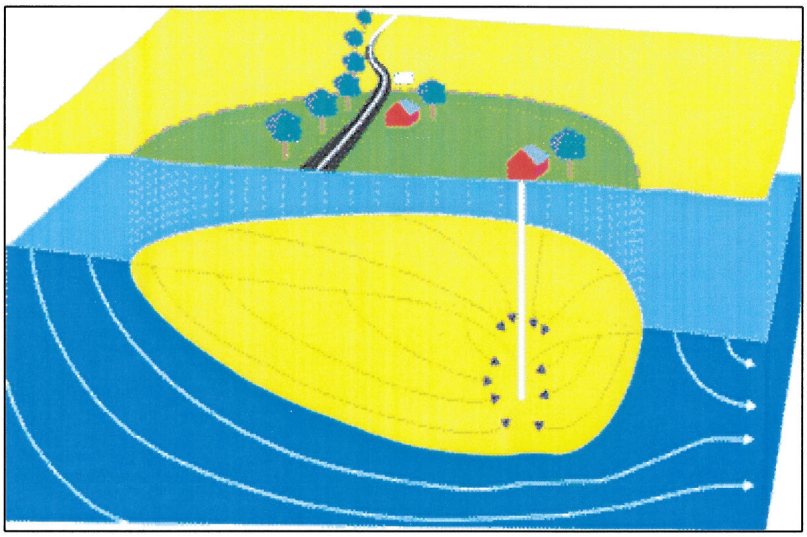
SOURCE WATER ASSESSMENT

FOR

PRINCE GEORGE'S COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
March 2005

MDE

Robert L. Ehrlich, Jr.
Governor

Kendl P. Philbrick
Secretary

Michael S. Steele
Lt. Governor

Jonas A. Jacobson
Deputy Secretary

Table of Contents

SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for twenty-nine transient noncommunity water systems in Prince George's County. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are: 1) delineation of an area that contributes water to the source; 2) identification of potential sources of contamination; and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

Confined aquifers protect water supplies from contaminants originating on the land surface. Transient water supply systems in Prince George's County use both confined and unconfined aquifers. Twenty-nine wells supply the twenty-nine transient systems in Prince George's County. Through investigation of MDE records and interviewing system owners it was concluded that twenty-eight of these are completed in confined aquifers and one is completed in an unconfined aquifer. The Source Water Assessment Area for the unconfined well was delineated by the WSP using EPA approved methods specifically designed for unconfined sources.

Potential point sources of contamination within the lone assessment area were identified from field inspections and contaminant inventory databases. Common potential sources of contamination can be on-site septic systems and underground storage tanks. The Maryland Office of Planning's 2002 land use map for Prince George's County was used to determine which land use was present in the assessment area. Forest was the most commonly identified use code within the assessment area. Figure 4 shows the well location, assessment area and potential contaminant source overlain on an aerial photograph.

The WSP reviewed water quality results, along with the presence of potential sources of contamination within the individual assessment area, the integrity of the system's well, and the inherent vulnerability of the aquifer. It was determined that none of the transient systems are susceptible to contamination by nitrogen compounds or volatile organic compounds. However, some systems are susceptible to microbiological contaminants through well construction deficiencies. The sanitary integrity of the water supply systems may be maintained by following the protection recommendations at the end of this report to individual water system owners and county officials. These include disinfection after work is performed on the systems, installing a two-piece cap on the wells, caulking the electrical conduits and continuing regular inspections.

INTRODUCTION

The Water Supply Program (WSP) has conducted a Source Water Assessment for twenty-nine transient noncommunity water systems in Prince George's County (Figure 1). As defined in Maryland's Source Water Assessment Plan (SWAP), a transient noncommunity water system is any noncommunity water system that does not regularly serve at least 25 of the same individuals over 6 months per year. Some good examples of transient water systems include hotels, restaurants, parks, fire departments, and churches. The transient systems must sample for two contaminants. The first is coliform, which is an indicator that other microbiological contaminants could be in the water supply. Systems are required to test for coliform regularly. Additional sampling is required following positive coliform results. The second contaminant is nitrogen in the form of nitrate or nitrite. This SWAP report will focus on these two contaminants, but will address other obvious potential sources of contamination.

Prince George's County is located in the Southern portion of the State and is located mostly in the Coastal Plain physiographic province. The Coastal Plain, geologically the youngest province in Maryland, covers nearly half of the State and consists entirely of unconsolidated sediments. All of the transient water supplies obtain their water from wells of various size and depth. Most of these wells are completed in confined aquifers, while one is using an unconfined aquifer. For the purpose of this report, depth of well, lithology, and nitrate data were used to determine whether the wells are in confined or unconfined aquifers. An accurate determination of the aquifer type is very important because it helps explain how vulnerable the water supply source is to contamination.

WELL INFORMATION

Well information for each system was obtained from the WSP's database, owner interviews, site visits, well completion reports, sanitary survey inspection reports, and published reports. A total of twenty-nine wells are used by the twenty-nine transient systems assessed in this report. The well tag number, which provides vital well information, was found for twenty-six of the twenty-nine wells (Table 1). From the well tag information, ground water appropriation data, and with the nitrate sampling data it was concluded that twenty-eight wells are completed in confined aquifers (Aquifer code "C"). It cannot be determined if the remaining well is completed in a confined aquifer, so for this report it is assumed to be completed in an unconfined aquifer (Aquifer code "U"). Table 1 contains a summary of the well information for each system.

Much good well information for the transient systems in Prince George's County was available at the start of this project. Using this information, it was determined that all but five of the wells were completed in confined aquifers. Thorough field investigations and interviews with the system owners revealed that the other four wells were completed in confined aquifers. The well for Top of the Hill Tavern was the only well that could not be labeled as a confined well. Well and contaminant locations were taken with a GPS unit at the five transient systems that required fieldwork. The other

wells were located by using both the county sanitary survey and DNR DOQQ photos. Information was found that at least eighteen of the twenty-nine wells were completed after 1973, which is when the State adopted the well completion standards for wells. Two of the wells that were visited were in excellent condition and above grade. The other above grade well was in fair condition, and the other two wells were unable to be assessed because they were in a pit or in a locked building.

HYDROGEOLOGY

Prince George's County is located in Southern Maryland. The county is located mostly in the Coastal Plain physiographic province, which is characterized by low topography due to the underlying horizontal sedimentary layers. The northern edge of the county is in the Piedmont Province. All of the transient wells in Prince George's County draw water from unconsolidated sediments. Ground water flows through pores between gravel, sand, and silt grains in unconsolidated sedimentary aquifers. An aquifer is any formation that is capable of yielding a significant amount of water. Confined aquifers are those formations that are overlain by a confining layer consisting of clay or fine silt (Figure 2). This confining layer, generally composed of clay and silt, allows very little water to travel vertically through it. Confined aquifers are recharged from the water stored in the confining unit above and from precipitation that infiltrates into the formation where it is exposed at the surface. Unconfined aquifers are also known as water table aquifers. Precipitation that falls on the ground surface infiltrates the water table aquifer. Transient water systems in Prince George's County pump water from one of four aquifers. The first and the shallowest, is the Quaternary aquifer. The Quaternary aquifer is always considered unconfined in Prince George's County. The second aquifer is the Aquia Aquifer and the third aquifer is the Magothy Aquifer. The fourth and deepest aquifer is the Patapsco aquifer. These aquifers can be confined or unconfined depending on where in Prince George's County the well is drilled (DNR 1987).

Quaternary Aquifer

The Quaternary sediments are composed predominantly of sand and gravel with some layers of silty clay and clay. Since the Quaternary sediments are mostly surficial, they usually function as water-table aquifers. Recharge comes from infiltration of precipitation, so the level of the water table may vary seasonally. The sand thickness averages about 30 feet thick. The water quality of the Quaternary Formation can vary dependant upon the local soil types and land use. Water quality impacts from farming and high-density development with on site septic systems can lead to elevated nitrate levels and pesticide contamination. In some areas the water may be slightly acidic and contain high concentrations of iron, requiring treatment before use (DNR 1987) (Department of Geology, Mines and Water Resources State of Maryland 1955).

Aquia Aquifer

The Aquia formation is composed of fine to coarse-grained, greenish-brown sand that contains layers of grayish-green silt and clay, indurated calcite-cemented

sand and fossil beds composed of shell debris. The greenish-brown color is from the minerals glauconite and goethite, which compose from 20 to 70 percent of the formation. The Aquia greensand is relatively thin, but it yields adequate supplies of water for domestic purposes to many dug wells. Permeability decreases downdip as a result of the decreasing grain size until the Aquia formation no longer functions as an aquifer. The Aquia formation ranges in thickness from about 0 to 200 feet from west to east across the county and reaches a maximum basal depth of about 460 feet at the southeast tip of the county. The natural water quality in the Aquia formation is generally good and, in many cases, suitable for domestic use without treatment. Total dissolved solids increase from 125 to 250 ppm between the outcrop area and the downdip facies. Moderately acidic pH values characterize updip areas of the Aquia Formation near its outcrop as a result of recharge from acidic rain. Iron removal is not a problem in most areas where the Aquia aquifer is used. The water is usually soft in the outcrop area because much of the fossil shell material and calcite cement has been leached out. Water in most of the formation, however, tends to be moderately hard to hard (DNR 1987).

Magothy Aquifer

The Magothy formation consists of light-gray cross-bedded coarse sand containing a small amount of glauconite and pyrite, which oxidizes to iron oxide where exposed, and brown, white or gray clay. Particles of carbonaceous matter are also common throughout the formation. The Magothy formation outcrops on the north side of Bowie and ranges in thickness from 0 to about 100 feet. It reaches a maximum basal depth of about 550 feet below sea level. The capacity of the water-bearing material in the Magothy formation is not uniform, but it is a very important aquifer in the county. It yields adequate supplies of water to several municipal and institutional and many domestic drilled wells. The chemical character of the water in the Magothy formation is fairly uniform throughout the county. Near the outcrop in the northern part of the county the hardness of the water is lower than in the southern part. The Magothy formation has undesirable concentrations of dissolved iron in some areas, but in general can be expected to yield water that is not objectionably high in iron. The water generally is neutral with the pH averaging 7.5 (Department of Geology, Mines and Water Resources State of Maryland).

Patapsco Aquifer

The Patapsco formation is the youngest formation of the Potomac group. It is composed chiefly of clay, sand and some gravel. The beds of sand are usually light gray to buff and the clay varies in color from white to gray to shades of red. The Patapsco Formation is present over all except the northwestern edge of Prince George's County. It outcrops in a broad area just inside of that northwestern boundary edge. It has a basal depth ranging from +200 to –1275 ft. relative to sea level; however, the thickness and extent of the aquifer are difficult to define. Water supplies for domestic use generally are readily obtained from the Patapsco

formation. The Patapsco formation water is highly mineralized. The hardness is variable, averaging 64 parts per million. The dissolved solids in the water in this formation averages 117 parts per million. The iron content averages 4.67 parts per million and the pH averages 6.7. The water in the Patapsco formation in the northern part of the county is lower in dissolved solids, hardness and pH than that in the southern part of the county (Department of Geology, Mines and Water Resources State of Maryland) (DNR 1987).

SOURCE WATER ASSESSMENT AREA DELINEATION

When Maryland's SWAP was written the method for delineating an assessment area for the unconfined transient systems using <10,000 gpd was not yet determined. An ongoing study between The United States Geologic Survey and MDE assisted MDE in selecting an appropriate method. One of the objectives of this study was to determine ground water flow paths for systems pumping <10,000 gpd in unconfined Coastal Plain aquifers. The study concluded that small users, pumping <10,000 gpd, have very little effect on the ambient ground water flow in unconfined aquifers. Using this information MDE created a wedge shape delineation area that will be used for all the transient systems using <10,000 gpd from unconfined aquifers, where the general direction of ground water flow is known. The wedge is based on an annual recharge of 1 ft and ground water flow directions. The wedge shape has an angle of 60 degrees that will extend against the ground water flow direction for a length of 1000-ft (Figure 3). The wedge was created to compensate for uncertainties in ground water flow direction and to provide sufficient recharge area to balance a withdraw of 10,000 gpd. A circle with a radius of 1000 ft will be used for all systems that pump from unconfined aquifers where the ground water flow direction is not known. As defined in Maryland's SWAP, no delineation area will be created for the transient systems drawing from confined sources. This is because the monitoring of these wells for their regulated contaminants and geologic protection has established that they are not vulnerable to contamination. The assessment focuses on the integrity of their water supply well(s).

POTENTIAL SOURCES OF CONTAMINATION

As stated in the introduction, the focus of this SWAP is on the sources of contamination that would cause a coliform or nitrite/nitrate problem in the unconfined aquifers. Potential sources of contamination can be broken into two types. The first type is point source contamination. Some examples of potential point source contaminants would be feed lots, ground water discharge permits, and underground storage tanks. The second type of potential sources of contaminants is non-point sources. Some types of non-point sources can include general row-crop farming; land application of waste, pesticide and herbicide application, and various land uses. On-site septic systems are often referred to as non-point pollution as they are very common in non-sewered residential areas. Over 300,000 households in Maryland rely on on-site sewerage disposal for domestic wastes. In this project the location of specific septic systems for the systems were identified. Therefore they have been included with point sources.

Point Sources

Within the area delineated on Figure 4 there are approximately ten residential dwellings and one commercial property. This was determined using the 2004 tax map, 2002 land use information, aerial photos of the delineated area, and observations made from field investigation. Each of these properties is served by on-site wastewater, which are potential sources of nitrates and pathogenic microorganisms. A properly sited, designed, installed, and maintained septic system is not a source of pathogenic bacteria or protozoa to the ground water due to the filtering capacity of the absorption bed and soil. On-site septic systems do not remove nitrogen from the wastewater. The dissolved nitrogen in the wastewater percolates down through the soil to the groundwater in the unconfined aquifer. Excessive concentrations in water supplies are prevented through requiring minimum lot sizes and strategic placement of wells relative to on-site disposal systems.

Land Use

The Maryland Office of Planning's (MOP) 2002 Land Use map for Prince George's County was used to identify predominant types of land use within the SWAP area (Figure 5). The two largest proportions of land use for the SWAP areas are forest and cropland at 46.9% and 25.4% respectively. The next land use is mixed pasture at 17.7%. These three land uses make up 90.0% of the total land area. The next 2 land uses; medium density residential and commercial contribute another 10.0% (Figure 6). These types of land uses would be expected since most of the systems are located in small population centers. Ground water contamination of unconfined aquifers is possible from a high density of multiple on-site systems, or from over fertilization of lawns and cropland.

Sewer

The Maryland Office of Planning 1996 Prince George's County Sewer map shows that 48.2 percent of the county currently has sewer service (Figure 7). Another 5.3 percent is public system area adequate for development planning and an additional 12.6 percent is area with future public system anticipation. At this time there are no plans to provide any new sewer service to the other 33.9 percent of Prince George's County.

WATER QUALITY DATA

Water quality data was reviewed from the Water Supply Program's database for Safe Drinking Water Act (SDWA) contaminants. All data reported is from the water supplied to consumers. Fourteen of the Prince George's County Transient Systems are known to have some type of water treatment. Table 2 summarizes the treatment methods and the reason for that treatment. Eight of the systems use disinfection. If coliforms are not present in the finished water for the other twenty-two systems this data can be used to evaluate ground water or source water quality. A review of the monitoring data shows that there is some microbiological contamination but no nitrate susceptibility.

Nitrogen compounds

Water quality data indicates that the nitrate levels for all of these twenty-nine systems are <50% of the SDWA maximum contaminate level (MCL) standards (Table 3). This should be expected since 28 of the 29 wells are completed in confined aquifers that shouldn't contain much if any nitrate or nitrite.

Microbiological Contaminants

All of the transient water suppliers are routinely sampled at least quarterly for microbiological contamination. If this routine sample is positive the system must then resample within twenty-four hours or as soon as possible. This bacteriological sampling is required by the SDWA (Table 4). Seventeen of the systems have never had a positive bacteriological sample. Three systems have had more than twenty-five percent of their bacteriological samples come back positive since 1996. Cleo's Restaurant and Motel has had positive fecal samples in the routine sampling twice, but in both cases the repeat samples came up negative for fecal coliform. Mobil Mart has had one instance where a routine and multiple repeat samples have both come up positive for fecal coliform. The only possibly unconfined system, Top of the Hill Tavern, doesn't have any treatment and has never had a positive bacteriological sample.

SUSCEPTIBILITY ANALYSIS

Wells serving the Prince George's County Transient Water Systems all draw their water from wells in unconsolidated sedimentary aquifers. All but one of these wells are known to be completed in confined aquifers. The wells drawing from confined aquifers are protected, if the well is maintained and constructed correctly, and are not susceptible to contamination from surface activity. The possibly unconfined aquifer well is more susceptible to contamination from surface activities. Prince George's County's unconsolidated sediments, and soil, provide protection from microbiological contamination as water percolates through the overlying soil and aquifer sediments. The lack of any positive total coliform samples at Top of the Hill Tavern proves this efficiency. However, nitrate and other water-soluble contaminants can percolate through the soil and contaminate unconfined wells. This is evident in the nitrate levels detected in the Robin Dale Golf Club's old unconfined well, which was abandoned and replaced by a deeper confined well.

Inorganic Compounds

There were no significant nitrate or nitrite results for the twenty-nine systems. This was expected because all but one of the systems are determined to be confined and the nitrate levels in confined aquifers are very low to nonexistent. The one possibly unconfined system in Prince George's County, Top of the Hill Tavern, does not have any significant nitrate or nitrite sample results.

Maryland Motor Court is using a 440 feet deep well completed in the Magothy Formation, which is confined in this location. Two samples taken from this well have had nitrate levels around 2 mg/L. This level of nitrate seems high for water

coming from a confined aquifer. Further sampling and investigations into where the nitrate source is should be done.

Oxen Hill is another system using a well completed in a confined aquifer. One of their nitrate sample results was above 1 mg/L. All other nitrate samples before and after this sample have been no detect or very close to the detection limit. The sample result above 1 mg/L may have been due to a collection or lab error.

Robin Dale Golf Club just replaced their hand dug well with a new confined well completed in the Magothy Formation. As long as the new well is properly constructed, there should be no further nitrates detected above 1 mg/L.

Microbiological Contaminants

As stated earlier in this report, Prince George's County's unconsolidated sediments, and soil, provide protection from microbiological contamination as water percolates through the overlying soil and aquifer sediments. Most, if not all, of the microbiological contamination of unconsolidated wells, confined or unconfined, comes from either well construction problems or contamination of the well water with bacteria in either the treatment or distribution.

Well construction problems can be caused from improper completion of the well by the well driller, but are mostly caused by vehicles hitting unprotected wells. Common problems include cracked or broken well casings, and well caps. Pitless adaptors and the grouting can also be damaged during well vehicle accidents. Wells constructed in pits or low areas that are subject to flooding should be inspected and sampled to ensure their integrity. All of these construction deficiencies can allow surface water containing microbial contaminants to enter a well. Two-piece insect proof caps should be installed on all wells to prevent insects from entering the wellhead, which can cause bacterial problems.

Contaminating clean well water with coliform is very easy. Ion-exchange units, and cartridge filters can harbor bacteria that will cause positive bacteriological samples. Storage or a distribution problem or repair can also introduce the coliform into the system. Correctly disinfecting the water system is very important after pulling a well pump or completing improvements to the distribution system. Dead ends in the water distribution can also cause bacteriological problems.

Confined Wells:

If there are no well construction problems with a well drawing from a confined aquifer the supply should be safe from microbiological contamination. A review of Table 4 indicates that nine of the twenty-eight confined systems have had at least one positive total coliform sample in the past eight years. Three of the systems have greater than 25% of their samples come back positive for coliform.

Alice Ferguson Foundation replaced the well that had positive bacteriological results with a new well. There have been no more positive results since the new well has been used.

From a field visit, it was determined that AMKO Market uses a well with a two-piece cap. The above ground well integrity appears to be good. The positive bacteriological results are most likely from the fouled cartridge filters used to treat the water from the well, not from contamination of the well itself.

The well for Moore's Country Store had a two-piece cap and appeared to be constructed to standards with casing above ground. The well is very close to the parking lot and may have been struck by a vehicle and damaged below grade. There is protection surrounding the well, but from a field investigation it was observed that the well is positioned so that it touches the concrete barrier at the closest point near the parking spot. The well could have sustained damage before the barrier was installed or may still sustain damage unless the protective concrete ring is moved away from the casing.

Cleo's Restaurant and Motel has had positive sample twice in their sample history, both times the repeat samples have come up negative. The routine samples could have been contaminated during the collection of the sample. The most recent water samples were negative. The wellhead, treatment, and distribution should be evaluated for deficiencies to ensure there is no problem with the water system.

Mobil Mart had positive routine and repeat fecal coliform samples in January of 2004. Since then they have not had any more positive fecal samples. Field investigations revealed that their well had a one-piece cap that could allow contamination of the well by insects or airborne dust.

Unconfined Wells:

If a well is drawing from an unconfined aquifer, it could become contaminated from various sources. However, a source of microbiologic contamination would have to be very close to a well because of the high filtration effectiveness of the unconsolidated soils. Maryland regulations require a four-foot separation between the seasonal high water table and the bottom of the absorption bed. The regulations also require at least a 100-foot separation between on-site septic systems and unconfined wells. These distances are adequate to prevent microbial (bacteriological) contamination from on-site septic systems. If a well has any of the construction deficiencies listed above it could be susceptible to surficial sources of pathogens. Surface water can carry contaminants down a well if these conditions are present.

SUMMARY AND RECOMMENDATIONS FOR PROTECTING WATER SUPPLIES

Key Findings:
This report identified transient water supplies in Prince George's County as being more likely to be contaminated by microbial contaminants than nitrate or nitrite nitrogen. Sources of microbial contamination, however, are not believed to be related to ground water contamination, but rather the maintenance of the integrity of the individual water supply system. The report also identified a specific area (SWAP area) immediately surrounding the only unconfined transient water supply source. This delineated area has the greatest potential to influence the quality of that water supply. Forest was the most common type of land use within the SWAP area. The recommendations that immediately follow are a result of the investigations required during the writing of this report.

Recommendations for Individual Water System Owners

- The sanitary integrity of the water supply system must be maintained. Sanitary defects noted in county sanitary surveys should be corrected. All work on the water system should be performed in a sanitary manner and followed with a one-time disinfection.
- Coliform testing results are a good indication if the sanitary integrity of the system has been affected. All positive results should be investigated to determine the cause of the positive tests. Corrective action should be taken to eliminate the source of the problem. Any sources with confirmed fecal contamination must be rehabilitated or abandoned.
- Installing new two-piece well caps is a good way to reduce potential contamination from insects. Caulking of the electrical conduit is needed to ensure a sanitary seal.
- Any wells in areas subject to flooding or just above grade should be sampled following significant rain events to demonstrate if they are sensitive to flooding impacts.
- Water systems for seasonal facilities should be disinfected and flushed prior to the opening of a new season.
- Wells should be protected from damage by vehicles or other machinery. If a well is or was damaged, it should be repaired. All work on wells should be followed by disinfection to avoid contamination of the water supply.
- Owners should keep track of potential changes in land use that might impact their water supply. Letting neighboring property owners and local officials know their concerns can prevent problems from occurring. Figure 4 should be a useful starting point for Top of the Hill Tavern to identify the specific area that has the greatest potential to impact the quality of its' water supply.

Recommendations for County Officials

- Continue regular inspection, oversight and testing of transient noncommunity water systems. Ensure that systems correct the cause of positive bacteriological test results.
- Test results show that some systems have a high percentage of positive results. Priority should be placed on those systems that have not corrected the root causes of past positive results.
- Encourage planting of cover crops for fields upgradient of water supplies, particularly if systems are experiencing nitrate levels greater than 50% of the MCL.

References

Maryland Department of the Environment Water Supply Program, 1999, Maryland's Source Water Assessment Plan.

Maryland Department of Natural Resources (DNR), 1987, The Quantity and Natural Quality of Ground Water in Maryland: DNR Water Resources Administration.

Cooke Wythe, Martin Robert, Meyer Gerald, 1952, Geology and Water Resources of Prince George's County: Department of Geology, Mines and Water Resources State of Maryland Bulletin 10.

Otton E., 1955 Southern Maryland Ground-Water Resources: Department of Geology, Mines and Water Resources State of Maryland Bulletin 15.

Other Sources of Data

Water Appropriation and Use Permits
Prince George's County Sanitary Survey Inspection Reports
MDE Water Supply Program (PDWIS) Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles
USGS Topographic 7.5 Minute Quadrangles
Maryland Office of Planning 1997 Prince George's County Land Use Map
Maryland Office of Planning 1996 Prince George's County Sewer Map

PWSID	System Name	Source #	Plant #	Use Code	Ground Water Appropriation	Aquifer Code	Aquifer Type	Well Tag #	Casing Depth	Well Depth
1161003	ALICE FERGUSON FOUNDATION	2	1	P	PG2000G005	217D	C	PG941483	451	493
1161010	BADEN VOL FIRE DEPT	1	1	P	PG1969G009	211D	C	PG690067	360	400
1161019	BRAGG MOTEL	1	1	P	PG1952G005	211D	C	PG011002	304	312
1161024	CEDARVILLE STATE FOREST	1	1	P	PG1966G004	217D	C	PG660122	610	648
1161027	CLEOS RESTAURANT & MOTEL	1	1	P	PG1969G006	211D	C	PG690050	106	111
1161034	FAMILY DELI	1	1	P	PG1984G003	125B	C	PG810504		
1161055	KNIGHTS OF COLUMBUS	1	1	P	PG1971G005	211D	C	PG710057	131	141
1161057	LAKE ARBOR GOLF CLUB	2	1	P	PG1998G018	211D	C	PG940413	97	107
1161059	LITTLE STORE	1	1	P	PG1978G014	125B	C	PG731015	315	560
1161065	MARYLAND MOTOR COURT	1	1	P	PG1981G011	211D	C	PG810087	357	440
1161067	MOORE'S COUNTRY STORE	1	1	P	PG1974G013	211D	C	PG920686	280	325
1161069	NATIONAL COLONIAL FARM	1	1	P	PG1981G008	217D	C	PG731444	211	231
1161071	OXON HILL RECREATION CLUB	1	1	P	PG1956G005	217F	C	PG023533	808	822
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	1	1	P		211D	C	PG730092	342	353
1161077	ROBIN DALE GOLF CLUB	3	1	P		211D	C	PG950130	200	430
1161094	TOP OF THE HILL TAVERN	1	1	P		9999	U			
1161113	MOYAONE ASSOCIATION POOL	1	1	P	PG1957G002	217D	C	PG027092	169	218
1161114	MERKLE WILDLIFE SANCTUARY & VISITOR CTR	1	1	P	PG1985G017	211D	C	PG811081	270	300
1161122	301 CITGO	1	1	P		211D	C	PG008066	365	370
1161225	PATUXENT RIVER 4-H CENTER	1	1	P	PG1982G007	211D	C	PG812348	255	280
1161226	BEALL FUNERAL HOME	2	1	P	PG1998G002	217D	C	PG940740	153	160
1161227	PATUXENT RIVER PARK GROUP CAMP	1	1	P		9999	C			105*
1161228	PATUXENT RIVER PARK AQUASCO/ GIRL SCOUT	1	1	P	PG1980G002	211D	C	PG731197	378	503
1161229	POLICE FIRING RANGE	1	1	P	PG1983G001	211D	C	PG810245	340	385
1161230	SHA- UPPER MARLBORO	2	1	P	PG1990G001	211D	C	PG941776	330	365
1161233	MOBIL MART/ BRANDYWINE MOBIL	1	1	P	PG1974G019	211D	C	PG920927	435	471
1161234	PATUXENT RIVER 4-H CABINS	1	1	P	PG1982G007	211D	C	PG882554	255	275
1161236	OUR LADY OF MATTAPONI RETREAT	1	1	P		211D	C	PG000043		291
1161237	AMKO MARKET/CROOM AMOCO	1	1	P		211D	C	PG920208	245	260

Table 1, Well Information for Prince George's County Transient Systems.

* Depth of pump for well.

PWSID	System Name	Plant ID	Known Treatment Methods	Reason for Treatment
1161122	301 CITGO	1	No Treatment	None
1161003	ALICE FERGUSON FOUNDATION	1	No Treatment	None
1161237	AMKO MARKET/CROOM AMOCO	1	Filtration, Cartridge	Particulate
1161010	BADEN VOL FIRE DEPT	1	Ion Exchange	Inorganics Removal
1161226	BEALL FUNERAL HOME	1	Ion Exchange	Inorganics Removal
1161226	BEALL FUNERAL HOME	1	Hypochlorination, PRE	Inorganics Removal
1161019	BRAGG MOTEL	1	No Treatment	None
1161024	CEDARVILLE STATE FOREST	1	Hypochlorination, PRE	Inorganics Removal
1161027	CLEOS RESTAURANT & MOTEL	1	No Treatment	None
1161055	KNIGHTS OF COLUMBUS	1	Hypochlorination, PRE	Inorganics Removal
1161055	KNIGHTS OF COLUMBUS	1	Ion Exchange	Inorganics Removal
1161057	LAKE ARBOR GOLF CLUB	1	No Treatment	None
1161059	LITTLE STORE	1	No Treatment	None
1161065	MARYLAND MOTOR COURT	1	No Treatment	None
1161114	MERKLE WILDLIFE SANCTUARY & VISITOR CTR	1	No Treatment	None
1161233	MOBIL MART/ BRANDYWINE MOBIL	1	No Treatment	None
1161067	MOORE'S COUNTRY STORE	1	No Treatment	None
1161113	MOYAONE ASSOCIATION POOL	1	No Treatment	None
1161069	NATIONAL COLONIAL FARM	1	Hypochlorination, PRE	Disinfection
1161236	OUR LADY OF MATTAPONI RETREAT	1	No Treatment	None
1161071	OXON HILL RECREATION CLUB	1	No Treatment	None
1161234	PATUXENT RIVER 4-H CABINS	1	Ion Exchange- Iron (non-SDWIS code)	Inorganics Removal
1161234	PATUXENT RIVER 4-H CABINS	1	Ultraviolet Radiation	Disinfection
1161225	PATUXENT RIVER 4-H CENTER	1	Ion Exchange- Iron (non-SDWIS code)	Inorganics Removal
1161225	PATUXENT RIVER 4-H CENTER	1	Ultraviolet Radiation	Disinfection
1161228	PATUXENT RIVER PARK AQUASCO/ GIRL SCOUT	1	No Treatment	None
1161227	PATUXENT RIVER PARK GROUP CAMP	1	Activated Carbon, Granular	Taste and Odor
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	1	Filtration, Cartridge	Particulate
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	1	Hypochlorination, PRE	Disinfection
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	1	Filter Cartridge (non-SDWIS)	Inorganics Removal
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	1	Ion Exchange	Inorganics Removal
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	1	Ultraviolet Radiation	Disinfection
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	1	Activated Carbon, Granular	Dechlorination
1161229	POLICE FIRING RANGE	1	Ultraviolet Radiation	Disinfection
1161229	POLICE FIRING RANGE	1	Lime-Soda Ash Addition	Inorganics Removal

Table 2, Known Treatment methods for Prince George's County Transient Systems.

PWSID	System Name	Plant ID	Known Treatment Methods	Reason for Treatment
1161077	ROBIN DALE GOLF CLUB	1	Ultraviolet Radiation	Disinfection
1161230	SHA- UPPER MARLBORO	1	pH Adjustment, PRE	Inorganics Removal
1161230	SHA- UPPER MARLBORO	1	Hypochlorination, PRE	Disinfection
1161034	FAMILY DELI	1	Ion Exchange	Inorganics Removal
1161094	TOP OF THE HILL TAVERN	1	No Treatment	None

Table 2 (cont.), Known Treatment methods for Prince George's County Transient Systems.

PWSID	System Name	Total # of Nitrate Samples	Number of Nitrate Samples		Total # of Nitrite Samples	Number of Nitrite Samples > 50% MCL
			> 1 ppm	> 50% MCL		
1161122	301 CITGO	4	0	0	4	0
1161003	ALICE FERGUSON FOUNDATION	5	0	0	2	0
1161010	BADEN VOL FIRE DEPT	5	0	0	3	0
1161226	BEALL FUNERAL HOME	5	0	0	1	0
1161019	BRAGG MOTEL	7	0	0	7	0
1161024	CEDARVILLE STATE FOREST	6	0	0	2	0
1161027	CLEOS RESTAURANT & MOTEL	7	0	0	2	0
1161055	KNIGHTS OF COLUMBUS	16	0	0	2	0
1161057	LAKE ARBOR GOLF CLUB	6	0	0	4	0
1161059	LITTLE STORE	4	0	0	4	0
1161065	MARYLAND MOTOR COURT	5	2	0	3	0
1161114	MERKLE WILDLIFE SANCTUARY & VISITOR CTR	6	0	0	1	0
1161233	MOBIL MART/ BRANDYWINE MOBIL	4	0	0	1	0
1161237	AMKO MARKET/ CROOM AMOCO	0	0	0	0	0
1161067	MOORE'S COUNTRY STORE	8	0	0	2	0
1161113	MOYAONE ASSOCIATION POOL	3	0	0	3	0
1161069	NATIONAL COLONIAL FARM	4	0	0	3	0
1161236	OUR LADY OF MATTAPONI RETREAT	1	0	0	1	0
1161071	OXON HILL RECREATION CLUB	3	1	0	1	0
1161234	PATUXENT RIVER 4-H CABINS	4	0	0	1	0
1161225	PATUXENT RIVER 4-H CENTER	9	0	0	1	0
1161228	PATUXENT RIVER PARK AQUASCO/ GIRL SCOUT	3	0	0	1	0
1161227	PATUXENT RIVER PARK GROUP CAMP	3	0	0	1	0
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	12	0	0	2	0
1161229	POLICE FIRING RANGE	6	0	0	2	0
1161077	ROBIN DALE GOLF CLUB	5	2	0	3	0
1161230	SHA- UPPER MARLBORO	3	0	0	1	0
1161034	FAMILY DELI	4	0	0	1	0
1161094	TOP OF THE HILL TAVERN	4	0	0	1	0

Table 3, Total IOC water quality samples collected for transient systems.

PWSID	System Name	Total Number of Samples Taken	Number of Positive Bacti. Samples	Percentage of Total Samples Positive	Number of Positive Fecal Samples
1161122	301 CITGO	21	0	0	0
1161003	ALICE FERGUSON FOUNDATION	28	9	**32**	0
1161237	AMKO MARKET/CROOM AMOCO	7	6	**86**	0
1161010	BADEN VOL FIRE DEPT	23	0	0	0
1161226	BEALL FUNERAL HOME	20	0	0	0
1161019	BRAGG MOTEL	40	5	13	0
1161024	CEDARVILLE STATE FOREST	17	0	0	0
1161027	CLEOS RESTAURANT & MOTEL	30	4	13	**2**
1161034	FAMILY DELI	14	0	0	0
1161055	KNIGHTS OF COLUMBUS	15	0	0	0
1161057	LAKE ARBOR GOLF CLUB	20	0	0	0
1161059	LITTLE STORE	12	0	0	0
1161065	MARYLAND MOTOR COURT	5	0	0	0
1161114	MERKLE WILDLIFE SANCTUARY & VISITOR CTR	17	0	0	0
1161233	MOBIL MART/ BRANDYWINE MOBIL	27	5	19	**4**
1161067	MOORE'S COUNTRY STORE	51	29	**57**	0
1161113	MOYAONE ASSOCIATION POOL	15	2	13	0
1161069	NATIONAL COLONIAL FARM	11	1	9	0
1161236	OUR LADY OF MATTAPONI RETREAT	5	0	0	0
1161071	OXON HILL RECREATION CLUB	4	0	0	0
1161234	PATUXENT RIVER 4-H CABINS	20	0	0	0
1161225	PATUXENT RIVER 4-H CENTER	32	4	13	0
1161228	PATUXENT RIVER PARK AQUASCO/ GIRL SCOUT	15	0	0	0
1161227	PATUXENT RIVER PARK GROUP CAMP	14	0	0	0
1161072	PATUXENT RIVER PK OFF/JUG BAY/GUN CLUB/E	33	1	3	0
1161229	POLICE FIRING RANGE	20	0	0	0
1161077	ROBIN DALE GOLF CLUB	28	6	21	0
1161230	SHA- UPPER MARLBORO	30	3	10	0
1161094	TOP OF THE HILL TAVERN	21	0	0	0

Table 4, Routine and repeat bacteriological samples for each system since 1996.

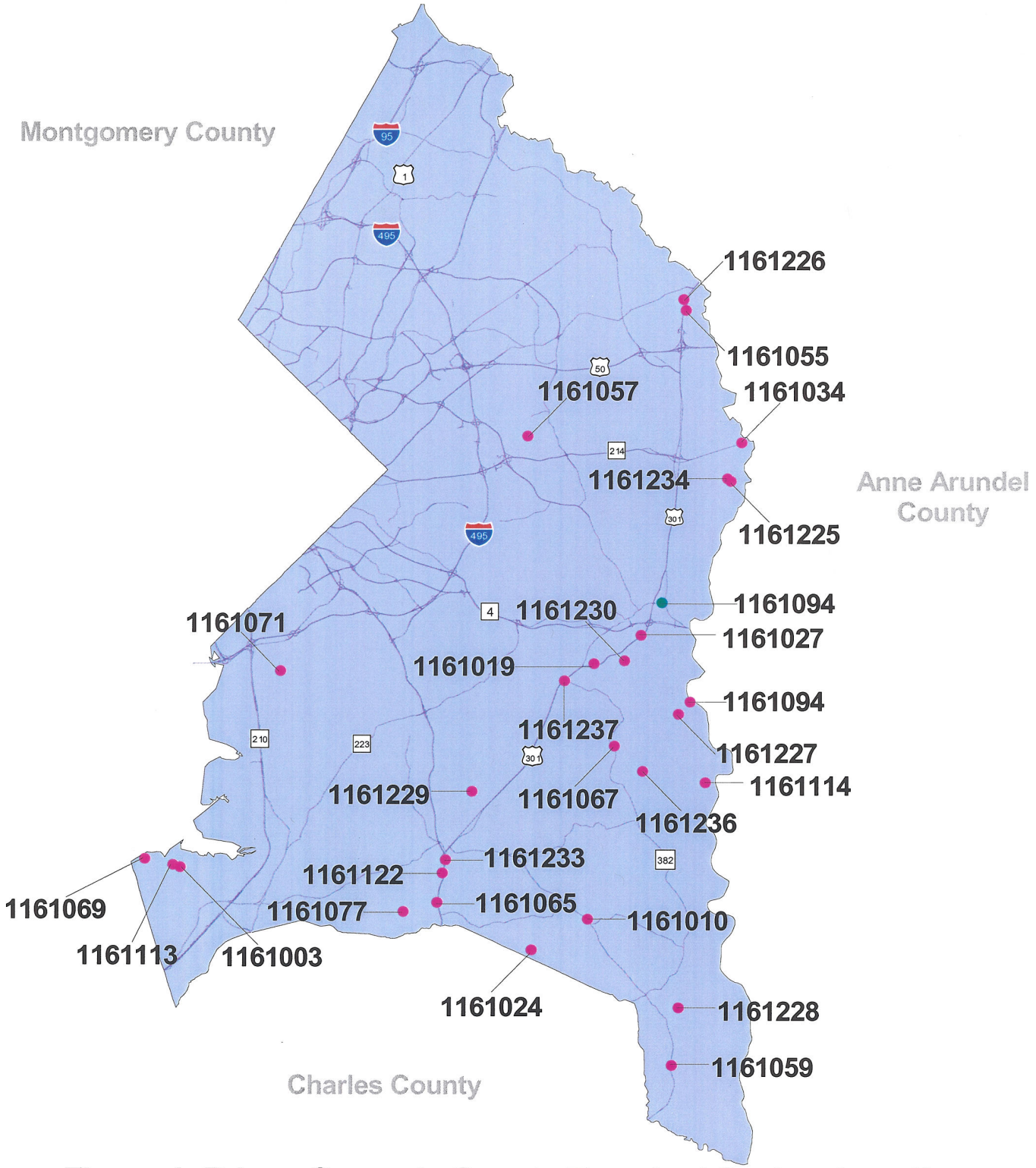


Figure 1. Prince George's County Transient System Locations

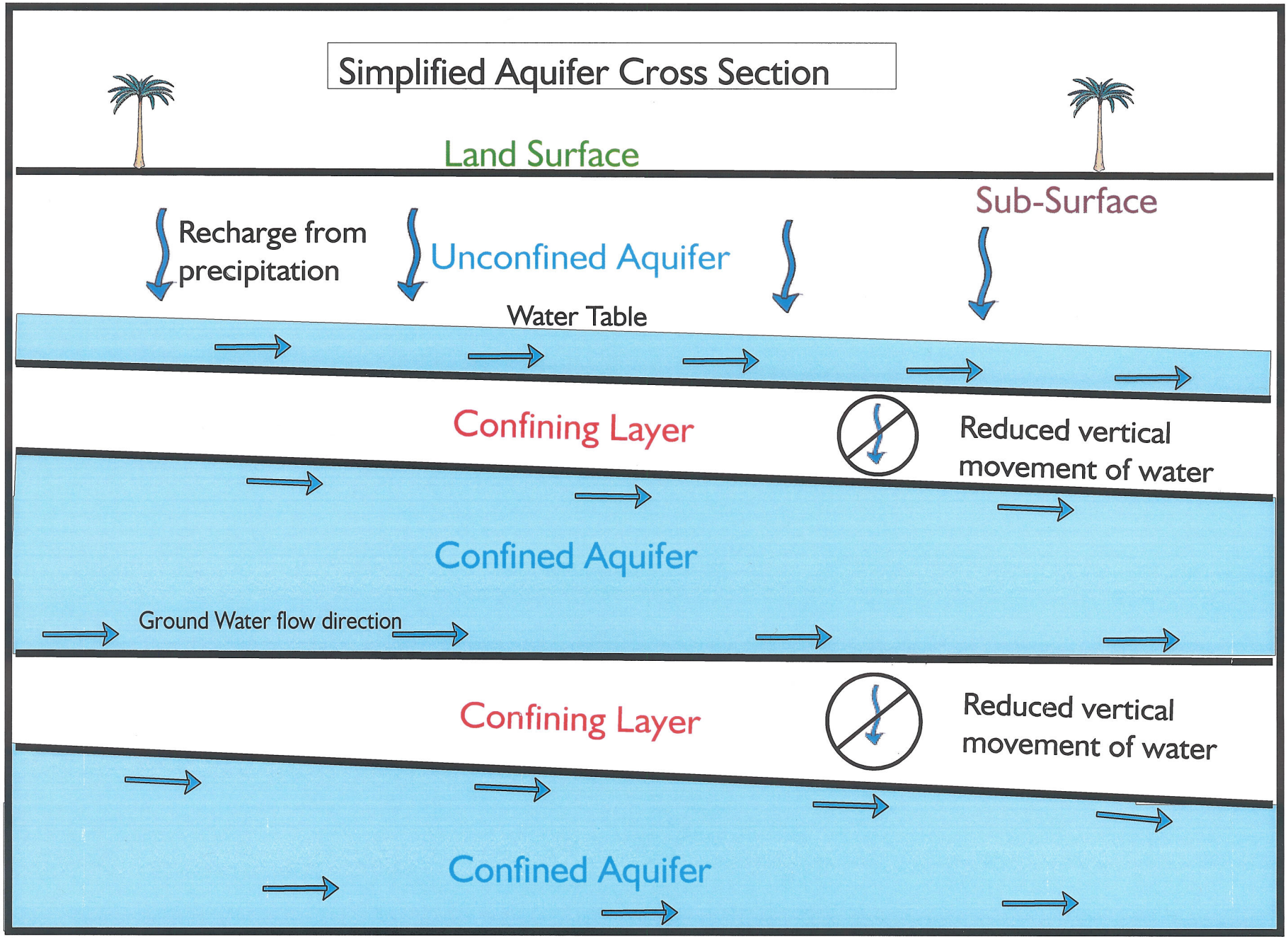
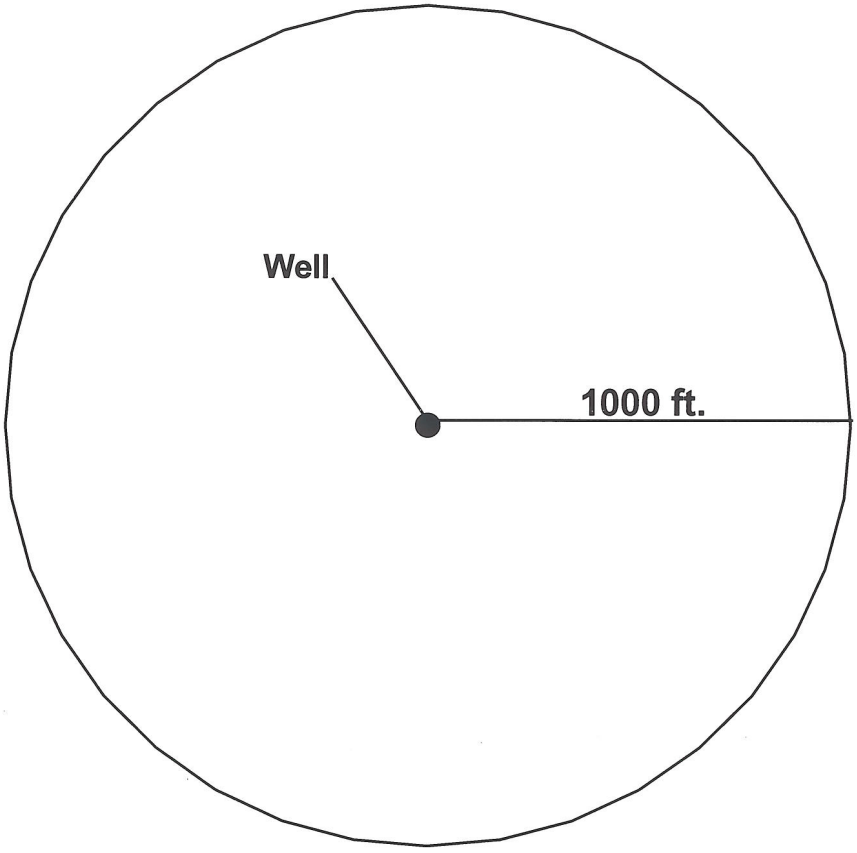

Simplified Aquifer Cross Section
Land Surface
Sub-Surface
Recharge from precipitation
Unconfined Aquifer
Water Table
Confining Layer
Reduced vertical movement of water
Confined Aquifer
Ground Water flow direction
Confining Layer
Reduced vertical movement of water
Confined Aquifer

Figure 2

Circle and Wedge Delineation Areas



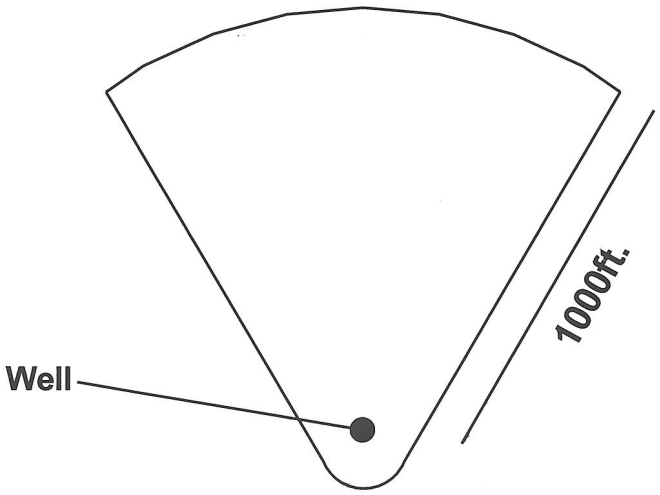


Figure 3

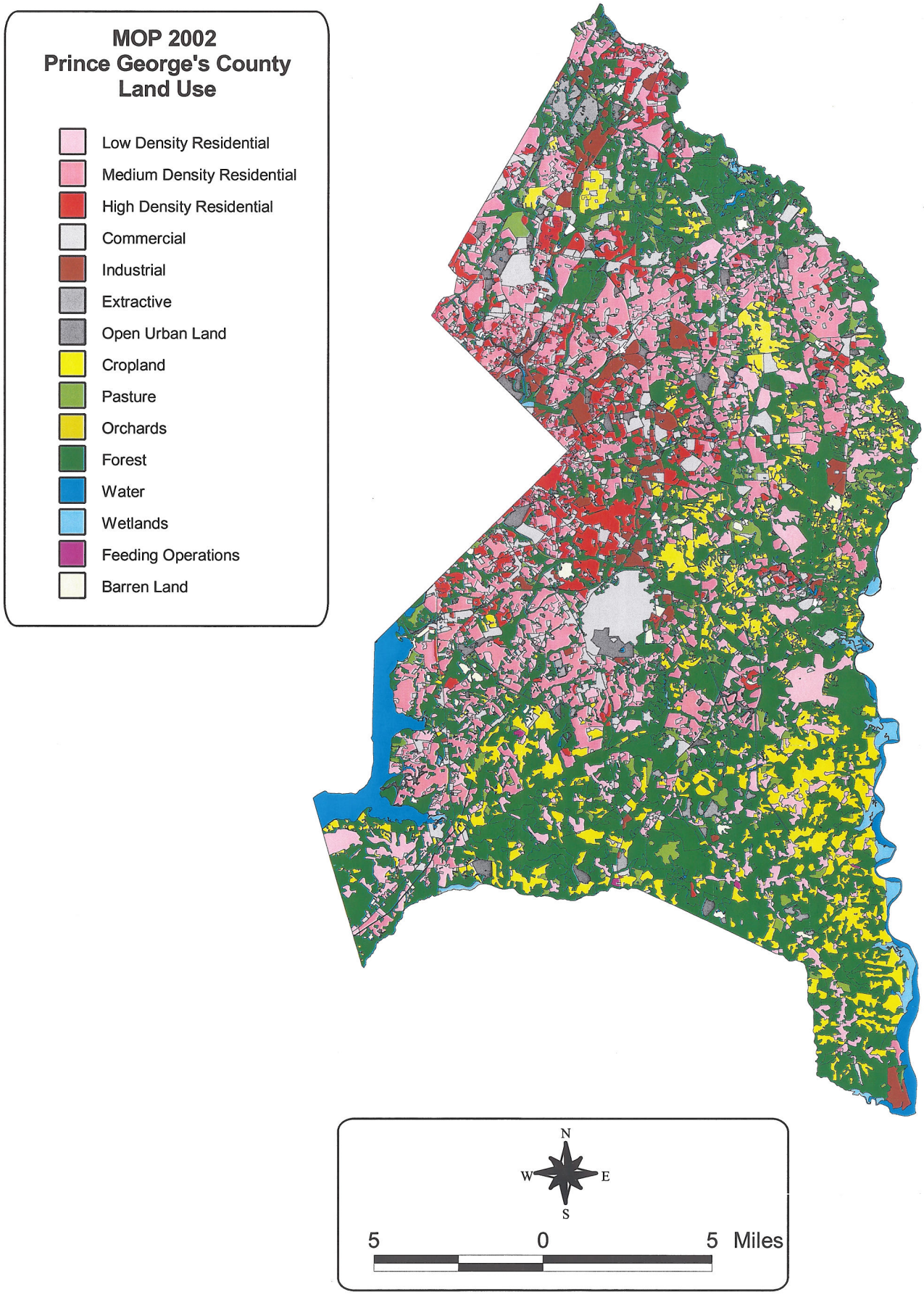

MOP 2002
Prince George's County
Land Use
Low Density Residential
Medium Density Residential
High Density Residential
Commercial
Industrial
Extractive
Open Urban Land
Cropland
Pasture
Orchards
Forest
Water
Wetlands
Feeding Operations
Barren Land
N
W
E
S
5
0
5 Miles

Figure 5

Prince Georges County SWAP Land Use Summary

Land Use Type	Land Use Code	Counts in SWAPs	Acres in SWAP	% of Total Area
Medium Density Residential	12	1	5.911	9.12
Commercial	14	1	0.558	0.86
Cropland	21	2	16.476	25.41
Pasture	22	5	11.48	17.70
Forest	41, 43	3	30.424	46.92
	Totals	12	64.849	100.00

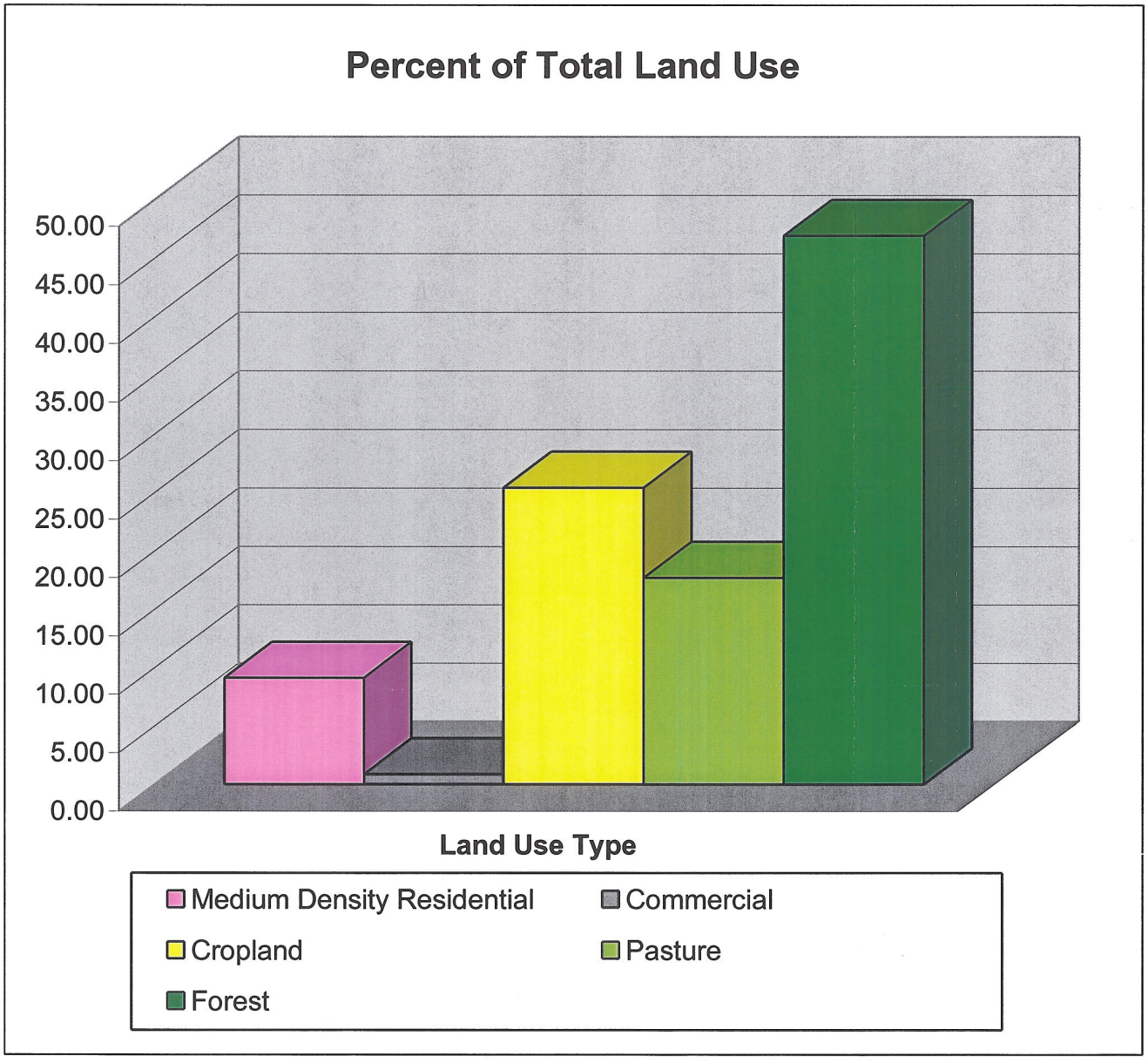
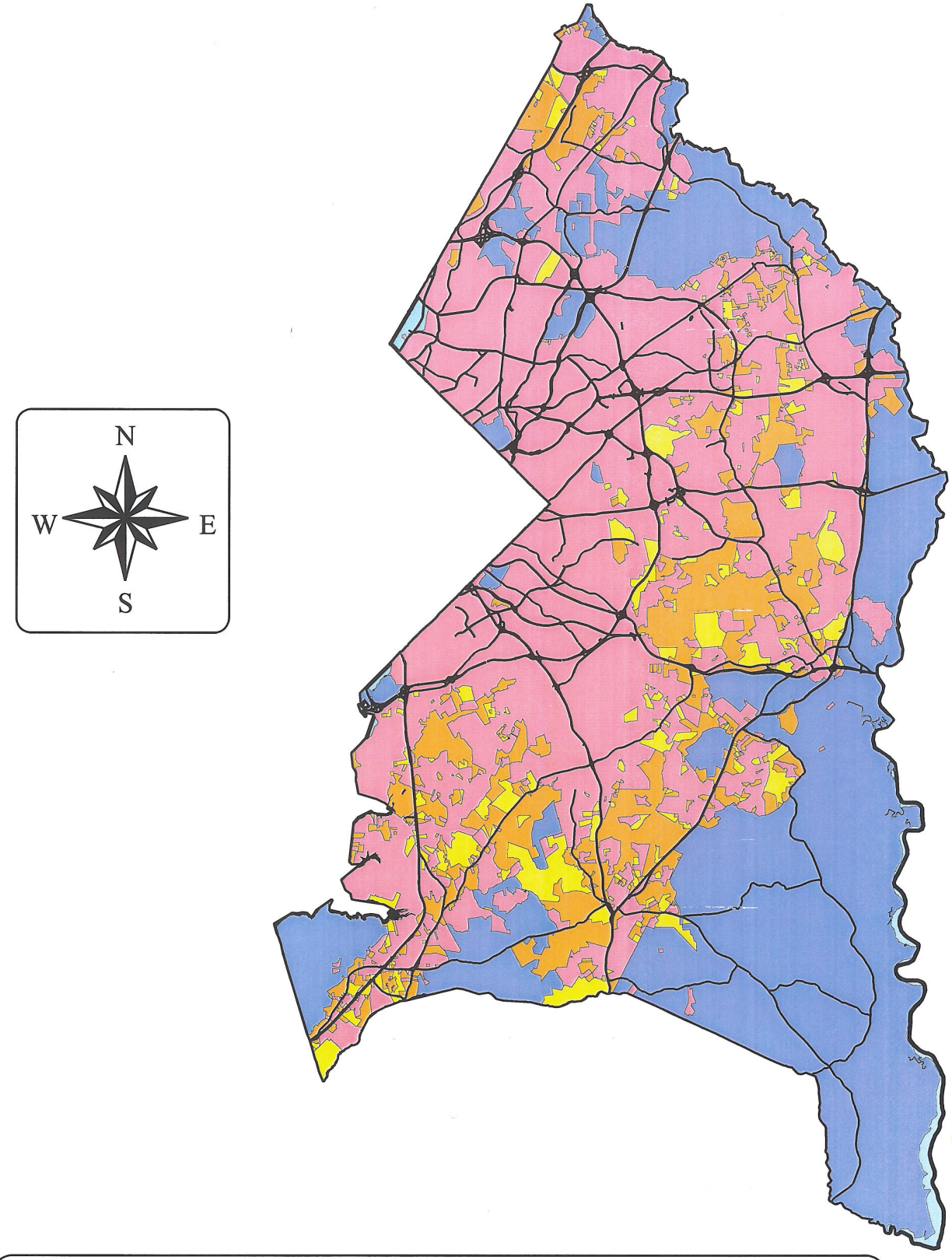


Figure 6



Sewer Service Map of Prince George's County

- No Planned Service Area
- Public System Area
- Public System Area Adequate for Development Planning
- Area with Future Public System Anticipated
- Major Roads
- Water

10 0 10 Miles

Figure 7