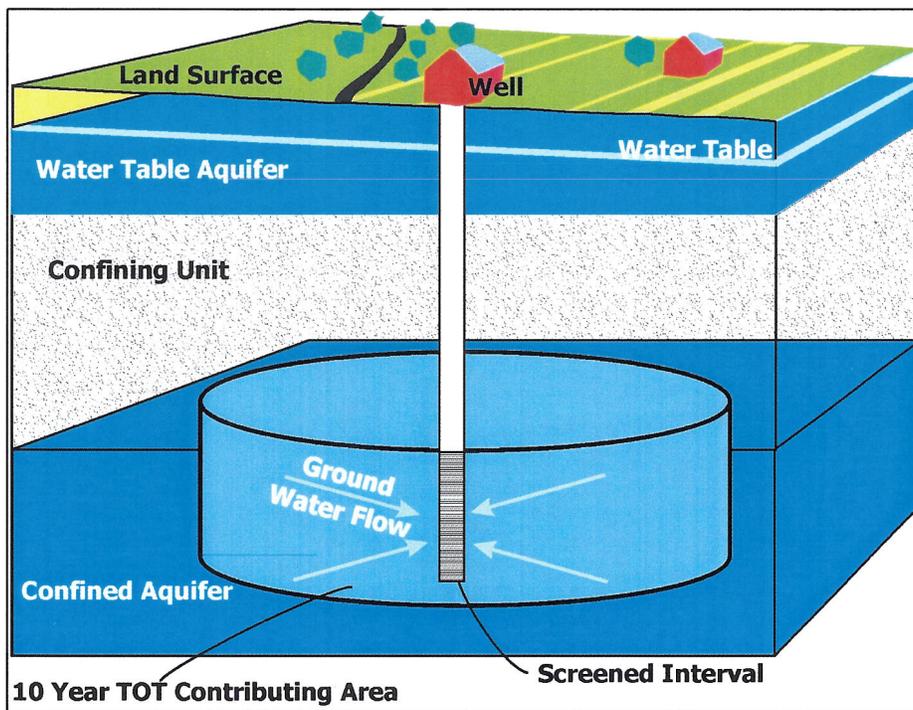


SOURCE WATER ASSESSMENT
FOR THIRTEEN COMMUNITY WATER SYSTEMS
IN WORCESTER COUNTY, MD



Prepared By
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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of these thirteen community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The thirteen community water systems included in this report are currently using twenty-five wells that pump water from two different confined aquifers. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for sources in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. Maps and aerial photographs showing Source Water Assessment areas are included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the water systems are not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifer. One system may be susceptible to microbiological contaminants due to well construction issues. One system is susceptible to naturally occurring radiological contaminants and twelve systems may be susceptible to naturally occurring iron.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for thirteen community water systems in Worcester County. Worcester County is located in the eastern shore of Maryland and is bounded by the Atlantic Ocean to the east, Delaware to the north, Virginia in the south and Wicomico and Somerset Counties to the west. Its total population, reported in July 2001 is 45,600 (Md. Assoc. of Counties, 2001/2002). In the summer months due to vacationers in Ocean City the population more than doubles. The thirteen community systems serve a population of approximately 10,500 of the county residents. The community systems include the two incorporated municipalities of Pocomoke City and the Town of Snow Hill, five individually owned and operated systems, and six owned and operated by the County (table1). The community systems included in this report are shown in figure 1.

WELL INFORMATION

Well information for each system was obtained from the Water Supply Program's database, site visits, well completion reports, sanitary survey inspection reports and published reports. A total of twenty-two wells are currently in use or are backup wells for the thirteen community water systems included in this report. Twenty-three of these wells were drilled after 1973 and should comply with Maryland's well construction regulations. The remaining two wells were drilled prior to 1973, when current regulations went into effect, and may not meet the current construction standards. Table 2 contains a summary of well information for each of the systems.

Based on site visits, most wells were in good condition and appeared to be regularly maintained, sealed and protected to insure integrity. Some of the older wells had a one-piece well cap, which may present a possible route of contamination (insects) through unscreened vents and electrical holes. This situation can be easily remedied with the installation of a new two-piece sanitary well cap to prevent contamination. Another common threat to wells observed during field inspections are unused wells in the same aquifer as the production wells. A few water systems have wells that are not in use due to screen problems, or were drilled as test wells during new well construction (table 2). As long as these wells are sealed with a tight cap, and the pumps are exercised regularly they pose little threat to the production wells. However, unused wells, with loose caps, no pumps or with no potential for use in the future should be rectified or permanently abandoned and sealed by a licensed well driller because they represent a pathway for contamination to the deep aquifer. Wells that are properly grouted and without pumps may be useful for long-term monitoring. Access to such wells should be restricted through locked caps and/or other security measures.

HYDROGEOLOGY

Ground water flows through pores between gravel, sand and silt grains in unconsolidated sedimentary rock aquifers such as those used by the community water

systems in Worcester County. An aquifer is any formation that is capable of yielding a significant amount of water. The transmissivity is a measure of the amount of water an aquifer is capable of producing and is related to the hydraulic conductivity and the thickness of the aquifer. A confining layer is generally composed of fine material such as clay and silt, which transmits relatively very little water. Confined aquifers are those formations that are overlain by a confining unit. 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.

Worcester County lies within the Atlantic Coastal Plain physiographic province. This province, which in Maryland includes roughly the area east of Interstate 95, is underlain by unconsolidated clastic sediments of Lower Cretaceous to recent age, which thicken to the southeast so that they appear wedge-shaped. The thickness of these sediments is greater than 8,500 feet beneath the Atlantic shore. The thirteen community water systems pump water from three confined aquifers known as the Pocomoke, Ocean City and Manokin aquifers. The Pocomoke aquifer is the shallowest and youngest of the three aquifers and the Manokin the deepest and the oldest (see Appendix- table 3). These aquifers have been studied considerably and hydrologic, lithologic and geochemical data is available in several Maryland Geological Survey reports (1955, 1972, 1974, 1982, and 1993). The descriptive material below is summarized from these reports and the reader is referred to them for further information.

Pocomoke Aquifer

The Pocomoke aquifer is used by six of the community systems. In Worcester County, the top of the Pocomoke aquifer ranges from about 50 feet below sea level in the northwestern portions of the county to about 150 feet below sea level in the southeastern portions of the county (see Appendix- figure 13). The Pocomoke aquifer rises to the northwest, at the rate of 5 to 6 feet per miles and directly underlies the Pleistocene and Pliocene relatively thin and permeable deposits in an intake belt (subcrop area), the nearest of which is about 5 miles northwest of Pocomoke City. The Pocomoke aquifer consists predominantly of gray medium-to fine-grained sand. In places, it has stringers of coarse sand and small gravel and thin lenses of brown or blue clay. The cumulative sand thickness of the Pocomoke ranges from 20 to 65 feet. Transmissivity values for the aquifer range from 2,000 to 8,000 ft²/day and the direction of ground water flow is towards the southeast (Appendix- figure 31). The Pocomoke aquifer is overlain by the upper confining bed which consists of lenticular bodies of silt, clay, and fine sand.

Ocean City Aquifer

The Ocean City aquifer is used by two of the community systems. The top of the Ocean City aquifer ranges from about 125 feet below sea level to 250 feet below sea level (see Appendix -figure 15). The Ocean City aquifer is restricted to northeastern Worcester County and appears to pinchout updip near Willards in Wicomico County. The general direction of ground water flow is from northwest to southeast with a gradient of about 1 ft/mile. The Ocean City aquifer consists of fine to coarse, orange tan sands, and greenish-gray, glauconite bearing clayey silts and fine sands. The

sediments contain lignite and shells in some intervals. The transmissivities of the Ocean City aquifer range from a high of 5,300 ft²/d to less than 2,700 ft²/d. The aquifer is overlain by a confining unit that consists of a fine, silty sand to clayey silt.

Manokin Aquifer

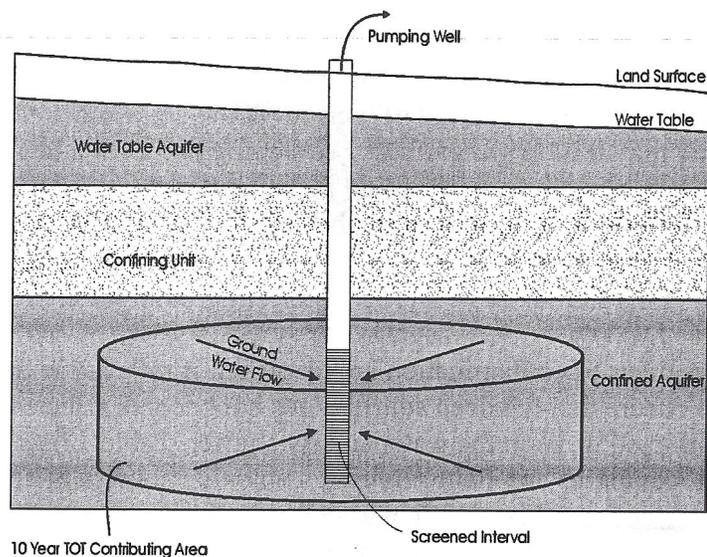
The Manokin aquifer is used by nine of the community systems. The top of the Manokin aquifer ranges from about 150 feet below sea level to 350 feet below sea level and dips to the southeast (see Appendix- figure 13). The Manokin aquifer has an intake belt beneath the sands and gravels of the Pleistocene and Pliocene series, from which it receives recharge directly. The belt is located in Wicomico County and is 2.5 to 6 miles in width and crosses the northwestern corner of the area from Nanticoke through Hebron to Delmar. The regional ground water flow direction in the Manokin aquifer is mainly towards the east (see Appendix- figure 33). The Manokin aquifer is a gray medium-to fine-grained sand. It is coarser in the lower portion, containing some coarse sand, granules, and small lenses of fine gravel. The upper portion is fine to very fine sand, becoming silt in places. Shell fragments are present in a few of the sand layers. The Manokin aquifer is overlain by the lower confining bed which consists of blue and gray clayey, silty and fine sand.

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment area for the system. The WHPAs were delineated using the methodology described in Maryland's Source Water Assessment Plan (MDE, 1999) for confined aquifers in the Coastal Plain, often referred to as the "Florida Method". The area is a radial zone of transport within the aquifer and is based on a 10-yr time of travel (TOT), the pumping rate and the screened interval(s) of the well or wells included in the WHPA, and the porosity of the aquifer (see illustration below for conceptual model). The Florida Method is a modification of Darcy's Law for radial flow to a well and the WHPA's were calculated using the following volumetric equation:

$$r = \sqrt{\frac{Qt}{\pi nH}}$$

- where r = calculated fixed radius (ft)
- Q = pumping rate of well (ft³/yr)
- t = time of travel (yr.)
- n = aquifer porosity (dimensionless)
- H = length of well screen (ft)



Conceptual illustration of a zone of transport for a confined aquifer

Table 3 gives the values used and the calculated radius for each water system's WHPA. The pumping rate (Q) used is generally the permitted daily average. If a water system has more than one well, the wells usually alternate pumpage. Therefore, the total appropriated amount was used in the calculation for each well, since, in theory each well is producing a zone of transport based on the average pumping rate. In some cases, the permitted amount was split between wells that do not alternate and are a significant distance apart, thus the permitted amount was divided amongst the wells based on pumping records for the last year.

A conservative estimate of porosity (n) of 25% was used for each of the aquifers based on published reports. The lengths of the well screens (H) were obtained from well completion reports. In the instance that there were multiple screens, the sum of the individual screen lengths was used. Using these parameters the radius was calculated with the above equation for the WHPA delineation (table 3). Circles around each of the wells with the appropriate calculated radius represents the WHPA and are shown in figure 2. The circles represent the aquifer zone of transport in the subsurface as illustrated above.

POTENTIAL SOURCES OF CONTAMINATION

In confined aquifer settings, sources of contamination at land surface are generally not a threat unless there is a pathway for direct injection into the deeper aquifer such as through unused wells or along well casings that are not intact or have no grout seal.

Potential sources of contamination are classified as either point or non-point sources. Examples of point sources of contamination are leaking underground storage tanks, landfills, discharge permits, large-scale feeding operations, and CERCLA sites.

These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via a discrete point location. Non-point sources of contamination are associated with certain land use practices that may lead to ground water contamination over a larger area. All potential sources of contamination are identified at the land surface and therefore have the potential to impact only the shallow water table aquifer. Therefore, as long as there is no potential for direct injection into the deeper confined aquifers, the water supply used by the community systems should be well protected from ground water contamination.

Potential point sources of contamination are identified if they fall within the WHPA for awareness and to ensure that the deep aquifer does not become affected by unused wells or poorly constructed wells in the water supply aquifer. Table 4 lists the facilities identified from MDE databases and field surveys as potential sources of contamination and their locations are shown in Figure 3. Underground storage tanks (USTs) sites are facilities that store petroleum/heating oil on site in underground tanks registered with MDE's Waste Management Administration. Controlled Hazardous Substance Generators (CHS) are facilities that may use or store any hazardous substance on site. Ground Water Discharge Permits (GWD) are issued by MDE's Water Management Administration for discharge of wastewater to ground water.

The contaminants associated with the types of facilities are based on generalized categories and often the potential contaminant depends on the specific chemicals and processes being used at the individual facility. The potential contaminants for an activity may not be limited to those listed in Table 4. Potential contaminants are grouped as Volatile Organic Compounds (VOC), Synthetic Organic Compounds (SOC), Heavy Metals (HM), Nitrates (N) and Microbiological Pathogens (MP).

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 finished (treated) water unless otherwise noted. The State's SWAP defines a threshold for reporting water quality data as 50% of the Maximum Contaminant Level (MCL). If a monitoring result is greater than 50% of the MCL, this report will describe the sources of such a contaminant and, if possible, locate the specific sources that are the cause of the elevated contaminant level. Table 5 summarizes the various treatment methods used at the water treatment plants for each of the thirteen community water systems.

A review of the monitoring data for the thirteen systems indicates that currently the water supplies meet the drinking water standards. Table 6 summarizes the water quality results for each of the water systems by contaminant group.

Inorganic Compounds (IOCs)

A review of the data shows that two different inorganic compounds, nitrate and arsenic, were detected one time above 50% of the MCL in two different water systems (table 7a). The nitrate was detected one time above 50% of the MCL in

Snow Hill's water supply in 1991 at the Ross Street plant. Samples taken prior to that and after that had no detects of nitrate. It is most likely that this sample was an erroneous one. In addition no nitrate has been detected in any samples from the other two plants for Snow Hill.

Radionuclides

Gross alpha was reported above 50% of the MCL in one of the systems assessed in this report (table 7b). Gross alpha is a measure of alpha radiation, which is emitted from certain radioactive minerals found in the aquifer sediments. The requirement for meeting the MCL of 15 pCi/L for gross alpha is that the average of four quarterly samples must be below that level.

Radon-222 was reported above 150 pCi/L at one community water system (table 7b). There is currently no MCL for radon-222, however EPA has proposed an MCL of 300 pCi/L or an alternate of 4000 pCi/L for community water systems if the State has a program to address the more significant risk from radon in indoor air. The health effects of radon found at levels in ground water are negligible compared to breathing radon. Since an MCL has not been finalized, this report considers the lowest proposed MCL of 300 pCi/L, in an effort to be more conservative and protective of public health.

Volatile Organic Compounds (VOCs)

A review of the data shows that methylene chloride was the only VOC detected above 50% of the MCL one time in one system (PWSID 0230002). Methylene chloride is a laboratory solvent and several systems in other counties had detects of this VOC around the same time. Hence this detect probably does not reflect the water quality at Newark. Other VOCs like xylene, toluene, carbon tetrachloride and trichloroethane have been detected at low levels in a few systems. In addition, trihalomethanes (THMs) like chloroform, bromoform, and bromodichloromethanes have been detected at levels below 50% of the MCL in several systems. THMs are disinfection products that are a result of the reaction between chlorine and organic material in the water system.

Synthetic Organic Compounds (SOCs)

A review of the data shows that di(ethylhexyl)phthalate was the only SOC detected above 50% of the MCL one time in one system (PWSID 0230008). Di(ethylhexyl)phthalate was also detected in the laboratory blank and hence does not represent the water quality in this supply. A few systems had one time very low level detections of 2, 4-D and dalapon. Subsequent sampling showed no detects of these SOCs.

Microbiological Contaminants

Routine bacteriological monitoring is conducted in the finished water for each water system on a monthly basis and measures total coliform bacteria. Since nine of the water systems disinfect their water at the treatment plant, the finished water data does not give much indication of the quality of raw water directly from the well.

Total coliform bacteria are not pathogenic, but are used as an indicator organism for other disease-causing microorganisms. A major breach of the system or the aquifer would likely cause a positive total coliform result despite disinfection and would require followup total and fecal coliform analysis. Four water systems had positive total coliform in their routine bacteriological samples with one of them including fecal coliform (table 8). Followup samples for three of them showed an absence of total coliform. The one with fecal coliform had a repeat occurrence for fecal coliform. Repeat sampling after chlorination of the system's well resulted in no detection of total coliform.

SUSCEPTIBILITY ANALYSIS

The wells serving the community water systems included in Worcester County pump water from confined aquifers. Confined aquifers are naturally well protected from activity on the land surface due to the confining layers that provide a barrier for water movement from the surface into the aquifer below. A properly constructed well with the casing extended to the confining layer above the aquifer and with sufficient grout should be well protected from contamination at the land surface. The only instance in which a contaminant at the surface would impact the water supply is through direct injection into the aquifer from within the WHPA. This could occur via poorly constructed wells, wells out of use that penetrate the aquifer and underground injection wells drilled into the aquifer.

Some contaminants like radionuclides and other chemical elements (e.g. arsenic and iron) are naturally occurring in the aquifer and in some instances can reach concentrations that pose a risk to the water supply. In the case of confined aquifers, this is generally more problematic than contaminants at the land surface.

The susceptibility of the source water to contamination is determined for each group of contaminants based on the following criteria: 1) the presence of natural and anthropogenic contaminant sources within the WHPA, 2) water quality data, 3) well integrity, and 4) the aquifer conditions. The susceptibility analysis is summarized for each water system in table 9.

Inorganic Compounds

The nitrate that was detected above one time above 50% of the MCL in Snow Hill's water supply was discussed in the water quality section. Arsenic is was detected one time above 50% of the MCL in South Point Village's water supply. The source of arsenic in these supplies is the natural occurrence and mobility of this contaminant in the aquifer material. A recent study of the occurrence of arsenic in the Coastal Plain aquifers indicates that the high concentrations are found certain aquifers in several counties in the eastern shore and southern Maryland. The data has not been fully interpreted, but arsenic concentration does not appear to be related to pH, specific conductance or depth to screened interval. The concentration of arsenic may be simply dependent on the amount of arsenic in the aquifer at certain locations. In Worcester county the highest arsenic level (0.14 mg/l) was found in a well in the

Pocomoke aquifer in southeastern part of the county. South Point Village, located in the northeastern part of the county, is using the Manokin aquifer as its main source with the Pocomoke as a standby source. The sample with the arsenic detect appears to have been from the Manokin aquifer which is not known to have high levels of arsenic.

Due to the naturally protected characteristics of the confined aquifers, the water quality data, and the lack of potential sources of contamination, the community water systems are considered **not susceptible** to inorganic compounds.

Based on the natural occurrence of iron at certain locations within the aquifers and treatment for iron removal, thirteen of the community systems (see table 9) **maybe** susceptible to iron.

Radionuclides

The source of radon in ground water can be traced back to the natural occurrence of uranium in rocks. Radionuclides are present in ground water due to radioactive decay of uranium bearing minerals in the sediment that makes up the aquifer material.

Gross alpha radiation was detected two times in Snow Hill's water supply, at above 50% of their MCLs (table 7b).

There is currently no MCL for radon-222, however EPA has proposed an MCL of 300 pCi/L or an alternate of 4000 pCi/L if the State has program to address the more significant risk from radon in indoor air. Using the more conservative lower proposed MCL, Mystic Harbor had radon levels greater than 50% of 300 pCi/L. one time.

Based on the natural occurrence of radionuclides in the aquifer and water quality data, Snow Hill is considered **susceptible** to radiological contaminants. If the lower proposed MCL of 300 pCi/L for radon-222 is taken in to account, Mystic Harbor **may be susceptible** to radon-222. The other nine community systems are **not susceptible** to radiological contaminants.

Volatile Organic Compounds

Volatile organic compounds (VOCs) have not been detected at 50% of the MCL in any of the systems, except for one detect of methylene chloride in Newark's water supply in 1991. Methylene chloride is a laboratory solvent and several systems in other counties had detects of this VOC around the same time. Hence this detect probably does not reflect the water quality at Newark. Sources of VOCs are present in the WHPAs of several systems (figures 3a-31), but the water supplies are protected from these contaminants due to the confined nature of the aquifers. Water quality data supports the protective nature of the aquifers.

Based on the above discussion, the community systems are **not susceptible** to contamination by VOCs.

Synthetic Organic Compounds

Synthetic organic compounds (SOCs) have not been detected in the water supplies except for one low level detection of PCB in one system. Subsequent sampling showed no detects of PCB in that system. The systems have all been issued a confined waiver for monitoring for SOCs. SOC sources are generally pesticides and herbicides and some industrial solvents. Due to the confined nature of the aquifer, these sources do not pose a threat to the water supply.

Based on lack of contaminant sources, water quality data and aquifer type, the water supplies are **not susceptible** to SOCs.

Microbiological Contaminants

Raw water monitoring for microbiological contaminants is not required of water systems in confined aquifers because they are considered naturally protected from sources of pathogens at the land surface. Three of the systems that had repeat positive total coliform, have not had any detections since 1999. One system, West Ocean City Village Apartments, had fecal coliform detection in August 2002. Since then there have been no coliform detection in its water supply. The well casing is at grade to the ground, and the well is located adjacent to a stormwater management pond and subject to flooding.

Therefore, eleven of the community water systems are **not susceptible** to microbiological contaminants. One system, West Ocean City Village Apartments **may be susceptible** to microbiological contaminants.

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

With the information contained in this report, the individual community water systems in Worcester County are in a position to protect their water supplies by staying aware of the areas delineated for source water protection. Specific management recommendations for consideration are listed below:

Public Awareness and Outreach

- The Consumer Confidence Report should list that this report is available to the general public through their county library, or by contacting the operator or MDE.

Monitoring

- Continue to monitor for all required Safe Drinking Water Act contaminants
- Annual raw water bacteriological testing is a good check on well integrity.

Contaminant Source Inventory Updates

- Conduct a survey of the WHPA and inventory any potential sources of contamination, including unused wells that may not have been included in this report.

Keep records of new development within the WHPA and new potential sources of contamination that may be associated with the new use.

- West Ocean City Village apartments should upgrade its well by extending the casing above ground to prevent contamination of the well by flooding, installing protective barriers around the well casing to prevent damage from vehicles and installing a modern well cap with a screened vent to allow venting, while simultaneously protecting the well from insects nesting.

Well Inspections/ Maintenance

- Work with the County Health Department to ensure that there are no unused wells within the WHPA. An improperly abandoned well can be a potential source of contamination to the aquifer.
- Water operation personnel should have a program for periodic inspections and maintenance of the supply wells and backup wells to ensure their integrity and protect the aquifer from contamination.

Changes in Use

- Water system owners are required to notify the MDE Water Supply Program if new wells are to be added or if they wish to increase their water usage. An increase in use or the addition of new wells may require revisions to the WHPA.

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- U.S. Environmental Protection Agency, 1991, Wellhead Protection Strategies for Confined-Aquifer Settings: Office of Ground Water and Drinking Water, EPA/570/9-91-008, 168 p.

OTHER SOURCES OF DATA

Water Appropriation and Use Permits
Public Water Supply Sanitary Survey Inspection Reports
MDE Water Supply Program Oracle® Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles
USGS Topographic 7.5 Minute Quadrangles for Worcester County
Maryland Office of Planning 2000 Worcester County Land Use Map
Maryland Office of Planning 1995 Worcester County Sewer Map

TABLES

Public Water System ID (PWSID)	System Name	Owner/Operator Type	Population Served
0230002	NEWARK	Local Government	250
0230006	POCOMOKE CITY	Local Government	4036
0230007	TOWN OF SNOW HILL	Local Government	2409
0230008	ST MARTINS BY THE BAY	Investor/Trust/Water Assoc.	150
0230011	MYSTIC HARBOUR	Local Government	2000
0230016	SUNSET VILLAGE	Local Government	150
0230018	OYSTER HARBOR	Local Government	350
0230023	WEST OCEAN CITY VILLAGE APARTMENTS	Investor/Trust/Water Assoc.	47
0230024	SOUTH POINT VILLAGE	Local Government	72
0230206	LAKE HAVEN MOBILE HOME PARK	Investor/Trust/Water Assoc.	384
0230210	FOUR SEASONS MOBILE HOME PARK	Investor/Trust/Water Assoc.	24
0230224	RIVERVIEW MOBILE HOME PARK	Investor/Trust/Water Assoc.	150
1230051	ASSATEAGUE POINTE	Local Government	500

Table 1. Community Water Systems in Worcester County

PWSID	System Name	Plant ID	Source ID	Use Code	Well Name	Well Permit #	Well Depth	Casing Depth	Screened Depth(s)	Year Drilled	Aquifer
0230002	NEWARK	01	01	P	NEWARK	WO710098	217	170	170-180, 192-202	1971	Pocomoke
0230006	POCOMOKE CITY	05	04	S	OAK ST WELL	WO930281	133	105	105-133	1994	Pocomoke
		05	06	P	MARYLAND AVE WELL	WO940434	133	65	65-95, 95-118, 118-133	1996	Pocomoke
		05	07	P	WILLIAMS ST WELL	WO940284	138	98	98-128	1996	Pocomoke
0230007	TOWN OF SNOW HILL	02	04	P	WASHINGTON ST	WO054057	359	301	301-359	1963	Manokin
		03	05	P	COLBOURNE LANE	WO880785	367	291	283-286, 294-364	1991	Manokin
		01	03	P	ROSS ST	WO002648	366	306	306-366	1948	Manokin
		04	02	U	FIRE STATION	N/A	N/A	N/A	N/A	N/A	Manokin
0230008	ST MARTINS BY THE BAY	01	01	P	ST MARTINS WELL 1	WO810732	165	138	138-165	1984	Pocomoke
0230011	MYSTIC HARBOUR	01	02	P	MYSTIC HARBOUR 2	WO730064	245	215	215-235	1973	Ocean City
		01	01	P	MYSTIC HARBOR 1	WO730329	150	112	112-122, 135-145	1975	Pocomoke
		01	03	S	MYSTIC HARBOUR 3	WO730330	150	139	97-102, 107-112, 124-134	1974	Pocomoke
0230016	SUNSET VILLAGE	01	01	P	SUNSET VILLAGE	WO812372	320	271	271-301	1988	Manokin
0230018	OYSTER HARBOR	01	01	P	OYSTER HARBOR WELL 1	WO880351	362	322	322-362	1990	Manokin
		01	02	P	OYSTER HARBOR WELL 2	WO940193	362	322	322-362	1996	Manokin
0230023	WEST OCEAN CITY VILLAGE APARTMENTS	01	01	P	WELL 1	WO812594	258	238	238-258	1989	Pocomoke
0230024	SOUTH POINT VILLAGE	01	01	S	OLD WELL 1	WO811786	140	130	130-140	1987	Pocomoke
		01	02	P	NEW WELL 2	WO940349	265	240	240-265	1998	Manokin
0230206	LAKE HAVEN MOBILE HOME PARK	01	02	P	LAKE HAVEN 2	WO880665	260	230	230-260	1991	Ocean City
		01	01	P	LAKE HAVEN 1	WO880664	260	230	230-260	1991	Ocean City

Table 2. Well Information for Community Water Systems in Worcester County

PWSID	System Name	Plant ID	Source ID	Use Code	Well Name	Well Permit #	Well Depth	Casing Depth	Screened Depth(s)	Year Drilled	Aquifer
0230210	FOUR SEASONS MOBILE HOME PARK	01	02	B	FOUR SEASONS OLD WELL	WO731279	102	92	92-102	1977	Manokin
		01	01	P	FOUR SEASONS 1	WO880417	258	238	238-258	1990	Manokin
		01	03	P	FOUR SEASONS 2 (NEW WELL)	WO942216	260	240	240-260	2001	Manokin
0230224	RIVERVIEW MOBILE HOME PARK	01	01	P	RIVERVIEW 1	WO811182	286	266	266-286	1985	Manokin
		01	02	P	RIVERVIEW 2	WO880114	295	265	265-295	1989	Manokin
1230051	ASSATEAGUE POINT	01	01	P	ASSATEAGUE PT 1	WO812475	306	270	270-306	1988	Manokin
		01	02	P	ASSATEAGUE PT 2	WO930040	265	230	230-265	1994	Manokin

Table 2 (Continued). Well Information for Community Water Systems in Worcester County

Use Code P = Production
S = Standby
U = Unused
B = Abandoned

PWSID	System Name	Wells Included in WHPA	Aquifer	Discharge (Q) in gal/day	Screened Interval (H) in feet	Calculated Radius for WHPA in feet	Acreage of WHPA	Comment
0230002	Newark	Source 01	Pocomoke	15000	20	683	33	
0230008	St. Martins By The Bay	Source 01	Pocomoke	6000	20	432	13	
0230016	Sunset Village	Source 01	Manokin	20000	30	644	30	
0230023	West Ocean City Village Apts.	Source 01	Pocomoke	3400	20	325	8	
0230018	Oyster Harbor	Source 01, 02	Manokin	38600	40	774	43	Two Circles Merged
0230210	Four Seasons MHP	Source 01	Manokin	6000	20	432	13	
0230024	South Point Village	Source 02	Manokin	9000	25	473	16	
0230206	Lake Haven MHP	Source 01, 02	Manokin	13200	30	523	20	
0230224	Riverview MHP	Source 01, 02	Manokin	23000	20	845	51	
0230011	Mystic Harbour	Source 01, 03	Pocomoke	60000	20	1365	134	
		Source 02	Manokin	28800	20	946	64	
0230006	Pocomoke City	Source 04	Pocomoke	39220	28	933	62	
		Source 06, 07	Pocomoke	294890	30	2471	438	Two Circles Merged
0230007	Town of Snow Hill	Source 03	Manokin	110825	60	1071	82	
		Source 04	Manokin	123825	58	1152	95	
		Source 05	Manokin	90350	73	877	55	
1230051	Assateague Pointe	Source 01, 02	Manokin	35000	35	600	48	Two Circles Merged

Table 3. Parameters used for WHPA delineations

ID	Type	Facility Name	Address	Reference* Location	WHPA System Name	No. of UST's/ Capacity/ Subatance/ Other Comments	Potential Contaminants
1	UST	Go Getters, Inc.	816 2ND ST	Figure 2b	Pocomoke City	1 - 275 gal. Heating Oil, 1 - 350 gal. Heating Oil	VOC
2	UST	Makemie Memorial Presbyterian Church	103 W MARKET ST	Figure 2a	Town of Snow Hill	1 - 1000 gal. Heating Oil	VOC
3	UST	State of Maryland Assessment Office	100 PEARL ST	Figure 2a	Town of Snow Hill	2- 550 gal. Heating Oil	VOC
4	UST	Worcester County Senior Center (Snow Hill)	107 E MARKET ST	Figure 2a	Town of Snow Hill	1 - 1000 gal. Heating Oil	VOC
5	UST	Worcester County Court House	1 W MARKET ST STE 112	Figure 2a	Town of Snow Hill	1- 6000 gal. Heating Oil, 1 - 1000 gal. Diesel, 1 - 4000 gal. Heating Oil	VOC
6	UST	Family Service Center, Inc.	431 W MARKET ST	Figure 2a	Town of Snow Hill	2 - 1000 gal. Gasoline, 1 - 2000 gal. Gasoline, 1 - 550 gal. Gasoline, 1 - 550 gal. Diesel (all tanks out of use)	VOC
7	UST	Bower's Groc.	418 W MARKET ST	Figure 2a	Town of Snow Hill	3 - Gasoline Tanks, 1 - Used Oil Tank, 1 - Kerosene Tank (all tanks out of use)	VOC
8	UST	Ocean City Fisherman's Marina, Inc.	12806 SUNSET AVE	Figure 2c	Sunset Village	2 - 4000 gal. Diesel, 1 - 2000 gal. Diesel, 1 - 4000 gal. Gasoline	VOC
9	CHS	Mayor & Council of Snow Hill	103 BANK STREET	Figure 2a	Town of Snow Hill		VOC, SOC
10	CHS	Sho-Wil Chevy Olds	204 N WASHINGTON ST	Figure 2a	Town of Snow Hill		N, MP

Table 4. Potential Contaminant Point Sources within WHPAs

*see referenced figure for location

PWSID	System Name	Plant ID	Treatment Name	Purpose
0230002	NEWARK	01	pH ADJUSTMENT, POST	CORROSION CONTROL
			GASEOUS CHLORINATION, POST	DISINFECTION
			AERATION, DIFFUSED	IRON REMOVAL
			FILTRATION, GREENSAND	IRON REMOVAL
			PERMANGANATE	IRON REMOVAL
0230006	POCOMOKE CITY	01	NO TREATMENT	PLANT INACTIVE
		02	NO TREATMENT	PLANT INACTIVE
		03	NO TREATMENT	PLANT INACTIVE
		04	NO TREATMENT	PLANT INACTIVE
		05	INHIB., POLYPHOSPHATE	CORROSION CONTROL
			GASEOUS CHLORINATION, POST	DISINFECTION
			FILTRATION, GREENSAND	IRON REMOVAL
			GASEOUS CHLORINATION, PRE	IRON REMOVAL
			PERMANGANATE	IRON REMOVAL
			FLUORIDATION	FLUORIDATION
0230007	TOWN OF SNOW HILL	01	GASEOUS CHLORINATION, POST	DISINFECTION
			FLUORIDATION	FLUORIDATION
		02	GASEOUS CHLORINATION, POST	DISINFECTION
			FLUORIDATION	FLUORIDATION
		03	GASEOUS CHLORINATION, POST	DISINFECTION
			FLUORIDATION	FLUORIDATION
		04	NO TREATMENT	PLANT INACTIVE
		0230008	ST MARTINS BY THE BAY	01
HYPOCHLORINATION, POST	DISINFECTION			
ION EXCHANGE	IRON REMOVAL			
0230011	MYSTIC HARBOUR	01	GASEOUS CHLORINATION, PRE	DISINFECTION
			FILTRATION, GREENSAND	IRON REMOVAL
			PERMANGANATE	IRON REMOVAL
			pH ADJUSTMENT, PRE	IRON REMOVAL

Table 5. Treatment Methods

PWSID	System Name	Plant ID	Treatment Name	Purpose
0230016	SUNSET VILLAGE	01	GASEOUS CHLORINATION, POST	DISINFECTION
			ION EXCHANGE -IRON (NON-SDWIS CODE)	IRON REMOVAL
			ION EXCHANGE	INORGANICS REMOVAL
0230018	OYSTER HARBOR	01	pH ADJUSTMENT	CORROSION CONTROL
			GASEOUS CHLORINATION, POST	DISINFECTION
			FILTRATION, GREENSAND	IRON REMOVAL
			PERMANGANATE	IRON REMOVAL
			pH ADJUSTMENT, PRE	IRON REMOVAL
0230023	WEST OCEAN CITY VILLAGE APARTMENTS	01	ION EXCHANGE	IRON REMOVAL
0230024	SOUTH POINT VILLAGE	01	HYPOCHLORINATION, POST	DISINFECTION
			ION EXCHANGE	IRON REMOVAL
0230206	LAKE HAVEN MOBILE HOME PARK	01	HYPOCHLORINATION, POST	DISINFECTION
			ION EXCHANGE	IRON REMOVAL
0230210	FOUR SEASONS MOBILE HOME PARK	01	ION EXCHANGE	SOFTENING, IRON REMOVAL
0230224	RIVERVIEW MOBILE HOME PARK	01	FILTRATION, GREENSAND	IRON REMOVAL
			HYPOCHLORINATION, PRE	IRON REMOVAL
			PERMANGANATE	IRON REMOVAL
			pH ADJUSTMENT, PRE	IRON REMOVAL
1230051	ASSATEAGUE POINTE	01	GASEOUS CHLORINATION, POST	DISINFECTION
			ION EXCHANGE	IRON REMOVAL

Table 5 (Cont.). Treatment Methods

PWSID	System Name	Plant ID	IOCs		Radionuclides		VOCs		SOCs	
			No. of Samples Collected	No. of Samples > 50% MCL	No. of Samples Collected	No. of Samples > 50% MCL	No. of Samples Collected	No. of Samples > 50% MCL	No. of Samples Collected	No. of Samples > 50% MCL
0230002	NEWARK	01	75	0	4	0	4	1	3	0
0230006	POCOMOKE CITY	05	24	0	6	0	10	0	3	0
0230007	TOWN OF SNOW HILL	01	70	0	6	2	4	0	1	0
		02	28	1	2	0	1	0	0	0
		03	57	0	2	0	1	0	1	0
		04	1	0	0	0	1	0	0	0
0230008	ST MARTINS BY THE BAY	01	20	0	5	0	6	0	4	1
0230011	MYSTIC HARBOUR	01	75	0	5	1	4	0	1	0
0230016	SUNSET VILLAGE	01	87	0	4	0	4	0	4	0
0230018	OYSTER HARBOR	01	53	0	4	0	7	0	1	0
0230023	WEST OCEAN CITY VILLAGE APARTMENTS	01	59	0	2	0	4	0	1	0
0230024	SOUTH POINT VILLAGE	01	73	1	3	0	8	0	2	0
0230206	LAKE HAVEN MOBILE HOME PARK	01	59	0	3	0	5	0	1	0
0230210	FOUR SEASONS MOBILE HOME PARK	01	57	0	4	0	5	0	1	0
	RIVERVIEW MOBILE HOME PARK	01	69	0	3	0	6	0	1	0
0230224	ASSATEAGUE POINTE	01	18	0	4	0	7	0	1	0

Table 6. Summary of Water Quality Results

Date: 11/11/2014
 Time: 10:11 AM
 User: [unclear]
 [unclear]

PWSID	System Name	Plant ID	Contaminant	MCL (mg/L)	Sample Date	Result (mg/L)
0230007	TOWN OF SNOW HILL	01	NITRATE	10	5-Jul-00	7.41**
0230024	SOUTH POINT VILLAGE	01	ARSENIC	0.01	14-Mar-01	0.005

Table 7a. Results of Inorganic Compounds where detected at least once above 50% of their MCL.

** Probable laboratory error

PWSID	System Name	Plant ID	Contaminant	MCL (pCi/L)	Sample Date	Result (pCi/L)
0230007	TOWN OF SNOW HILL	01	GROSS ALPHA	15	18-Apr-02	13.1
		02	GROSS ALPHA	15	30-Jan-01	8
0230011	MYSTIC HARBOUR	01	RADON-222	300/4000*	6-Jun-94	250

Table 7b. Results of Radionuclides where detected at least once above 50% of their MCL or proposed* MCLs.

PWSID	System Name	Plant ID	Contaminant	MCL (mg/L)	Sample Date	Result (mg/L)
0230002	NEWARK	01	METHYLENE CHLORIDE	5	11-Feb-91	9***

Table 7c. Results of Volatile Organic Compounds where detected at least once above 50% of their MCL.

PWSID	System Name	Plant ID	Contaminant	MCL (mg/L)	Sample Date	Result (mg/L)
0230008	ST MARTINS BY THE BAY	01	DI(ETHYLHEXYL)PHTHALATE	6	19-Jun-95	3.84***

Table 7d. Results of Synthetic Organic Compounds where detected at least once above 50% of their MCL.

*** Results invalid since found in laboratory blanks

PWSID	PWS_NAME	No. of Samples Collected	No. of Positive Samples	Disinfection Treatment
0230002	NEWARK	75	0	Y
0230006	POCOMOKE CITY	74	1	Y
0230007	TOWN OF SNOW HILL	72	1	Y
0230008	ST MARTINS BY THE BAY	76	0	Y
0230011	MYSTIC HARBOUR	74	1	Y
0230016	SUNSET VILLAGE	76	0	Y
0230018	OYSTER HARBOR	75	0	Y
0230023	WEST OCEAN CITY VILLAGE APARTMENTS	73	1*	N
0230024	SOUTH POINT VILLAGE	52	0	Y
0230206	LAKE HAVEN MOBILE HOME PARK	71	0	Y
0230210	FOUR SEASONS MOBILE HOME PARK	74	0	N
0230224	RIVERVIEW MOBILE HOME PARK	76	0	N
1230051	ASSATEAGUE POINTE	85	0	Y

Table 8. Routine Bacteriological Monitoring Results from System Distribution
(Sample results are since 1995).

* fecal coliform

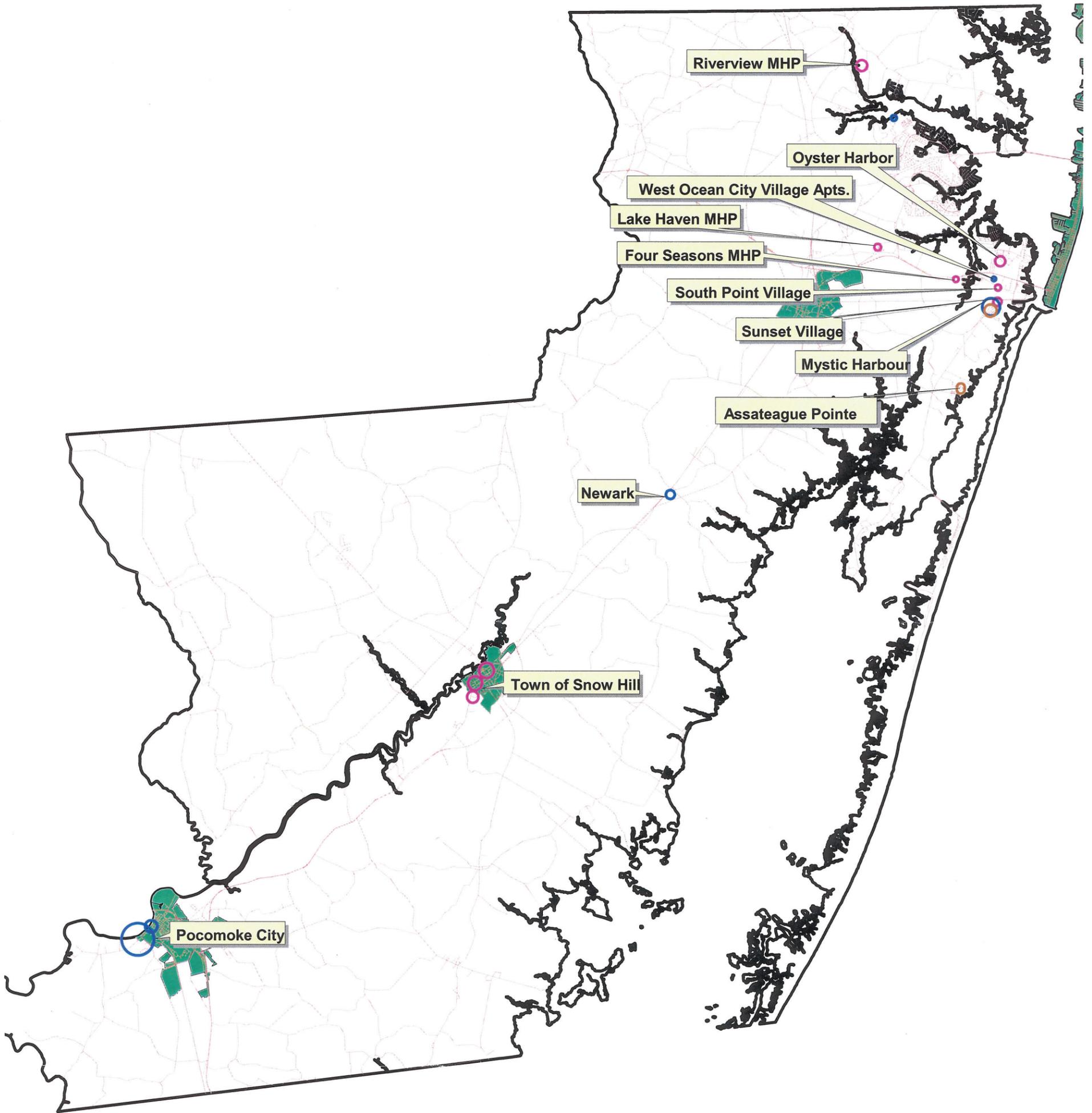
PWSID	SYSTEM NAME	Is the Water System Susceptible to....				
		Inorganic Compounds	Radionuclides	Volatile Organic Compounds	Synthetic Organic Compounds	Microbiological Contaminants
0230002	NEWARK	NO*	NO	NO	NO	NO
0230006	POCOMOKE CITY	NO*	NO	NO	NO	NO
0230007	TOWN OF SNOW HILL	NO	YES	NO	NO	NO
0230008	ST MARTINS BY THE BAY	NO*	NO	NO	NO	NO
0230011	MYSTIC HARBOUR	NO*	MAYBE	NO	NO	NO
0230016	SUNSET VILLAGE	NO*	NO	NO	NO	NO
0230018	OYSTER HARBOR	NO*	NO	NO	NO	NO
0230023	WEST OCEAN CITY VILLAGE APARTMENTS	NO*	NO	NO	NO	NO
0230024	SOUTH POINT VILLAGE	NO*	NO	NO	NO	NO
0230206	LAKE HAVEN MOBILE HOME PARK	NO*	NO	NO	NO	NO
0230210	FOUR SEASONS MOBILE HOME PARK	NO*	NO	NO	NO	NO
0230224	RIVERVIEW MOBILE HOME PARK	NO*	NO	NO	NO	NO
1230051	ASSATEAGUE POINTE	NO*	NO	NO	NO	NO

Table 9. Susceptibility Analysis

*System has treatment for iron removal, which suggests source water is susceptible to iron

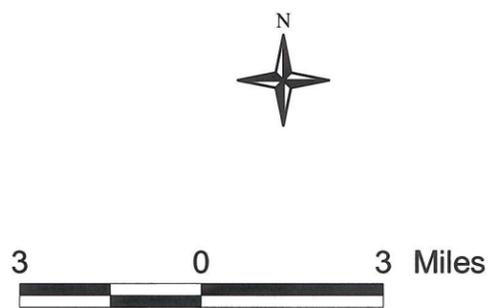
FIGURES

Figure 1. Wellhead Protection Areas for Community Water Systems using Confined Aquifers in Worcester County, MD



LEGEND

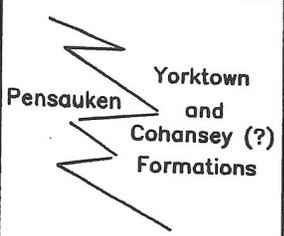
<p>WELLHEAD PROTECTION AREAS (by aquifer)</p> <ul style="list-style-type: none"> Manokin Ocean City Pocomoke 	<ul style="list-style-type: none"> Municipal Boundaries
---	---

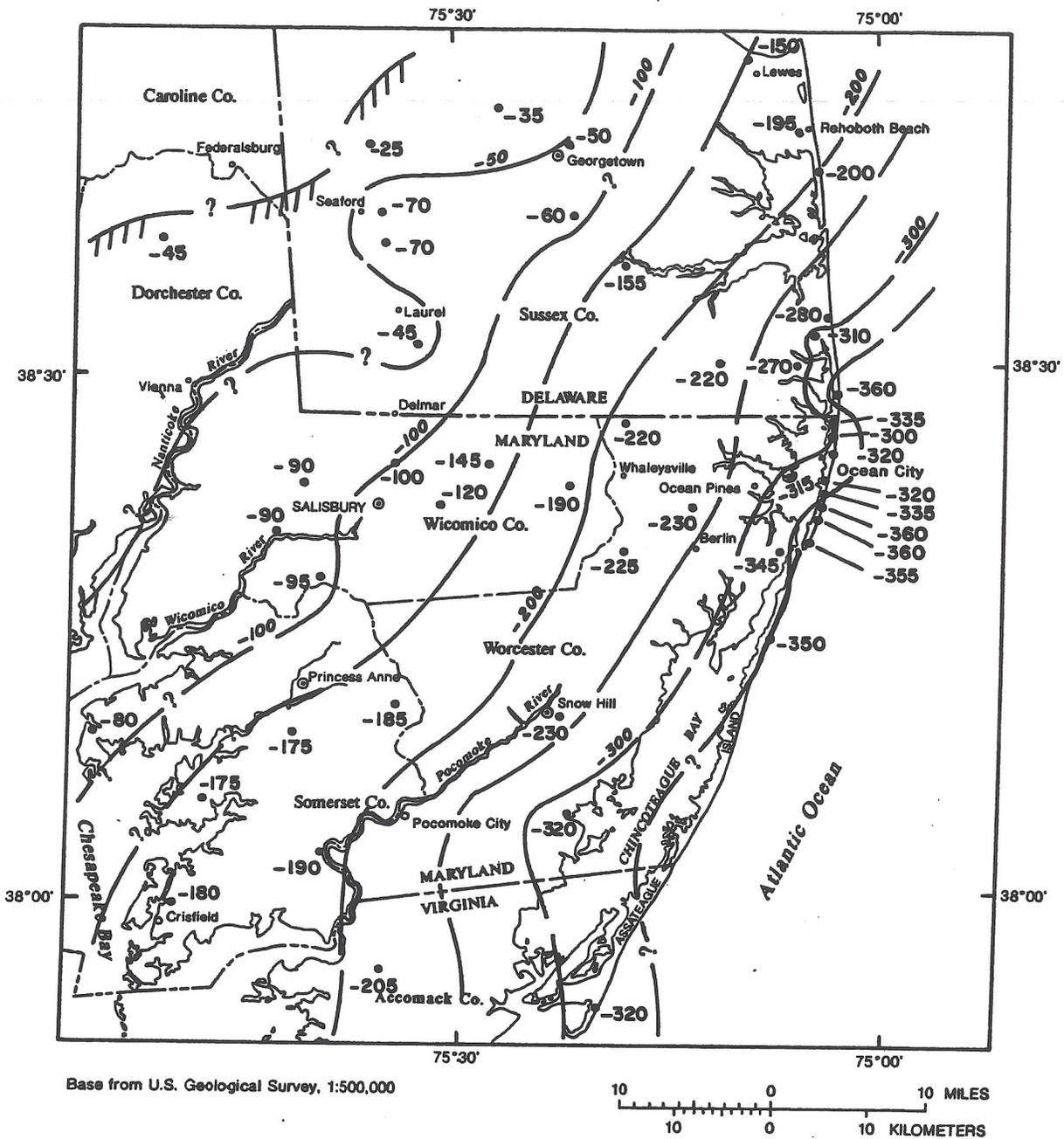


APPENDIX

Table 3.—Lithostratigraphic and hydrostratigraphic nomenclature used in Wicomico, Worcester, and Somerset Counties, Maryland, and adjacent parts of Delaware

from M.S.S. Report of Investigations No 57

Lithostratigraphic units						Hydrostratigraphic units			
System	Series	Stage	Owens and Denny (1979) <small>Worcester, Wicomico and Somerset counties</small>	Andres (1986) <small>Southern Delaware, northern Worcester County, Maryland</small>	Groot, Ramsey and Wehmiller (1990) <small>Southern Delaware</small>	This Report <small>Ocean City and northeastern Worcester County</small>	Rasmussen and Slaughter (1955) <small>Worcester, Wicomico and Somerset counties</small>	Weigle (1974) Weigle and Achmad (1982) <small>Ocean City and northeastern Worcester County</small>	This Report <small>Ocean City and northeastern Worcester County</small>
Quaternary	Holocene		Barrier beach and lagoonal deposits	Unnamed beds	not studied	Recent deposits	Unnamed units	Unconfined aquifer	Leaky confining unit
		Pleistocene	Sinepuxent, Ironshire and Omar Formations	Omar Formation	Omar Formation	Sinepuxent, Ironshire and Omar Formations	Pleistocene sands and aquicludes Beaverdam Sand	partial confining bed Pleistocene aquifer (Beaverdam Sand)	Columbia aquifer
	Beaverdam Formation			Beaverdam Sand					
	Pliocene		Walston Silt	No units assigned to the Pliocene	Beaverdam Formation	Beaverdam Sand	Red gravelly sand	No units assigned to the Pliocene	
Beaverdam Sand									
Tertiary	Miocene	Upper		Bethany formation	Bethany formation	Pocomoke beds	upper aquiclude Pocomoke aquifer lower aquiclude	upper confining bed Pocomoke aquifer	confining unit Pocomoke aquifer confining unit
						Ocean City beds		Ocean City aquifer basal part of lower confining bed	Ocean City aquifer and confining unit
						Manokin formation	not studied	Manokin formation	Manokin aquifer
	Middle		St. Marys (?) Formation	St. Marys (?) Formation	in southern Delaware	St. Marys Formation	aquiclude (St. Marys (?) Fm.)	confining unit (St. Marys Fm.)	
			not studied	Choptank Formation	Choptank Formation	Choptank Formation	Choptank aquifer and confining beds	Choptank aquifer	
				Calvert Formation	Calvert Formation	Calvert Formation	Nanticoke aquifer	aquifers and confining beds of the Calvert Fm.	confining unit (Calvert Fm.)

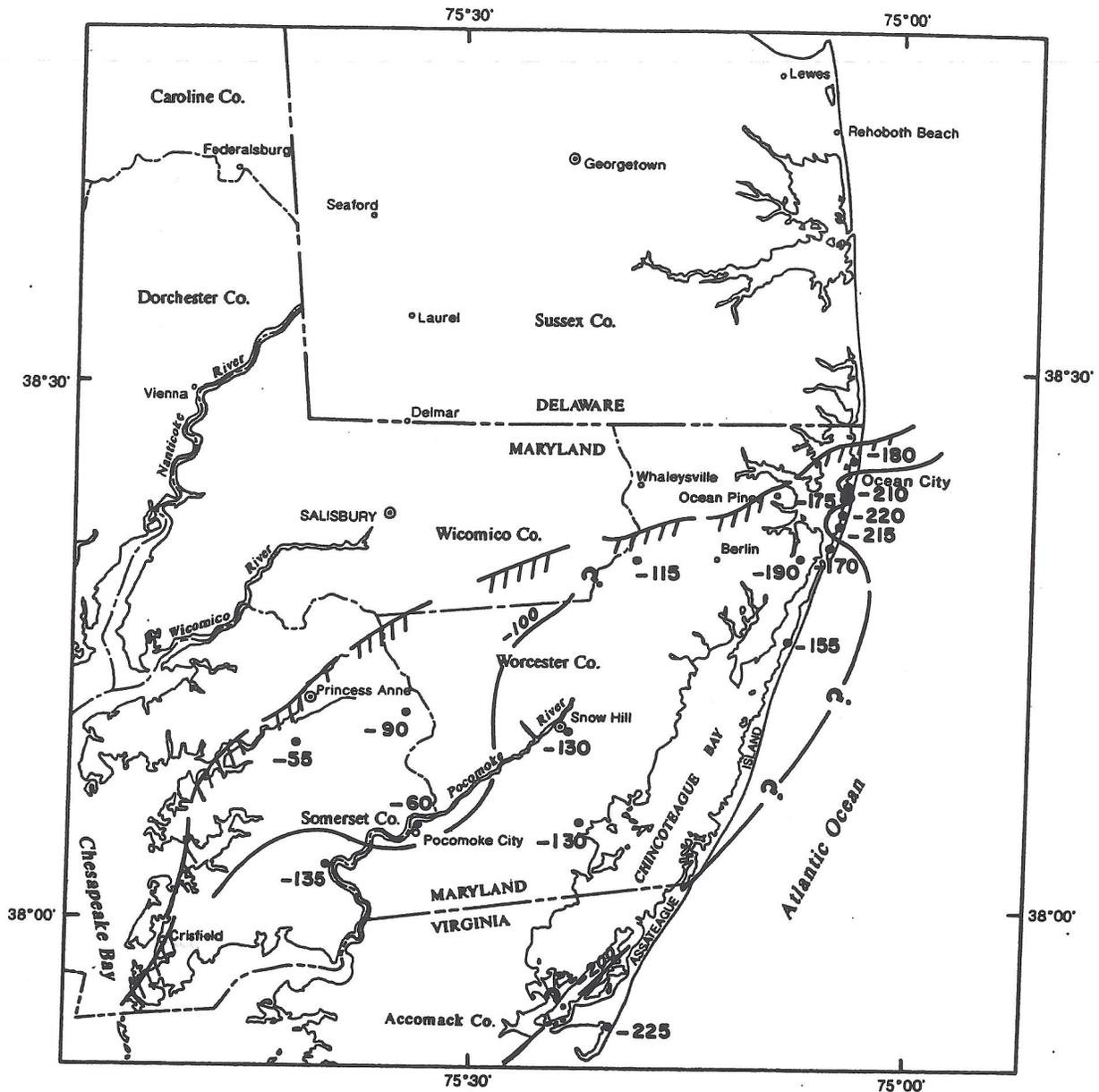


EXPLANATION

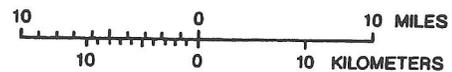
- -190 Data point and altitude in feet below sea level.
 - 200 ? Line of equal altitude; queried where uncertain.
 - //// Updip limit of formation; queried where uncertain.
- Contour interval 50 feet. Datum is sea level.

Figure 9.—Altitude of the top of the Manokin formation.

from M.G.S. Report of Investigations No. 57



Base from U.S. Geological Survey, 1:500,000

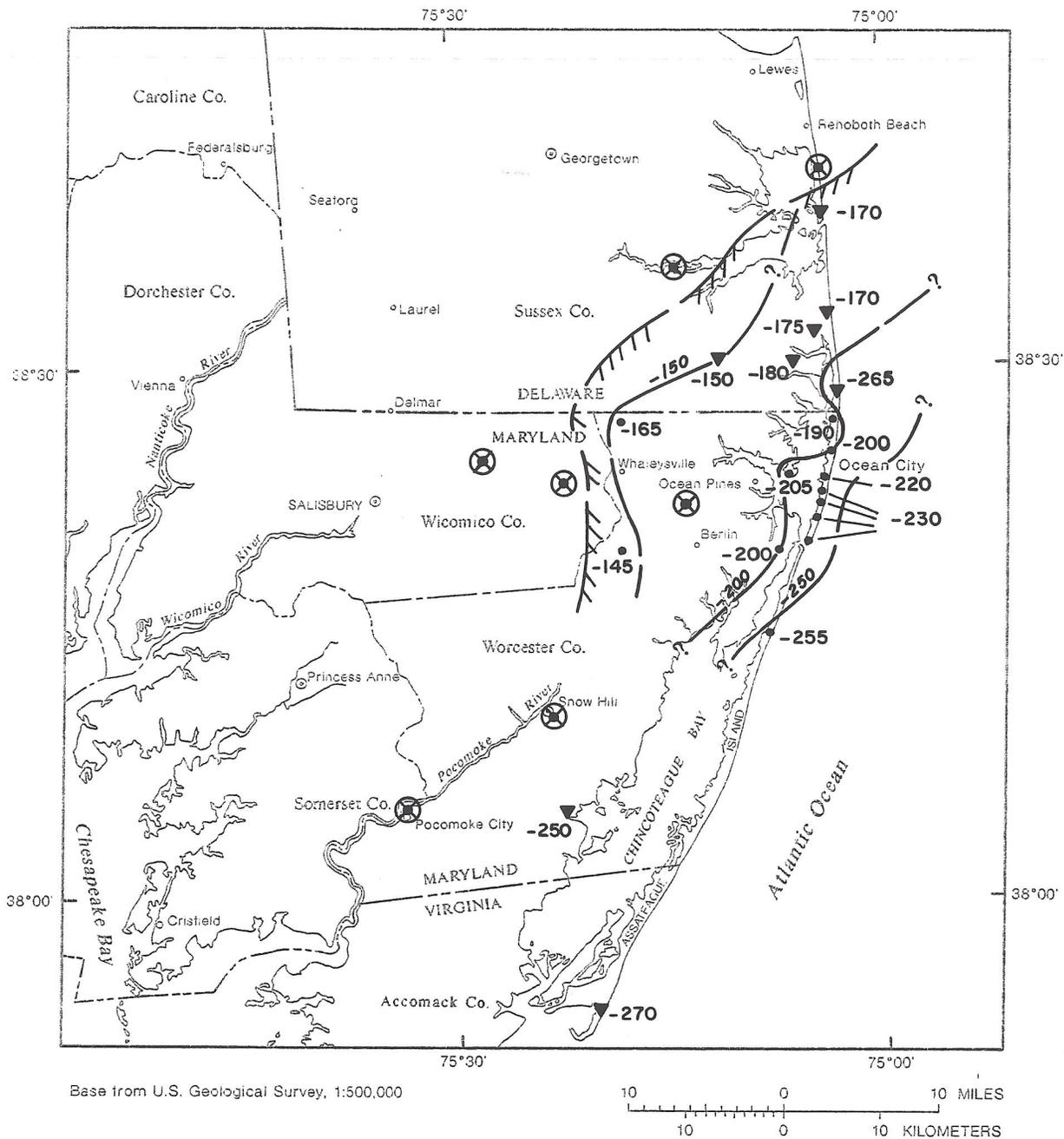


EXPLANATION

- -130 Data point and altitude in feet below sea level.
 - 200 — ? — Line of equal altitude; queried where uncertain.
 - ////// Approximate updip limit of Pocomoke aquifer.
- Contour interval 50 feet. Datum is sea level.

Figure 13.—Altitude of the base of the Pocomoke aquifer.

from M.G.S. Report of Investigations No. 57



EXPLANATION

- -250 Data point and altitude in feet below sea level.
 - ▼ -270 Data point and altitude of hydraulically equivalent sand.
 - ⊗ Sites where the Ocean City aquifer is absent.
 - 150 — ?— Line of equal altitude; queried where uncertain.
 - ////// Approximate updip limit of the Ocean City aquifer.
- Contour interval is 50 feet.

Figure 15.—Altitude of the top of the Ocean City aquifer and equivalent sands.

from MGS Report of Investigations No. 57

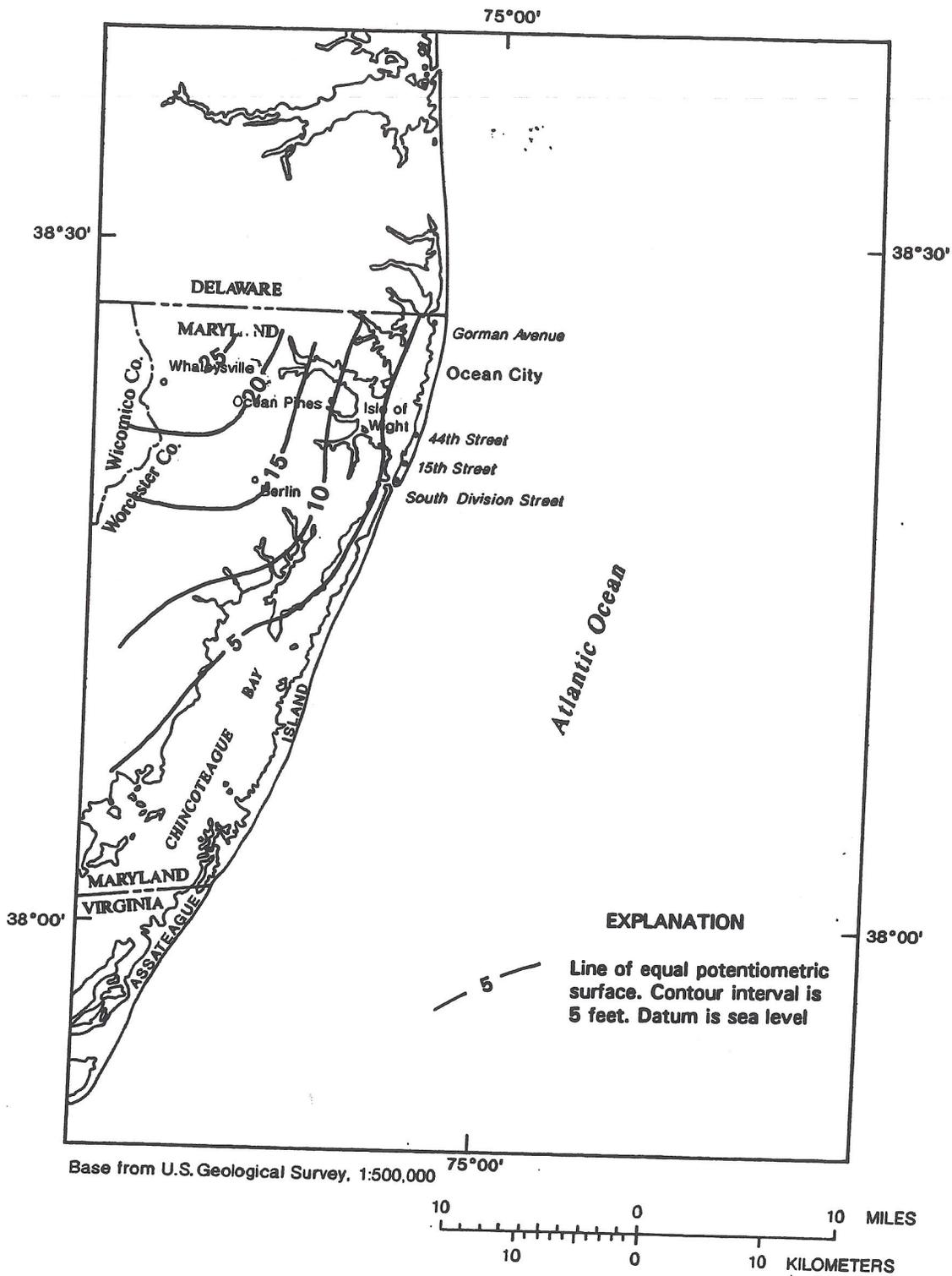


Figure 31.—Simulated potentiometric surface of the Pocomoke aquifer depicting the 1900 steady-state flow conditions.
from M.G.S. Report of Investigations No. 57

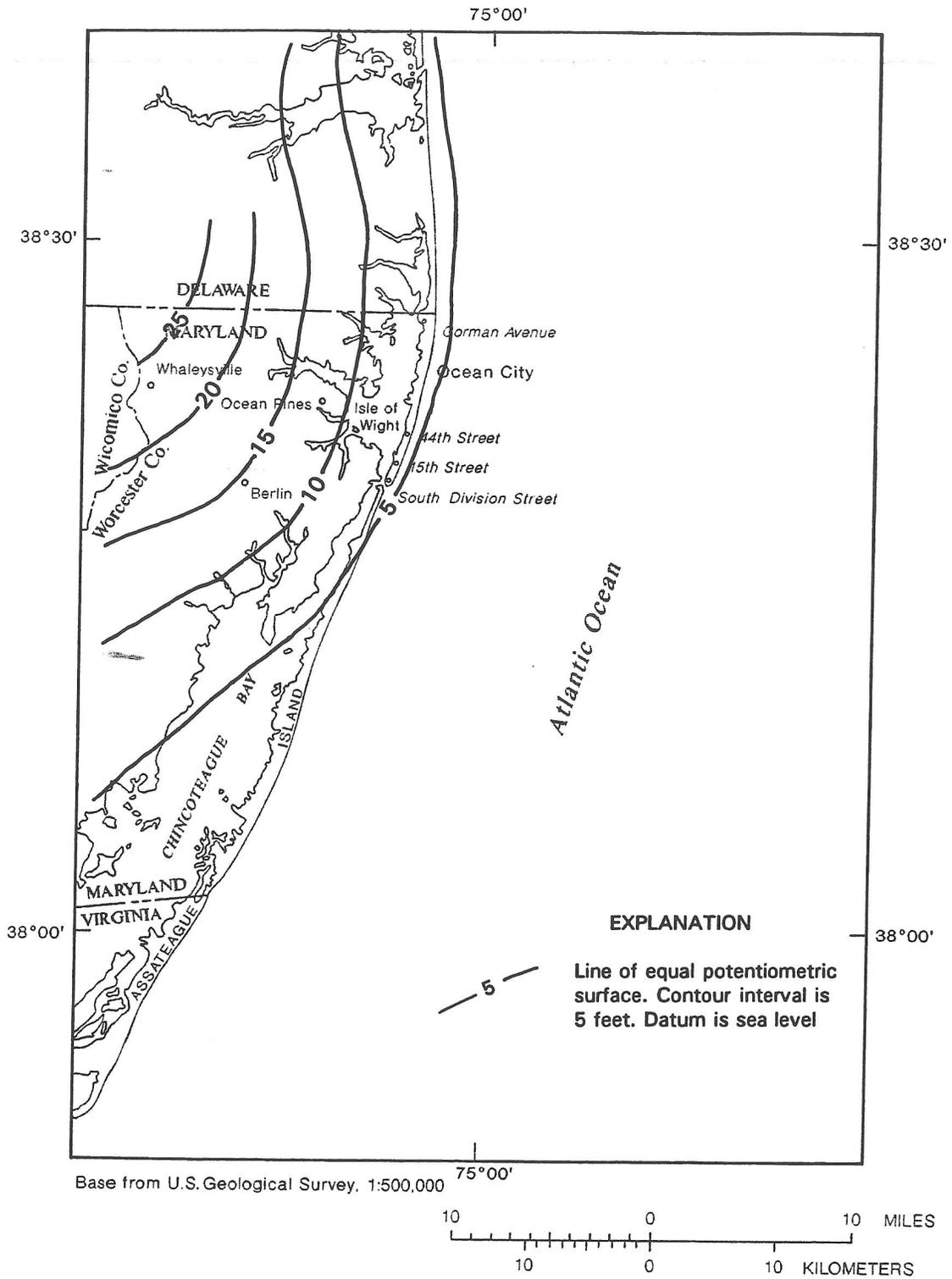


Figure 32.—Simulated potentiometric surface of the Ocean City aquifer depicting the 1900 steady-state flow conditions.

from MGS Report of Investigations No. 57

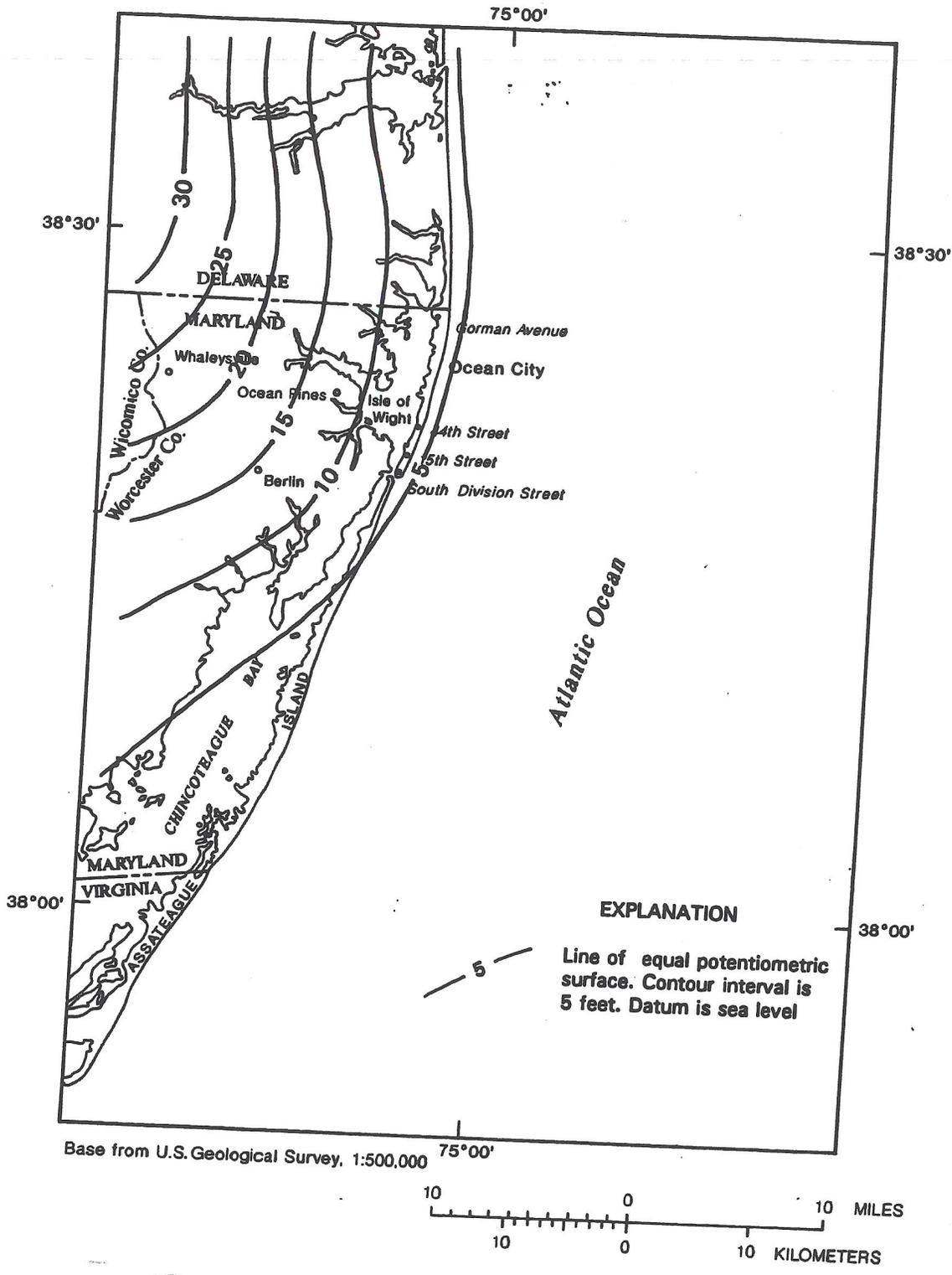


Figure 33.—Simulated potentiometric surface of the Manokin aquifer depicting the 1900 steady-state flow conditions.

from M.G.S Report of Investigations No. 57

EXECUTIVE SUMMARY NEWARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Newark water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Newark water system is currently using one well that pumps water from the Pocomoke aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Newark water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY POCOMOKE CITY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Pocomoke City water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Pocomoke water system is currently using three wells that pumpwater from the Pocomoke aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Pocomoke City water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY TOWN OF SNOW HILL

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Town of Snow Hill water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Town of Snow Hill water system is currently using three wells that pump water from the Manokin aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Town of Snow Hill water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply is susceptible to naturally occurring radiological contaminants.

EXECUTIVE SUMMARY ST MARTINS ON THE BAY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the St Martins On The Bay water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The St Martins On The Bay water system is currently using one well that pumps water from the Pocomoke aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the St Martins On The Bay water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY MYSTIC HARBOUR

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Mystic Harbour water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Mystic Harbour water system is currently using one well that pumps water from the Ocean City aquifer, and two wells that pump water from the Pocomoke aquifer. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Mystic Harbour water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The susceptibility of the water supply to radon, a naturally occurring element, will depend upon the final MCL that is adopted for this contaminant. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY SUNSET VILLAGE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Sunset Village water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Sunset Village water system is currently using one well that pumps water from the Manokin aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Sunset Village water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY OYSTER HARBOR

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Oyster Harbor water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Oyster Harbor water system is currently using two wells that pump water from the Manokin aquifer. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Oyster Harbor water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY

WEST OCEAN CITY VILLAGE APARTMENTS

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the West Ocean City Village Apartments water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The West Ocean City Village Apartments water system is currently using two wells that pump water from the Pocomoke aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that West Ocean City Village Apartments water supply is may be susceptible to microbiological contaminants due to well construction. It is not susceptible to inorganic, volatile organic, synthetic organic or radiological contaminants. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY SOUTH POINT VILLAGE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the South Point Village water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The South Point Village water system is currently using two wells that pump water from the Manokin and Pocomoke aquifers, respectively. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems for is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that South Point Village water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY

LAKE HAVEN MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Lake Haven Mobile Home Park water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Lake Haven Mobile Home Park water system is currently using two wells that pump water from the Manokin aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Lake Have Mobile Home Park water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY

FOUR SEASONS MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Four Seasons Mobile Home Park water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Four Seasons Mobile Home Park water system is currently using two wells that pumps water from the Manokin aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Four Seasons Mobile Home Park water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY

RIVERVIEW MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Riverview Mobile Home Park water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Riverview Mobile Home Park water system is currently using two wells that pump water from the Manokin aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Riverview Mobile Home Park water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.

EXECUTIVE SUMMARY ASSATEAGUE POINTE

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for thirteen community water systems in Worcester County, including the Assateague Pointe water system. 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 each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies conclude this report.

The water supply sources of the community systems in Worcester County are naturally protected confined aquifers of the Atlantic Coastal Plain physiographic province. The Assateague Pointe water system is currently using two wells that pump water from the Ocean City aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for supplies in confined aquifers.

Potential point sources of contamination were researched and identified within the assessment areas from field inspections, contaminant and well inventory databases, and land use maps. Well information and water quality data were also reviewed. A map showing the Source Water Assessment areas for all the water systems is included in this report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and aquifer characteristics. It was determined that the Assateague Pointe water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of high iron from its raw water.