evaluated. While insufficient safe yields may not be a problem during most times of the year, during droughts these systems may not be able to rely on sustained yields from their water sources to meet demand. It is recommended that safe yield be determined for these systems.

Table 11
Adequacy of Community Water Source
Adams County Water Supply Plan
Adams County Office of Planning and Development

Community Water System	PWS ID (1)	Safe Yield					Emergency Response Measures			Potential Interconnect (4)
		1997		2010						
		Adequate	Deficit/ Surplus (gpd) (2)	Adequate	Deficit/ Surplus (gpd) (2)	Adequate w/Best Source Out of Service (3)	Plan	Emer. Power Gen.	Alternate Water Provision	
Abbottstown Municipal Authority	31	X	85,362e	X	(-21,822)e	no	-	-	-	43, 51
Anchor MHP Association	17	X	27,000a	X	27,000a	no	X	no	no	
Arendtsville Municipal Water Co.	1	X	57,100	X	35,772	X	X	no	no	
Beaver Creek MHP	43	no	(-2,000)	no	(-2,000)	no	no	X	no	31, 51
Bendersville Water Co.	2	no	(-23,227)	no	(-53,099)	no	X	no	no	34
Biglerville Water Co.	20	X	14,000	no	(-17,826)	no	X	no	no	
Bonneauville Municipal Authority	12	no	(-60,800)	no	(-136,515)	no	X	no	no	39
Castle Hill MHP	14	X	13,720a	X	4,805a	no	X	no	no	
Cavalry Heights MHP	39	X	1,000	X	1,000	no	X	no	no	12, 35
Chesapeake Estates MHP	41	X	171,644a	X 171,644a	171,644a	X	X	no	no	23, 25
Childrens Development Center	51	unknown	unknown	unknown	Unknown	Unknown	-	-	-	31, 43
Citizens Utilities Water Co.	35	X	172,900	X	76,883	no	X	no	no	39
East Berlin Boro Water	3	no	(-37,484)	no	(-83,250)	no	X	no	X(not spec.)	29
Fairfield Municipal Authority	5	X	32,000	no	(-27,331)	no	X	no	Ft. Det.	33 & Ft. D.
Franklin Twp. Municipal Authority	32	X	27,500	X	16,208	no	-	-	-	
Gettysurg Municipal Authority	19	X	92,000*	no	(-233,120)*	no	X	X(p)	no	38, 44
Hillside Rest Home	6	X	200+	X	200+	X	-	-	-	
Hoffman Homes for Youth	21	no	(-13,100)	no	(-13,000)	no	X	X	no	
Lake Meade Municipal Authority	36	X	159,400	X	75,925	no	X	X	X(Hanover)	
Lincoln Estates MHP	38	X	38,000	X	38,000	no	no	no	no	19
Littlestown Municipal Authority	22	no	(-66,724)	no	(-297,881)	no	-	-	-	
Meadows Property Owners Assn.	44	X	55,500	X	55,500	no	X	no	no	19
Mountainview MHP	29	X	10,279	X	10,279	no	X	no	no	3
New Oxford Manor MHV	23	X	0	X	0	no	X	X	no	25, 41
New Oxford Municipal Authority	25	X	16,000	no	(-269,362)	no	-	-	-	23, 28, 41
Oak Village MHP	11	X	43,660	X	43,660	X	-	-	-	
Panorama MHP	28	X	14,277	X	14,277	X	no	X	no	25
Pine Run Inc.	52	X	31,109a	X	29,932ae	no	X	X(o)	no	
Piney Mountain Home Est.	7	X	110,100	X	110,100	X	X	X	no	
Possum Valley Municipal Authority	34	X	22,000	X	5,835	X	X	X	no	2
Round Top MHP & Camp	46	X	15,200a	X	15,200a	no	X	-	no	
Section A Water Corp.	33	X	58,000	X	1,864	no	-	-	-	5
Stockham's Village (MHP)	24	X	22,800	X	22,800	no	-	-	no	
Timeless Towns of America	48	X	9,920	X	9,920	X	X	no	no	
Walnut Grove MHP	53	X	39,000	X	28,350	no	X	no	no	
York Springs Municipal Authority	30	X	277,559e	X	218,404e	no	no	no	no	
County Totals	36	29	-	25	-	8	23	9	3	19 systems
Countywide Percent	100	81%	-	69%	-	22%	64%	25%	8%	53%

(1) Public Water System identification number (last two digits)
(2) Adequacy of safe yield to meet peak water needs
(3) Adequacy of safe yield to meet average water needs
(4) For systems within approximately one mile of another system
\- = no survey response
o = available off-site
p = partial for system
e = estimated (unknown existing peak water use)
a = approximated (unknown safe yields)
* This system added a new source in 2000 which would add another 200,000 gpd in safe yield capacity to these figures.

Of the 36 water systems, seven, or 19% of the total, utilize single wells as their water source, and one uses a single surface source. Should any of these sources go out of service for any reason, these systems will produce no water. In addition, another 19 water systems with more than one well have inadequate safe yields to meet average 2010 water needs with their best source out of service. The seven systems with more than one well that have one or more unknown safe well yields cannot be fully evaluated for adequacy in the event the best source of any of them is out of service; however, source pumping data for three of these systems indicates that there probably would be adequate yield. This leaves 8 systems, or 22%, with anticipated adequate 2010 safe yields should any of their best sources be out of service. Two systems – Gettysburg and Possum Valley – responded in surveys that they have experienced water shortfalls in times of drought. However, DEP reports that several additional systems thereafter experienced drought shortfalls in the summer of 1999.

Under the provisions of the Pennsylvania Safe Drinking Water Act Regulations §109-707, each community water system is required to develop an Emergency Response Plan (ERP) to establish procedures for a variety of emergencies. Twenty-three systems, or 64%, indicated that they have a DEP-approved ERP. The purpose of the ERP is to establish contingency measures to be followed in the event of potential contamination and possible structural, equipment, natural and other failures that could endanger the water supply. According to DEP's regional office, most ERPs have not been kept current and many are inadequate. The DEP offers a course on developing ERPs which community water systems may avail themselves of. The minimum requirements of an emergency response plan are summarized in Appendix C. Only nine systems, or 25%, responded that they have an emergency power generator, most of which are present on-site. Just three systems, or eight percent, have a contractual arrangement for an alternate water source in the event of an emergency.

Finally, besides the one system that presently has an emergency interconnection, 18 additional community water systems have the potential for an emergency interconnection as they lie within approximately one mile of one or more other systems.

DROUGHT OF RECORD

For the second time in its history, the Susquehanna River Basin Commission declared a drought emergency in the summer of 1999 for most of the basin, including Adams County. Significant precipitation deficits throughout the basin resulted in record low groundwater levels and record low streamflows. The impact of the drought was felt particularly by the Gettysburg, Littlestown, Arendtsville, Bendersville and New Oxford Manor systems, which experienced difficulty meeting water demand during this period and on which DEP imposed mandatory water restriction. For the Gettysburg system, this difficulty was likely due to the significant reliance on its surface water source. The Arendtsville system has a safe yield which is close to its peak daily water use level. For the Littlestown and Bendersville systems the shortfall could have been anticipated with safe yield data that would have alerted the systems to the potential problem. Systems that have not determined safe groundwater yields - a conservative measure of water availability in times of drought – will continue to be unprepared for future droughts and water shortages. The experience of Littlestown and Bendersville underscores the need for the County's nine community water systems with unknown safe yields to take stock of their groundwater availability in times of drought, and, if needed, plan for additional water sources. Several other systems, including Bonneauville, Franklin Township, East Berlin and New Oxford also experienced more moderate water shortfalls, in most cases related to safe yields only slightly above peak daily water use levels or, in one case, under peak water use levels.

3. ADEQUACY OF WATER TREATMENT

All of Adams County's community water systems are subject to the requirements of the federal Safe Drinking Water Act (SDWA) and amendments and the Pennsylvania Safe Drinking Water Act and Regulations, which set forth monitoring requirements, programs and rules to protect drinking water quality (see Appendix D). These requirements are set forth specifically in the PA Safe Drinking Water Act and Regulations. The DEP divides community water systems into three categories based on population served. Small systems serve 3,300 or fewer persons, medium systems serve between 3,301 and 10,000 persons, and large systems serve more than 10,000 persons. All but three of the community water systems in Adams County are small, while the Littlestown and New Oxford systems are considered medium, and the Gettysburg system is considered large. Monitoring regulations for some contaminants differ somewhat for water systems based on the size of the system.

Table 12 provides data on adequacy of water treatment. All of the County's 36 community water systems provide disinfection, as they are minimally required to do. In addition, 15 others provide further treatment, including corrosion control, taste/odor control, softening, and the removal of manganese, organics, inorganics, particulates, and radionuclides. Two systems – Gettysburg and New Oxford - provide filtration; both of these systems use surface water sources. Water quality compliance is difficult to evaluate, as systems that are usually in compliance may occasionally be found in noncompliance. Normally, noted problems are rectified immediately. Of the County's 36 community water systems, seven have been found, during one or more monitoring periods in the last three years (1996-98) to be in noncompliance with current water quality standards. The table notes the areas in which maximum contaminant levels or action levels have been exceeded or violated. Exceedences indicate individual monitoring test results (often taken quarterly) that are above action levels or maximum contaminant levels. Violations reflect either single sample high contaminant levels or monitoring results over the course of a year, which average above action levels or maximum contaminant levels. Therefore, one or more exceedences for a contaminant may or may not result in a violation at year's end. The most frequently occurring exceedence in the County is for lead.

Table 12 further evaluates the potential for surface water influence on groundwater sources. Community water systems that utilize wells or springs that are surface water influenced must provide for filtration of the water supply or locate alternative water sources. For this reason, some systems have abandoned surface water-influenced sources in recent years. The DEP has evaluated 35, or 97% of the County's systems for surface water influence. Those systems influenced by surface water usually exhibit one or more of the following indicators:

1. The well is within 200 feet of a surface water source.

2. The well is less than 50 feet deep or of unknown depth.

3. The well water becomes cloudy or turbid, and undergoes changes in temperature after a storm event.

Table 12 Adequacy of Community Water Treatment Adams County Water Supply Plan Adams County Office of Planning and Development						
	Existing Treatment			Surface Water Influence		
Community Water System	Treatment (1)	Water Quality Compliance	AL/MCL Exceedences (2)	Evaluated	Influenced	Indicators
Abbottstown Municipal Authority	D	X				
Anchor MHP Association	D,M	X		X	no	
Arendtsville Municipal Water Co.	D,C	X (3)		X	no	w/in 200' of surface water
Beaver Creek MHP	D	X (4)		X	no	w/in 200' of surface water
Bendersville Water Co.	D,C		asbestos	X	X	w/in 200' of surface water
Biglerville Water Co.	D	X (4)		X	no	w/in 200' of surface water
Bonneauville Municipal Authority	D	X		X	no	
Castle Hill MHP	D		nitrates	X	no	
Cavalry Heights MHP	D	X		X	no	
Chesapeake Estates MHP	D	X		X	maybe	w/in 200' of surface water
Childrens Development Center	D		copper/lead	X	no	
Citizens Utilities Water Co.	D	X		X	no	w/in 200' of surface water
East Berlin Boro Water	D		lead/copper	X	no	w/in 200' of surface water
Fairfield Municipal Authority	D	X		X	no	w/in 200' of surface water
Franklin Twp. Municipal Authority	D	X		X	no	
Gettysurg Municipal Authority	D,P,T,S,C,I	X		X	no	surface source
Hillside Rest Home	D,C	X		X	no	
Hoffman Homes for Youth	D,S	X		X	no	
Lake Meade Municipal Authority	D,R	X		X	no	
Lincoln Estates MHP	D,S	X		X	no	
Littlestown Municipal Authority	D	X		X	maybe	
Meadows Property Owners Assn.	D,S	X		X	no	
Mountainview MHP	D	X		X	no	
New Oxford Manor MHV	D	X		X	no	
New Oxford Municipal Authority	D,T,P,O,C		SOC (5)	X	NA	surface source
Oak Village MHP	D	X		X	no	
Panorama MHP	D	X		X	no	
Pine Run Inc.	D,P	X		X	no	w/in 200' of surface water
Piney Mountain Home Est.	D,C		copper/lead	X	no	w/in 200' of surface water
Possum Valley Municipal Authority	D,C	X		X	X	
Round Top MHP & Camp	D,C	X		X	maybe	
Section A Water Corp.	D	X		X	missing data	
Stockham's Village (MHP)	D	X		X	no	
Timeless Towns of America	D		lead	X	no	
Walnut Grove MHP	D,S	X		X	no	
York Springs Municipal Authority	D	X		X	no	w/in 200' of surface water
County Totals	36	29	7	35	2/ 3maybe	11
Countywide Percent	100%	81%	19%	97%	6/ 8%	31%

(1) D = disinfection, M = manganese removal, C = corrosion control, P = particulate removal, T = taste/odor control,
S = softening, I = inorganics removal, R = radionuclides removal
(2) Action levels or maxim contaminant levels exceeded in last three years (1996-98)
(3) System has leaded joints
(4) System has lead lines
(5) Synthetic Organic Compounds

Of the 35 systems which have been evaluated for surface water influence, the Bendersville and Possum Valley systems are noted to be so influenced, and the Littlestown, Chesapeake Estates and Round Top systems may be influenced and are undergoing additional testing. One system lacks data, and the remaining systems are not influenced or probably not influenced by surface water.

4. ADEQUACY OF FINISHED WATER STORAGE

Adequacy of finished water storage is evaluated in Table 13. Storage adequacy is evaluated both with respect to the need for water for human consumption and for firefighting purposes. The PA DEP recommends that finished water storage for domestic demands be between one day's average and one day's peak water use, depending upon safe yield. The DEP also recommends that community water systems evaluate their own water needs for firefighting purposes using the requirements of the Insurance Services Office (ISO), the Iowa State University method, or the Illinois Institute of Technology Research Institute method. However, in the absence of data about the existence of any such evaluations, this Plan makes its own recommendations for water storage for firefighting purposes. Recommended standards for systems providing fire protection include adequate supply for domestic demands. The typical fire-fighting reserve capacities are 60,000 gallons for residential uses (based on 500 gpm for two hours), 120,000 gallons for typical commercial and institutional uses (based on 1,000 gpm for two hours), or 180,000 for typical industrial users (based on 1,500 gpm for two hours). Fire flow storage capacity shown in Table 13 represents the amount of water remaining after distribution storage is accounted for.

An evaluation of the adequacy of finished water storage that considers safe yield is presented in Chapter IV. Table 13 evaluates minimal storage adequacy based on existing storage alone. Eighteen of the County's 36 community water systems, or 50%, currently have adequate distribution storage capacity for one day’s average water use, while 18 other systems do not. Three systems lack any storage at all, while another three have storage of fewer than 1,000 gallons. All size systems are represented among those with storage deficiencies. By the year 2010, adequate finished water storage for human consumption decreases to 17 or 47% of the County's community water systems.

Ten of the County's 36 community water systems, or 28%, currently have adequate fire flow storage capacity. Of the 18 systems that have fire hydrants, 9 have adequate storage capacity and 9 do not. An additional system (Childrens Development Center) without hydrants has a separate tank for fire fighting purposes that is adequate to meet needs. Of the 18 systems without fire hydrants, 6 others have adequate storage capacity and 12 do not. By the year 2010, 10 or 28% of the County’s community water systems are projected to have sufficient water storage for firefighting purposes.

Table 13 Adequacy of Community Finished Water Storage Adams County Water Supply Plan Adams County Office of Planning and Development								
	Distribution Storage Capacity (1)				Additional Fire Flow Storage Capacity (2)			
	1997		2010		1997		2010	
Community Water Systems	Adequate	Deficit/Surplus (gal)	Adequate	Deficit/Surplus (gal)	Adequate	Deficit/Surplus (gal)	Adequate	Deficit/Surplus (gal)
Abbottstown Municipal Authority	no	(-43,221)	no	(-126,916)	no	(-223,221)	no	(-3061916)
Anchor MHP Association	no	(-10,470)	no	(-10,470)	NA	NA	NA	NA
Arendtsville Municipal Water Co.	X	226,063	X	216,045	X	106,063	X	96,045
Beaver Creek MHP	no	(-26,593)	no	(-26,593)	NA	NA	NA	NA
Bendersville Water Co.	no	(-82,739)	no	(-105,861)	no	(-262,739)	no	(-285,861)
Biglerville Water Co.	X	326,403	X	305,597	X	146,403	X	125,597
Bonneauville Municipal Authority	no	(-27,512)	no	(-58,103)	no	(-147,512)	no	(-178,103)
Castle Hill MHP	no	(-5,669)	no	(-13,535)	NA	NA	NA	NA
Cavalry Heights MHP	X	4,000	X	4,000	NA	NA	NA	NA
Chesapeake Estates MHP	no	(-12,532)	no	(-12,532)	NA	NA	NA	NA
Childrens Development Center (3)	no	(-2,751)	no	(-2,751)	X	7,149	X	7,149
Citizens Utilities Water Co.	no	(-45,082)	no	(-120,522)	NA	NA	NA	NA
East Berlin Boro Water	X	277,247	X	243,284	X	92,247	X	63,284
Fairfield Municipal Authority	X	173,260	X	145,360	no	(-6,740)	no	(-34,640)
Franklin Twp. Municipal Authority	no	(-16,882)	no	(-20,390)	NA	NA	NA	NA
Gettysurg Municipal Authority	X	1,509,764	X	1,279,494	X	1,329,764	X	1,099,494
Hillside Rest Home	no	(-2,627)	no	(-2,627)	NA	NA	NA	NA
Hoffman Homes for Youth	X	61,143	X	61,143	no	(-58,857)	no	(-58,857)
Lake Meade Municipal Authority	X	190,330	X	154,322	X	70,330	X	34,322
Lincoln Estates MHP	X	11,000	X	11,000	NA	NA	NA	NA
Littlestown Municipal Authority	X	553,897	X	389,938	X	373,897	X	209,938
Meadows Property Owners Assn.	no	(-5,202)	no	(-5,202)	no	(-65,202)	no	(-65,202)
Mountainview MHP	no	(-5,483)	no	(-5,483)	NA	NA	NA	NA
New Oxford Manor MHV	X	15,500	X	15,500	NA	NA	NA	NA
New Oxford Municipal Authority	X	957,690	X	759,351	X	777,690	X	579,351
Oak Village MHP	X	26,061	X	26,061	NA	NA	NA	NA
Panorama MHP	no	(-2,034)	no	(-2,034)	NA	NA	NA	NA
Pine Run Inc.	X	48,200	X	41,711	NA	NA	NA	NA
Piney Mountain Home Est.	X	106,409	X	106,409	no	(-13,591)	no	(-13,591)
Possum Valley Municipal Authority	no	(-24,600)	no	(-34,315)	no	(-204,600)	no	(-214,315)
Round Top MHP & Camp	no	(-3,114)	no	(-3,114)	NA	NA	NA	NA
Section A Water Corp.	X	17,962	no	(-25,354)	NA	NA	NA	NA
Stockham's Village (MHP)	no	(-8,105)	no	(-8,105)	NA	NA	NA	NA
Timeless Towns of America	X	124,165	X	124,165	X	4,165	X	4,165
Walnut Grove MHP	X	148,000	X	142,627	X	88,000	X	82,627
York Springs Municipal Authority	no	(-62,112)	no	(-110,276)	No	(-122,112)	no	(-170,276)
Countywide Totals	18	-	17	-	10	-	10	-
Countywide Percent Adequate	50%	-	47%	-	28%	-	28%	-

(1) Equal to average daily water use

(2) For systems with hydrants, capacity computed after consideration of distribution storage, as follows: 60,000 gallons for systems with residential uses only; 120,000 gallons for systems with institutional and commercial uses; and 180,000 gallons for systems with industrial uses. NA = not applicable to systems without hydrants. However, for Childrens Development Center, values based on average daily water use (see footnote 3).

(3) A 10,000-gallon tank for emergency fire use is not considered connected to distribution system.

5. ADEQUACY OF PUMPING AND DISTRIBUTION SYSTEMS

Table 14 evaluates the adequacy of source and transmission pumping and distribution systems. Thirty-three systems, or 92%, have adequate source pumping capabilities to meet projected year 2010 peak day needs. Of the 13 systems with pumping stations, at least six have adequate capability to meet year 2010 needs, while seven have unknown pumping capacities or pumping capacities less than peak daily 2010 water needs. Pumping capacity which is less than anticipated needs is only a problem if future water needs to be pumped rather than delivered by gravity.

Pumping equipment should be provided in duplicate. All but one of the systems with pumping stations have two or more pumps.

The evaluation of system distribution lines was done largely for purposes of assessing fire protection capabilities and is based primarily on survey responses. Eighteen systems indicate that they have hydrants used for fire protection. Number of hydrants is noted in parentheses where this information was supplied. The remaining systems presumably rely on public tanker trucks or local surface sources, such as farm ponds.

Only those water systems utilizing fire hydrants or with the potential to be interconnected to other systems were evaluated for adequate piping diameter, which is six inches. For fire hydrant systems, four of the 18 systems meet this standard, while 12 have some piping that meets the standard, and two systems have inadequate piping diameter. For the 19 systems with the potential for interconnections (within one mile of another system), three meet this standard while eight have some piping that meets this standard, and eight have inadequate piping diameter.

Of the 28 systems for which surveys were returned, 23 systems indicate that they provide adequate pressure (minimum 20 psi under all conditions, including fire), while one indicates inadequate pressure and four indicate unknown pressure. Of the responding systems, 15 state that they have blow-off valves and 13 do not. At least eight systems lack both blow-off valves and hydrants, most of them are mobile home parks; blow-off valves or hydrants are important to enable the periodic flushing of the system. Finally, 23 systems, or 64%, indicate on annual water supply reports that they have approved cross-connection control programs to minimize the potential for contaminated water entering the system.

6. ADEQUACY OF OPERATIONAL MANAGEMENT

The adequacy of system management is assessed in Table 15 based on size of the system, operations, recordkeeping and financial factors. As noted in the preceding Section 3, Adams County has one large system and two medium systems, while the rest are small systems. Larger systems often experience economies of scale that promote cost-effective operation and professional management.

Table 14
Adequacy of Community Pumping and Distribution Systems
Adams County Water Supply Plan
Adams County Office of Planning and Development

Community Water System	2010 Pumping		Distribution					
			Fire Protection					
					Adequate Piping (4)			
	Adequate Source (gpd) (1)	Adequate Transmission (gpd) (1)	Hydrants (2)	Adequate Pressure (3)	Fire	Interconnects	Blow-Off Valves	Approved CCC Program (5)
Abbottstown Municipal Authority	X	NA	X (-)	-	partial	partial	_	
Anchor MHP Association	X	NA	no	no	NA	NA	X	X
Arendtsville Municipal Water Co.	X	NA	X (31)	X	partial	NA	X	X
Beaver Creek MHP	X	X (2F)	no	X	NA	no	no	
Bendersville Water Co.	X	NA	X (-)	X	partial	partial	no	
Biglerville Water Co.	X	NA	X (40)	unknown	partial	NA	X	X
Bonneauville Municipal Authority	no	NA	X (35)	X	X	X	X	X
Castle Hill MHP	X	NA	no	unknown	NA	NA	no	
Cavalry Heights MHP	X	NA	no	X	NA	no	no	X
Chesapeake Estates MHP	X	unknown (1F)	no	X	NA	no	no	X
Childrens Development Center	X	NA	-	-	-	unknown	-	
Citizens Utilities Water Co.	X	NA	no	X	NA	partial	no	X
East Berlin Boro Water	X	NA	X (-)	X	partial	partial	X	X
Fairfield Municipal Authority	X	NA	X (30)	X	partial	partial	X	X
Franklin Twp. Municipal Authority	X	NA	no	-	NA	NA	-	X
Gettysburg Municipal Authority	X	unknown (2F/ 2R)	X (246)	X	partial	partial	X	X
Hillside Rest Home	X	NA	-	-	-	NA	-	X
Hoffman Homes for Youth	X	NA	X (4)	X	X	NA	X	X
Lake Meade Municipal Authority	X	NA	X (8)	X	partial	NA	X	
Lincoln Estates MHP	X	unknown (2F)	no	X	NA	no	X	
Littlestown Municipal Authority	X	NA	X (-)	-	partial	NA	-	
Meadows Property Owners Assn.	X	X (2F)	X (-)	X	X	X	no	X
Mountainview MHP	X	NA	no	unknown	NA	no	no	X
New Oxford Manor MHV	X	unknown (2F)	no	X	NA	no	X	
New Oxford Municipal Authority	no	unknown (3F/3R)	X (-)	-	partial	partial	-	X
Oak Village MHP	X	X (2F)	no	-	NA	no	-	X
Panorama MHP	X	X (2F)	no	X	NA	no	X	X
Pine Run Inc.	X	unknown (2F)	no	X	NA	NA	no	X
Piney Mountain Home Est.	X	NA	X (4)	X	no	NA	no	X
Possum Valley Municipal Authority	X	X (2F)	X (7)	X	partial	partial	X	X
Round Top MHP & Camp	X	NA	no	X	NA	NA	no	
Section A Water Corp.	X	NA	no	-	NA	X	-	
Stockham's Village (MHP)	X	unknown (4F)	no	X	NA	NA	X	
Timeless Towns of America	no	unknown (3F)	X(2)*	X	no	NA	no	X
Walnut Grove MHP	X	NA	X(12)	X	X	NA	no	
York Springs Municipal Authority	X	NA	X(24)	unknown	partial	NA	X	X
County Totals	33	6	18	23	4/12 partial	3/8 partial	15	23
Countywide Percent	92%	17%	50%	64%	11/33%	8/22%	42%	64%

(1) Ability to supply peak daily 2010 water needs; F = finished; R = raw
(2) Number of fire hydrants is in parentheses
(3) Minimum 20 psi under all conditions
(4) minimum 6-inch diameter piping; applies only to fire hydrant systems (fire) and systems within one mile of another system (interconnects)
(5) Cross-Connection Control Program
partial = some piping meets standard while some does not * = if necessary - = no survey response
unknown = either pumping station capacity unknown or capacity less than peak daily 2010 water needs

Table 15
Adequacy of Community Operational Management
Adams County Water Supply Plan
Adams County Office of Planning and Development

Community Water System	Size of System			Operations					Record Keeping		Financial	
					Certified Operator (1)							
	Small	Medium	Large	Permitted	Primary	Secondary	DEP Monitoring Compliance (2)	Approved O&M Plan (3)	Current AWSR (4)	Current System Drawing	Reasonable Rates	Costs Adequately Covered (5)
Abbottstown Municipal Authority	X			X	X	none	X	-	X	X	X	X
Anchor MHP Association	X			X	X	no	X	X	X	X	NA	NA
Arendtsville Municipal Water Co.	X			X	X	unknown	X	X	X	X	X	X
Beaver Creek MHP	X			X	X	none	X	X	X	X	NA	NA
Bendersville Water Co.	X			X	X	X	X	no	X	no	no	X
Biglerville Water Co.	X			X	X	X	X	no	X	no	X	no
Bonneauville Municipal Authority	X			X	X	X	X	X	X	X(6)	X	X
Castle Hill MHP	X			X	X	none	X	X	X	X	NA	NA
Cavalry Heights MHP	X			X	X	X	X	X	X	X	NA	NA
Chesapeake Estates MHP	X			X	X	unknown	X	X	X	X	NA	NA
Childrens Development Center	X			X	X	X	X	-	X	X	NA	NA
Citizens Utilities Water Co.	X			X	X	X	X	no	X	X	X	-
East Berlin Boro Water	X			X	X	unknown	X	X	X	X	X	X
Fairfield Municipal Authority	X			X	X	unknown	X	X	X	X	X	X
Franklin Twp. Municipal Authority	X			X	unknown	X	X	-	X	X	X	X
Gettysburg Municipal Authority			X	X	X	X	X	X	X	X	X	X
Hillside Rest Home	X			X	X	none	X	-	X	no	NA	NA
Hoffman Homes for Youth	X			X	X	none	X	X	X	X	NA	NA
Lake Meade Municipal Authority	X			X	X	X	X	no	X	no	X	X
Lincoln Estates MHP	X			X	X	unknown	X	X	X	X	NA	NA
Littlestown Municipal Authority		X		X	X	unknown	X	-	X	X	X	no
Meadows Property Owners Assn.	X			X	X	none	X	X	X	X	X	X
Mountainview MHP	X			X	X	none	X	X	X	X	NA	NA
New Oxford Manor MHV	X			X	unknown	unknown	X	X		X	NA	NA
New Oxford Municipal Authority		X		X	X	none	X	-	X	X	X	X
Oak Village MHP	X			X	X	X	X	-	X	X	NA	NA
Panorama MHP	X			X	X	none	X	X	X	X	NA	NA
Pine Run Inc.	X			X	X	none	X	X	X	X	NA	NA
Piney Mountain Home Est.	X			X	X	X	X	X	X	X(6)	NA	NA
Possum Valley Municipal Authority	X			X	X	X	X	X	X	X	no	no
Round Top MHP & Camp	X			X	X	X	X	X	X	X	NA	NA
Section A Water Corp.	X			X	X	unknown	X	-	X	X(6)	X	-
Stockham's Village (MHP)	X			X	X	X	X	unknown	X	X	NA	NA
Timeless Towns of America	X			X	X	unknown	X	X	X	X	NA	NA
Walnut Grove MHP	X			X	X	unknown	X	X	X	X	NA	NA
York Springs Municipal Authority	X			X	X	none	X	X	X	X(6)	X	X
County Totals	33	2	1	36	34	14	36	23	35	32	2	12
Countywide Percent	92%	5%	3%	100%	94%	39%	100%	64%	97%	89%	6%	33%

(1) no = operator needs higher level of training; none = no operator; unknown = qualifications of operator unknown
(2) compliance with water quality monitoring and testing schedule
(3) Operation and Maintenance Plan
(4) Annual Water Supply Report
(5) see Table 8 Net Profit/Deficit column
(6) not detailed
- = no response to survey
NA = not applicable as water charges included in other dues/rent

Operational adequacy criteria include: a permitted system, a system with two certified operators, monitoring compliance, and an approved Operation and Maintenance (O & M) Plan which is being implemented. All 36 of the County's community water systems have been officially permitted by the DEP. Thirty-four systems, or 94%, have certified primary operators with the necessary qualifications to operate their particular systems; two systems have primary operators with unknown qualifications. DEP regulations require that all community water systems have both a primary and a secondary certified operator (Public Water Supply Manual, Part V, 7.3). However, just 14 of the County's systems, or 39%, have secondary certified operators with the necessary qualifications to operate their systems. The remaining 22 systems either lack a secondary operator altogether, have secondary operators whose qualifications are unknown, or have operators who lack certification at the level required for their system. An additional problem is systems with absentee operators who allow someone who is not certified to perform day-to-day operations. The primary areas of deficiency are a lack of secondary operators and secondary operators whose qualifications are unknown. The addition of chemicals to water supplies is an issue of serious concern, and all of the County's community water systems are strongly encouraged to maintain two fully qualified certified operators at all times.

All of the County's community water systems maintain satisfactory to good compliance with their water quality monitoring schedules, according to the DEP. Twenty-three systems, or 64%, have indicated on the system surveys that they have approved O & M Plans, while four systems indicated they do not, and one does not know; eight systems did not return system surveys. According to the regional DEP office, many O & M Plans are inadequate. O & M Plans need to be reviewed regularly to determine if they are complete and up-to-date.

Recordkeeping is evaluated, including submission of a 1997 Annual Water Supply Report (AWSR) to DEP and maintenance of a current system map. Thirty-five systems, or 97%, have submitted their 1997 AWSRs to the DEP; these reports are required to be submitted annually. Not evaluated in this plan, with several exceptions, are the monthly system operation reports meeting DEP requirements. These reports can be useful in determining average monthly water use and in estimating safe yields of systems. The DEP maintains a current system drawing for 32 systems, or 89%, of which 28 provide good detail. A system drawing is lacking for four systems. These systems are encouraged to participate in a DEP/ PA Rural Water Association program to provide small community water systems with water audits and distribution system maps.

Finally, financial management is evaluated. The systems are evaluated for reasonable quarterly rates. Rates are considered to be reasonable if annual water charges do not exceed 1.5% of median household income for the municipality in which the system is located (Pennvest criteria). Two systems have annual water charges that are above this standard. Twelve systems, or 33%, have costs that are adequately covered by revenues, while three systems, or 12%, have costs that exceed revenues. Nineteen systems do not separate water expenses and revenues from other expenses and revenues, and so cannot be evaluated in this manner. Finally, two other systems did not return the survey or did not submit financial data and, therefore, cannot be evaluated. As a qualifier, it must be stated that this determination of reasonability of rates is more a reflection of the affordability of water service to the consumer than it is an indicator of the current and future viability of community water systems from a financial standpoint. An assessment of the reasonability of rates from the system perspective, that is of the ability of rates to fully cover existing and future system costs, including indebtedness and the need for future improvements, is beyond the scope of this study, but should be undertaken by each system.

C. NON-COMMUNITY WATER SYSTEMS AND OTHER WITHDRAWALS

A number of non-community water systems serving commercial, institutional and industrial uses on the perimeter of some of the County's municipal systems, especially Gettysburg's, could benefit from connection to the municipal systems while allowing the municipal systems to grow in a logical fashion and expand their rate bases. Some of these systems are experiencing water quality problems and water quality is generally not as closely monitored as for community water systems. The number of new non-community water systems within the County is projected to continue to grow but should be discouraged in areas where community water systems can provide the needed service. The location of large noncommunity system within close proximity to existing CWSs could adversely impact CWS water yields.

Withdrawal of water by self-suppliers for recreational, food processing and other uses may also be expected to increase. The location of large, new self-suppliers should similarly be discouraged near existing CWSs. Agricultural water use is also expected to continue to grow as agricultural activities change within the County, despite the steady loss of farmland. Recent trends in agriculture include increased cultivation of dwarf species of orchard crops and the establishment of confined animal operations. Both of these trends raise questions of adequate future water availability for these agricultural uses. Dwarf fruit species are known to be more water-consumptive than traditional fruit stock, and confined animal operations also require high water yields. Agriculture depends on having a clean, abundant water supply. In rural areas, farmers and residences may in the future be competing for limited water resources.

D. ON-LOT WATER SUPPLIES

Problems encountered by individual well and spring users include substandard quality and low yields. Low yields have periodically been a problem for some parts of the County during droughts and dry periods. Fecal coliform contamination and high nitrate concentrations from on-lot sewage disposal systems and farming practices are other problems encountered by on-lot water system users in the County. The land application of fertilizers, manure, septage, sludge, and pesticides can result in reduced surface and groundwater quality. Unfenced livestock, overapplication of nutrients, and lack of buffer strips separating pasture and croplands from streams contribute to the problem.

On-lot sewage disposal problems stem from a combination of factors, including inadequately sized sewage disposal fields, too-close on-lot sewage disposal systems, failure to maintain and periodically empty septic tanks, and improperly sited and constructed wells. On-lot sewage disposal systems throughout the State were not regulated by the DEP until 1966. Failing on-lot sewage disposal systems, as a result of improper siting or poor soils and old systems in need of replacement, can contribute to surface and groundwater quality problems.

Where groundwater problems, and specifically fecal coliform contamination, already exists, they can sometimes be remedied by the installation of disinfection systems. Where contamination problems are pervasive, or where multiple contaminants are present, the municipality may wish to explore the possible extension of water from a nearby community water system, or the creation of a new community water system. Before any such action is undertaken, the municipality's first responsibility is to address groundwater cleanup.

Neither Pennsylvania nor Adams County requires testing for new on-lot water systems to ascertain adequate water quality or yield, either prior to or as part of the well drilling process. However, DEP regulations relating to the siting of new on-lot sewage disposal systems have the effect of protecting groundwater quality to a certain degree. The DEP requires new on-lot sewage disposal systems to be set back at least 100 feet from any existing on-lot well, and encourages minimum lot sizes of at least one acre where on-lot sewage disposal systems are used. While these measures will help protect water quality in developing areas of the County; there are additional measures that municipalities can and should undertake to further protect their groundwater resources from possible contamination. These measures are explored in Chapters IV and VI.

IV. SYSTEM VIABILITY AND ALTERNATIVE SOLUTION STRATEGIES

A. INTRODUCTION

This chapter utilizes the water resources analysis of Chapter III to evaluate the existing and projected future viability of the County's community water systems. A viable water system is one that is self-sustaining and has the commitment and the financial, managerial, and technical capability to reliably meet performance requirements on a long-term basis. The chapter also describes a wide variety of possible solution strategies that can be used to maintain and promote viability in these water systems. Finally, the chapter makes specific recommendations for stand-alone system improvements as well as regional strategies for enhancing water system viability.

B. COMMUNITY WATER SYSTEM VIABILITY

There are a variety of methods for assessing the existing and projected future viability of community water systems. The method selected must be meaningful in its usefulness and appropriate for application to the types of small community water systems found in Adams County. The 1996 Safe Drinking Water Act (SDWA) amendments require that water systems demonstrate financial, technical and management capacity to function as viable public water systems (Curry, 1998).

1. POTENTIAL ASSESSMENT METHODS

One approach to assessing small system viability is the "Dozen Questions" diagnostic (EPA, 1995). This approach, produced for the *AWWA Guidance Committee to Small Systems*, provides a procedure for evaluating existing water systems' abilities to meet current and future operating and financial requirements. The objective is to promote strategic planning among small system owners. The method consists of a series of detailed questions in 12 categories that define small system viability. Because of the extensive and confidential nature of some of the questions involved, addressing such issues as customer awareness, managerial competence and financial stability, the Dozen Questions diagnostic approach is primarily a tool to be used by system owners who are well motivated to assess, plan ahead and improve their systems. In a more streamlined format, where data is available and cooperation from water systems forthcoming, this approach can be used by outside parties to assess the viability of small community water systems. Many of the types of questions asked in the Dozen Questions diagnostic have been incorporated into the assessment method developed to evaluate Adams County's community water systems.

Another approach to assessing small system viability is the "Development of Benchmark Measures."(Apogee Research, 1997) This approach combines an examination of municipal social indicators relating to poverty, income, age and population growth, with a financial profile of the system, average water use and water quality information. These indicators are intended to gauge overall system stability. This approach is most useful where applied to systems that serve a high proportion of the municipality's population, but is less useful for small systems that might or might not share a common social profile with the municipality as a whole. In addition, this approach works only where financial records for water systems are maintained separately from financial records for other aspects of a development, and where those records are made available on request. Applicable components of the Benchmark Measures approach were also incorporated into the assessment method developed to evaluate Adam's County's community water systems.

2. SELECTED ASSESSMENT METHOD

Nearly half of Adams County's community water systems are municipal systems or authorities serving from several hundred to several thousand persons. Just over half are small, private systems, serving a population range of less than 100 persons to a few hundred persons. Many private systems serve mobile home parks and have part-time "contractual" operators. The ability to collect financial data for the County's community water systems depended on the responses from a survey, although, for several systems, additional financial data was available from Annual Water Reports. For a few systems, no financial data was available. On the other hand, highly useful, and fairly complete data on system infrastructure and management was available through the DEP PADWIS database, Annual Water Supply Reports, and Water System Inventories. This data together with additional information generated from surveys was compared with DEP's Community Water System design standards as set forth in its Public Water Supply Manual-Part II and with as many applicable aspects of the Dozen Questions diagnostic and the Benchmark Measures as possible.

3. RATING CRITERIA

This section of the Plan evaluates the current and future anticipated viability of the County's 36 community water systems by assigning various point values to 18 specific rating criteria, described in the boxed insets on the following pages. These criteria are developed by the consultant for the purpose of this study and are based primarily on DEP's Community Water System Design Standards together with applicable standards from the Dozen Questions diagnostic and Benchmark Measures. It must be noted, however, that future criteria are being established by the 1996 SDWA amendments and subsequent rule-making by the U.S. EPA. Where applicable, information related to new or changing requirements is noted in this section.

WATER SYSTEM VIABILITY RATING CRITERIA

A. WATER SOURCES

1. ***Multiple/Dual/Single Water Sources*** - Each available water source reported was given credit up to a maximum of four points for systems with multiple sources. Systems with an emergency power generator, or a contractual arrangement for alternative water, or with existing or potential interconnections with other systems were credited with up to two additional water sources. Systems not having 3 points for both current and future demands should be further evaluated for future improvements.
   - 4 = Multiple water sources
   - 3 = Three water sources
   - 2 = Two water sources
   - 1 = One water source

2. ***Safe Yield Compared to Water Demands*** – The combined safe yield from groundwater production sources was compared to current and projected future (Year 2010) average daily and peak daily demands values. Systems reporting water shortfalls in times of drought had one point deducted. Systems not having 1 point for current demands and 3 points for future demands should be further evaluated for improvements.
   - 4 = Existing safe yield ≥ future peak daily demand
   - 3 = Existing safe yield ≥ future average daily demand
   - 2 = Existing safe yield ≥ current peak daily demand
   - 1 = Existing safe yield ≥ current average daily demand
   - 0 = Existing safe yield < current average daily demand

3. ***Main Production Source Out-of-Service*** – This represents the remaining water that would be available if the main production source were out-of-service. Systems not having 1 point for current demands and/or 3 points for future demands should be further evaluated for improvements.
   - 3 = Remaining sources > future average daily demand
   - 2 = Remaining sources ≥ current peak daily demand
   - 1 = Remaining sources ≥ current average daily demand
   - 0 = Remaining sources < current average daily demand

4. ***Source Pumping Capacity*** – The existing raw water source pumping capacities were compared to both current and future water demands. System pumping capacities of dual or multiple sources were combined. Systems not having 2 points for current demands and/or 4 points for future demands should be further evaluated for improvement. Systems having 1 or 3 points may be acceptable if water storage is adequate to supply the peak daily demand and/or fire flow demands (if applicable). Refer to Section C-1.
   - 4 = Existing pumping capacity ≥ future peak daily demand
   - 3 = Existing pumping capacity ≥ future average daily demand
   - 2 = Existing pumping capacity ≥ current peak daily demand
   - 1 = Existing pumping capacity ≥ current average daily demand
   - 0 = Existing pumping capacity < current average daily demand

B. WATER TREATMENT FACILITIES

1. ***Treated Water Quality*** – Treated water quality varies and depends on the specific chemical, biological, and physical contaminants in the water and their concentrations. Water quality must meet primary and secondary water quality standards prior to being distributed. Systems using groundwater which has been determined to be under or possibly under the direct influence of surface water in several instances meets all water quality standards but may in the future be required to provide full filtration, which will be a significant expense. Systems not having 3 points for current water quality should be further evaluated for improvements.
   - 4 = Water quality meets all primary and secondary standards routinely, no surface water influence
   - 3 = Water quality meets all primary and secondary standards routinely, possible surface water influence
   - 2 = Water quality meets all primary and secondary standards routinely, surface water influence
   - 1 = Water quality primary and/or secondary standards compliance problem trends
   - 0 = Water quality does not meet all primary and secondary standards routinely

C. FINISHED WATER STORAGE

1. ***Distribution Water Storage*** – Existing water storage was compared to the average and peak daily flow demand volumes for both the current and future time periods. Points were provided based on the volume of existing storage exceeding the calculated demand volumes. Water storage should be equivalent to or exceed one day's average water use depending on the total volume of water stored and the safe yield. The availability of an average daily storage volume was assumed to meet the system peak hourly demand. Systems not having 2 points for current demands and/or 4 points for future demands should be further evaluated for improvements.
   - 5 = Existing storage ≥ future peak daily demand volume
   - 4 = Existing storage ≥ future average daily demand volume
   - 3 = Existing storage ≥ current peak daily demand volume
   - 2 = Existing storage ≥ current average daily demand volume
   - 1 = Existing storage < current average daily demand volume
   - 0 = Existing storage < current peak-average demand volume (accumulated peak hourly demands)

2. ***Additional Fire Storage*** – Systems providing fire protection (see Section D-3) were evaluated for water needed for fire fighting by using the Insurance Services Office's (ISO) recommendations of 500, 1,000 and 1,500 gallons per minute for a 2-hour duration (60,000 gallons, 120,000 gallons and 180,000 gallons, respectively). Systems providing for additional fire storage for 2010 over that provided in Section C-1 above were given points as follows:
   - 3 = Fire storage ≥ 180,000 gallons
   - 2 = Fire storage ≥ 120,000 gallons
   - 1 = Fire storage ≥ 60,000 gallons
   - 0 = Fire storage < 60,000 gallons
   - NA = systems not providing fire protection

D. WATER DISTRIBUTION SYSTEM

1. ***Booster Pumping System(s)*** – Pumping equipment within a well house, treatment facility or distribution booster station used to convey water between the system's sources to distribution system components should be provided in duplicate. Systems that do not have a duplex arrangement are recommended to have a spare pump and motor available with other critical components. Systems not having 2 points for current and future demands should be further evaluated and considered for improvements.
   - 1 = Duplex pumping unit installed or single pump with spare unit available
   - 0 = Single pump system without spare unit available
   - NA = No booster pump systems required

2. ***Piping Systems Sized for Appurtenances*** – Distribution system piping should be properly designed and sized to support water system appurtenances such as fire hydrants and blow-off units. The minimum size of water main providing fire protection serving fire hydrants shall be 6" in diameter. Distribution systems not having 1 point for current piping should be evaluated and considered for improvements (refer to Section D-3).
   - 2 = Proper piping size
   - 1 = Piping size does not meet current minimum standards
   - NA = System does not support distribution system appurtenances

3. ***Distribution System Appurtenances*** – Distribution system appurtenances such as fire hydrants, standpipe valves, blow-off valves, and air release valves should be installed at critical system locations and distances. Systems should have isolation valves installed to isolate piping for repairs. All systems should have at least 1 point currently or be further evaluated for improvements.
   - 2 = Fire hydrants installed
   - 1 = Blow-off valves or flushing hydrant installed
   - 0 = No blow-off valves or hydrants installed

4. ***Distribution System Pressure*** – Adequate system pressure is required during typical average and peak daily demand periods for proper system operation. Additionally, the distribution system must be able to provide a 20 psi residual pressure during a high flow event such as fire fighting. Systems that cannot provide adequate pressure during high flow events are at risk of cross-contamination, distribution system failure, and inability to support the high flow demand. Systems having 0 points or unknown pressures for current and future system standards should be further evaluated for improvements.
   - 1 = Adequate pressure during high flow events
   - 0 = Inadequate pressure during high flows

5. ***Cross-Connection Prevention*** – Cross-connections allow potentially contaminated water to enter the potable water distribution system. Cross-connection equipment is required to be installed and cross-contamination prevention plans are required for all systems.
   - 1 = Cross-connection equipment installed and/or cross-contamination prevention plan prepared
   - 0 = No cross-connection equipment installed and no cross contamination plan prepared

E. WATER SYSTEM MANAGEMENT

1. ***System Size*** **–** The DEP defines small systems as serving 3,300 or fewer people, medium systems as serving between 3,301 and 10,000 persons, and large systems as serving over 10,000 persons. The larger the system, the more likely economies of scale apply. However, no points are required in regard to system viability.
   - 2 = System serves > 10,000 persons
   - 1 = System serves ≥ 3,301 and ≤ 10,000 persons
   - 0 = System serves < 3,300 persons

2. ***Certified Water System Operators*** **–** Water systems must be operated and maintained by a primary and secondary state certified operator. Points were given for certified operators responsible for each system. Systems must have 2 points for current and future operations.
   - 2 = Two state certified operators
   - 1 = One state certified operator
   - 0 = No state certified operator

3. ***Water System Record Keeping*** **–** Records of water system components, plans, and programs must be developed, submitted to DEP, and maintained by each water system. An Operations and Maintenance Plan (O&M Plan) and Emergency Response Plan (ERP) should be developed by the water system's engineer, operator or other responsible individual(s). The Annual Water Supply Report (AWSR) should be prepared and submitted annually to the DEP. Monitoring Plans for water sampling are needed to keep the system in compliance. Up-to-date water system drawings should be maintained on each system and reflect ongoing modifications. Each required record set was given 1 point. Systems should have 5 points for current system operations.
   - 5 = System drawings, O&M Plan, ERP, AWSR, Monitoring Plan available
   - 4 = Four of the 5 required documents available
   - 3 = Three of the 5 required documents available
   - 2 = Two of the 5 required documents available
   - 1 = One of the 5 required documents available
   - 0 = None of the 5 required documents available

4. ***Financial Management*** **–** Financial management is critical in determining future water system viability. Systems were evaluated for reasonable rates, reasonable operating expenses per 1,000 gallons, reasonable operating revenues per connection, and reasonable operating ratio of revenues and expenses. Systems with reasonable rates were assigned one point for this criterion. Systems with reasonable operating expenses, revenues or ratios were assigned two points for each criteria, while systems with borderline operating expenses, revenues, or ratios were assigned one point for each criteria. Systems should have 4 points for current operations.
   - 7 = All four financial criteria met
   - 6 = Reasonable revenues, expenses and ratio met
   - 5 = Reasonable rates and reasonable two of three of reasonable: revenues, expenses or ratio met
   - 4 = Reasonable two of three reasonable: revenues, expenses or ratio met
   - 3 = Reasonable rates and reasonable revenues, expenses or ratio met
   - 2 = Reasonable revenues, expenses or ratio met
   - 1 = Either reasonable rates or borderline revenues, expenses, or ratio met
   - 0 = None of the 2 required documents available
   - NA = Financial records for water system not separate from other services provided

5. ***Social Indicators*** – Various social indicators provide background information by which to evaluate the relative affordability of water service to households. Water service is considered to be less affordable to households in municipalities in which 1) the percent of families living below the poverty line is greater than 9.5% and 2) the median household income is less than 90% of that for the state.
   - 2 = No indicators present
   - 1 = One indicator present
   - 0 = Both indicators present

6. ***Source Water Protection Program*** – The 1996 SDWA amendments require public water source recharge areas be assessed for locations and types of possible contaminants and the vulnerability of the source to those contaminants. Systems should develop a wellhead protection program or implement protective procedures and actions to minimize potential bacteriological and/or chemical contamination.
   - 1 = Wellhead protection program, procedures or action have been taken or developed
   - 0 = No program, procedures or action have been developed

A maximum number of possible points are set forth for each criterion. A minimum number of points for each criterion are established as current and future thresholds for compliance with DEP requirements. The maximum number of points that a water system can attain is 54. To demonstrate current compliance with DEP requirements and other rating criteria, water systems must score a minimum of 30 "adjusted" points, while to show future compliance, a score of at least 39 adjusted points must be achieved. Adjusted points account for the inapplicability of three criteria to certain systems; these include additional fire storage where there are no hydrants, booster pumps where no stations exist, and piping adequacy where there are no appurtenances. Systems demonstrating compliance with DEP requirements are termed "strong" systems. Systems scoring 75% of the points required for compliance with DEP standards are rated "fair" (29 points), while those scoring 50% of the points required for DEP compliance are judged to be "weak" (20 points). Finally, systems scoring fewer than 50% of the points needed to demonstrate compliance with DEP requirements are rated "very weak."

In addition to rating systems as a whole, five system components – source, treatment, storage, distribution, and management – are rated separately for each system to provide a closer look at individual system strengths and weaknesses. To demonstrate future compliance for each system component, that component must score the minimum number of points to be needed by 2010 as indicated on Table 16. Again, systems scoring 75% of the points required for compliance are rated "fair" for that component, while systems scoring 50% of the points required are rated "weak", and those scoring fewer than 50% of the needed points are rated "very weak". Of the five system components analyzed, the Water System Management component includes what DEP believes to be the best indicators of long-term system viability. The other four components indicate need for various structural improvements. For this reason, the Water System Management component may be weighed more heavily by individual systems or the County in evaluating potential stand-alone or regional solution strategies. However, projected future viability should also consider the extensiveness of structural improvements that are needed. Borderline-viable systems may be able to finance limited structural improvements, whereas they may be unable to provide extensive improvements.

4. SYSTEM RATINGS

Following the rating criteria description is Table 16, which sets forth the assigned community water system viability ratings, and Table 17, which provides a comparative 2010 assessment of the County's community water systems. Using the foregoing rating system, 28 community water systems, or 78% of the County's total, have demonstrated current overall compliance with DEP requirements and are judged to be fundamentally sound, well operated, and doing a good job of meeting current water demands. Of these systems, however, only five or 14%, should be able to meet projected needs by the year 2010 and are considered to be strong systems. Twenty-one systems or 58% are rated fair in their ability to meet year 2010 demands and will need to make additional investment in system improvements and management practices to accommodate planned growth and development. Nine of the County's systems, or 25%, are considered to be a weak systems, while one was determined to be a very weak system, largely because of unavailable information.

These systems will need to make substantial structural, management, and financial improvements to meet projected year 2010 water needs.

All of the systems that received a strong rating for the year 2010 are municipal systems or authorities, while four municipal systems or authorities rated fair, and two rated weak. Most of the County's mobile home parks rated fair or weak, in part because of the lack of separate financial record-keeping for water system use.

The following listing provides abbreviations and adjusted scores for each of the County's community water systems.

AB	Abbottstown Municipal Authority	30	LM	Lake Meade Municipal Authority	44
AN	Anchor MHP Association	28	LE	Lincoln Estates MHP	34
AR	Arendtsville Municipal Water Co.	47	LI	Littlestown Municipal Authority	35
BC	Beaver Creek MHP	26	MP	Meadows Property Owners Assoc.	34
BE	Bendersville Water Co.	26	MV	Mountainview MHP	26
BI	Biglerville Water Co.	39	NE	New Oxford Municipal Authority	35
BO	Bonneauville Municipal Authority	28	NO	New Oxford Manor MHV	32
CH	Castle Hill MHP	22	OV	Oak Village MHP	35
CV	Cavalry Heights MHP	35	PA	Panorama MHP	35
CE	Chesapeake Estates MHP	34	PR	Pine Run Inc.	34
CD	Childrens Development Center	17	PM	Piney Mountain Home Estates	35
CU	Citizens Utilities Water Co.	32	PV	Possum Valley Municipal Authority	35
EB	East Berlin Boro Water	35	RT	Round Top MHP & Camp	30
FM	Fairfield Municipal Authority	41	SA	Section A Water Corp.	30
FT	Franklin Twp. Municipal Authority	28	SV	Stockham's Village (MHP)	32
GM	Gettysburg Municipal Authority	50	TT	Timeless Towns of America	32
HR	Hillside Rest Home	25	WG	Walnut Grove MHP	33
HH	Hoffman Homes for Youth	31	YS	York Springs Municipal Authority	32

Table 16
Community Water Systems Viability Ratings
Adams County Water Supply Plan
Adams County Office of Planning and Development

	Points Needed[1]			Community Water System[1]																	
Criteria	**Possible**	**Current**	**Year 2010**	AB	AN	AR	BC	BE	BI	BO	CH	CV	CE	CD	CU	EB	FM	FT	GM	HR	HH
A. Water Sources																					
1. Number of Sources	4	3	3	2	2	3	4	4	3	4	1	3	4	3	3	4	3	1	4	2	2
2. Safe Yield	4	1	3	4	4	4	3	0	3	0	4	4	4	U	4	1	3	4	3	4	1
3. Source Out of Service	3	1	3	0	0	3	0	0	1	0	0	1	3	U	1	0	0	0	2	3	0
4. Source Pumping Capacity	4	2	4	4	4	4	4	4	4	0	4	4	4	4	4	4	4	4	4	4	4
B. Water Treatment																					
1. Water Quality	4	3	3	4	4	4	2	1	4	4	1	3	4	1	4	1	4	4	4	4	4
C. Water Storage																					
1. Distribution Storage	5	2	4	0	0	5	0	0	5	1	0	5	1	0	0	5	5	0	5	0	5
2. Additional Fire Storage	3	NA/1	NA/1	0	NA	3	NA	0	3	0	NA	NA	NA	U	NA	3	2	NA	3	U	1
D. Water Distribution																					
1. Booster Pumps	2	NA/1	NA/1	NA	NA	NA	2	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	2	NA	NA
2. Piping	1	NA/2	NA/2	1	NA	1	NA	1	1	1	NA	NA	NA	-	NA	1	1	NA	1	-	1
3. Appurtenances	2	1	1	2	1	2	0	2	2	2	0	0	0	-	0	2	2	0	2	-	2
4. Pressure	1	1	1	-	0	1	1	1	U	1	U	1	1	-	1	1	1	-	1	-	1
5. Cross-Connection	1	1	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	1	1	1
E. System Management																					
1. System Size	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
2. Operators	2	2	2	1	1	1	1	2	2	2	1	2	1	2	2	1	1	1	2	1	1
3. Recordkeeping	5	5	5	3	5	5	4	3	3	5	5	5	5	3	4	5	5	3	5	2	5
4. Financial Management	7	4	4	5	NA	7	NA	5	4	4	NA	NA	NA	NA	3	3	6	5	7	NA	NA
5. Social Indicators	2	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	0	2	2
6. Source Protection	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Benchmark Score Value	**54**	**26/30**	**35/39**	29	24	46	23	25	38	27	18	31	31	15	29	34	40	25	50	23	29
Adjusted Score	**54**	**30**	**39**	**30**	**28**	**47**	**26**	**26**	**39**	**28**	**22**	**35**	**34**	**17**	**32**	**35**	**41**	**28**	**50**	**25**	**31**

Table 16 (cont'd)
Community Water Systems Viability Ratings
Adams County Water Supply Plan
Adams County Office of Planning and Development

Criteria	Points Needed[1]			Community Water System[2]																	
	Possible	Current	Year 2010	LM	LE	LI	MP	MV	NE	NO	OV	PA	PR	PM	PV	RT	SA	SV	TT	WG	YS
A. Water Sources																					
1. Number of Sources	4	3	3	4	3	3	2	1	1	4	2	4	2	3	4	2	3	3	3	1	3
2. Safe Yield	4	1	3	4	4	1	4	4	3	2	4	4	4	4	4	4	4	4	4	4	4
3. Source Out of Service	3	1	3	3	0	0	0	0	0	0	3	3	0	3	3	3	3	3	3	0	1
4. Source Pumping Capacity	4	2	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	0	4	4
B. Water Treatment																					
1. Water Quality	4	3	3	4	4	3	4	4	1	4	4	4	4	1	2	3	3	4	1	4	4
C. Water Storage																					
1. Distribution Storage	5	2	4	4	5	5	0	0	5	5	5	1	5	5	0	0	3	0	5	5	0
2. Additional Fire Storage	3	NA/1	NA/1	2	NA	3	0	NA	3	NA	NA	NA	NA	1	0	NA	NA	NA	2	2	0
D. Water Distribution																					
1. Booster Pumps	2	NA2	NA/2	NA	2	NA	2	NA	2	2	2	2	2	NA	2	NA	NA	2	2	NA	NA
2. Piping	1	NA/1	NA/1	1	NA	1	1	NA	1	NA	NA	NA	NA	0	1	NA	NA	NA	0	1	1
3. Appurtenances	2	1	1	2	1	1	1	0	1	1	0	1	0	1	1	0	0	1	1	1	2
4. Pressure	1	1	1	1	1	-	1	U	-	1	-	1	1	1	1	1	-	1	1	1	U
5. Cross-Connection	1	1	1	0	0	0	1	1	1	0	1	1	1	1	1	0	0	0	1	0	1
E. System Management																					
1. System Size	3	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2. Operators	2	2	2	2	1	1	1	1	1	U	2	1	1	2	2	2	1	2	1	1	1
3. Recordkeeping	5	5	5	3	4	3	5	5	3	4	3	4	5	5	5	5	3	3	5	5	4
4. Financial Management	7	4	4	7	NA	3	6	NA	7	NA	NA	NA	NA	NA	2	NA	1	NA	NA	NA	5
5. Social Indicators	2	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
6. Source Protection	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benchmark Score Value	**54**	**26/30**	**35/39**	43	31	34	34	22	35	29	32	32	31	33	35	26	27	29	31	31	31
Adjusted Score	**54**	**30**	**39**	**44**	**34**	**35**	**34**	**26**	**35**	**32**	**35**	**35**	**34**	**35**	**35**	**30**	**30**	**32**	**32**	**33**	**32**

(1) for a determination of strong system status
(2) system names abbreviated alphabetically
U = unknown values
- = information not provided by water systems
NA = not applicable

Table 17 Community Water System Assessments Adams County Water Supply Plan Adams County Office of Planning and Development				
Community Water System	2010 Assessments			
	Strong	Fair	Weak	Very Weak
Abbottstown Municipal Authority		X		
Anchor MHP Association			X	
Arendtsville Municipal Water Co.	X			
Beaver Creek MHP			X	
Bendersville Water Co.			X	
Biglerville Water Co.	X			
Bonneauville Municipal Authority*			X	
Castle Hill MHP			X	
Cavalry Heights MHP		X		
Chesapeake Estates MHP		X		
Childrens Development Center				X
Citizens Utilities Water Co.		X		
East Berlin Boro Water		X		
Fairfield Municipal Authority	X			
Franklin Twp. Municipal Authority				
Gettysburg Municipal Authority	X			
Hillside Rest Home				
Hoffman Homes for Youth		X		
Lake Meade Municipal Authority	X			
Lincoln Estates MHP		X		
Littlestown Municipal Authority		X		
Meadows Property Owners Assn.			X	
Mountainview MHP*		X		
New Oxford Municipal Authority		X		
New Oxford Manor MHV		X		
Oak Village MHP		X		
Panorama MHP		X		
Pine Run Inc.		X		
Piney Mountain Home Est.		X		
Possum Valley Municipal Authority		X		
Round Top MHP & Camp		X		
Section A Water Corp.		X		
Stockham's Village (MHP)		X		
Timeless Towns of America		X		
Walnut Grove MHP		X		
York Springs Municipal Authority		X		
County Totals	5	21	9	1

Notes:
S= Strong systems exceed future year point criteria.
F = Fair systems meet current and future year point criteria.
W = Weak systems meet current but not future year point criteria.
VW=Very weak systems do not meet current year point criteria.
For all systems, individual components should be examined for adequacy.
* = System added additional source and storage in 1999, which were not considered in the analysis.

Table 18 provides a comparative assessment of the five components comprising each community water system. For “water source”, 19 are rated strong, 6 fair, 20 weak, and 1 very weak. For “water treatment”, 27 systems are judged to be strong, none fair, two weak, and seven very weak. Seventeen systems are rated strong for “water storage”, while one is rated fair, none weak, and 18 very weak. For “water distribution”, 22 systems are judged to be strong, five fair, none weak, and nine very weak. Finally, nine systems are rated to be strong in “system management”, 10 fair, 16 weak, and one very weak. Major component shortcomings are in the areas of storage and overall management.

C. ALTERNATIVE SOLUTION STRATEGIES

Strategies for enhancing the viability of community water systems include both individual system and regional strategies. Under the system approach, each community water system addresses its own problems through internal changes. Under the regional approach, cooperative solutions involving multiple systems are discussed.

1. EXISTING SYSTEM STRATEGIES

Structural Improvements - Table 19 sets forth recommended structural system improvements for each community water system together with their estimated costs. Estimated costs are based on the R. S. Means Company, Inc.’s *Building Construction Cost Data*, 1996 48th Edition and the U.S. EPA's *Very Small Systems - Best Available Technology Cost Document*, September, 1992. An annual inflation factor of 2% and estimates derived from recently completed construction projects are used to estimate these costs. Improvement categories include water source, treatment, storage, and distribution. Individual improvements are indicated by use of a code that is linked to the Water System Viability Criteria descriptions and on Table 16. Recommended system improvement notations are used that correlate with those in Table 16. For instance, Table 19 notes that the Abbottstown system is recommended for Water Source Improvement A-3, which on Table 16 correlates with Source Out of Service, described in detail in the inset on Page IV-3. Total estimated costs for recommended improvements for each system are provided in the far right column of Table 19. While the ratings shown in Table 16 are the primary basis for the recommended improvements, individual system strengths and weaknesses were also considered. For instance, certain systems with inadequate storage but with more than sufficient safe yield to the year 2010 were not recommended for additional storage. (The Water System Summary sheets in Appendix A provide individualized assessments of each system’s future needs).

Twenty-four of the County’s community water systems were identified as needing water source improvements with costs estimated to be at least $446,000 total. Nine systems are in need of water treatment improvements totaling at least $428,000.

Table 18 Community Water System Component Assessments Adams County Water Supply Plan Adams County Office of Planning and Development																				
Community Water System	**Source**				**Treatment**				**Storage**				**Distribution**				**Management**			
	S	**F**	**W**	**VW**	**S**	**F**	**W**	**VW**	**S**	**F**	**W**	**VW**	**S**	**F**	**W**	**VW**	**S**	**F**	**W**	**VW**
Abbottstown Municipal Authority			X		X							X	X				X			
Anchor MHP Association			X		X							X				X			X	
Arendtsville Municipal Water Co.	X				X				X				X				X			
Beaver Creek MHP			X				X					X		X					X	
Bendersville Water Co.			X					X				X	X				X			
Biglerville Water Co.			X		X				X					X				X		
Bonneauville Municipal Authority*				X	X							X	X				X			
Castle Hill MHP			X					X				X				X			X	
Cavalry Heights MHP			X		X				X					X				X		
Chesapeake Estates MHP	X				X							X		X					X	
Childrens Development Center			X					X				X				X			X	
Citizens Utilities Water Co.			X		X							X		X				X		
East Berlin Boro Water			X					X	X				X					X		
Fairfield Municipal Authority			X		X				X				X				X			
Franklin Twp. Municipal Authority			X		X							X				X		X		
Gettysurg Municipal Authority		X			X				X				X				X			
Hillside Rest Home	X				X							X				X				X
Hoffman Homes for Youth			X		X				X				X						X	
Lake Meade Municipal Authority	X				X				X				X				X			
Lincoln Estates MHP		X			X				X				X						X	
Littlestown Municipal Authority			X		X				X							X		X		
Meadows Property Owners Assn.		X			X							X	X				X			
Mountainview MHP*		X			X							X				X			X	
New Oxford Municipal Authority			X		X				X				X				X			
New Oxford Manor MHV			X		X				X				X						X	
Oak Village MHP		X						X	X				X						X	
Panorama MHP	X				X							X	X						X	
Pine Run Inc.			X		X				X				X						X	
Piney Mountain Home Est.	X							X	X				X					X		
Possum Valley Municipal Authority	X						X					X	X					X		
Round Top MHP & Camp		X			X							X				X		X		
Section A Water Corp.	X				X					X						X			X	
Stockham's Village (MHP)	X				X							X	X						X	
Timeless Towns of America			X					X	X				X						X	
Walnut Grove MHP			X		X				X				X						X	
York Springs Municipal Authority			X		X							X	X					X		
County Totals	9	6	20	1	27	0	2	7	17	1	0	18	22	5	0	9	9	10	16	1

Notes:
S = Strong systems exceed future year point criteria.
F = Fair systems meet current and future year point criteria.
W = Weak systems meet current but not future year point criteria.
VW = Very weak systems do not meet current year point criteria.
For all systems, individual subcomponents should be examined for adequacy.
* = System added additional source and storage in 1999, which were not considered in the analysis.

Table 19
Recommended Community Water System Structural Improvements
Adams County Water Supply Plan
Adams County Office of Planning and Development

Code	Community Water System	Water Source		Treatment		Storage		Distribution		Total Costs
		Improvement	Cost	Improvement	Cost	Improvement	Cost	Improvement	Cost	
AB	Abbottstown Municipal Authority	A-3	$30,000			C-1, C-2	$340,000			$370,000
AN	Anchor MHP Association	A-3	$16,000			C-1	$85,000			$101,000
AR	Arendtsville Municipal Water Co.									$0
BC	Beaver Creek MHP	A-3	$16,000			C-1*	ND-$150,000	D-3	$3,000	$19,000-$169,000
BE	Bendersville Water Co.	A-3	$20,000	B-1*	30K-100K	C-1, C-2	$340,000			$390,000-$460,000
BI	Biglerville Water Co.	A-3	$30,000							$30,000
BO	Bonneauville Municipal Authority	A-3	$20,000							$20,000
CH	Castle Hill MHP	A-3	$15,000	ND		C-1	$60,000	D-3	$3,000	$78,000
CV	Cavalry Heights MHP	A-3	$15,000					D-3	$3,000	$18,000
CE	Chesapeake Estates MHP			B-1	$8,000	C-1*	$30K-$60K	D-3	$3,000	$41,000-$71,000
CD	Childrens Development Center			B-1	$10,000	C-1	$35,000	D-3	$3,000	$48,000
CU	Citizens Utilities Water Co.	A-3*	30K-35K			C-1*	ND-$350,000	D-3	$3,500	$38,500-$383,500
EB	East Berlin Boro Water	A-2, A-3	$16,000	B-1	$10,000					$26,000
FM	Fairfield Municipal Authority	A-3	$20,000							$20,000
FT	Franklin Twp. Municipal Authority	A-3	$16,000			C-1	$85,000	D-3	$3,500	$104,500
GM	Gettysurg Municipal Authority									$0
HR	Hillside Rest Home					C-1*	$21K-$35K	D-3	$3,000	$24,000-$38,000
HH	Hoffman Homes for Youth	A-3	$15,000							$15,000
LM	Lake Meade Municipal Authority	A-3	$30,000							$30,000
LE	Lincoln Estates MHP	A-3	$20,000							$20,000
LI	Littlestown Municipal Authority	A-2	$25,000	B-1*	$350,000					$25,000-$375,000
MP	Meadows Property Owners Assn.	A-3*	$15,000			C-1*, C-2*	$35,000			$50,000
MV	Mountainview MHP	A-3	$15,000					D-3	$3,000	$18,000
NE	New Oxford Manor MHP									$0
NO	New Oxford Municipal Authority	A-3*	ND-$240K	B-1*	ND-$60K					$60,000-$240,000
OV	Oak Village MHP							D-3	$3,000	$3,000
PA	Panorama MHP									$0
PR	Pine Run Inc.	A-3	$15,000					D-3	$3,000	$18,000
PM	Piney Mountain Home Est.			B-1	$10,000					$10,000
PV	Possum Valley Municipal Authority					C-1, C-2	$150,000			$150,000
RT	Round Top MHP & Camp	A-3	$16,000			C-1*	$21,000	D-3	$3,000	$40,000
SA	Section A Water Corp.	A-3	$20,000			C-1*	$35K-$85K	D-3	$3,500	$58,500-$108,500
SV	Stockham's Village (MHP)					C-1*	$21K-$35K			$21,000-$35,000
TT	Timeless Towns of America			B-1	$10,000					$10,000
WG	Walnut Grove MHP	A-3	$16,000							$16,000
YS	York Springs Municipal Authority	A-3	$30,000			C-1*, C-2*	$185K-$350K			$215,000-$380,000
	County Totals	24	$461+K	9	$428+K	16	$1,443+K	13	$40K	$2,372,000+

ND - Not Determined (needs further evaluation based on limited available data)

*Note - System improvement(s) could be accomplished with one or more identified alternatives. Therefore, a budget estimate range is provided for these alternatives. A detailed engineering review should be accomplished to determine the optimum improvement alternative for meeting future water system design standards.

Fifteen systems could be improved through the provision of additional storage for costs estimated at a minimum of $1,290,000. Thirteen systems are in need of improvements to their distribution systems for costs estimated at $40,000. The total estimate for needed structural improvements to the County's systems is a minimum of $2,372,000.

Management Improvements - In addition to recommended physical system improvements, various management improvements would benefit the majority of the County's community water systems. System operations and recordkeeping, particularly for smaller water providers, are not always in compliance with DEP regulations. System management can be improved through various restructuring options, as summarized in the inset below.

SYSTEM RESTRUCTURING OPTIONS

Strategy	Examples	Applicability
· Internal Changes	· report/recordkeeping · operations · structural improvements · financing	· Where systems are viable.
· Informal/Formal Cooperation	· bulk/regional/discount purchase of supplies · shared/loaned/equipment & supplies · operator's association · municipal assistance · cooperatives	· Where systems desire increased efficiency/reduced costs.
· Contractual Assistance	· operations & maintenance · circuit rider/regionalized O & M & lab services · other professional service · interconnections · bulk water purchase · direct service by another system · satellite management · third-party management	· Where specialized or regular assistance is desired.
· Joint Powers Agencies	· joint service areas · consolidation of systems · centralized management · County/municipal authority	· Where two or more systems can be strengthened by combining system attributes or jointly addressing deficiencies.
· Ownership Transfer	· public system acquisition · private viable system acquisition · annexation	· Where system is non-viable.

Currently, most, if not all of the County's 36 community water systems address their own needs independently through *internal changes*. This works well for some larger water systems, but can be costly for smaller systems that do not enjoy similar economies of scale.

Informal/Formal Cooperation is an approach that is rarely used within Adams County. Many of the smaller community water systems could, however, benefit from shared purchasing arrangements and shared contracting of services, such as for certified operators. Such arrangements could reduce operating costs while maintaining system autonomy.

Contractual Assistance is used primarily for services and is fairly common on an individual-system basis within the County. Procurement of services could be undertaken regionally for increased cost savings. Such assistance could also play an expanded role, such as in the third-party management of a troubled system.

Joint Powers Agency involves the creation of a new entity or authority, potentially including a County-wide authority, to serve member water systems. Such an entity could address major system improvements that are beyond the ability of a single water system to undertake or that are too costly.

Ownership Transfer is often the best option for systems at risk. Such a transfer can infuse troubled systems with needed expertise and financing to back major system improvements that would otherwise not occur.

In many cases, community water systems may need to implement multi-faceted restructuring, or more than one type of restructuring option at a time. Specific recommendations for management improvements are made under the Regional Strategies section that follows later in the chapter.

2. NEW SERVICE STRATEGIES

There are several types of new service strategies that could be implemented by Adams County and its communities to meet new water demands outside of the service areas of existing CWSs. Each of these strategies is discussed with respect to impact on local aquifers, relative contamination risks, sufficiency of groundwater quality and quantity, management and/or operational challenges, approval from regulatory agencies, and applicability of well construction and abandonment considerations.

Extensions – The extension of service lines from existing CWSs to serve new or remedial development should be the preferred method of new service provision throughout the County, particularly when planned growth is adjacent or nearby and where existing CWSs have ample source yield and storage capacity. Extensions are most cost-effective in areas with permitted development densities of at least three units per acre. They are also most cost-effective where public sewer is provided simultaneously. Typically, public sewer and water extensions are financed by private developers. However, several municipal systems, including Gettysburg's, have treatment plants that are operating at or over effective capacity. Where this is the case, availability of public sewer treatment is not keeping up with demand. The DEP requires all municipalities to develop and adopt Act 537 Sewage Facilities Plans to address the planned future treatment of sewage within municipalities. Yet at least 20 of the County's 34 municipalities have outdated 537 Plans or have not filed a plan with the County. This situation has implications for the extension of public water lines. Where developers are unable to receive assurance of available sewage plant capacity, they may be forced to build on larger lots to accommodate on-lot septic systems. Such large lots will effectively preclude the potential extension of public water to these sites. Thus, it is critical that public sewer and water planning be coordinated for extensions to be attractive, or even possible, options for developers.

Interconnections - New interconnections are most likely to be needed by water systems that need to supplement or replace the water supplied to the communities or developments that they serve. Depending on the size, scale and resources of these developments, interconnections are most cost-effective for systems that lie within about one mile of each other. Greater distances involve not only higher costs, but often raise serious concerns regarding the extension of lines through large land areas that lie outside areas designated for growth and development in applicable comprehensive plans. Water systems with surplus water and system capacity should be encouraged to consider the water needs of their neighbors and the possibility of a mutually-beneficial relationship including a water interconnection. New interconnections for contingency planning purposes alone can provide a valuable benefit for all participating parties by assuring access to a backup water supply in the event of an emergency. Interconnections require the approval of DEP.

New Community Water Systems **–** New community water systems that service 25 persons or more present a lower risk of contamination because they are legally required to be properly sited and constructed. New CWSs must be grouted, effectively preventing the well hole from acting as a conduit for contaminants at the surface of the land from reaching the groundwater. Additionally, new standards require Zone I areas (within 100-400 feet of the wellhead) to be under the direct management and control of the CWSs. Although these new systems must meet regulatory standards, the quality and quantity of groundwater will ultimately depend on subsurface geology and groundwater quality in the vicinity of the source well. However, water quality tends to be higher because these systems must monitor groundwater quality and treat water where appropriate. These systems are also permitted to withdraw only as much groundwater as safe yield projections indicate can be sustained, thereby protecting the aquifer as well as providing a reliable water supply for clients. Finally, regulatory agencies provide funding through grants for the installation of community water systems. The operational or management costs of community water systems tend to be more expensive and will vary depending on system **size. A** business plan is a required part of a construction permit application for new CWSs. This plan must show that the system will have the technical, managerial, and financial capacity to comply with all Safe Drinking Water requirements over time.

Noncommunity Water Systems - Noncommunity water systems are public systems that serve 25 or more transient or nontransient persons connected with commercial, industrial, institutional, agricultural and seasonal uses. Such systems frequently exist to serve a single user. Often, though not always, they are located some distance from CWSs, which otherwise could provide the same service. The finished water quality requirements for non-community water systems are the same as those for community water systems. Groundwater quantity and quality provided by such systems depend upon local contaminant threats, aquifer withdrawal and subsurface geology. Noncommunity water systems are regulated, but to a lesser degree than CWSs. Noncommunity water systems are generally less expensive to construct and maintain than community water systems. Such systems should be discouraged where CWSs could provide the same service.

Non-Public Water Systems

- *Non-Residential Self-Suppliers* – Self-suppliers are private systems that serve fewer than 25 persons. They typically supply water for industrial, commercial, institutional, agricultural and seasonal uses, and frequently serve a single user. Often, though not always, they are located at some distance from CWSs. The water quality requirements of these systems vary depending on water use. Groundwater quantity and quality provided by such systems depends upon local contaminant threats, aquifer withdrawal, surface water quality and subsurface geology. Self-suppliers that use groundwater are not regulated unless they withdraw more than 100,000 gpd and are located within the Susquehanna River Basin. Self-supplying systems are generally less expensive to construct and maintain than are noncommunity water systems.

  Because the great majority of water withdrawn by self-suppliers is not intended for human consumption, surface water sources, including streams and ponds, are frequently used. Farmers, especially, rely on runoff water they collect in ponds for many of their water needs. It is important that they be able to continue to rely on this water source with a minimum of regulation. An added benefit of farm pond creation is their potential use for dry hydrants for fire fighting purposes. The availability of pond water for fire fighting can provide ready access to water in remote areas and also conserves the more costly, treated CWS water for uses that require potable water. Water conservation on farms should be promoted, particularly through the use of trickle irrigation. Because such systems are expensive to install, cost-sharing programs should be considered by the Conservation District, Penn State Cooperative Extension or County.

- *Small Water Systems* - Small water systems are private water systems that serve fewer than 15 connections or 25 people. These systems are not regulated by government agencies. Wells are typically ungrouted and are therefore at risk of groundwater contamination from nearby septic tanks and other contaminants from agricultural, residential, commercial, and industrial activities. The sufficiency of groundwater quality and quantity may be variable and often depends upon withdrawal by other sources from the aquifer in the surrounding area, as well as the subsurface geology. Small systems are generally less expensive than community water systems to construct and maintain. Additionally, due to new DEP requirements that pertain to the construction and maintenance of community water systems, as well as rigorous new EPA water quality standards, developers of small subdivisions may find small water systems increasingly attractive in the future. However, these systems have all of the disadvantages of on-lot water systems in that they are completely unregulated. In addition, residents of such subdivisions may assume that because they do not have on-lot systems, they need not worry about groundwater quality or yield.

Small systems have a poor track record of adequate maintenance and should be discouraged. Municipalities should provide incentives for landowners and developers to either interconnect with existing, or develop new community water systems. These systems should be designed to serve other planned development sites. Where County-designated growth areas exist, municipalities should know where these areas are. Landowners and potential developers should be approached before they submit preliminary plans, while their plans may still be influenced. Incentives might include municipal assistance in funding or maintenance, additional development rights or a combination of the two. Landowners should also be made aware of DEP funding sources.

- *On-lot Residential Water Wells* - On-lot residential water wells are exposed to a high contamination risk from on-lot septic systems, which are often in close proximity to each other. These wells are nearly always ungrouted, and may be contaminated by nearby agricultural, residential, commercial, and industrial activities. On-lot residential water wells are the least expensive type of water system to construct and maintain. However, they have high environmental costs. For example, each new on-lot residential well is a potential conduit for contaminants to enter the groundwater. In addition, residences and other uses may be built in areas with insufficient water yields, especially in times of drought, which can cause serious problems for landowners. These systems are not regulated by the government. The sufficiency of on-lot residential groundwater quality and quantity depend upon local contaminant threats, surrounding aquifer withdrawal and subsurface geology. The combined effects of numerous on-lot residential wells, or a proliferation of new wells, could adversely impact water quality and yield.

  It is not unusual for municipalities to inadvertently place groundwater quality and yield at risk by permitting low-density zoning (one and two-acre lots) that can only be served by on-lot residential water and septic systems. Dispersed development patterns in combination with a lack of public oversight for septic system maintenance has frequently resulted in localized areas of septic system failure and contaminated on-lot wells. This situation, in turn, creates a need to extend public sewer and water lines for great distances and at great public cost to remediate these situations.

It must also be recognized that even areas planned for growth are not always zoned or built at densities that are conducive to the development of new community water and sewer systems, nor are they always located near existing community water and sewer systems. Several municipalities within Adams County do not have municipal zoning. This places them at the greatest risk for potential contamination or overdrawing of groundwater because of unpredictable future land uses.

Municipalities can protect their groundwater quality and yields by taking the following actions related to on-lot water wells:

- Adopt well siting, construction, water quality testing, and abandonment standards as part of the subdivision and permitting process to protect groundwater quality; such requirements should involve siting wells at safe distances from potential contaminant threats, grouting, and the placement of a sanitary seal on all at- or below-grade well openings.

- Adopt on-lot septic system ordinances to assure adequate siting, maintenance, pumping, and replacement of systems so as to minimize potential adverse impacts on groundwater. On-lot septic systems should be pumped every three years. Alternatively, a municipality might create a local sewer district in which it charges each household a small annual fee, and in return takes responsibility for the maintenance and replacement of septic systems.

- Adopt aquifer testing requirements for proposed new subdivisions and land developments to assure adequate water supply and to assure no adverse impacts on adjacent existing development.

- Require that any new development within one-half mile of an existing municipal community water system be connected to the municipal water system.

- Discourage the proliferation of on-lot water systems by revising comprehensive plans and zoning ordinances to:

  1) direct future development into planned growth areas with densities conducive to the provision of community water and sewer systems (three to four units per acre),
  2) rezone large areas of productive agricultural and forest lands using a fixed area or sliding scale district that results in a maximum density of one unit per 25 acres,
  3) rezone suburbanizing areas at the edge of municipal water systems for cluster development that can be served by the municipal system

Groundwater quality in the County can only be protected through a coordinated effort among residents, municipalities and the County. Intensive community planning programs and the application of appropriate zoning standards are absolutely essential. Residents must also be educated as to the necessity of regularly pumping septic systems and proper septic system usage. At a minimum, municipalities should monitor the incidence of septage system pumping. If indicated, municipalities should require such pumping through the adoption of on-lot disposal system ordinances.

3. REGIONAL STRATEGIES

Within some of the County's regions there are significant deficits in individual system safe yield and storage capacity that could be reduced through potential interconnects with other nearby existing systems with surpluses. Within all of the County's regions there are systems with significant shortcomings in operational or financial management which could be addressed through various regional, cooperative and other joint approaches. Finally, recommendations are made for regions of the County, which, because of few or weak systems, will likely need new community water systems to accommodate planned future growth and development.

For purposes of making regional recommendations, Adams County's community water systems were divided into five regions as follows:

Region 1: ***South***
Region 2: ***Central***
Region 3: ***West***
Region 4: ***North***
Region 5: ***East***

Each of these regions, in turn, was divided into sub-regions to enable more specific recommendations to be made. These sub-regions are as follows:

Region 1: ***Littlestown sub-region***
Fairplay sub-region

Region 2: ***Gettysburg sub-region***
Bonneauville sub-region
Straban sub-region

Region 3: ***Fairfield sub-region***
Franklin sub-region

Region 4: ***Butler sub-region***
Bendersville sub-region
Latimore sub-region
Heidlersburg sub-region

Region 5: ***East Berlin sub-region***
Reading sub-region
Abbottstown sub-region
New Oxford sub-region
Hanover sub-region

In the following narrative, those characteristics of systems lending themselves to regional management are set forth. Significant projected year 2010 system capacity surpluses and deficits are noted (10,000+gpd), as are existing and potential interconnections (within one mile). Recommendations for the shared provision of adequate safe yield and storage are made, together with the interconnections that would make this possible. Systems with inadequate piping diameter for interconnections are noted. While Table 15 identifies these systems, only the larger systems are noted in this discussion to be problematic, as very small systems can be interconnected at the water source or storage site. The recommendations continue by proposing joint approaches to system management. Finally, recommendations for new community water systems are also provided.

REGION 1: SOUTH

This region encompasses the Littlestown and Fairplay sub-regions and includes Littlestown Borough and parts of Germany, Union, Mount Joy, Cumberland, and Freedom Townships.

Littlestown Sub-Region					
		System Capacity		Interconnections	
System	Viability	Surpluses	Deficits	Existing	Potential
1. Littlestown Municipal Authority	Fair (35)	• storage	• safe yield		X(1)
2. Private (proposed)					?

[1]piping diameter partially adequate for interconnection

The Littlestown Municipal Authority is a "fair" system with surplus storage but a safe yield deficit. The 1999 drought of record called into question the adequate availability of water to this system. The system is in the process of adding a filter plant to put the quarry back on line as a source. While anticipated future development within Germany Township will most likely need public water, the lack of zoning within the Township makes it extremely difficult to predict where development will occur. If the Township were to adopt zoning that directed future growth and development in close proximity to Littlestown Borough, the ability of this municipal system to serve the area would be enhanced, making the creation of a new community water system unnecessary. It is recommended that the Township adopt such zoning and that the Littlestown Municipal Authority extend its service to accommodate projected nearby needs.

Fairplay Sub-Region					
		System Capacity		Interconnections	
System	Viability	Surpluses	Deficits	Existing	Potential
1. Fairplay (proposed)					?
2. Hoffman Homes for Youth	Fair (31)	• storage	• safe yield		
3. Private (proposed)					?
4. Round Top MHP and Campground	Fair (30)	• safe yield			
5. Timeless Towns of America	Fair (32)	• storage			

The Fairplay sub-region has three existing "fair" systems and two proposed new systems. While there is surplus storage and safe yield capabilities among the existing systems, none are close enough to any other system to allow for interconnection. This region could benefit from enacting formal cooperation and joint contractual assistance as a way to lower costs and improve management. As currently proposed, the recommended Fairplay and private community water systems would be a little over one mile from each other, making interconnection unlikely. If local planning and zoning could be modified to place these systems closer together, they could potentially benefit from interconnection or shared system components. Most efficient would be the creation of a single new community water system serving the southern Freedom Township area.

REGION 2: CENTRAL

This region encompasses the Gettysburg, Bonneauville, and Straban sub-regions in the Borough of Gettysburg, Bonneauville Borough, and parts of Cumberland, Mount Joy, Mount Pleasant, and Straban Townships.

Gettysburg Sub-Region

System	Viability	System Capacity		Interconnections	
		Surpluses	Deficits	Existing	Potential
1. Gettysburg Municipal Authority	Strong (50)	• storage			X(1)
2. Lincoln Estates MHP	Fair (34)	• safe yield • storage			X
3. Meadows Property Owners Assn.	Fair (34)	• safe yield			X

[1]piping diameter partially adequate for interconnection

During the drought of 1999, the Gettysburg system experienced water shortages due to its high reliance on its surface water source. A new well that is to come online in the summer of 2000 should provide added security for this system. The Lincoln Estates and Meadows Property Owners systems are functioning adequately, both lie within approximately one mile of the existing Gettysburg service area and both are located in the path of planned growth and development. As such, it is likely that the Gettysburg system will eventually extend its service to these general areas, making interconnection a definite possibility. These systems should consider whether they might benefit from interconnection with the Gettysburg system. There are, in addition, many non-community water systems along the Baltimore Pike and the Emmitsburg Road that could interconnect with the Gettysburg system.

Bonneauville Sub-Region

System	Viability	System Capacity		Interconnections	
		Surpluses	Deficits	Existing	Potential
1. Bonneauville Municipal Authority	• weak (28)*		• safe yield • storage		X
2. Cavalry Heights MHP	• fair (35)				X
3. Citizens Utilities Water Co.	• fair (32)	• safe yield	• storage		X(1)

[1]piping diameter partially adequate for interconnection

Viability ratings for three systems located in the Bonneauville sub-region range from fair to weak. Although each of them is close enough to be interconnected, Citizens Utilities does not have enough surplus safe yield to provide for Bonneauville's year 2010 needs. *Bonneauville added a new source and 300,000 gallons in additional treated storage in March of 1999, but still needs additional source water and would do well to examine the causes of its high operating expenses. If Cavalry Heights is found to be under the influence of surface water after additional testing, this system should be encouraged to interconnect with Citizens Utilities or Bonneauville. While the current service areas for Citizens Utilities and the Gettysburg system are more than one mile apart, as Gettysburg grows outward, it may well come to serve areas adjacent to Citizens Utilities. Citizens might also be able to service the future development in the vicinity of the Route 15/97 interchange. For these reasons, these systems should explore the potential for shared system storage or other joint efforts.

Straban Sub-Region

System	Viability	System Capacity		Interconnections	
		Surpluses	Deficits	Existing	Potential
1. Castle Hill MHP	Weak (22)		• storage		
2. Hunterstown (proposed)					X
3. Oak Village MHP	Fair (35)	• safe yield • storage			X

The Straban sub-region includes three systems that are all in close proximity to each other, with the Oak Village and proposed Hunterstown systems having the potential for interconnection. Castle Hill will need to provide for additional storage and rectify its water quality problems on its own; it is currently in the process of permitting a second well. However, these three systems could benefit by enacting formal cooperation and shared contractual assistance programs as a way to lower costs and improve management.

REGION 3: WEST

This region includes the Fairfield and Franklin Sub-regions and involves Fairfield and Carroll Valley Boroughs and parts of Hamiltonban and Franklin Townships.

Fairfield Sub-Region

System	Viability	System Capacity		Interconnections	
		Surpluses	Deficits	Existing	Potential
1. Fairfield Municipal Authority	Strong (41)	• storage	• safe yield	X	X(1)
2. Hillside Rest Home	Weak (25)				
3. Section A Water Corp.	Fair (30)		• storage		X

[1] piping diameter partially adequate for interconnection

The Fairfield and Section A systems are about one mile from each other and could be interconnected, especially in view of planned growth and development between the two systems. Both systems lack sufficient storage. The possibility of shared additional storage should be investigated. The Section A system could be strengthened by pursuing joint strategies with the Fairfield system such as the consolidation of systems. The Hillside Rest Home could be integrated with the other two systems as a way to lower costs and improve management.

Franklin Sub-Region					
		System Capacity		Interconnections	
System	Viability	Surpluses	Deficits	Existing	Potential
1. Franklin Twp. Municipal Authority	Weak (28)		• storage		
2. Orrtanna (proposed)					
3. Piney Mountain Home Est.	Fair (35)	• safe yield • storage			

The Franklin sub-region includes three systems, which, due to distance issues, could not be interconnected easily. However, they are good candidates for intermunicipal cooperation or joint contractual assistance as a way to lower costs and improve management.

REGION 4: NORTH

This region includes the Butler, Bendersville, Latimore, and Heidlersburg sub-regions covering Arendtsville, Bendersville, Biglerville, and York Springs Boroughs, and parts of Franklin, Menallen, Butler, Huntington, Tyrone, Latimore, and Reading Townships.

Butler Sub-Region					
		System Capacity		Interconnections	
System	Viability	Surpluses	Deficits	Existing	Potential
1. Anchor MHP	Weak (28)	• safe yield	• storage		
2. Arendtsville Municipal Water Co.	Strong (47)	• storage			
3. Biglerville Water Co.	Strong (39)	• storage	• safe yield		
4. Private (proposed)					?

The two municipal systems in the Butler sub-region are strong and should continue to operate primarily as separate entities. However, to keep costs to a minimum, each could benefit from formal cooperation and joint contractual assistance. The Anchor MHP system is weak but is too far away to interconnect with any other system. It is possible that in the distant future the Gettysburg system could extend north this far and be able to interconnect with and serve this system. In the meantime, the Anchor system might benefit from formal cooperation and joint contractual assistance with both municipal systems. It is unknown where the proposed private community water system might locate, as Butler Township has no zoning to indicate where future growth and development should be directed. It is possible that future water service will be needed south of the Biglerville system; if it is close enough to interconnect with the Biglerville system, this would eliminate the need for a new system. Butler Township should be encouraged to adopt zoning that directs future growth and development close enough to Biglerville Borough that water service can be extended from this source.

Bendersville Sub-Region					
		System Capacity		Interconnections	
System	Viability	Surpluses	Deficits	Existing	Potential
1. Bendersville Water Co.	Weak (26)		• storage • safe yield		X(1)
2. Possum Valley Municipal Auth.	Fair (35)		• storage		X(1)
3. Gardners (proposed)					

[1]piping diameter partially adequate for interconnection

The Bendersville sub-region includes two municipal systems (one rated "fair" and one "weak"). Both have the potential of benefiting from a variety of joint approaches to system management, ranging from shared new source and storage to consolidation of systems. In addition, these systems both have water quality problems for which there may be a common solution. Finally, shared high system operational costs could be lowered and management improved by joining forces. The proposed Gardners system could benefit from being included in some of these shared approaches.

Latimore Sub-Region					
		System Capacity		Interconnections	
System	Viability	Surpluses	Deficits	Existing	Potential
1. Lake Meade Municipal Authority	Strong (44)	• safe yield • storage			
2. York Springs Municipal Authority	Fair (32)	• safe yield	• storage		
3. Private (proposed)					

The Latimore sub-region includes two systems which are located too far apart to be interconnected or to benefit from shared system components. In addition, a new system, Peek View Mobile Home Park, is under development but is also too far from other systems for interconnection. However, all three systems could benefit by enacting formal cooperation or joint contractual assistance to lower costs and improve system management. Huntington Township has recently adopted zoning that directs much of its future growth and development in close proximity to York Springs Borough, probably making the creation of a new community water system unnecessary.

Heidlersburg Sub-Region					
		System Capacity		Interconnections	
System	Viability	Surpluses	Deficits	Existing	Potential
1. Heidlersburg (proposed)					X
2. Walnut Grove MHP	Fair (33)	• safe yield • storage			X

If the Heidlersburg system is eventually constructed, these two systems would be located close enough to interconnect. Interconnections should be considered due to Walnut Grove's significant storage surplus. Capacity at Walnut Grove should be sufficient to serve the Heidlersburg area. Alternatively, these systems could consolidate into one system or transfer ownership to the Heidlersburg system.

REGION 5: EAST

This region includes the East Berlin, Reading, Abbottstown, New Oxford, and Hanover sub-areas within East Berlin, Abbottstown, New Oxford, and McSherrystown Boroughs, and parts of Reading, Hamilton, Berwick, Mount Pleasant, Oxford, and Conewago Townships.

East Berlin Sub-Region

System	Viability	System Capacity		Interconnections	
		Surpluses	Deficits	Existing	Potential
1. East Berlin Boro Water	Fair (35)	• storage	• safe yield		X(1)
2. Mountainview MHP	Weak (26)*	• safe yield			X
3. Pine Run Inc.	Fair (34)	• safe yield • storage			
4. Private (proposed)					X

1 piping diameter partially adequate for interconnection

The East Berlin system is a "fair" one with significant excess storage and could be extended north to areas planned for growth and development (stream crossing required, however). It will need to add a new water source. The proposed private system is close enough to East Berlin Borough so that it is in fact unnecessary, as the Borough's system could serve this area. Currently East Berlin is the only Adams County borough that does not serve outside its boundaries. However, it should be encouraged to do so to avoid the development of new community water systems where they are not necessary. *Mountainview MHP added a new source and 10,000 gallons in finished storage in 1999, giving the system an effective "fair" rating. The Pine Run system appears to be operating adequately but might benefit from shared formal cooperation and contractual assistance together with this sub-region's other systems to reduce costs and improve management.

Reading Sub-Region

System	Viability	System Capacity		Interconnections	
		Surpluses	Deficits	Existing	Potential
1. Hampton (proposed)					X
2. Stockham's Village (MHP)	Fair (32)	• safe yield			X

These two systems would be close enough to interconnect, and should consider doing so, and possibly consolidating or transferring ownership, particularly in view of planned growth and development in between.

Abbottstown Sub-Region					
System	Viability	System Capacity		Interconnections	
		Surpluses	Deficits	Existing	Potential
1. Abbottstown Municipal Authority	Fair (30)		• safe yield • storage		X(1)
2. Beaver Creek MHP	Weak (26)		• storage		X
3. Childrens Development Center	Very weak (17)		• unknown safe yield		X

1 piping diameter partially adequate for interconnection

These three systems, which range from very weak to fair, are all very close and could be interconnected. Because growth and development are planned for the intervening areas between them, it would make sense to consolidate these systems, possibly through transfer of ownership of the Beaver Creek and Childrens Development Center systems to the Abbottstown system. Projected future needs for additional storage and safe yield could then be undertaken by a single entity and overall management and operational costs reduced through economies of scale.

New Oxford Sub-Region					
System	Viability	System Capacity		Interconnections	
		Surpluses	Deficits	Existing	Potential
1. Chesapeake Estates MHP	Fair (34)	• safe yield	• storage		
2. New Oxford Manor MHV	Fair (32)	• storage			
3. New Oxford Municipal Authority	Fair (35)	• storage	• safe yield		?
4. Panorama MHP	Fair (35)	• safe yield			
5. Private (proposed)					

The three smaller systems are each about one mile from the New Oxford system and could potentially be interconnected (two connections would involve stream crossings). However, the only smaller system with a projected deficit that would benefit from this would be the Chesapeake system and it is not in the path of growth. Because of the relatively strong status of this sub-region's systems, this area would probably benefit most from utilizing formal cooperation and shared contractual assistance. It would also be beneficial for Oxford Township to enact zoning so that it might direct future growth and development towards community water service availability. This might make the creation of a new community water system unnecessary. Considerable projected growth and development will probably occur within this Township over the next 10 years. The New Oxford system must provide significant additional safe yield to meet future needs.

Hanover Sub-Region*					
		System Capacity		Interconnections	
System	Viability	Surpluses	Deficits	Existing	Potential
1. Centennial (proposed)					
2. Green Springs (proposed)					X
3. Hanover Municipal Waterworks					X

* The Hanover system, located in York County, is not evaluated in this report, although it is projected to serve substantial anticipated new population growth within Adams County. Its service area within Adams County is not sufficiently close to the proposed centennial water system to permit interconnection, but it is potentially close enough to the proposed Green Springs System as well as to the new Eagle View Mobile Home park system, which is under development. All three proposed systems could benefit from formal cooperation and shared contractual assistance together with the Hanover system to improve management and reduce the costs of operation.

4. CONCLUSIONS

Municipal support for the recommendations of this Plan is essential. Community water systems capable of assisting others may not reach out on their own to help troubled systems without active local support and encouragement. Weaker community water systems and troubled on-lot developments may not ask for assistance and need to be supported in requesting help as well. The fewer new wells that are drilled into the County's aquifers, the fewer the potential sources of contamination. As a limited water supply is produced by the County's wells, it makes sense to utilize them to the fullest before drilling new wells.

Municipal comprehensive planning and zoning can support the recommendations of this plan or undermine them. If the County's strong community water systems are to be encouraged to make needed improvements and extend water service to remedial water users, they must be permitted to extend their systems to serve new development as well. Only a significant increase in rate bases can be expected to help fund needed system improvements. It is critical that local municipalities plan and zone land for development at densities that can utilize community water adjacent to their stronger community water systems. New growth should be directed primarily into growth areas as identified in the County’s 1991 Comprehensive Plan.

V. POTENTIAL NEW WATER SOURCES

A. INTRODUCTION

As Adams County grows, the demand for potable water will increase, and new water source locations will need to be identified. This chapter will evaluate the quality and quantity of potential water sources. Future measures needed to protect new water sources will also be recommended. Further, potential reservoir locations within Adams County will be evaluated for beneficial purposes, need, and implementation costs and requirements.

B. POTENTIAL WATER RESOURCES: GROUNDWATER

In Adams County, there are four major hydrogeologic units that are groundwater resources: the Gettysburg Lowland, Blue Ridge Province, Piedmont Upland, and the Piedmont Lowland. For a full description of each unit, the United States Geological Survey has prepared a "Summary of Hydrogeologic and Ground-Water Quality Data and Hydrogeologic Framework at Selected Well Sites, Adams County, Pennsylvania" (Low And Dugas, 1999).

1. AQUIFER CAPACITY

From a water supply perspective, it is important to evaluate the water-bearing characteristics of these hydrogeologic units based on their individual groundwater recharge capacity. Groundwater recharge is determined by a hydrogeologic unit's ability to collect and store precipitation and other surface water from a relatively large surface area. This process is highly dependent upon bedrock type and geologic structural condition (faults and fractures). It is also dependent upon annual precipitation. During wet years, groundwater recharge is relatively higher. The opposite is true during dry years.

For this evaluation, groundwater recharge rates during a 1 in 10 year drought frequency were used to establish overall groundwater capacity for use as a water supply under these recharge conditions. The Gettysburg Lowland unit, which covers approximately 67 percent of the County, has a 10-year drought recharge rate of 132,276 gallons per day per square mile (gpd/mi^2). Within this unit, there is an igneous diabase that underlies approximately 55 square miles (mi^2) of the County (USGS 1999). This diabase inhibits groundwater recharge because of its dense crystalline composition. Therefore, the 10-year drought groundwater recharge rate for the Gettysburg Lowland is the lowest of all the hydrogeologic units in Adams County. The western-most unit in the county, the Blue Ridge, has an average annual recharge of 180,000 gpd/mi^2 during a 10-year drought condition. The Piedmont Upland and Lowland units have 10-year drought recharge rates of 317,105 gpd/mi^2 and 441,588 gpd/mi^2, respectively. The groundwater recharge rates referenced above were taken from the USGS (1999) report for Adams County and represent average annual values per hydrogeologic unit under the 10-year drought frequency recharge condition.

2. PROTECTION TECHNIQUES

Several types of regulatory and nonregulatory protection techniques exist that could help protect the County's groundwater sources for future consumptive use. For instance, the delineation of Wellhead Protection Areas (WHPAs) and the adoption of regulatory measures to protect community water system supply wells would safeguard not only existing wells, but potential future wells. Further discussion on WHPAs is provided in Chapter VI.

Other methods of groundwater protection, in areas where community water systems do not currently exist, include zoning and subdivision and land development (SALDO) regulations, which can be used to protect potential source water locations from contamination; these measures can also be used to protect vital areas of groundwater recharge. Some specific zoning and SLDO techniques include:

- Land purchase or easement acquisition,
- Creation of regional watershed associations,
- Very low-density zoning, including cluster and rural conservation zoning that requires large areas to be retained in a natural state,
- On-lot septic maintenance, cleaning and replacement regulations,
- On-lot water system well construction and abandonment requirements, and demonstration of adequate supply,
- The promotion of Integrated Pest Management Practices on farms and in gardens,
- Annual hazardous materials collection days,
- Identification and careful monitoring of hazardous materials production, use, storage, transport, and disposal (see County's GIS database),
- Up-to-date municipal Emergency Operations Plans,
- Zoning protection for floodplains, wetlands, riparian corridors, steep slopes, and woodland areas, low maximum impervious surface standards and the promotion of pervious surfaces for development,
- Best management practices for storm water management, including the promotion of non-structural solutions, and other techniques as described both in Chapter VI and Chapter IV and
- Non-regulatory approaches supporting the protection of groundwater include education, conservation, land acquisition, easement acquisition and transfer of development rights, to name a few.

These techniques should be used at surrounding an upgradient of the sites identified in Table 20 and the accompanying text as proposed new community water systems. The implementation of these techniques will require the cooperation and coordination of the efforts of municipalities, CWSs, the County Conservation District, Cooperative Extension, Adams County, and other participants.

Finally, Adams County is partly located within the Susquehanna River basin, which is under the authority of the Susquehanna River Basin Commission (SRBC). The SRBC conducts a public review of proposed surface and groundwater uses, taking into consideration local concerns in evaluating requests for groundwater and surface water withdrawal permits. Parts of Adams County are also located within the Potomac River basin. There is an Interstate Commission on the Potomac River Basin that provides information on the use and conservation of water and land resources of the Potomac River basin through regional and interstate cooperation. Municipalities and community groups in Adams County with concerns about water quantity and quality should contact these Commissions for additional information.

C. POTENTIAL WATER RESOURCES: SURFACE WATER

Currently, five community water systems in Adams County use surface water or springs to provide potable water to their customers. In addition to groundwater wells, the Bendersville Water Company, Possum Valley Municipal Authority, and York Springs Municipal Authority utilize one or more springs to provide water to their respective service populations. The Gettysburg Municipal Authority and New Oxford Municipal Authority withdraw water from streams. The trend in recent years has been for the County's community water systems to rely less on surface water sources in favor of groundwater. Consequently, a greater proportion of water supplied in the County today is derived from groundwater than what was typically derived in the past.

1. SURFACE WATER SUMMARY

Adams County has several streams and surface water bodies that are potential sources of water for consumers in the County. Two major reservoirs (Meade and Heritage) store water from some of the larger creeks in the County, such as Conewago Creek, Bermudan Creek, and Rock Creek. However, both reservoirs are surrounded by large housing developments and used for boating. In addition to these potential surface water sources, small creeks could be used to supplement community water demand. For example, the New Oxford Municipal Authority recently increased its utilization of the Conewago Creek from 0.65 million gallons per day (mgd) to 1.3 mgd. Since the safe yield of the Creek is estimated to be 7.45 mgd, there may be room for further growth (ACOPD, 1991).

Through individual, or possibly combined, initiatives, Adams County CWSs may wish to develop one or more of these surface water resources if groundwater safe yields fall short of projected demand or as the need for water increases. However, the high costs associated with providing filtration of surface water sources, as required by amendments to the Safe Drinking Water Act, may discourage many existing and projected new systems from using such sources. For this reason, the Adams County Water Supply Plan recommends that the Gettysburg and New Oxford systems, which currently provide filtration, continue to do so and increase their withdrawals where permissible. However, the County's remaining existing, as well as proposed, systems should plan to rely on groundwater to meet future water demand. The exception to this would be any system proposing to use a surface water source that has a sufficient customer base to justify the capital investment needed for full surface water source filtration such as the Littletown system, such as the Littlestown system.

2. PROTECTION TECHNIQUES

Protection techniques for surface water are similar to those for groundwater. With financial and technical assistance from the EPA, community water suppliers could initiate surface water protection zones, which are primarily used for identifying potential spill hazards. Three zones are used when watersheds are greater than 100 mi^2 and two zones are used for watersheds smaller than 100 mi^2. The first two zones (A and B) are largely based on time of travel (TOT), which is the distance a particle can travel in a given length of time under flow rate conditions monitored from February 1995 to February 1998 for the specific stream. Zone A is delineated as ¼ mile on either side of the stream and an area ¼ mile upstream up to the point from which a particle is five-hours in travel time away. (five-hour TOT). Zone B is the actual watershed area surrounding Area A and is identified by the first direct flow 14 digit hydrologic unit code watershed cataloged by the USGS on either side of the river or stream extending upstream to a 25 hour TOT . Zone C is the remainder of the watershed.

Surface water protection zones are recommended in those municipalities with surface water sources that are currently used or potentially could be used for human consumption. Other regulatory and non-regulatory protection techniques could be used to protect surface water sources; chief among them are watershed plans and associated implementation measures. Other techniques range from special zoning provisions to public outreach programs and would be very similar to those techniques used for protecting groundwater sources.

D. NEW COMMUNITY WATER SYSTEMS

Up to fourteen new community water systems may be necessary for Adams County to serve existing and planned future growth areas as reflected on the County's Land Use Plan Map (ACOPD, 1991). These systems are listed in Table 20 and described in Chapter III. However, with careful attention to local planning and zoning, fewer than half of these systems may actually be necessary. Specifically, three townships with proposed private systems - Butler, Germany, and Oxford - lack zoning. The adoption of zoning that would direct growth to areas adjacent to nearby municipal water systems may eliminate the need for community water systems in these townships. In seven other instances, proposed new systems lie close enough to other existing or proposed systems that they could potentially be interconnected. These include the proposed private systems in Freedom, Huntington, Straban, Tyrone, Reading, and Hamilton Townships and the proposed Fairplay, Green Spring, and Heidlersburg systems.

Where existing groundwater pollution problems are the primary impetus for proposed new community water systems, removal of contaminant sources and cleanup of water sources are appropriate and possible alternatives. In particular, where pollution problems are due primarily to malfunctioning septic systems, it will likely be more cost-effective for these systems to be repaired or replaced than for a new public water system to be developed. At the same time, existing homeowners should consider the replacement of any ungrouted, malfunctioning or poorly-sited wells that may be contributing to the problem. In-home disinfection could be provided until the sewage problems are corrected, and other means of preventing such problems in the future could be implemented by municipalities (see Chapter IV).

Any proposed new community water systems will only be able to obtain a construction permit if the financial part of the required business plan can provide assurances of revenues and cash flow to cover the cost of construction, operation, and maintenance of the systems for at least five full years. The initial cost of developing a new small community water system is in the range of $400,000 to $750,000 for capital costs alone. Small systems additionally have a very difficult time complying with the operation and maintenance costs and regulations relating to Safe Drinking Water requirements. The limited rate bases of any proposed new community water systems would likely result in annual debt service per connection that would be prohibitive, without outside financial assistance.

For these reasons, in areas of the County where projected new growth cannot reasonably be served by existing systems or through interconnections, it is recommended that a County authority be created to assist in the development and management of any new systems. A regional water provider, such as a County authority, through economies of scale and larger customer bases, would be more capable than individual small systems of implementing required solutions at affordable customer costs.

New water sources will have to be located for the new CWSs that are found to be necessary. Some will likely be municipal systems. Information is provided below for each site and its geologic formation as to how many acres are required for groundwater recharge. In Adams County, the average household consists of 2.7 people, each of whom will use a peak daily water rate of 111 gpd.

TABLE 20 POTENTIAL NEW COMMUNITY WATER SYSTEMS: ADAMS COUNTY		
Water System	**Projected Service Population in 2010**	**Township**
Centennial	750	Mt. Pleasant
Fairplay	100	Freedom
Gardners	200	Tyrone
Green Spring	786	Berwick
Hampton	1,000	Reading
Heidlersburg	200	Tyrone
Hunterstown	500	Straban
Orrtanna	381	Franklin/Hamiltonban
Private	230	Butler
Private	1,500	Freedom
Private	300	Germany
Private	525	Hamilton
Private	300	Huntington
Private	300	Oxford
TOTAL	**7,072**	

In addition, guidelines will be given for each geologic formation as to how many acres are required for groundwater recharge (per use rate, usually per household), in the event that a proposed growth area has no projected population. DEP guidelines specify that for Adams County the average household consists of 2.7 people, each of whom will use a peak daily rate of 111 gpd. Therefore, the following calculations assume that the average household will use 300 gpd/household. If the community water system is installed in the Gettysburg Lowlands, it is estimated that for each household 1.45 acres of land be allowed for groundwater recharge. In the Blue Ridge hydrogeologic unit, 1.07 acres per household will be needed. Approximately 0.43 acres will be needed for recharge in the Piedmont Lowlands and 0.61 acres for systems in the Piedmont Uplands.

It should be noted these estimates are guidelines only and actual well yields and local recharge rates may differ on a sitely basis. For example, most of the development in Carroll Valley Borough is underlain by the Blue Ridge, Gettysburg Lowland and diabase recharge units. It must be expected that average recharge rates for this development would be between 132,276 gpd/mi^2 and 179,252 gpd/mi^2, and that 1.07 to 1.45 acres per family of recharge area would be required for sustainable groundwater resources. However, due to the low permeability of the geologic units drilled near the Borough to date, actual well yields are much lower than this. In this situation, alternative water resources (such as neighboring groundwater or surface water resources) should be evaluated and considered for implementation.

1. AVAILABLE WATER RESOURCES

Each of the systems listed in Table 20 will be evaluated based on location, capacity, and quality of available water resources, as well as the amount of area required for aquifer recharge needed for the projected 2010 population.

Location of Resource **-** Groundwater for the projected future community water systems will be drawn from all four of the hydrogeologic units found in the County. The four hydrogeologic units will be abbreviated as follows: Blue Ridge (BR), Gettysburg Lowland (GL), Piedmont Upland (PU), and Piedmont Lowland (PL).

Capacity of Resource - The capacity of the groundwater supply is typically the safe yield of the system - the amount of water that can be withdrawn from the aquifer without creating excessive water table drawdown. However, because these systems are not yet in existence, safe yield can not be measured at this time. Therefore, the capacity for the proposed systems will be estimated to be the 10-year drought recharge rate.

In most of the projected future water service areas for existing and anticipated new CWSs, sufficient land area and aquifer recharge are available to support projected groundwater demand, although individual system yield will vary from location to location. Based on 10-year drought condition recharge rate, locations with projected year 2010 groundwater shortfalls are East Berlin Borough (39,228 gpd), Gettysburg Borough (459,251 gpd), Biglerville Borough (20,247 gpd), New Oxford Borough (85,508 gpd), York Springs Borough (83,302 gpd) and Hamilton Township (22,431 gpd). These values along with those for other water systems in Adams County can be viewed in Table 21. In addition, Carroll Valley has experienced exceptionally low yielding wells and apparent groundwater recharge shortfalls due to low aquifer yield conditions. These low yield conditions are probably the result of even lower permeability and recharge rates than referenced herein, which are expected to persist in and near Carroll Valley in the future.

Table 21
Groundwater Projections
Adams County Water Supply Plan
Adams County Office of Planning and Development

Municipality	Community Water System(s)	Hydrogeologic Unit	Projected 2010 Service Pop.	Total 2010 Service Pop.	Estimated 2010 Peak Use/person (gpd)	Growth Areas	Estimated Area of Growth (mi2)	Drought Recharge (gpd/mi2)	Area Required for Groundwater Recharge per Growth Area (mi2)	Surplus/Deficit space (mi2)	Drought Recharge per Area (gpd)	Surplus or Deficit based on Drought Recharge & Peak Usage (gpd)
Bouroughs												
Abbottstown	Abbottstown Mun. Auth.	GL	725		111		0.6	132,276	0.6	-0.0	76,720	-3,755
	Beaver Creek MHP		125	850	111					___		__
Arendsville	Arendtsville Mun. Water Co.	GL	785	785	111		1.0	132,276	0.7	0.4	136,244	49,109
Bendersville	Bendersville Water Co.	BR	620		111		0.8	180,000	0.4	0.4	138,600	69,780
Biglerville	Biglerville Water Co.	GL	1,100	1,100	111		0.8	132,276	0.9	-0.2	101,853	-20,247
Bonneauville	Bonneauville Mun. Auth.	GL	1,900	1,900	111		1.6	132,276	1.6	0.0	216,933	6,033
Carroll Valley	Section A Water Corp.	BR	300		165		4.9	180,000	0.3	4.6	885,600	836,100
	Section A Water Corp.	GL	300		165		5.0	132,276	0.4	4.6	654,766	605,266
	Fairfield Municipal Auth.		50	650								
East Berlin	East Berlin Borough Water	GL	1,700	1,700	111		1.1	132,276	1.4	-0.3	149,472	-39,228
Fairfield	Fairfield Municipal Auth.	GL	850	850	111		1.4	132,276	0.7	0.6	178,573	84,223
Gettysburg	Gettysburg Mun. Auth.	GL	7,100	7,100	111		2.6	132,276	6.0	-3.5	339,949	-459,251
Littlestown	Littlestown Mun. Auth.	PL	4,500	4,500	111		2.5	441,588	1.1	1.3	1,090,722	591,222
McSherrystown	Hanover Mun. Auth.	PL	3,050	3,050	111		1.1	441,588	0.8	0.3	463,667	125,117
New Oxford	New Oxford Mun. Auth.	GL	1,850	1,850	111		0.9	132,276	1.6	-0.6	119,842	-85,508
York Springs	York Springs Mun. Auth.	GL	640	640	111		0.1	132,276	0.5	-0.4	12,698	-58,342
Townships					111							__
Berwick	Abbottstown Mun. Auth.	GL	180		111		5.6	132,276	0.2	5.4	734,132	714,152
	Abbottstown Mun. Auth.	PU	20		111		0.6	317,105	0.0	0.6	183,921	181,701
	Beaver Creek MHP		375		111					___		__
	Childrens Development Center		64		111					___		__
	Potential Green Springs Sys.	PL	534		111		2.1	441,588	0.1	2.0	938,375	879,047
	Potential Green Springs Sys.	PU	252		111		1.0	317,105	0.1	0.9	317,105	289,186
	New Oxford Mun. Auth.	GL	100		111		0.6	132,276	0.1	0.5	75,397	64,297
	Hanover Mun Auth.		250	1,800	111					___		__
Butler	Anchor MHP	GL	170		135			132,276	0.2	___		__
	Arendtsville Mun. Water Co.	GL	200		111		0.5	132,276	0.2	0.3	67,461	45,261
	Biglerville Water Co.	GL	300		111		4.1	132,276	0.3	3.8	541,009	507,709
	Potential Private System	GL	230	800	111	Area N of Gettysburg	1.3	132,276	0.2	1.1	170,636	145,106
Conewago	Hanover Mun Auth.		7,400	6,200	111					___		__
Cumberland	Gettysburg Mun. Auth.	GL	2,700		111	Areas N and W of Gettysburg	8.8	132,276	2.3	6.5	1,161,383	861,683
	Lincoln Estates MHP	GL	450		111			132,276	0.4	___		__
	Meadows Prop. Owners Assn.	GL	90		111			132,276	0.1	___		__
	Round Top MHP and Camp.	GL	200		182			132,276	0.3	___		__
	Timeless Towns of America	GL	300	3,640	113			132,276	0.3	___		__
Franklin	Arendtsville Mun. Water Co.	GL	50		111		1.2	132,276	0.0	1.1	154,763	149,213
	Franklin Twp. Mun. Auth.	BR	135		111		0.6	180,000	0.1	0.5	104,400	89,415
	Franklin Twp. Mun. Auth.	GL	365		111		1.6	132,276	0.3	1.3	206,351	165,836
	Piney Mountain Home Est.		124		386					___		__
	Future Orrtanna Water System	GL	226		111	half of Orrtanna	0.6	132,276	0.2	0.4	76,720	51,634
Freedom	Holloway Development		1,500		111			132,276	1.3	___		__
	Future Fairplay Water System	GL	100	1,600	111	Fairplay/Greenmount Area	1.7	132,276	0.1	1.6	228,837	217,737
Germany	Littlestown Mun. Auth.	GL	415		111	Area W of Littlestown	2.9	132,276	0.3	2.6	387,569	341,504
	Littlestown Mun. Auth.	PU	85		111	Area SE of Littlestown	0.6	317,105	0.0	0.6	196,605	187,170
	Potential Private System		300	800	111					___		__
Hamilton	New Oxford Mun. Auth.	GL	500		111		0.3	132,276	0.4	-0.2	33,069	-22,431
	Abbottstown Mun. Auth.	GL	650		111		1.4	132,276	0.5	0.8	179,895	107,745
	Potential Private System	GL	525		111	Area E of New Oxford	2.0	132,276	0.4	1.6	268,520	210,245
	Pine Run Inc.		125	1,800	111					___		__

Table 21 Groundwater Projections Adams County Water Supply Plan Adams County Office of Planning and Development												
Municipality	Community Water System(s)	Hydrogeologic Unit	Projected 2010 Service Pop.	Total 2010 Service Pop.	Estimated 2010 Peak Use/person (gpd)	Growth Areas	Estimated Area of Growth (mi2)	Drought Recharge (gpd/mi2)	Area Required for Groundwater Recharge per Growth Area (mi2)	Surplus/Deficit space (mi2)	Drought Recharge per Area (gpd)	Surplus or Defecit based on Drought Recharge & Peak Usage (gpd)
Hamiltonban	Fairfield Mun. Auth.	GL	370		111		0.5	132,276	0.3	0.2	66,138	25,068
	Hillside Rest Home		45		111					____		__
	Future Orrtanna Water System	GL	155	570	111	half of Orrtanna	0.6	132,276	0.1	0.4	76,720	59,515
Huntington	York Springs Mun. Auth.	GL	400		111		2.5	132,276	0.3	____	329,896	285,496
	Potential Private System	BR	300	700	111	Idaville Area	1.8	180,000	0.2	1.6	315,000	281,700
Latimore	Lake Meade Mun. Auth.	GL	900		149		1.6	132,276	1.0	0.6	216,933	82,833
	York Springs Mun. Auth.	GL	200		111		0.7	132,276	0.2	0.5	89,948	67,748
Liberty			0	0	111					____		__
Menallen	Bendersville Water Co.	BR	8		111		0.1	180,000	0.0	0.1	14,400	13,512
	Bendersville Water Co.	GL	192		111		2.2	132,276	0.2	2.0	287,039	265,727
	Possum Valley Mun. Auth.		400	600	128					____		__
Mt. Joy	Citizens Utilities Water Co.	GL	1,250		111	Lake Heritage	1.9	132,276	1.0	0.9	255,293	116,543
	Hoffman Homes for Youth	GL	256	1,506	129			132,276	0.2	____		__
Mt. Pleasant	Bonneauville Mun. Auth.	GL	800		111		3.6	132,276	0.7	3.0	480,162	391,362
	Cavalry Heights MHP		80		111					____		__
	Chesapeake Estates MHP		470		111					____		__
	Citizens Utilities Water Co.	GL	650		111	Lake Heritage	0.9	132,276	0.5	0.3	115,080	42,930
	New Oxford Manor MHP		350		111					____		__
	Future Centennial Water Sys.	GL	450		111		0.4	132,276	0.4	0.0	51,588	1,638
	Future Centennial Water Sys.	PL	300	3,100	111		0.3	441,588	0.1	0.2	114,813	81,513
Oxford	New Oxford Mun. Auth.	GL	4,153		111		7.5	132,276	3.5	4.0	986,779	525,796
	Panorama MHP		70		111					____		__
	Potential Private System		300	4,523	111					____		__
Reading	Lake Meade Mun. Auth.	GL	2,100		149		2.1	132,276	2.4	-0.2	280,425	-32,475
	Mountainview MHP	GL	177		111			132,276	0.1	____		__
	Stockham's Village	GL	200		111			132,276	0.2	____		__
	Future Hampton Water Sys.	GL	1,000	3,477	111		2.7	132,276	0.8	1.9	359,791	248,791
Straban	Castle Hill MHP	GL	120		136			132,276	0.1	____		__
	Citizens Utilities Water Co.	GL	350		111	Lake Heritage	0.8	132,276	0.3	0.5	101,853	63,003
	Gettysburg Mun. Auth.	GL	2,200		111	Area NE of Gettysburg	2.3	132,276	1.8	0.4	300,267	56,067
	Oak Village MHP	GL	300		111			132,276	0.3	____		__
	Potential Hunterstown Sys.	GL	500		111	Hunterstown & Rt15/394	2.9	132,276	0.4	2.5	384,923	329,423
Tyrone	Walnut Grove MHP		335		111					____		__
	Future Heidlersburg Water Sys	GL	200		111		2.3	132,276	0.2	2.1	305,558	283,358
	Future Gardners Water Sys.	BR	200	735	111		0.3	180,000	0.1	0.1	46,800	24,600
Union	Littlestown Mun. Auth.	PL	713		111		0.6	441,588	0.2	0.4	256,121	177,034
	Littlestown Mun. Auth.	PU	538		111		0.4	317,105	0.2	0.2	136,355	76,693

All but one of the above mentioned locations are located within a borough which may have additional local water resources available to offset the deficit. For instance, the Biglerville Water Company has a deficit of 20,247 gpd within the borough of Biglerville, but a surplus of 507,709 gpd for the area in Butler Township that surrounds the borough. The surplus in the surrounding township may be used to supplement the deficit in Biglerville because of the larger recharge area available in Butler Township. The East Berlin Borough Water Company is predicted to have a deficit of approximately 40,000 gpd based on predicted 2010 populations and estimated area of growth. However, water surpluses exist in nearby communities such as Lake Meade, Abbottstown, and the proposed Hampton area that might be utilized to supplement the water supply. The closest of those communities is the Abbottstown area. An additional location for water resources might be in neighboring York County.

As growth in Adams County continues, the available ground and surface water will be shared between the new residential, commercial, and industrial populations. This growth will bring new contamination sources, in addition to increased usage of groundwater and surface water supplies, which may cause some systems to experience yield shortages. Options for CWSs with inadequate source capacity include reduced development, purchasing water from neighboring communities, obtaining groundwater resources from recharge areas outside the development area, or surface water development. In addition, zoning and land use regulations could be passed that would aid in the prevention of source water contamination.

Quality of Resource – Based on information collected from 352 wells and a tile drain between 1950 to 1996, the groundwater quality in Adams County is generally very good, overall (Dugas and Low, 1999). The median values for nitrate nickel, chromium, cadmium, fluoride, and arsenic were below their respective maximum contaminant levels (mcl) for each hydrogeologic unit in Adams County. Likewise, the median values for pH total dissolved solids chloride sulfate, aluminum, iron and zinc were all below their respective secondary maximum contaminant levels (smcl) for each of the four hydrogeologic units within Adams County. The median value for copper was below the action level for each of the hydrogeologic units in the County. However, the median concentration of lead for the Piedmont Lowland (0.027 mg/l) was above the action level of 0.015 mg/l (Dugas and Low, 1999). The Piedmont Upland unit had a median concentration of 0.06 mg/l for manganese, which is above the smcl for manganese (0.05 mg/l) (Dugas and Low, 1999).

According to Dugas and Low, a regional study of pesticides in groundwater found the highest concentrations in agricultural areas, but values rarely exceeded the EPA mcl. Dugas and Low also noted that a higher likelihood of pesticide contamination would be in the carbonate rock of the Piedmont Lowland and any agricultural areas underlain by the sandstone and shale of the Gettysburg Lowland because of its high permeability.

There is a limited amount of data available on radionuclide concentrations in groundwater. However, Dugas and Low report that radon-222, uranium, and tritium were detected in all five of the well samples. The concentrations of radon-222 ranged from 230 to 3,300 picuries per liter (pCi/l). No MCL exists for radon. The concentration of uranium ranged from 0.14 to 5.8 pCi/l. An MCL of 30 micrograms per liter was established for uranium in 2000, to become effective in 2003. Concentrations of tritium ranged from 1 to 48 pCi/l . However, no MCL exists for tritium (Dugas and Low, 1999).

The Pennsylvania Geological Survey reports that groundwater from the Gettysburg Lowland (GL) is generally hard, with elevated concentrations of dissolved calcium and magnesium, but that water quality is predominately good (1981). However, within the Gettysburg Lowland, twenty-five percent of the New Oxford Formation samples displayed iron and manganese concentrations that were above the recommended limit, and groundwater from the diabase unit was generally of poor quality. The Piedmont Lowland (PL) generally provides good quality water, but it is hard. The Piedmont Upland (PU) unit can provide hard or soft water depending upon which formation it is withdrawn from, and the Blue Ridge (BR) unit generally provides soft water (Pennsylvania Geological Survey, 1981).

2. SUMMARY OF FUTURE WATER NEEDS

The location, capacity, and quantity of the potential water resources available to meet the County's projected 2010 community water needs are provided in Table 21. This capacity data is based upon averaged data available for the major geologic units in and near Adams County. Therefore, actual data would vary from location to location within each geologic unit. Consequently, these data are provided to serve as general guidelines only. The geologic location, capacity (per 100 homes), and recharge area required for projected 2010 population demand in Adams County are summarized below. The location and configuration of the recharge area will be dependent upon placement of the new water sources for these systems. It is recommended that a water resource evaluation be completed during the development planning phases to outline recharge area protection strategies and to address watershed capacity issues related to sustained community water supply.

Centennial Water System

- Hydrogeologic Unit: GL and PL
- Capacity of Resource: 132,276 gpd/mi^2 (GL) and 441,588 gpd/ mi^2 (PL)
- Area Required for Recharge: 0.4 mi^2 (GL) and 0.1 mi^2 (PL)

Fairplay Water System

- Hydrogeologic Unit: GL
- Capacity of Resource: 132,276 gpd/mi^2
- Area Required for Recharge: 0.1 mi^2

Gardners Water System

- Hydrogeologic Unit: BR
- Capacity of Resource: 180,000 gpd/mi^2
- Area Required for Recharge: 0.1 mi^2

Green Spring Water System

- Hydrogeologic Unit: PL and PU
- Capacity of Resource: 441,588 gpd/mi^2 (PL) and 317,105 gpd/mi^2 (PU)
- Area Required for Recharge: 0.1 mi^2 (PL and PU)

Hampton Water System

- Hydrogeologic Unit: GL
- Capacity of Resource: 132,276 gpd/mi^2
- Area Required for Recharge: 0.8 mi^2

Heidlersburg Water System

- Hydrogeologic Unit: GL
- Capacity of Resource: 132,276 gpd/mi^2
- Area Required for Recharge: 0.2 mi^2

Hunterstown Water System

- Hydrogeologic Unit: GL
- Capacity of Resource: 132,276 gpd/mi^2
- Area Required for Recharge: 0.4 mi^2

Orrtanna Water System (Franklin and Hamiltonban Townships)

- Hydrogeologic Unit: GL
- Capacity of Resource: 132,276 gpd/mi^2
- Area Required for Recharge: 0.3 mi^2

Private Water System (Butler Township)

- Hydrogeologic Unit: GL
- Capacity of Resource: 132,276 gpd/mi^2
- Area Required for Recharge: 0.2 mi^2

Private Water System (Freedom Township)

The location of this proposed water system is unknown at this time. It is believed that this system will be southwest of the proposed Fairplay System. Therefore, the area required for recharge will be based on the land required per household. However, this area is underlain solely by the diabase unit of the Gettysburg Lowland, which typically produces low well yields and is often unsuitable for obtaining groundwater.

- Hydrogeologic Unit: GL (entirely in the diabase unit)
- Capacity of Resource: 75,000 gpd/mi^2 (diabase)
- Area Required for Recharge: 2.56 acres per family

Private Water System (Germany Township)

This proposed system location is unknown at this time, but it is likely to be southwest of the Littlestown system in the Gettysburg Lowland. Therefore, the area required for recharge will be based on the amount of land required per household.

- Hydrogeologic Unit: GL
- Capacity of Resource: 132,276 gpd/mi^2
- Area Required for Recharge: 1.45 acres per family

Private Water System (Hamilton Township)

- Hydrogeologic Unit: GL
- Capacity of Resource: 132,276 gpd/mi^2
- Area Required for Recharge: 0.4 mi^2

Private Water System (Huntington Township)

- Hydrogeologic Unit: BR
- Capacity of Resource: 180,000 gpd/mi^2
- Area Required for Recharge: 0.2 mi^2

Private Water System (Oxford Township)

The exact location and size of this proposed system's service area is unknown at this time, but is expected to be southeast of the New Oxford System. It is assumed that groundwater will come from both the Piedmont Upland and the Piedmont Lowland. The recharge area will be based on the amount of land required per family because the actual service area is unknown.

- Hydrogeologic Unit: PL and PU
- Capacity of Resource: 441,588 gpd/mi^2 (PL) and 317,105 gpd/mi^2 (PU)
- Area Required for Recharge: 0.43 acres/family (PL) and 0.61 acres/family (PU)

The potential community water systems may also benefit from abundant local streams, creeks and springs that may be developed and treated for use as additional water supply sources, although this would be costly. In addition, stream flows tend to be very irregular, depending on the occurrence and intensity of rainfall events. Generally, the smaller the stream, the more unreliable the minimum flow volume can be estimated or is sustained.

The foregoing-noted potential recharge areas should be protected from development and land use activities that could contaminate ground and surface water and, thereby, jeopardize the future use of these areas for consumptive water purposes. A listing of protection techniques is found on Page V-2 and 4. The Pennsylvania Municipalities Planning Code, which establishes a legal framework for local planning and zoning in the State, permits joint municipal planning and zoning and the shifting of the responsibility for providing for the full range of potential land uses among municipalities. This can be a very useful tool for communities that share and are motivated to protect a common ground or surface water resource, as a proposed use which could pose a water quality threat in one community might instead be located in an adjacent community.

Another feasible option for the foregoing areas would be to share water with existing systems with a surplus of water. Based on current yield, projected 2010 population, and 10-year recharge rates, the Citizens Utility and York Springs systems may have surplus water available to share with new or existing systems.

However, it should be noted that nearly half of the CWSs in Adams County have insufficient storage to cover one day and approximately 90 percent have insufficient storage for seven days. If CWSs opt to share water resources, the problem of water storage should be addressed as well.

E. POTENTIAL SURFACE WATER RESERVOIRS

The Adams County Comprehensive Sewer and Water Plan (1968) indicates that the Soil Conservation Service of the U.S. Department of Agriculture identified 81 potential water reservoir sites in Adams County. A consultant and a hydraulic engineer narrowed the list to ten locations after reviewing the Soil Conservation Service report (Adams County, 1968). These locations are as follows:

1. Pine Run - Hamilton Township
2. Conewago Creek – Buchanan Valley
3. Alloway Creek - Germany & Mt. Joy Township
4. Little Marsh Creek - Highland Township
5. Middle Creek - Liberty Township
6. Middle Creek - Freedom Township
7. Bermudian Creek - Huntington Township
8. Bermudian Creek - Tyrone Township
9. Plum Run – Reading Township
10. Rock Creek - Cumberland & Straban Township

In 1991, Adams County adopted a Comprehensive Plan for future development that revisited the need for reservoirs in light of more recent hydrogeologic data available for geologic units in the County and in consideration of the population and employment projections set forth in the plan. The hydrologic data presented in the report was used and referenced in previous sections of this chapter. The following sections provide a summary of each of the ten potential reservoirs listed above in the 1968 report, and discuss any differences in the 1968 and 1991 report recommendations.

1. POTENTIAL PURPOSES

Each of the ten potential reservoir sites was evaluated in 1968 for potential purposes such as flood control, water supply, fire protection, irrigation, and recreational usage.

The Pine Run location, referred to as Site 22 in the 1968 Adams County report, was reported as having good, clear flow, an indication of the an absence of sewage. However, it was noted that pasture land, cornfields, a horse farm and several businesses within the watershed were possible sources of pollution. This eliminated the site from consideration as a water supply or recreational resource (ACOPD, 1968). Thus the Pine Run location was slated for flood control, limited recreation, and irrigation use in 1968. In the Adams County Comprehensive Plan (1991), it is indicated that this location could be a multi-purpose area providing flood control, water supply, fire protection, irrigation, as well as full recreational purposes. The feasibility of using this area for surface water supplies should be further evaluated to determine its current and future capabilities for meeting growth criteria related to all of these factors.

The Conewago Creek location, site 42 in the 1968 report, was noted as the best location for a reservoir site in Adams County . There are no signs of water pollution, a limited number of contamination sources in the area, and a minimum potential for algae formation at this site. Furthermore, the average depth of a reservoir at this location could be 20 feet, providing approximately 4,000 acre feet of water available for water supply, recreation and irrigation, as well as providing flood control benefits (ACOPD, 1968). This site was noted as serving the same purposes in the 1991 Adams County Comprehensive Plan.

In 1968, Adams County evaluated the potential for a surface water supply reservoir for the Bonneauville-Littlestown-New Oxford Area (Site 48) .The best location was determined to be Alloway Creek. This location was selected based on its large watershed and storage potential even though it would require longer distance water transmission (ACOPD, 1968). In 1968 and 1991, Adams County believed this site would be useful for flood control, water supply, fire protection, irrigation, and recreation.

In 1968, a potential reservoir location on the Little Marsh Creek (Site 67) was noted as having good, clear flow with little to no signs of pollution. However, several cattle farms, orchard land, and businesses within nearby Orrtanna Village provided enough potential threat that this location was not deemed useful as a water supply (ACOPD, 1968). The 1968 Adams County report suggested a more detailed water quality study was needed. In 1991, the Adams County Comprehensive Plan indicated this location could be beneficial for flood control, water supply, fire protection, irrigation, and recreational usage.

The Middle Creek locations in Liberty Township and Freedom Township (Sites 73 or 74) were noted as questionable because of water quality issues for water supply purposes in the 1968 report. However, in 1991, Adams County indicated these locations would be beneficial for flood control, water supply, fire protection, irrigation, and recreation. Since 1995, land development plans for a large, privately owned and managed “retreat” have been approved for much of the site.

Sites located along the Bermudian Creek sites in Huntington Township and Tyrone Township (Sites 14 or 16) were not likely candidates for water supply due to pollution from Idaville and Peach Glen. In both the 1968 and 1991 reports, these locations were noted as beneficial for flood control, irrigation and limited recreational usage (ACOPD, 1968 and 1991).

Water at a Plum Run location (Site 29) was noted as having a brown tint and a small amount of froth indicating sewage (ACOPD, 1968). Poor water quality, in addition to potential problems with heavy algal growth, indicate this location would not be ideal for water supply development. Both the 1968 and 1991 reports from Adams County indicate this location would be useful for flood control, irrigation, and limited recreational use.

A site located along Rock Creek, Site 59, was eliminated as a water supply due to poor water quality and algal growth . This location was noted as providing flood control, irrigation, and limited recreational usage (ACOPD, 1968 and 1991).

In summary, the 1968 report suggested that joint water communities would benefit from surface water supplies for water supply, flood control, recreation, and limited recreation. The report also recommended future studies to evaluate each potential site for reservoir development. The report suggested that groundwater resources are less expensive to develop, maintain, and protect. However, it should be noted that we now know they are also more expensive to remediate when contaminated.

The 1991 plan, in contrast, tended to stress the fact that in most areas, groundwater resources are sufficient to meet projected demands. Much of the information and supporting data behind the 1991 plan, which is summarized in Table 22, has been used in this report. It should be recognized that both groundwater and surface water represent viable water resources for Adams County now and in the future. The development of one or the other (and in some cases both resources simultaneously) should be evaluated on a case by case basis and include evaluation of:

- Up front capital costs
- Long term maintenance costs
- Long term water quality issues
- Long term protection issues
- Competition for available groundwater resources
- Impacts of groundwater mining on environment
- Impacts on environment due to reduced stream flow
- Other beneficial uses

TABLE 22 SUMMARY OF RESERVOIR SITES POTENTIAL PURPOSES ADAMS COUNTY COMPREHENSIVE PLAN (1991)							
Location	Flood Control	Water Supply	Fire Protection	Irrigation	Recreation	Limitations	Recommended For Use
Pine Run, Hamilton Township	Yes	Yes	Yes	Yes	Yes	None	Yes
Conewago Creek, Buchanan Valley	Yes	Yes	Yes	Yes	Yes	Historic Fruitbelt	No
Alloway Creek, Germany & Mt. Joy Townships	Yes	Yes	Yes	Yes	Yes	No Zoning in Germany Twp.	Maybe
Little Marsh Creek, Highland Township	Yes	No	Yes	Yes	Yes	No Zoning	Maybe
Middle Creek, Liberty Township	Yes	Yes	Yes	Yes	Yes	Existing Development	No
Middle Creek, Freedom Township	Yes	Yes	Yes	Yes	Yes	Existing Develoment	No
Bermudian Creek, Huntington Township	Yes	No	No	Yes	Limited	Historic Fruitbelt and Surrounding Development	No
Bermudian Creek, Tyrone Township	Yes	No	No	Yes	Limited	Historic Fruitbelt and Surrounding Development	No
Plum Run, Reading Township	Yes	No	No	Yes	Limited	Further Study Needed	Maybe
Rock Creek, Cumberland & Straban Townships	Yes	No	No	Yes	Limited	Further Study Needed	Maybe

2. IMPLEMENTATION POTENTIAL

The implementation of a surface reservoir is dependent upon several factors. The most important decision is whether the purpose and need for a reservoir outweigh environmental and economic factors. The potential sites were evaluated in the section above for potential uses such as water supply, flood control, fire protection, irrigation and recreation. The need for each project is discussed below. These factors must be compared to land acquisition costs, permitting requirements, construction costs and requirements, and long-term costs of environmental damage, which will be discussed in the following sections.

- ***Need for Project*** - Based on the amount of water available for safe withdrawal from the aquifer and the anticipated 2010 population, there is one surface reservoir site that Adams County should evaluate for development as a supplementary water source. The Pine Run Reservoir location in Hamilton Township would benefit the planned growth areas around East Berlin, Abbottstown and New Oxford, which are anticipated to have groundwater shortfalls by the year 2010. However, Pine Run has a relatively small watershed. Surface water storage capacities may be stressed during drought years in the area because of limited surface recharge areas. For that reason, a more detailed study of surface water usability for Pine Run is recommended.

There are other areas in Adams County that may have increased need for surface water due to lower than expected aquifer yields or that may possibly need surface water resources after 2010, as growth continues. Areas of concern include the Carroll Valley and the Fairplay/Greenmount Area. Although the Fairplay/Greenmount area did not show signs of water deficit based on peak 2010 usage, both Carroll Valley and Fairplay/Greenmount are underlain by the diabase unit of the Gettysburg Lowland hydrogeologic unit. The diabase unit has the bwest recharge rate of the Gettysburg Lowland hydrogeologic unit, so the amount available for withdrawal may be less than predicted.

The Gettysburg area should also consider future usage of surface reservoirs to ensure adequate future water supplies. This area is expected to experience substantive development north, east, and west of the Borough, in addition to supporting a growing tourist population. The Borough of Gettysburg is predicted to have a deficit of 459,251 gpd in 2010. Although, the water supplied from the Townships surrounding Gettysburg may offset the deficit within the Borough itself, such an increase in growth may jeopardize groundwater supplies. A surface water feasibility analysis would be required to best evaluate this option for water supply alternatives in Gettysburg.

Land Acquisition Costs **-** Site selection for a reservoir will invariably involve prioritization of and compromise between multiple location variables. Ideal sites should be selected in consideration of site elevation, hydraulic gradients, proximity to proposed service areas and existing water transmission piping routes, and environmental factors. Typically, preliminary site location surveys are based at a minimum on review of contour maps and aerial photographs. After general site requirements have been developed and potential solutions have been proposed, on-site ground checks and professional hydrologic study can be used to further evaluate potential sites for technical feasibility.

The search for practicable and available land begins with reviewing county tax maps for land ownership. Land negotiations should include the determination of the appropriate price of the land required. This cost can be established with an independent land appraisal and by comparing the costs of similar and/or nearby properties recently sold.

Condemnation is a final process that can be used to acquire property required for the project if necessary. However, lengthy project delays and increased project legal costs can be incurred in the "eminent domain" proceedings. The court will determine the value of payment to be made for the property, if the public interest can be demonstrated.

The selection of total land area required for construction of a reservoir should not only consist of the land slated for flooding, but also the adjacent watershed forming the reservoir's perimeter. Creation of a vegetative buffer zone around the reservoir is important to hinder pollutants, debris, and sediment from entering the reservoir.

Permitting Requirements **-** Plans to construct a reservoir are considered a large civil works project and are categorized as a "major modification", which must be approved and permitted by the Commonwealth of Pennsylvania. An application, modules, plans, engineer's report, water quality reports, specifications, and other design documents must be prepared and submitted by a registered engineer. Upon approval, the state will issue a community water supply systems permit for construction (valid for two years). After construction is completed, a certificate of construction is completed and submitted to the state. The state will inspect the facility and issue an operations permit upon approval.

Additional approval may be required from federal and local regulatory agencies. As an example, construction work within waterways requires the approval of federal agencies such as the United States Army Corps of Engineers (COE). In addition, approval may be required from one or more river basin commissions. Also, an environmental assessment document such as an Environmental Impact Statement (EIS) may be needed addressing disturbance of the existing lands, construction activity impact, constructed appearance, and inducements to growth. The EIS is sent to federal, state, and local governmental agencies and made available to public and special interest groups.

Construction Requirements - Construction of a reservoir in any location will require extensive exploration of the geology under the proposed flooded area. Foundation design of dams and hydraulic structures will be determined after the area's geology has been categorized. Local faults will be identified and evaluated for threats to proposed reservoir structures. In addition, hydrogeologic evaluation for potential contamination of groundwater supplies by surface water and formation of sinkholes or water passages will be of particular importance. The combination of findings from these evaluations will be used to select the control elevations of the water surface, areal extent of the retained water, and the total volume of storage.

Removal of timber, structures, brush, top soils, and other general excavation will need to be accomplished to prepared the basin for use. Consideration should be given to include contingency costs to mitigate unusual or difficult site conditions and problems discovered during construction.

Along with reservoir structures and construction concerns, upstream flooding potentials, basin sedimentation, and other potential threats should be considered. Additional design and construction of control structures may be necessary to protect the reservoir and ultimate final water quality. Environmental impact studies would also need to be conducted to address water temperature issues, nutrient loadings, baseflow conditions, wetlands encroachment, endangered species, and changes to downstream fisheries.

F. SUMMARY

There are essentially two sources of potable water that can be used to meet the demand of year 2010 populations in Adams County. These water sources include groundwater and surface water supplies. The limiting factors for accessing and creating new surface water supplies are related mainly to land use issues, strict regulatory requirements, infrastructure development, and cost feasibility. The use of groundwater to supplement future potable demand is generally more feasible from a cost perspective, but 2010 demand may exceed the aquifer capacities in the identified growth areas within the county. Water planning needs to go hand-in-hand with the development of new water sources in the County to best meet the needs of water users in the County.

VI. WELLHEAD PROTECTION PLAN

A. INTRODUCTION

A wellhead protection plan is a strategy to protect groundwater quality, particularly that of public supply wells, from potential contaminant threats. Historically, community water systems have been motivated to improve and expand their physical facilities in response to growing demands for water fueled by population growth. However, there has been no equivalent effort to protect the quality of groundwater sources, even as they are exposed to increasing levels of contaminant threats, except, typically, after contamination has already occurred. Wellhead protection is a proactive, preventative step that increasing numbers of communities are undertaking to avoid the potential loss or degradation of established public water sources.

> "Estimates of cleanup of contaminated water sources can be 30 to 40 times more costly than preventing them in the first place!" (EPA, 1995)

This chapter first presents an inventory of major federal and state-identified contaminant sources. This data can be used by existing and potential new community water systems to site new public water wells away from these locations. The chapter goes on to describe the process of delineating, or defining, wellhead protection areas or areas vulnerable to potential contamination. Next is found the Wellhead Protection Workbook, which sets forth a five-step process that communities can follow to protect their wells from potential contamination. A description of a wide variety of voluntary and regulatory approaches to protection and their applicability is included. Finally, wellhead protection plans for four pilot project municipalities (Abbottstown, Fairfield, Gettysburg, and Littlestown) are presented (under separate cover), which may serve as models for other communities within the County that would like to develop wellhead protection programs.

B. CONTAMINANT SOURCE IDENTIFICATION

Degraded water quality occurs when contaminants enter surface or groundwater sources. Community water systems and municipalities which must rely on groundwater to meet future water needs should take action now to protect the resources from potential contamination. Wellhead protection programs can offer a far more effective and less expensive approach to assuring continued clean water than cleaning up after contamination occurs.

While a primary component of a wellhead protection program should be to avoid the siting of new potential contaminant sources near existing and future community wellhead locations, such a program should also include mitigation of any potential adverse impacts of existing contaminant sources at these locations. Adams County has several industrial and commercial sites of concern. In addition, significant rural development, especially during the decades of the 1960s and 1970s, has resulted in a proliferation of on-lot sewage disposal systems, which have come to constitute another significant contaminant threat.

1. FEDERAL AND STATE DATABASES

Potential contaminant sources have been identified and located using a combination of approaches. First, the services of a data-gathering provider, VISTA Information Solutions, Inc., was used to search 36 major federal, State and other databases, 16 of which have data on Adams County. Each of these databases is described in the inset on page 4, while the detailed findings are listed in Appendix G. Mapped locations are shown on Plate 2. The type and number of Potential contaminant sources found within Adams County and their numbers are as follows:

- Emergency Response Notification System - ERNS (110)
- Above Ground Storage Tanks (51)
- State Underground Storage Tanks (126)
- State Leaking Underground Storage Tanks (122)
- State Priority List (1)
- Resource Conservation Recovery Act (RCRA) Transporters (2)
- Resource Conservation Recovery Act (RCRA) Large Generators (11)
- RCRA Small Generators (101)
- No Further Remedial Action Planned - NFRAP (10)
- Toxic Release Inventory System (11)
- National Priority List (3)
- State Cleanup List (6)
- RCRA Violators (6)
- Facility Index System Database (268)
- Federal Wells (521)

The major potential "point sources" of contamination included in the above list are primarily underground storage tanks, and to a lesser degree, RCRA Small Generators, ERNS releases and above ground storage tanks. There is frequent duplication in the foregoing listing, both in contaminant source sites identified and in number of incidents. For instance, an Underground Storage Tank might also be a Leaking Underground Storage Tank as well as the site of a RCRA Large Generator. Also, a given incident at a site which is reported through two possible reporting channels is sometimes listed twice, particularly ERNS incidents.

A total of 1,349 federal, state and other records (inclusive of all sites) are reported in this database for Adams County. For all sites, information is provided on the name and address of the facility, and the type of contaminant source, if applicable. Additional information is provided on the date of the pollution event, the substance or material released, and the precise location (latitude and longitude) of the site. An electronic version of the entire database has been provided to Adams County for purposes of creating a complete Geographic Information System coverage. The County is strongly encouraged to provide this mapped database to its municipalities and community water systems to assist them in protecting groundwater resources. Where these sites are close to existing community water systems, they should be cleaned up. Where existing or new community water systems are considering the construction of new wells, care should be taken to avoid close proximity to these sites.

2. LOCAL CONSULTATION

A second survey method was applicable to four selected "pilot project" community water systems – Abbottstown, Fairfield, Gettysburg, Littlestown. These systems elected to participated in a wellhead protection program as part of this planning process (see section D of this chapter). The survey method consisted of consultations with local Wellhead Protection Steering Committees on existing and historic land uses involving contaminant sources, and a Committee survey of the Wellhead Protection Area conducted under the direction of the Pennsylvania Rural Water Association staff. This effort resulted in mapped inventories of contaminant sources for each of the pilot project systems.

3. OTHER DESIRABLE GIS DATA

Two additional contaminant sources that should be included by Adams County on a Geographic Information System map are the National Pollution Discharge Elimination System (NPDES) Permitted Discharge points and the location of any major oil pipelines. An NPDES listing would include the County's sewage treatment plant discharge points and possibly other discharge points. Adams County should contact the PA DEP to obtain this data.

C. WELLHEAD PROTECTION AREA DELINEATIONS

Groundwater is a precious resource. The best access to clean potable groundwater is through properly drilled and constructed water supply wells. It is important to protect our groundwater resource for current and future generations. The best way to protect our groundwater is to develop a community wellhead protection program that outlines the land area contributing water to wells and then to take actions to ensue that groundwater is protected from potential contaminants within this area. Through community efforts, groundwater protection zones can be established to better identify and coordinate land use in water sensitive areas.

FEDERAL, STATE AND OTHER CONTAMINANT SOURCE DATABASES

AST: Aboveground Storage Tanks (see UST); State, Regional and County database: This database is provided by the State Water Resources Control Board.

ERNS: Emergency Response Notification System; Federal EPA database: This EPA database contains information on reported releases of oil and hazardous substances. The data comes from spill reports made to the EPA, U.S. Coast Guard, the National Response Center and/or the Department of Transportation. Over 380,000 spills occurring since 1987 are included.

FEDERAL WATER WELLS: USGS Water Wells; Federal database: The Ground Water Site Inventory (GWSI) database was provided by the United States Geological Survey (USGS). The database contains information for over 1,000,000 wells and other sources of groundwater which the USGS has studied.

FINDS: Facility Index System Database: This system was developed to help identify and cross reference which sections or departments within EPA maintain a file on any specific site.

LUST: Leaking Underground Storage Tanks; State, Regional, and County database: Leaking underground storage tanks are a major cause of soil and groundwater contamination. Along with stricter regulation of USTs, most states now maintain lists of reported LUSTs.

NFRAP: No Further Remedial Action Planned; Federal database: These are sites which have been removed from CERCLIS. After initial investigation, either no contamination was found, contamination was removed quickly, or the contamination was not serious enough to require Federal Superfund action or NPL consideration.

NPL: National Priority List; Federal EPA database: This database includes a listing of all U. S. EPA National Priority List sites. These sites fall under the EPA's Superfund program established to fund cleanup of contaminated sites that pose risk to human health and the environment.

RCRIS: Resource Conservation Recovery Act Information System; Federal EPA databases: This includes generators (large and small), transporters, and violations, providing information on sites which generate, transport, store, treat, or dispose of hazardous wastes. Other databases, which fall under RCRA are Corrective Actions (CORRACTS); Treatment, Storage, and Disposal (TSD) facilities; and TSD-CORRACTS facilities.

SPL and SCL: State Priority List and State Cleanup Lists; State databases: There is no standard or legal definition for a State Priority List (SPL) or State Cleanup List (SCL). In general, VISTA classifies a list as a State Priority List (SPL) only if confirmed contamination sites and the state is involved in cleanup activities or is actively pursuing responsible parties. Other lists containing unconfirmed sites or sites where no further action is expected are classified as State Cleanup Lists. Often, SCLs will contain some priority sites as well.

SWLF: Solid Waste Landfill Sites; State, Regional, and County databases: Collected at the state and, sometimes, local level, this database reflects perhaps the most comprehensive list available. Depending on the state, these lists may include active landfills, inactive landfills, incinerators, transfer stations, recycling locations, and other facilities where solid waste is treated or stored.

TRIS: Toxic Release Inventory System Database; Federal EPA database: This database includes annual reporting by all owners or operators of facilities which manufacture, process, or import toxic chemicals in quantities exceeding 25,000 pounds annually, as required by SARA Title III, Section 313 of EPCRA (SARA Title III). Annual reports concerning chemical releases since 1987 are included. Overall reporting covers about 25,000 to 30,000 sites annually.

UST: Underground Storage Tank Registrations; State, Regional, and County databases: USTs regulated under Subtitle 1 of the Resource Conservation and Recovery Act (RCRA) must be registered with the state agency responsible for administering the UST program. Some states require registration of aboveground tanks (ASTs) as well. Note that various states also exempt certain types of tanks, most notably smaller heating oil tanks for residential use.

1. ZONES OF WELLHEAD PROTECTION

There are three generally recognized zones of wellhead protection (WHP): These zones are defined in the Pennsylvania Safe Drinking Water regulations (25 PA Code §109.1) as:

Wellhead protection area—The surface and subsurface area surrounding a water well, well field, spring or infiltration gallery supplying a public water system, through which contaminants are reasonable likely to move toward and reach the water source. A wellhead protection area shall consist of the following zones:

- Zone I. The protective zone immediately surrounding a well, spring or infiltration gallery, which shall be a 100-foot to 400-foot radius depending on site-specific source and aquifer characteristics.

- Zone II. The zone encompassing the portion of the aquifer through which water is diverted to a well or flows to a spring or infiltration gallery. Zone II shall be a ½-mile radius around the source unless a more detailed delineation is approved.

- Zone III. The zone beyond Zone II that contributes surface water and groundwater to Zones I and II. The Zone III area includes the drainage basin that is upgradient from a well's area of groundwater diversion or a spring's groundwater collection point unless a smaller area is sufficiently justified.

2. FIVE STEPS TO DEVELOP WELLHEAD PROTECTION AREAS (WHPAS)

Zones of WHP can be determined using a generalized approach that takes into account the available information related to water supply wells or points of groundwater collection. This approach consists of five steps.

SAIC has developed and applied a five-step approach to four water supply systems that volunteered to participate in the Adams County WHP Program. These systems (and their associated water production wells) include Abbottstown Municipal Authority (well No. 6), Fairfield Municipal Authority (wells No. 4 & 5), Gettysburg Municipal Authority (well No. 5), and Littlestown Municipal Authority, (Meadowview well A).

Each of the four systems participating in the Adams County WHP Program is located in a different geologic terrain within the County. The four hydrogeologic settings associated with these terrains are discussed more completely in a 1999 United States Geological Survey (USGS) Water-Resources Investigations Report 99-4108 entitled "Summary of Hydrogeologic and Ground-Water-Quality Data and Hydrogeologic Framework at Selected Well Sites, Adams County, Pennsylvania."

The goal of the Adams County WHP program is to incorporate the findings of the USGS report into a general approach for delineating WHPAs around wells in each of the four participating water systems. These general procedures can be applied to produce appropriate Zone II and Zone III WHPA delineations and can be used to evaluate WHP requirements for other systems in the county.

Step 1: Identify the physical condition of the groundwater source location - First, it is important to identify the physical conditions that are specific to a groundwater source, such as well construction, water yields, groundwater recharge, aquifer characteristics, surface water influences, and local geologic features. All of these parameters can affect or impact groundwater flow to a source location.

Step 1 identifies physical parameters and lists data options that can be used to for each parameter. This information is available from water system annual reports, municipal and state regulatory agency databases, published scientific literature, drilling and testing reports, and system operational and maintenance documents.

The general information and source data that were used to develop WHP delineations for the four systems in Adams County are summarized in Tables 23 and 24 of each pilot project Wellhead Protection Plan. Each step in the delineation process contains specific information relevant to groundwater flow conditions for system wells.

Step 2: Develop a conceptual groundwater flow model that addresses physical conditions - Once physical parameters are verified and tabulated, it is then possible to develop a conceptual groundwater flow model that utilizes all the information. The conceptual model ranks the physical parameters relative to importance and quality of data, establishes boundary conditions for groundwater flow, and outlines the estimated land area that contributes water to a source location.

Step 2 in Table 23 lists the data that were selected for the development of a conceptual groundwater flow model, and provides a rationale as to why those values were chosen for each system. In developing a conceptual model, it was important to establish operational and hydrogeologic conditions that directly affect groundwater flow to a well. In this procedure, values that represent maximum or extreme conditions were used to provide for "worst-case scenario" WHP results, which produced the largest justifiable protection area. For example, safe yield numbers (where available) were used to establish groundwater withdrawal rates. These numbers tend to be higher than actual maximum daily uses, and therefore represent a condition likely to occur only under rare and extreme water consumption.

Step 3: Select and Apply a Wellhead Protection Area (WHPA) delineation method - Several computer applications for wellhead protection have been developed by the United States Environmental Protection Agency (USEPA) and are useful tools for initial approximations. The type of groundwater model chosen for WHP delineations should be evaluated and selected based on the level of detail of available data and the conceptual groundwater flow model. This step may also involve hydrogeologic mapping, aquifer testing, regional water table gauging, dye tracing, and other field measurements to better identify groundwater flow conditions.

Step 3 in Table 23 illustrates data that were used specifically for a WHPA computer model application. Model input data included safe yield, transmissivity, aquifer thickness, water table gradient, and groundwater flow direction for each well. The computer model then calculated the extent of the area that diverts groundwater flow to a well under pumping conditions in an ideal aquifer. This computer output was used as a map overlay to estimate the theoretical maximum extent of groundwater diversion around a wellhead for a selected set of operational parameters.

Step 4: Complete a sensitivity analysis - The sensitivity analysis helps to refine the computer model output by changing input parameters to determine the most sensitive values. Several additional runs of the computer model confirm which parameters are most important for each area of wellhead protection. Parameters that result in the greatest changes in model output are critically examined for accuracy.

Step 4 in Table 23 lists the variables used in a sensitivity analysis to determine changes in capture boundaries based on changes with input parameters. Computer input variables, for example Abbottstown, were increased and decreased to evaluate their impact on capture boundary distances from the original values. An 0.5x reduction in groundwater withdrawal resulted in a 0.5x reduction in distance of the capture boundary from the pumping well. A 0.1x reduction in transmissivity resulted in a 10x increase in distance of capture boundary.

Step 5: Prepare wellhead delineations to identify Zone I, Zone II, and Zone III WHPAs - By combining the elements of each step, it is possible to outline an area on a map designating each zone of wellhead protection. Since these areas are the fundamental planning units for WHP, their delineations must be as accurate as possible and take into account all of the hydrogeologic information available.

Step 5 in Table 24 shows the parameters that were used to finalize Zone I, Zone II, and Zone III WHPAs.

<u>Zone I WHPAs</u>, for all wells, were determined from a graphical interpretation of the volumetric flow equation developed and presented by the PADEP (1996). This technique matches pumping rates (safe yield where available) to a fixed curve that corresponds to a radius needed to meet WHPA requirements based on given well construction criteria.

Table 23 Development of Wellhead Protection Areas: Steps 1 Through 4 Adams County Water Supply Plan Adams County Office of Planning and Development							
Step 1: Identify Physical parameters		**Step 2: Develop Conceptual Groundwater Flow Model**		**Step 3: Computer Model**	**Step 4: Model Sensitivity Analysis**		
Parameter	**Options To Consider**	**Selection**	**Rationale For Selection**	**Data Applications**	**Input Value**	**Change in Value**	**Distance to Capture Boundary**
Groundwater Discharge (Q_{out})	Safe Yield (SY), Average Daily Demand (ADD), Maximum Daily Demand, Tested Yield, Drilling Yield (Blown), Pump Capacity, Treatment Capacity, Permitted Yield, Estimated Yield	**Abbottstown** SY, 0.432 mgd **Fairfield** SY, 0.259 mgd **Gettysburg** SY, 0.320 mgd **Littlestown** ADD, 0.119 mgd	Information on a well's safe yield is generally available from system's annual water supply report. It is also typically a conservative number that generally exceeds the maximum daily demand. Average daily demand is used for Littlestown because a safe yield is not currently available.	**Abbottstown** 300 gpm **Fairfield** 180 gpm **Gettysburg** 222 gpm **Littlestown** 83 gpm	300 150 600	-- 0.5x 2x	-- 0.5x 2x
Groundwater Recharge (Q_{in})	Stream Baseflow, Precipitation Derived, Published or Tested, Aquifer Specific, Normal Year Frequency, Drought Year Frequency, Impervious Cover, Estimated Value	**Abbottstown** 0.220 mgd/mi2 **Fairfield** 0.310 mgd/mi2 **Gettysburg** 0.350 mgd/mi2 **Littlestown** 0.300 mgd/mi2	Groundwater recharge rates used for Adams County were derived from 1 in 10 frequency baseflow conditions reported by USGS. These drought year values represent a conservative groundwater recharge condition.	N/A	N/A	N/A	N/A
Transmissivity (T)	Tested, Well Specific, Median Aquifer Values, Median Regional Value, Published Value, Estimated Value	**Abbottstown** 331 ft2/d **Fairfield** 94 ft2/d **Gettysburg** 550 ft2/d **Littlestown** 122 ft2/d	Transmissivity (T) values vary for wells installed in similar aquifers. T-values here were selected from the USGS report. Abbottstown, pg. 59, table 35; Fairfield, pg. 66, table 40; Gettysburg, pg. 51, table 31, 10% exceedence; Littlestown, pg. 74, para. 2.	**Abbottstown** 331 ft^2/d **Fairfield** 94 ft^2/d **Gettysburg** 550 ft^2/d **Littlestown** 122 ft^2/d	331 33.1 3310	-- 0.1x 10x	-- 10x 0.1x
Storativity (S)	Tested, Well Specific Median Aquifer Value Median Regional Value Published Value Estimated	Optional; for use with non-equilibrium analytical modeling	Wellhead delineations were derived using an equilibrium model to establish groundwater flow to wells. Under these conditions, S is not a factor to groundwater flow to a well.	N/A	N/A	N/A	N/A
Anisotropy	Fracture Trace Analysis, Published or Tested, Topography Controlled, Geology Controlled, Estimated	**Abbottstown** **Fracture-stratigraphy** **Fairfield** Cleavage oriented **Gettysburg** **Fracture-stratigraphy** **Littlestown** NE-SW, fracture	Since Adams County has a variety of geologic and topographic settings, a variety of options were used to estimate anisotropy of groundwater flow at each well site.	Attempted, but EPA code not compatible with anisotropy transform adjustments to flow grid.	N/A	N/A	N/A

Table 23 (Cont'd)
Development of Wellhead Protection Areas: Steps 1 Through 4
Adams County Water Supply Plan
Adams County Office of Planning and Develoment

Step 1: Identify Physical parameters		Step 2: Develop Conceptual Groundwater Flow Model		Step 3: Computer Model	Step 4: Model Sensitivity Analysis		
Parameter	**Options To Consider**	**Selection**	**Rationale For Selection**	**Data Applications**	**Input Value**	**Change in Value**	**Distance to Capture Boundary**
Aquifer Thickness	Well Depths, Length of Water Column, Depth to Groundwater, Published or Researched, Estimated Value	**Abbottstown** 345 feet **Fairfield** 310 feet **Gettysburg** 313 feet **Littlestown** 495 feet	This information is specific to each well and readily available in published USGS reports for Adams County.	**Abbottstown** 345 feet **Fairfield** 310 feet **Gettysburg** 313 feet **Littlestown** 495 feet	345 172.5 690	-- 0.5x 2x	-- 0 0
Water Table Gradient	Topographic Inferred, Stream Gradient, Field Mapping, Published or Researched, Estimated Value	**Abbottstown** 40:2,800 = 0.0143 **Fairfield** 60:3600 = 0.0167 **Gettysburg** 60:8,000 = 0.0075 **Littlestown** 20:1,900 = 0.0105	This information was derived from USGS water table mapping in each test area. It represents elevation change over map distance is the direction of inferred groundwater flow.	**Abbottstown** 0.0143 **Fairfield** 0.0167 **Gettysburg** 0.0075 **Littlestown** 0.0105	0.0143 0.00714 0.0286	-- 0.5x 2x	-- 2x 0.5x
Groundwater Flow Direction	Regional Flow, Local Flow, Pumping Induced,	**Abbottstown** N 70° W **Fairfield** N 10° W **Gettysburg** N 120° W **Littlestown** N 95° W	This information was derived from USGS water table mapping in each test area. It represents an orientation perpendicular to local and immediate groundwater contours near the well. For more detailed descriptions of inferred groundwater flow, refer to Chapter VI, Section 7.	**Abbottstown** N 70° W **Fairfield** N 10° W **Gettysburg** N 120° W **Littlestown** N 95° W	N/A	N/A	N/A
Boundary Conditions	Hydrologic Features, Geologic Features, Limiting Factors, Contributing Factors, Pumping Interference	Hydrologic Features Geologic Features Limiting or Contributing Pumping Interference	Since Adams County has a variety of geologic and topographic settings, a variety of selected options will be used according to the requirements of each well site.	N/A	N/A	N/A	N/A

Table 24
Development of Wellhead Protection Areas: Step 5, Zone I, Zone II, Zone III Delineations
Adams County Water Supply Plan
Adams County Office and Planning Development

Water Supply System	Aquifer Parameters		Well Parameters						Wellhead Protection Areas (WHPA)		
Operator (Well ID)	Geologic Aquifer	Drought Recharge Rate (gpd/mi2)	Well Number	Well Depth (ft)	Casing Depth (ft)	Open Interval (ft)	Reported Safe Yield (gpm)	Reported Safe Yield (mgd)	Zone 1 Radius Around Well (ft)	Zone 2 Diversion Area (mi2)	Zone 3 Area
Gettysburg (7010019)	Gettysburg Fm	350,000	5	420	58	362	222	0.320	120	0.9	19 mi2
Abbottstown (7010031)	New Oxford Fm	220,000	6	452	44	408	300	0.432	130	2.0	7.6 mi2
Fairfield (7010005)	Harpers Fm, Metarhyolite	310,000					180	0.259		0.8	8.9 mi2
			4	345	42	303	150	0.216	100		
			5	420	33	387	30	0.043	100		
Littlestown (7010022)	Conestoga Fm	300,000	Meadowview A	498	58	440	83	0.119	100	0.4	0.65 mi2

Zone II WHPAs are derived from a water mass balance relationship: $Q_{in} = Q_{out}$. The groundwater withdrawal rate (Q_{out}) must equal the groundwater recharge rate (Q_{in}) over a given area under specific conditions. In the Adams County WHP program, Zone II area is determined using safe yield values in gpd (where available) and drought (1 in 10 year frequency) groundwater recharge rates in gpd/mi^2. The result is a land area in mi^2 that diverts water to a well under safe yield pumping conditions during a 1 in 10 year drought.

The model output serves to approximate the downgradient and lateral extent of groundwater capture. The recharge area serves to limit the size of the capture zone. The conceptual hydrogeologic model serves as the basis to approximate the shape of the capture zone.

Zone III WHPAs are established by evaluating the upgradient land area (watershed) that contributes water to Zone II. Additional land area that is outside the local watershed may also be included in Zone III if geologic conditions favor groundwater flow along preferred pathways, such as fractures or open bedding planes. Conversely, a lesser area may be delieated by other means such as time-of-travel, if sufficient justification exists.

3. CHOICE OF USEPA WELLHEAD PROTECTION AREA (WHPA) MODEL CODE

The goals of a conceptual groundwater model are to establish the boundary conditions that apply to groundwater flow by determining the local and regional hydrogeologic setting and by identifying the available data for each well. The EPA WHPA model is used to refine the location of the capture zone configuration around a well under pumping conditions.

For this exercise, the EPA WHPA code MWCAP Version 2.2 (September 1993, EPA Office of Groundwater Protection) was chosen as a tool for the capture area analyses because of its simplicity, ease of use, and repeatable results. The underlying assumption is that fractured bedrock approximates an isotropic homogeneous porous media (such as unconsolidated sediments) for this scale of study. This condition is met in all of the hydrogeologic units in Adams County except the Triassic sedimentary sequence for the Gettysburg and Abbottstown prototype areas.

The model outputs were coupled with simple hydrogeologic analysis tools. The final product was guided by professional judgment and founded upon literature review and the results of hundreds of test wells, pumping tests, slug tests, dye trace tests, water level contouring, and impact analyses completed as unpublished reports for water supply development and permitting projects in similar hydrogeologic settings.

Unless otherwise demonstrated, groundwater flow in fractured rock is assumed by most practicing hydrogeologists to be in a hydrologic continuum from conduit fracture flow to laminar flow in a homogeneous, isotropic medium (USGS Adams County Report, 1999). In general, groundwater flows into a well from bedrock fractures through discreet water-bearing zones. In each of these zones, particularly near to the well, flow is linear and very similar to that in a rough pipe. However, local fractures around a well intersect many other natural fractures further out in the flow system. These fractures in turn intersect many other fractures in the region. The flow of groundwater toward a well is distributed in these many intersecting fractures. Viewed on a wellhead protection and/or watershed scale, this system functions the same as the interconnected porosity in a gravel aquifer. In this hydrogeologic setting, laminar, non-linear flow dominates as distance from the well increases, which reinforces the assumption of a hydrogeologic continuum for regional groundwater flow to a well.

There are five methods to subjectively determine fractured bedrock aquifer behavior in equivalent porous media, as proposed by the EPA, in "Delineation of Wellhead Protection Areas in Fractured Rocks", and recognized by Risser and Barton (1995) in "A Strategy for Delineating the Area of Ground-Water contribution to Wells Completed in Fractured Bedrock Aquifers in Pennsylvania". Each of these methods were evaluated for use in Adams County and include:

1. Pumping test response – Use the results of pumping tests to examine the relationships between well discharge and aquifer drawdown (water level analysis). This method can provide excellent data for WHP delineation work; however, pumping tests are expensive, full of pitfalls (if not properly conducted and analyzed) and are subject to multiple interpretations. This method is not recommended for Adams County program because of the limited availability of pumping test data.

2. Water-table configuration – Use water level data and measuring point elevations to contour the water table surface. This method can provide useful data when the water levels are presented under equivalent hydrogeologic conditions and are taken simultaneously; however, it can be expensive to develop a regional "snap-shot" of the water table configuration. This method is also full of pitfalls (particularly with different well penetration depths and resultant hydrologic problems), subject to multiple interpretations and was not recommended for the Adams County WHP program.

3. Ratio of fracture scale to problem scale – Compare the density of fractures in the bedrock to the WHP study area (Zone II). In this Adams County example study area, fracture spacings are typically narrow (i.e., in the 10 to 100 feet range, Geyer and Wilshusen, 1982). Since the size of the Zone II WHPAs for the pilot systems is over 100 times the average fracture spacing, the assumption of a hydrologic continuum is justified. Field studies necessary to verify the fracture spacing in each wellhead protection area are beyond the scope of this study.

4. Hydraulic conductivity distribution – Compare the hydraulic conductivity measured in several wells penetrating similar aquifers in the area. If a bimodal distribution is present, the assumption of a continuum may not be valid; however this method is expensive (field-testing required), subject to multiple interpretations, and the continuum approach may still be valid

depending upon the data source distribution. It was not recommended for Adams County WHP program for these reasons.

5. Variations in water chemistry – Compare the water quality variations of a well with time to detect seasonal or precipitation related changes, with the assumption that high variability indicates fractured media. This method is expensive (field-testing required), and does not address the fact that deep fracturing may exist and would not necessarily be detected. It could indicate the presence of fractured media, but certainly not the absence, so it was not recommended for the Adams County study.

4. EQUILIBRIUM CONDITION

The EPA WHPA code was run under equilibrium conditions for the Adams County WHP delineations (the model provides for the use of either equilibrium or non-equilibrium conditions). In each of the delineation areas, pumping withdrawals are limited by the well's construction, the relatively shallow nature of the aquifer systems from which wells draw groundwater, and ultimately by the volume of rainfall and resulting groundwater recharge which may be captured by the well. Consequently, the withdrawals are balanced by the recharge on a weekly, monthly, and / or annual basis. The resulting pumping is therefore in a long-term equilibrium state (although transient, non-equilibrium conditions are always present). This is in contrast to a confined alluvial aquifer system, upon which the model code was founded, in which the pumping is often not in equilibrium and may be modeled as such. This type of model is extremely sensitive to selection of a model time frame, which is often somewhat arbitrary.

5. SENSITIVITY ANALYSIS

The EPA Sensitivity Analysis Code cannot be run with the EPA WHPA wellhead protection model as it was used for Adams County. It does not accommodate the equilibrium condition most appropriate for this region. An attempt was made to adapt the code / analyses to the Adams County delineation methods but was not successful. In lieu of the automated sensitivity analysis, the entire range for each of the input parameters was run independently and tabulated. The lateral extent of capture, measured as a radius perpendicular to the groundwater gradient, was used as an indicator of capture area for this analyses.

The results of the sensitivity analysis are shown under Step 4 in Table 23. As measured in this method, the sensitivity of the model is directly proportional to the pumping rate (Q) and inversely proportional to the aquifer transmissivity (T) and the water table slope (dh/dl). The model is not sensitive to the aquifer thickness (b). The aquifer storage coefficient (S) is not used in the equilibrium model. The model output is equally sensitive in all of the areas studied in Adams County - only the analyses for Abbottstown is shown in the table since the other areas show exactly the same sensitivity.

In general, the Q for modeling purposes was assumed fixed. The water table gradient was taken from the USGS Adams County Report (1999), if appropriate;

otherwise, the topographic gradient along an appropriate local stream valley was used. Various values for T, within the range presented in the USGS Adams County Report (1999), were run until an output which did not unreasonably cross known or assumed hydrologic flow boundaries (as watershed divides or low-permeability aquifer areas; no recharge boundaries were used for conservatism).

Confidence limits for these parameters were not determined since the EPA sensitivity analysis did not work. The suitability of the parameters was based on the USGS (1999) data and best professional judgement.

6. TRANSFORMATION FOR ANISOTROPY

Due to the extreme anisotropy exhibited by the Triassic rocks (Gettysburg and Abbottstown study areas) the anisotropic transformation program was attempted. The EPA module is designed to simulate anisotropic aquifer effects by transforming the WHPA output into a new coordinate grid based on the hydraulic conductivity ellipse equations, and then reconverts the transformed data onto the original coordinate system.

The latest version of the EPA WHPA (as of September 1999) and the transform adjustment model were applied to WHP delineations in this study. However, after numerous model runs, extensive background research, help desk discussions, and general head scratching, the transform module did not work. The initial transformation was possible, but the re-adjustment to original coordinates step was the obstacle. Due to the extensive time investment in these attempts, the frustration factor on this transform method was extremely high, even for trained scientists / groundwater modelers. On this basis and after repeated failures, this method had to be discarded as too difficult to be implemented by common practitioners.

7. US EPA WHPA DELINEATION RESULTS

The following are summaries of WHPA delineations procedures for Abbottstown Well No. 6, Fairfield Wells No. 4 & 5, Gettysburg Well No. 5, and Littlestown Meadowview A. Maps are included within each of the individual Wellhead Protection Plans.

Littlestown Municipal Water Authority

Geologic Terrain: Fractured carbonate rock of Piedmont Lowland.

Hydrogeologic Information: USGS Adams County Report (1999), groundwater conceptual flow model, well and water use data.

Quality of Hydrogeologic Data: Good

Procedure:

1. Establish conceptual groundwater flow model and boundary conditions using data from the USGS 1999 report and water use data from the system reports.
2. Set up USEPA WHPA code using best available hydrogeologic data (Table 23).
3. Model equilibrium conditions using single-point withdrawal at average daily pumping rate.
4. Generate zone of contribution and superimpose onto scaled topography (USGS 7 ½ minute quadrangles).
5. Calculate groundwater recharge area (acres) needed to supply enough groundwater to meet pumping requirements under drought conditions.
6. Delineate upgradient limits of groundwater diversion (Zone II) to encompass the groundwater recharge area needed to feed the withdrawal.
7. Adjust Zone II to accommodate anisotropic groundwater flow along prominent fracture traces in accordance with the conceptual model.
8. Adjust Zone III to accommodate Zone II and the entire upgradient catchment basin.

Disclaimer: The Zone III watershed contributes to Zone II as delineated. It has not been demonstrated that this entire area provides groundwater recharge for Zone II.

Fairfield Municipal Authority

Geologic Terrain: Fractured crystalline rock of Blue Ridge Province

Hydrogeologic Information: USGS Adams County Report (1999), conceptual groundwater flow model, well and water use data.

Quality of Hydrogeologic Data: Fair

Procedure:

1. Establish conceptual groundwater flow model and boundary conditions using data from the USGS 1999 report and water use data from the system reports.
2. Set up USEPA WHPA code using best available hydrogeologic data.
3. Model equilibrium conditions using single-point withdrawal at safe yield pumping rate.
4. Generate zone of contribution and superimpose onto scaled topography (USGS 7 ½ minute quadrangles).
5. Calculate groundwater recharge area (acres) needed to supply enough groundwater to meet safe yield pumping under drought conditions.
6. Delineate upgradient limits of groundwater diversion (Zone II) to encompass the groundwater recharge area needed to feed the withdrawal.
7. Adjust Zone II to accommodate anisotropic groundwater flow along prominent fault/fracture zones, cleavage orientations, and anticipated bedrock dip direction in accordance with the conceptual model. In this case, the model output could only be used for broad guidance. The capture zone modeled extends across the entire northeast-trending fracture zone identified in the conceptual model. As such, it completely taps this zone, and the shape of the fracture zone then defines the zone of capture. The overlay of model capture zone area, therefore, is only representative of expected groundwater flow at the wells. Zone II was reconfigured to match the local fracture pattern, which is oriented through the long axis of the valley (approximately N45E). The elliptical nature of Zone II is assumed to simulate the anisotropy of the broad valley fracture system. The area of the ellipse was calculated based on safe yields and groundwater recharge under drought conditions. Additionally, the width of the capture zone depicted is less than that estimated by the computer model since it was adjusted to account for an inferred cross-valley hydrologic boundary represented by the topographic high point downgradient from the well(s). Local topography was used to determine the downgradient extent of the Zone II ellipse. There is a topographic ridge that crosses the valley to the northeast of Maria Furnace. It is assumed that this ridge is composed of relatively unfractured rock that would create a downgradient limit for groundwater capture associated with water withdrawal from Fairfield Wells 4 and 5. The downgradient limit of Zone II was positioned to match the location of the ridge using best professional judgement.

8. Adjust Zone III to accommodate Zone II and the entire upgradient catchment basin. This Zone III area is relatively large, and encompasses the entire drainage basin for Toms Creek upgradient of Fairfield Wells No. 4 & 5. This is due to the fact that these wells are in close proximity to Toms Creek, and that there is the possibility that the creek is in direct contact with local groundwater. Since the Zone II area of groundwater diversion for this well extends to the opposite side of Toms Creek, by definition, Zone III is the zone beyond Zone II that contributes surface water or groundwater to Zones I and II. However, this large Zone III area is difficult to manage from a wellhead protection standpoint. So it is recommended that the Zone III management area for Fairfield Wells No. 4 & 5 be coincident with the identified Zone II area of groundwater diversion. The Zone II area is determined using the safe yield (in gpd) from both well's combined and the average groundwater recharge rate (in gpd/mi2) for the aquifer under 1-in-10 year drought condition. The safe yield for Wells No. 4 & 5 was reported to be 259,200 gpd, which is about two and one-half times greater than the actual maximum daily demand (108,000 gpd) reported from the well in the water year 1997. This will allow for conservative and functional Zone III wellhead protection area around Wells No. 4 & 5 that relates directly to a daily safe yield groundwater production rate and a drought aquifer condition.

   Disclaimer: The Zone III watershed contributes to Zone II as delineated. It has not been demonstrated that this entire area provides groundwater recharge for Zone II.

Gettysburg Municipal Authority

Geologic Terrain: Sandstone and Shale of Triassic Lowlands.

Hydrogeologic Information: USGS Adams County Report (1999), conceptual groundwater flow model, well and water use data.

Quality of Hydrogeologic Data: Fair

Procedure:

1. Establish conceptual groundwater flow model and boundary conditions using data from the USGS 1999 report and water use data from the system reports.
2. Estimate geologic trend of primary rock units (strike and dip) using best available data.
3. Use total well depth, bedding dip angle, and the tangent function (trigonometry), to estimate how far from the wellhead (horizontal distance) the deepest aquifer zones tapped by the well come up to the surface (crop out).
4. Plot the maximum reach of outcrop onto scaled topography (USGS 7 ½ minute quadrangles), using the most appropriate direction of bedrock trend (strike).
5. Calculate groundwater recharge area (acres) needed to supply enough groundwater to meet safe yield pumping under drought conditions.
6. In absence of other data, delineate limits of groundwater diversion (Zone II) up dip from the well in either (strike) direction to encompass the groundwater recharge area needed to feed the withdrawal (the magnitude of the withdrawal is such that more area is needed to feed it than can be captured from the up-dip area alone; adjacent aquifer areas are assumed to contribute equally as groundwater flow through local fractures across bedrock strike). A well depth of 420 feet and a bedrock dip of 15 degrees (assumed) along strike was used to calculate an up dip Zone II limit of 1,567 feet from the well. In order to balance the withdrawal rate with the recharge rate, it was necessary to include the well site area and down-dip portions of the aquifer.
7. Adjust Zone II out of any areas underlain by diabase, which has much different hydrogeologic characteristics and is not considered a major source of water to the groundwater wells in this area. For Gettysburg, this moved Zone II to the northeast, with the southwest edge against diabase.
8. Adjust Zone III to accommodate Zone II and the entire upgradient catchment basin. This Zone III area is relatively large, and encompasses the entire drainage basin for Rock Creek upgradient of Gettysburg Well No. 5. This is due to the fact that Well No. 5 is in close proximity to Rock Creek, and that there is the possibility that Rock Creek is in direct contact with local groundwater. Since the Zone II area of groundwater diversion for this well extends to the west side of Rock Creek, by definition, Zone III is the zone beyond Zone II that contributes surface water or groundwater to Zones I and II. However, this large Zone III area is

difficult to manage from a wellhead protection standpoint. So it is recommended that the Zone III management area for Gettysburg Well No. 5 be coincident with the identified Zone II area of groundwater diversion. The Zone II area is determined using the safe yield (in gpd) from Well No. 5 and the average groundwater recharge rate (in gpd/mi2) for the aquifer under 1-in-10 year drought condition. The safe yield of Well No. 5 was reported to be 320,000 gpd, which is about two times the actual maximum daily demand (162,093 gpd) reported from the well in the water year 1997. This will allow for conservative and functional Zone III wellhead protection area around Well No. 5 that relates directly to a daily safe yield groundwater production rate and a drought aquifer condition.

Disclaimer: The Zone III watershed contributes to Zone II as delineated. It has not been demonstrated that this entire area provides groundwater recharge for Zone II.

Abbottstown Municipal Water Authority

Geologic Terrain: Sandstone and Shale of Triassic Lowlands.

Hydrogeologic Information: USGS Adams County Report (1999), conceptual groundwater flow model, well and water use data.

Quality of Hydrogeologic Data: Good

Procedure:

1. Establish conceptual groundwater flow model and boundary conditions using data from the USGS 1999 report and water use data from the system reports.
2. Estimate geologic trend of primary rock units (strike and dip) using best available data.
3. Use total well depth, bedding dip angle, and the tangent function (trigonometry), to estimate how far from the wellhead (horizontal distance) the deepest aquifer zones tapped by the well come up to the surface (crop out).
4. Plot the maximum reach of outcrop onto scaled topography (USGS 7 ½ minute quadrangles), using the most appropriate direction of bedrock trend (strike).
5. Calculate groundwater recharge area (acres) needed to supply enough groundwater to meet safe yield pumping under drought conditions.
6. In absence of other data, delineate limits of groundwater diversion (Zone II) up dip from the well in either (strike) direction to encompass the groundwater recharge area needed to feed the withdrawal (the magnitude of the withdrawal is such that more area is needed to feed it than can be captured from the up-dip area alone; adjacent aquifer areas are assumed to contribute equally as groundwater flow through local fractures across bedrock strike). Initially, a well depth of 452 feet and a bedrock dip of 20 degrees (assumed) along strike was used to calculate an updip Zone II limit of 1,241 feet from the well. However, the size of the Zone II elipse created by this limit was not large enough to accommodate the area needed to match pumping withdrawal rates and prescribed recharge area requirements. In order to balance the withdrawal rate with the recharge rate, it was necessary to include the well site area and down dip portions of the aquifer.
7. Adjust Zone II along dip direction to encompass areas along prominent fracture traces (preferential zones of groundwater flow) considered to be sources of groundwater for the wells in this area and was enlarged to meet recharge area requirements based on withdrawal rate.
8. Adjust Zone III to accommodate Zone II and the entire upgradient catchment basin.

Disclaimer: The Zone III watershed contributes to Zone II as delineated. It has not been demonstrated that this entire area provides groundwater recharge for Zone II.

D. WELLHEAD PROTECTION WORKBOOK

Workbook follows.

E. PILOT PROJECT WELLHEAD PROTECTION PLANS

Plans in separate binders.

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APPENDICES

(Bound as Separate Document)

APPENDIX A

Community Water System Summaries

APPENDIX B

Community Water System Surveys

APPENDIX C

Emergency Response Plan Requirements

An Emergency Response Plan for a Community Water System should provide a discussion of how the system will respond to a variety of potential emergencies, including:

1. Contamination of supply
2. Disinfection failure
3. Power outages
4. Distribution system problems
5. Equipment failure
6. Loss of supply
7. Strikes
8. Structural failure
9. Vandalism and sabotage

The Plan should include a public notification procedure, note the availability and location of standby equipment and how it is hooked up, and identify any contractual arrangements for alternative water sources. All contacts and telephone numbers should be listed and kept current, and a clear chain-of-command should be identified.

Source: PA Department of Environmental Protection *Public Water Supply Manual Part VI.*

APPENDIX D
Safe Drinking Water Act Requirements

SAFE DRINKING WATER ACT REQUIREMENTS

Existing Regulations

- ***Surface Water Identification Protocol*** - Most groundwater sources are required to perform the Surface Water Identification Protocol (SWIP) monitoring to determine if the groundwater source is influenced by surface water. SWIP testing is required for springs, infiltration galleries, ranney wells, and crib intakes. Based on well characteristics, including geology, location, depth, and construction, the DEP determines if the groundwater is considered a protected source or if it is questionable. SWIP testing normally consists of monitoring of groundwater over a period of six months. The influence of surface water on groundwater can be determined by shifts in groundwater quality. If the source is considered to be under direct influence of surface water, the supplier has two options: install adequate treatment for the groundwater or abandon the source. The supplier has 48 months to be in compliance with the Surface Water Treatment Rule.

- ***Synthetic Organic Compounds*** - Synthetic Organic Compound (SOC) monitoring is a regulation under the SDWA. Pesticides and PCBs are the major contributors of SOC contamination in water. The initial monitoring, which consists of four consecutive quarterly samples, was to have been started by January 1, 1995, unless a waiver was granted by the DEP. If an SOC level was detected equal to or greater than the maximum contaminant level (MCL), quarterly monitoring is to be continued until reduced monitoring is granted. If this SOC level is not detected in the initial monitoring, small system monitoring is reduced to one sample in each three-year compliance period, and medium system monitoring is reduced to two consecutive quarterly samples in each compliance period. When treatment has been installed for SOCs, compliance monitoring is required annually.

- ***Inorganic Compounds*** - Monitoring for Inorganic Compounds (IOC) and arsenic is required under the SDWA. Asbestos, nitrite and nitrate are several chemicals included in this regulation. Asbestos monitoring can be waived if the system's distribution system is proven not to be susceptible to asbestos contamination. Initial monitoring for asbestos was to have begun by January, 1995, and entails the testing of one sample from each “vulnerable” sampling port during the three-year compliance period. The compliance cycle is a nine-year period. If the asbestos MCL is exceeded during initial testing, monitoring for asbestos is quarterly. Systems that do not disinfect with chlorine, dioxide, ozone, or free chlorine are required to monitor for nitrites and nitrates by initially taking annual samples beginning no later than January, 1993. If nitrite and nitrate levels are greater than 50% of the MCL then monitoring should be continued on a quarterly basis until reduced monitoring is granted. After four consecutive quarterly samples below the MCL, monitoring is reduced to one sample per year. All community water systems were to initially monitor groundwater sources for arsenic, barium, cyanide, antimony, beryllium, cadmium, chromium, fluoride, mercury, nickel, selenium, and thallium beginning in January, 1994, and every three years thereafter. Systems that exceed the MCL for these contaminants require monitoring quarterly until reduced. Systems below the MCL in initial monitoring are required to follow reduced monitoring procedures set by the DEP.

- ***Volatile Organic Compounds*** - In addition to SWIP, SOC, and IOC monitoring, requirements exist for volatile organic compounds (VOC) under the SDWA. Since no waivers are granted by the DEP for VOC monitoring, the initial monitoring for VOCs should have been completed by all water systems. Deadlines for initial monitoring were for January, 1993, for small systems and January, 1994, for medium systems. Water systems that detect trichloroethylene, tetrachlorethylene, trans-1,2-dichloroethylene or 1,1-dichloroethylene are required to monitor for vinyl chloride. For all systems, four consecutive quarterly samples should be taken for initial monitoring. After four consecutive quarterly samples are below the MCL, monitoring is reduced to one sample a year. When VOC levels are above or equal to the MCL in initial monitoring, monitoring is repeated every quarter until reduced monitoring is granted.

- ***Lead and Copper Rule*** - Lead (Pb) and copper (Cu) testing and monitoring is required, in accordance with the Lead and Copper Rule (LCR). Results from Pb and Cu testing were to be reported by July, 1994, for small systems, and July of 1993 for medium systems. Initial monitoring consists of samples being taken for two sixth-month monitoring periods. If Pb and/or Cu action levels are exceeded during this initial monitoring, the system must comply with the corrosion control treatment compliance schedule. If suppliers do not exceed action levels, then monitoring is reduced to yearly samples at half the number of initial sample sites. Beginning in 1998, systems that do not exceed action levels during three consecutive years of monitoring, can qualify for triennial monitoring.

- ***Wellhead Protection Requirements*** - In 1986, amendments were made to the SDWA strengthening provisions for the protection of underground sources of drinking water. The SDWA amendments include Section 1428, the Wellhead Protection Program, which requires each state to develop a program to protect wellhead areas for community water supplies. The DEP has responded by establishing a wellhead protection program which assigns to local governments the responsibility for developing programs, including regulations and management controls, to protect community water supplies from contamination. Part of this Water Resources Plan is a Wellhead Protection Plan intended as a guide for municipalities and community water systems in protecting groundwater quality.

- ***Public Reporting and Other Requirements*** - In 1996, amendments to the SDWA were enacted which require officials of larger drinking water systems to tell their customers about contamination problems by mail and in plain language. It also requires states to test and train system operators, and mandates new health standards for arsenic, cryptosporidium and radon in drinking water.

Future Regulations

- ***Other Maximum Contaminant Levels*** - 25 additional contaminants are planned to be added to the regulatory list every three years.

- ***Disinfectant/Disinfection Byproduct Rule (D/DBP)*** - The D/DBP rule will pertain to all systems that use a disinfectant. Specific monitoring requirements will be phased, and will vary according to the size and type of system. For small and medium systems with a groundwater source, the D/DBP rule is planned to become effective in January, 2002.

Maximum Contaminant Levels

Primary Contaminant Levels

Volatile Organic Compounds (VOCs)	(mg/L)
Benzene	0.005
Carbon Tetrachloride	0.005
1,2-Dichloroethane	0.005
o-Dichlorobenzene	0.6
para-Dichlorobenzene	0.075
1,1-Dichloroethylene	0.007
cis-1,2-Dichloroethylene	0.07
trans-1,2-Dichloroethylene	0.1
Dichloromethane	0.005
1,2-Dichloropropane	0.005
Ethylbenzene	0.7
Monochlorbenzene	0.1
Styrene	0.1
Tetrachlorethylene	0.005
Toluene	1
1,2,4-Trichlorobenzene	0.07
1,1,1-Trichloroethane	0.2
1,1,2-Trichloroethane	0.005
Trichloroethylene	0.005
Vinyl Chloride	0.002
Xylenes (total)	10
TTHMs[1]	0.10

Synthetic Organic Chemicals (SOCs)	(mg/L)
Alachlor	0.002
Atrazine	0.003
Benzo(a)pyrene	0.0002
Carbofuran	0.04
Chlordane	0.002
2,4-D	0.07
Dalapon	0.2
Di(2-ethylhexyl) adipate	0.4
Di(2-ethylhexyl) phthalate	0.006
Dibromochloropropane (DBCP)	0.0002
Dinoseb	0.007
Diquat	0.02
Endothall	0.1
Endrin	0.002
Ethylene dibromide (EDB)	0.00005
Glyphosate	0.7
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane	0.0002
Methoxychlor	0.04
Oxamyl (Vydate)	0.2
PCBs	0.0005
Pentachlorphenol	0.001
Picloram	0.5
Simazine	0.004
2,3,7,8-TCDD (Dioxin)	$3 x^{-8}$
Toxaphene	0.003
2,4,5-TP (Silvex)	0.05

Inorganic Chemicals (IOCs)	(mg/L)
Antimony	0.006
Arsenic	0.05
Asbestos	7 million fibers (longer than 10 um/L)
Barium	2
Beryllium	0.004
Cadmium	0.005
Chromium	0.1
Copper[2]	1.3
Cyanide (free)	0.2
Fluoride	2
Lead[2]	0.015
Mercury	0.002
Nickel	0.1
Nitrate (as N)	10
Nitrite (as N)	1
Nitrate and Nitrite (as N)	10
Selenium	0.05
Thallium	0.002

[1]Sum of the concentration of chloroform, dibromochloromethane, bromodichloromethane, and bromoform.
[2]Copper and lead have action levels instead of MCLs. An action level is exceeded when the concentration in more than 10% of tap water samples collected during a monitoring period exceeds the action level.

Primary Contaminant Levels		Secondary Contaminant Levels[3]	
Other Contaminant	**Level**	**Contaminant**	**Level**
Microbiological (Coliform Bacteria)	Monthly MCL No more than one positive total coliform sample per month for systems collecting fewer than 40 samples per month. OR No more than 5.0% positive total coliform samples per month for systems collecting more than 40 samples per month. Acute MCL No positive total and fecal coliform combinations (routine + check sample) per month.	Aluminum	0.2 mg/L
		Chloride	250 mg/L
		Color	15 Color Units
		Corrosivity	Non-Corrosive
		Foaming Agents	0.5 mg/L
		Iron	0.3 mg/L
		Manganese	0.05 mg/L
		Odor	3 T.O.N.
		pH[4]	6.5 - 8.5
		Silver	0.1 mg/L
		Sulfate	250 mg/L
		Total Dissolved Solids (TDS)	500 mg/L
		Zinc	5 mg/L
Radiological			
Natural			
Gross Alpha[1]	15 pCi/L		
Combined Radium - 226 & 228	5 pCi/L		
Man-made			
Annual Dose Equivalent	4 mrem/yr		
Gross Beta[2]	50 pCi/L		
Tritium	8 pCi/L		
Strontium	20,000 pCi/L		

[1]Includes Radium 226 but excludes radon and uranium. Compliance with the combined Radium MCL is assumed if gross alpha is less than or equal to 5 pCi/L. A sample must be further analyzed for Radium 226 and Radium 228 whenever the gross alpha exceeds 5 pCi/L.

[2]If gross beta is less than 50 pCi/L, and tritium and strontium are less than 4 mrem/yr, compliance with the man-made radiological MCLs is assumed. If gross beta is greater than 50 pCi/L, further analysis of major radioactive constituents including all major man-made beta and photon emitters to determine annual dose equivalent is required.

[3]Routine compliance monitoring is generally not required for these contaminants unless the department determines monitoring is necessary for these contaminants.

[4]Not an enforceable maximum contaminant level. This value represents a reasonable goal.

APPENDIX E

Model Wellhead Protection Overlay Zone

APPENDIX F

Model Remediation of Potential Hazards Ordinance

This table is to be used in conjunction with the Wellhead Protection Overlay Zone with respect to permitted industrial, commercial or institutional facilities which generate, use, store, or transport hazardous substances. The table below conveys the threshold levels at which various substances which might be used by such facilities are considered hazardous.

HAZARDOUS SUBSTANCE ACTIVITIES

Type of Business	SIC Codes	Possible Hazardous Substances	Hazardous Threshold
Agricultural Chemical Warehousing and Distribution	5191 2873 2874 2875 2879	Ammonium Nitrate Sulfate Chloride Pesticides & herbicides	1,600 lb as NH_4NO_3 370 lb as NH_4NO_3 3,000 lb as $(NH_4)_2SO_4$ 1,200 lb as KCl
Aluminum Rolling Mills	3353	Hydrocarbon solvents Methyl ethyl ketone 1, 1, 1-Trichloroethane Gasoline and diesel fuels Chloride salts Chromium salts	110 gal 105 gal 70 gal 110 gal 1,000 lb as NaCl 90 lb as $Na_2Cr_2O_7$
Aluminum Reduction	3334 3341	Fluoride salts Chromium salts Gasoline & diesel fuels Fluoride & Cyanide wastes	300 lb as AlF_3 90 lb as $Na_2Cr_2O_7$ 110 gal
Building Materials Production	2435 2436 2439 2491 2492	Pentachlorophenol Copper salts Chromium salts Phenolic resin glue Caustic soda	70 gal 5% soln. 90 lb as CuSO4 90 lb as $NaCr_2O_7$ 15 lb based on formaldehyde 850 lb
Chemical & Plastics Manufacturing	2813 2816 2819 282	All types of chemicals may be on site	
Chemical Warehousing & Distribution	5161	All types of chemicals may be on site	
Cleaning Supplies, Manufacturing & Distribution	2841 2869 5087 5161	Isopropyl alcohol Chlorinated phenols Dibutylphthalate	110 gal 20 lbs 3,000 gal
Dry Cleaning Establishments	7215 7217	Trichloroethene Tetrachloroethene Hydrocarbon solvents	2.5 gal 2.0 gal 110 gal
Educational Institutions	8221 8222	All chemicals may be present in laboratory quantities.	
Electrical & Electronic Products Manufacturing	3612 3641 3662 3674 3677 3679 3825 3993	Metal salts (Cu, Ni, Zn) Cyanide Methylene chloride 1,1,1-Trichloroethane Acetone Methyl ethyl ketone Formaldehyde	90 lb 150 gal 10% NaCN soln. 10 gal 70 gal 60 gal 105 gal 1 gal
Electroplating Operations	3471	Metal salts (Cr, Cu, Ni, & Zn) Cyanide Sodium Phosphate Trichloroethene Tetrachloroethene Xylene Other solvents	90 lb 150 gal 10% NaCN soln. 300 gal 30% soln. 2.5 gal 2.0 gal 110 gal 110 gal
Foundries	3321 3322 3325 3361 3362 3369	Metal salts (Cr, Cu, Ni, & Zn) Cyanide Trichloroethene Isopropyl alcohol Caustic soda cleaning soln.	90 lb 125 lbs as NaCN 2.5 gal 110 gal 250 gal 35% soln.

Furniture Refinishing	7641	Methylene chloride Acetone Hydrocarbon solvents Paint-related products	10 gal 60 gal 110 gal
Medical Facilities	0742 8062 8069 8071	Mono and Polycyclic Aromatic Hydrocarbons Prescription drugs Biological contaminants	 1 gal
Paint Manufacturing & Wholesale Distribution	2816 2865 5198	Metal salts (Cr, Pb, Sb, & Zn) Phthalate esters Methylene chloride Methyl ethyl ketone Ethylene glycol Hydrocarbon solvents	90 lb 10 gal 105 gal 7.5 gal 110 gal
Paint Shops	7535	Hydrocarbon solvents Xylene Methylene chloride	110 gal 110 gal 10 gal
Petroleum Products Production & Storage: Bulk Distribution of Petroleum Products	2992 5171 5172	Gasoline Diesel fuel & heating oil Lubricating oils Ethylene glycol Methyl alcohol	110 gal 110 gal 110 gal 7.5 gal 60 gal
Photo Processing	7333 7395	Silver salts Phenols Cyanide Aromatic Hydrocarbons	50 lbs as $AgNO_3$ 10 lbs 125 lbs as NaCN 110 gal
Printing Establishments	2711 2751 2752 2761	Silver salts Aromatic Hydrocarbons Phenols Cyanides Tetrachloroethene Hydrocarbon solvents	50 lbs as $AgNO_3$ 110 gal 10 lbs 125 lbs as NaCN 2.0 gal 110 gal
Gasoline Distribution	5541	Gasoline Diesel fuel Lubricating oils Ethylene glycol Methyl alcohol	110 gal 110 gal 110 gal 7.5 gal 60 gal
Metal Fabrication	3441 3442 3443 3444	Metal salts (Cr, Cu, Ni, & Zn) Caustic cleaning solutions Hydrochloric acid Sulfuric acid Hydrocarbon solvents Xylene Caustic soda Sodium phosphate Sodium hydroxide	90 lb 250 gal 155 gal 150 gal 110 gal 110 gal 250 gal 35% soln. 300 gal 30% soln. 600 lb
Secondary Metals Refining	3341	Metal salts (Al, Cr, Zn) Chloride Sulfate	90 lb 1,000 lbs as NaCl 3,000 lbs as $(NH_4)_2SO_4$
Seed Cleaning & Treating	721	Hexachlorobenzene Other pesticides	1 gal
Solvent Recycling	2911	1, 1, 1-Trichloroethane Trichloroethene Tetrachloroethene	70 gal 2.5 gal 2.0 gal
Trucking Companies	4171 4172 4231	Gasoline & diesel Hydrocarbon solvents Ethylene glycol Caustic soda cleaning soln.	110 gal 110 gal 7.5 gal 250 gal 35% soln.

Source: Spokane County, Washington, 1983 Aquifer Sensitive Area Overlay Zone Ordinance

APPENDIX G

Contaminant Source Inventories

APPENDIX H

State Standards for Salt Storage & Handling

APPENDIX I

Federally-Prohibited Hazardous Substances Within Floodplains

Acetone
Ammonia
Benzene
Calcium carbide
Carbon disulfide
Celluloid
Chlorine
Hydrochloric acid
Hydrocyanic acid
Magnesium
Nitric acid and oxides of nitrogen
Petroleum products (gasoline, fuel oil, etc.)
Phosphorus
Potassium
Sodium
Sulphur and sulphur products
Pesticides (including insecticides, fungicides and rodenticides)
Radioactive substances, insofar as such substances are not otherwise regulated

Source: PA Floodplain Management Act of 1978, Act 166 and regulations

APPENDIX J

Underground Storage Tank Regulations

APPENDIX K

Model Water Well Ordinance

APPENDIX L

Sample Water Well Ordinance

APPENDIX M

AWWA Well Construction Standards

APPENDIX N

Ground Source Heat Pump Manual
(includes well abandonment standards)

APPENDIX O

Sample On-Lot Sewage Disposal System Ordinance

APPENDIX P

Understanding Septic Systems

APPENDIX Q

Wellhead Protection Area Signage