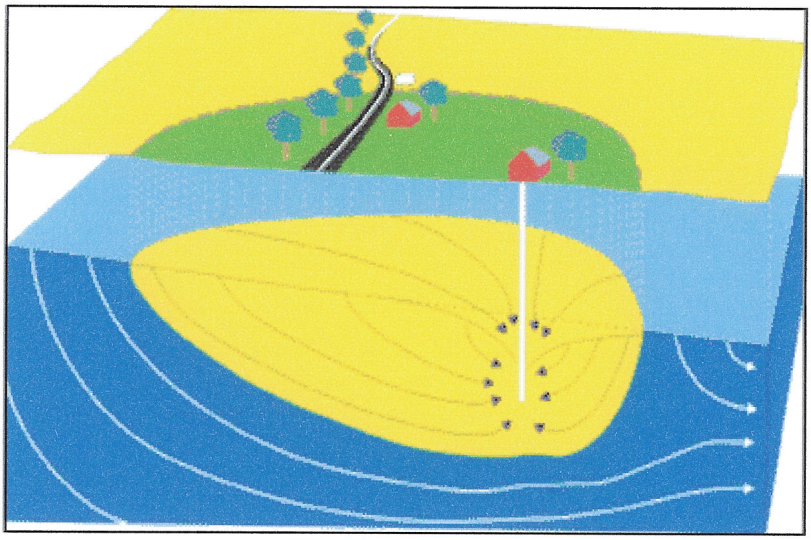
SOURCE WATER ASSESSMENT
for
CHESTERTOWN FOODS
KENT COUNTY, MD



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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for Chestertown Foods. The required components of this report as described in Maryland's Source Water Assessment Plan (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.

The source of the Chestertown Foods water supply is an unconfined Coastal Plain aquifer, known as the Aquia Formation. The system currently maintains five wells for potable and processing water needs. The Source Water Assessment Area was delineated by the Water Supply Program using U.S. EPA approved methods specifically designed for each source.

Potential sources of contamination within the assessment area were identified based on site visits, database reviews and land use maps. Well information and water quality data were also reviewed. Figures showing land uses and potential contaminant sources within the Source Water Assessment Area and an aerial photograph of the well locations are enclosed at the end of the report.

The susceptibility analysis for the Chestertown Foods water supply is based on a review of the water quality data, potential sources of contamination, aquifer characteristics, and well integrity. It was determined the Chestertown Foods water supply is susceptible to contamination by nitrates. It is not susceptible to volatile organic compounds, synthetic organic compounds, other inorganic compounds, or microbiological contaminants. The systems should abandon unused wells to protect the aquifer from contamination.

INTRODUCTION

The Water Supply Program has conducted a source water assessment for the Chestertown Foods water supply located about 2 miles northeast of Chestertown in Kent County (figure 1). The Chestertown Foods water supply is considered a nontransient noncommunity (NTNC) water system, which is defined as a public water system that regularly serves at least 25 of the same individuals over six months per year. The facility and operates its water supply system and serves water to 250 employees. This facility was formerly owned and operated by Campbell Soup Company, which ceased operations in September 1995. The facility is now owned and operated by Chestertown Foods.

WELL INFORMATION

Well information was obtained from the Water Supply Program's database, site visits, well completion reports, sanitary survey inspection reports and published reports. There are 8 wells at the Chestertown Foods site. Two wells (Nos. 1 and 5) are the primary production wells, three wells (Nos. 2, 4 and 8) are used as standby wells, two wells (Nos. 3 and 7) are not in use, and one well (No.6) is used for heating and cooling. In addition, there are three monitoring wells as part of the discharge permit for the facility. A review of well data and sanitary surveys of the Chestertown Foods water system indicates that five of the wells were drilled prior to 1973, when the State's well construction regulations went into effect, and may not be in compliance with current construction standards. The remaining three wells were drilled after 1973 and should meet current standards. Well information is shown in Table 1 below. Well No. 3 has a hole in the well cap, which may provide an avenue for contamination of the well and aquifer since it is not in use.

WELL NAME	USE CODE	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
Chestertown Foods 1	P	KE036140	97	80	1959
Chestertown Foods 2	S	KE037133	96	76	1959
Chestertown Foods 3	U	KE810582	110	85	1986
Chestertown Foods 4	S	KE037131	98	81	1959
Chestertown Foods 5	P	KE811386	113	83	1990
Chestertown Foods 6	O	KE660086	397	357	1966
Chestertown Foods 7	U	KE037132	92	73	1959
Chestertown Foods 8	S	KE811387	120	90	1990

Table 1. Chestertown Foods Well Information.

Use Code: P - Production
S - Standby
U - Unused
O - Other

Chestertown Foods has a Water Appropriation Permit that allows it to use an average of 700,000 gallons per day (gpd) and 800,000 gpd in the month of maximum use. Most of the water is for industrial use like food processing and cooling. No information is available on the actual water use.

HYDROGEOLOGY

Ground water flows through pores between gravel, sand and silt grains in unconsolidated sedimentary rock aquifers such as the one used by Chestertown Foods. An aquifer is any formation that is capable of yielding a significant amount of water. 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. The Chestertown area 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. These sediments crop out in a concentric band that lies parallel to the Fall Line, which marks the western boundary of the Coastal Plain. The Chestertown Foods wells pump water from the Aquia Formation in the area where the aquifer outcrops. At this location, the Aquia is an unconfined aquifer with the top of the aquifer about 25 feet above sea level and bottom about 90 feet below sea level. The Aquia aquifer consists of a fine to coarse, glauconitic quartz sand, which locally contains clayey layers, shell beds, cemented zones, and highly weathered zones (Drummond, 1998).

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 source water assessment area for public water systems with an average appropriation amount of greater than 10,000 gpd and drawing from unconfined aquifers in the Coastal Plain can be delineated using the EPA WHPA Code ground water model (MD SWAP, 1999). The EPA WHPA Code version 2.0 is a user-friendly two-dimensional ground water model, which assumes uniform flow and calculates a capture area based on pumping rate and aquifer characteristics. This model provides a good estimate of time-of-travel zones for a well in an unconfined aquifer in the Coastal Plain.

For the WHPA delineation the daily average pumpage of 700,000 gpd was divided between equally between the two production wells (Nos. 1 and 5). The same pumpage was also assigned to each of the standby wells (Nos.2, 4, and 8). The model was run using Well Nos 1 and 5 pumping as each of these wells with each of the standby wells pumping. The outputs from all these runs were combined to produce the final WHPA zones. The unused wells or Well No. 6 are not included in the modeling.

The parameters used for the WHPA Code model were:

Pumpage per well = 350,000 gpd (46,785 ft^3/day)
Transmissivity of the aquifer = 1400 ft^2/day
Thickness of aquifer = 60 ft.
Recharge rate = 0.0048ft/day
Hydraulic gradient = 0.001
Ground water flow direction = SW (225 degrees)

Delineation Zones

Zone 1: Zone 1 is the WHPA delineated using a 1-year time-of-travel (TOT) criterion. Zone 1 serves as a first zone of protection. The one-year criterion was selected based on the maximum known survival times of microbial organisms in ground water. The delineated Zone 1 WHPA is a combination of the areas for each well based on their pumpage and has an area of 65.3 acres

Zone 2: Zone 2 is the WHPA delineated using a 10-year TOT criterion. It would take any chemical contaminant present at the Zone 2 boundary 10 years to reach the well (if it moves at the same rate as ground water). Zone 2 provides adequate time for facilities outside the WHPA to address chemical contamination before it could reach the well. The delineated Zone 2 WHPA is also a combination of the areas for each well based on their pumpage and has an area of 260.2 acres.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are classified as either point of non-point sources. Examples of point sources of contamination are leaking underground storage tanks, landfills, ground water discharge permits, large scale feeding operations and Superfund sites. These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via discrete point location. Non-point sources of contamination are associated with certain types of land use practices such as the use pesticides, application of fertilizers or animal wastes, or septic systems that may lead to ground water contamination over a larger area.

Point Sources

A review of MDE contaminant databases as well as a field survey revealed no known point sources of contamination in the WHPA.

Non-Point Sources

The Maryland Department of Planning's 2002 digital land use map for Kent County was used to determine the predominant types of land use in Zone 2 of the WHPA (figure 3). Table 2 shows the land use categories within the Chestertown Foods WHPA. The largest portion of the WHPA is cropland followed by orchard which together makeup 85% of the WHPA.

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Industrial	18.42	7.1
Cropland	151.26	58.1
Orchard	69.93	26.9
Forest	20.00	7.7
Wetlands	0.55	0.2
Total	260.15	100.00

Table 2. Land Use Summary for the Chestertown Foods WHPA (Zone 2)

Agricultural land (cropland and orchard) is commonly associated with nitrate loading of ground water. These land uses represent a potential source of synthetic organic compounds (SOCs) to ground water depending on use of pesticides and properties of the soil. Industrial properties may be a source of chemical contamination form storage and use of solvents, heating oil, gasoline or other processing chemicals used in industry. In addition a horse farm is located adjacent to Chestertown Foods property on the east and may be a source of nitrate and microbiological pathogens from animal waste.

A review of the Maryland Department of Planning's 2002 Kent County Sewer Map indicates that there is no planned sewer service for the entire WHPA. Chestertown Foods has a surface water discharge permit (00-DP-0009) for disposing off treated wastewater from the facility. The permit allows the facility to use pretreated wastewater for spray irrigation (figure 2) on 21 spray zones with a total or 60 acres at the rate of two inches per week per acre. The spray irrigation effluent may be a potential source of nitrates and microbiological pathogens.

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database and system files for Safe Drinking Water Act contaminants. 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 at or greater than 50% of a MCL, this assessment will describe the sources of such a contaminant and, if possible, locate the specific sources which may be the cause of the elevated contaminant level. All data reported is from the finished (treated) water unless otherwise noted. There is currently no treatment for the Chestertown Foods water system.

A review of the monitoring data since 1993 for the Chestertown Foods water supply indicates that it meets the current drinking water standards. Since the facility was inactive between 1995 and 2003, there is limited water quality data. The water quality sampling results are summarized in Table 4.

	Nitrate		SOCs		VOCs		IOCs (except nitrate)		Radionuclides*	
PLANT NO	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	No. of Samples Collected	No. of samples > 50% MCL
01	14	9	1	0	6	0	2	0	0	0

Table 3. Summary of Water Quality Samples for the Chestertown Foods Water Supply.

Inorganic Compounds (IOCs)

The only IOC detected above 50% of the MCL was nitrate. The MCL for nitrate is 10 ppm and it has been detected several times above 50% of the MCL. These nitrate detections are shown in Table 4. The highest value measured was collected in the February 2005 sample. More frequent monitoring is recommended for the year to see if this represents an increasing trend.

CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
NITRATE	10	8-Mar-94	5.2
NITRATE	10	16-Aug-94	5.11
NITRATE	10	17-Jan-95	5.23
NITRATE	10	11-Apr-95	5.68
NITRATE	10	16-Feb-98	5.73
NITRATE	10	26-Mar-02	5.47
NITRATE	10	5-Feb-03	6.03
NITRATE	10	4-Feb-04	5.38
NITRATE	10	22-Feb-05	7.7

Table 4. Inorganic Compounds detected above 50% of the MCL

Volatile Organic Compounds (VOCs)

No VOCs have been detected in the Chestertown Foods water supply.

Synthetic Organic Compounds (SOCs)

No SOCs above 50% of the MCL have been detected in Chestertown Foods's water supply. The one SOC detected was di(ethylhexyl)phthalate in a sample collected on February 2, 2005 at 1.5 ppb. The MCL for this SOC is 6 ppb. This SOC was also detected in the laboratory blank on the same date and therefore does not likely represent the water quality of Chestertown Foods

Radionuclides

Nontransient noncommunity systems are currently not regulated for radionuclides. Currently no radionuclide sampling data is available for this water supply.

Microbiological Contaminants

Routine bacteriological monitoring is conducted in the finished water for each noncommunity nontransient water system on a quarterly basis and measures total coliform bacteria. Since Chestertown Foods had no treatment for its potable

water supply, the routine bacteriological samples could represent the aquifer water quality. Total coliform bacteria are not pathogenic, but are used as an indicator organism for other disease-causing microorganisms. A breach of the system such as due to flooding a well, ruptured water line or back siphonage of contaminated water could cause a positive total coliform result in the distribution system, and would require follow-up total and fecal coliform analysis. Coliform contamination can also occur from openings in the well casing or well cap. Since 1998 Chestertown Foods has conducted routine bacteriological sampling 21 times. In a sample taken on November 2003, total coliform bacteria were detected, but none of these were fecal coliform. Repeat samples collected showed no fecal coliform. Subsequent bacteriological sampling since then has shown no presence of total coliform in the water supply.

SUSCEPTIBILITY ANALYSIS

The Chestertown Foods wells obtain water from an unconfined Coastal Plain aquifer. Wells in unconfined aquifers are generally vulnerable to any activity on the land surface that occurs within the WHPA. Therefore, managing this area to minimize the risk to the supply and continued routine monitoring of contaminants is essential in assuring a safe drinking water supply. The susceptibility of the wells to contamination is determined for each group of contaminants based on the following criteria: (1) available water quality data, (2) presence of potential contaminant sources in the WHPA, (3) aquifer characteristics, (4) well integrity, and (5) the likelihood of change to the natural conditions. The susceptibility of the water supply to the various types of contaminants is summarized in Table 5.

Inorganic Compounds (IOCs)

Nitrate was the only IOC detected above 50% of the MCL in the Chestertown Foods water supply. A review of the nitrate data shows a possible increasing trend in nitrate levels (figure 4). There are several sources of nitrate in the WHPA. Spray irrigation of the crops with pretreated wastewater and the adjacent horse farm are possible sources of nitrate in the ground water. Fertilizer applied to agricultural fields, and adjacent properties for landscaping, are source of nitrate loading in ground water. The entire WHPA is in an area not planned for public sewer and has onsite septic systems for wastewater disposal. Onsite septic systems in the WHPA are also sources of nitrate in ground water.

Based on above analysis the Chestertown Foods water supply **is** susceptible to nitrates but not to other inorganic compounds.

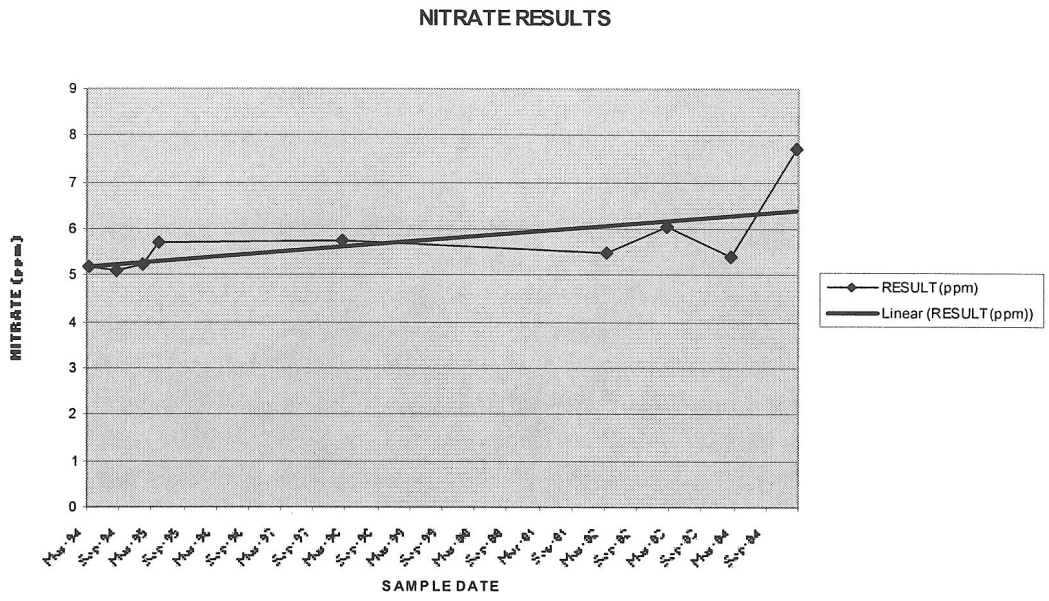

Figure 4. Nitrate levels in Chestertown Foods Water Supply.

Volatile Organic Compounds (VOCs)

No VOCs above 50% of the MCL have been detected in Chestertown Food's water supply since 1993. No potential sources of VOC contamination were found within the WHPA (figure 2).

Based on the above discussion, the Chestertown Foods water supply **is not** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

No SOCs have been detected in Chestertown Food's water supply. Application of pesticides on agricultural fields can be potential nonpoint sources of SOCs. But so far, due to combination of proper application, and aquifer and well characteristics no SOCs have been detected in the water supply.

Based on the above analysis, the Chestertown Foods water supply is **not** susceptible to SOC contamination.

Radionuclides

Nontransient noncommunity systems are currently not regulated for radionuclides. . No sampling data for radionuclides is available at present for the Chesteretown Foods water supply. Due to unavailability of water quality information, no determination can be made for the susceptibility of the Chestertown water supply to radionuclides.

Microbiological Contaminants

Since 1998, 21 bacteriological samples have been collected for the Chestertown Foods water supply. Only one sample had total coliform bacteria detection, but

no fecal coliform bacteria. Subsequent sampling has shown no presence of coliform in the water supply. There are several potential sources of microbiological contaminants in the WHPA like the pretreated wastewater used for spray irrigation and the animal waste from the nearby horse farm. But the unconsolidated sediments of the Coastal Plain aquifer act as a natural filter for these pathogens.

Based on the above discussion, the Chestertown Foods water supply **is not** susceptible to microbiological contaminants.

CONTAMINANT TYPE	Are Contaminant Sources present in the WHPA?	Are Contaminants detected in WQ samples at 50% of the MCL	Is Well Integrity a Factor? *	Is the Aquifer Vulnerable?	Is the System Susceptible to the Contaminant
Nitrate	YES	YES	NO	YES	YES
Inorganic Compounds (except nitrate)	NO	NO	NO	YES	NO
Volatile Organic Compounds	NO	NO	NO	YES	NO
Synthetic Organic Compounds	YES	NO	NO	YES	NO
Radionuclides ()	NO	NO DATA	NO	NO	CANNOT BE DETERMINED
Microbiological Contaminants	YES	NO	NO	YES	NO

Table 6. Susceptibility Summary for the Chestertown Foods water supply.

MANAGEMENT OF THE WHPA

The following recommendations for protection of the water supply are listed below:

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Carefully monitor the pretreated wastewater being spray irrigated to ensure that contaminants are not getting in to the shallow unconfined aquifer being use for water supply.
- Conduct annual raw water bacteriological testing of the supply wells to ensure well integrity

Contaminant Source Inventory/Well Inspection

- 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.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.
- The well cap for Well No.3 should be replaced since it has a hole in the center and provides a pathway for contaminants to flow into the aquifer.
- If there are no plans to use either Well No. 3 or 7, these wells should be abandoned and sealed in compliance with State well construction standards

Cooperative Efforts with Other Agencies

- Work closely with MDE's Wastewater Permits Program to ensure that all the discharge permit conditions are being complied with and that the shallow aquifer is being protected from contamination.

Changes in Use

- Any increase in pumpage or addition of new wells to the system may require revision of the WHPA. The system is required to contact the Water Supply Program when an increase pumpage is applied for or when new wells are being considered.

REFERENCES

Bolton, David W., 1996, Network Description and Initial Water-Quality Data from a Statewide Ground-Water Quality Network in Maryland: Maryland Geological Survey Report of Investigations No. 60, 167 p.

Drummond, David D., 1998, Hydrogeology, Simulation of Ground-Water Flow, and Ground-Water Quality of the Upper Coastal Plain Aquifers in Kent County, Maryland: Maryland Geological Survey Report of Investigations No. 68. 76p.

Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36 p.

Tompkins, M. D., Cooper, B. F., and Drummond, D. D., 1994, Ground-Water and Surface-Water Data for Kent County, Maryland: Basic Data Report No. 20, 155p.

OTHER SOURCES OF DATA

Water Appropriation and Use Permit: KE1959G003
Public Water Supply Inspection Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangle: Chestertown
USGS Topographic 7.5-Minute Chestertown Quadrangle
Maryland Department of Planning 2002 Kent County Land Use Map
Maryland Department of Planning 2002 Kent County Sewer Map

FIGURES

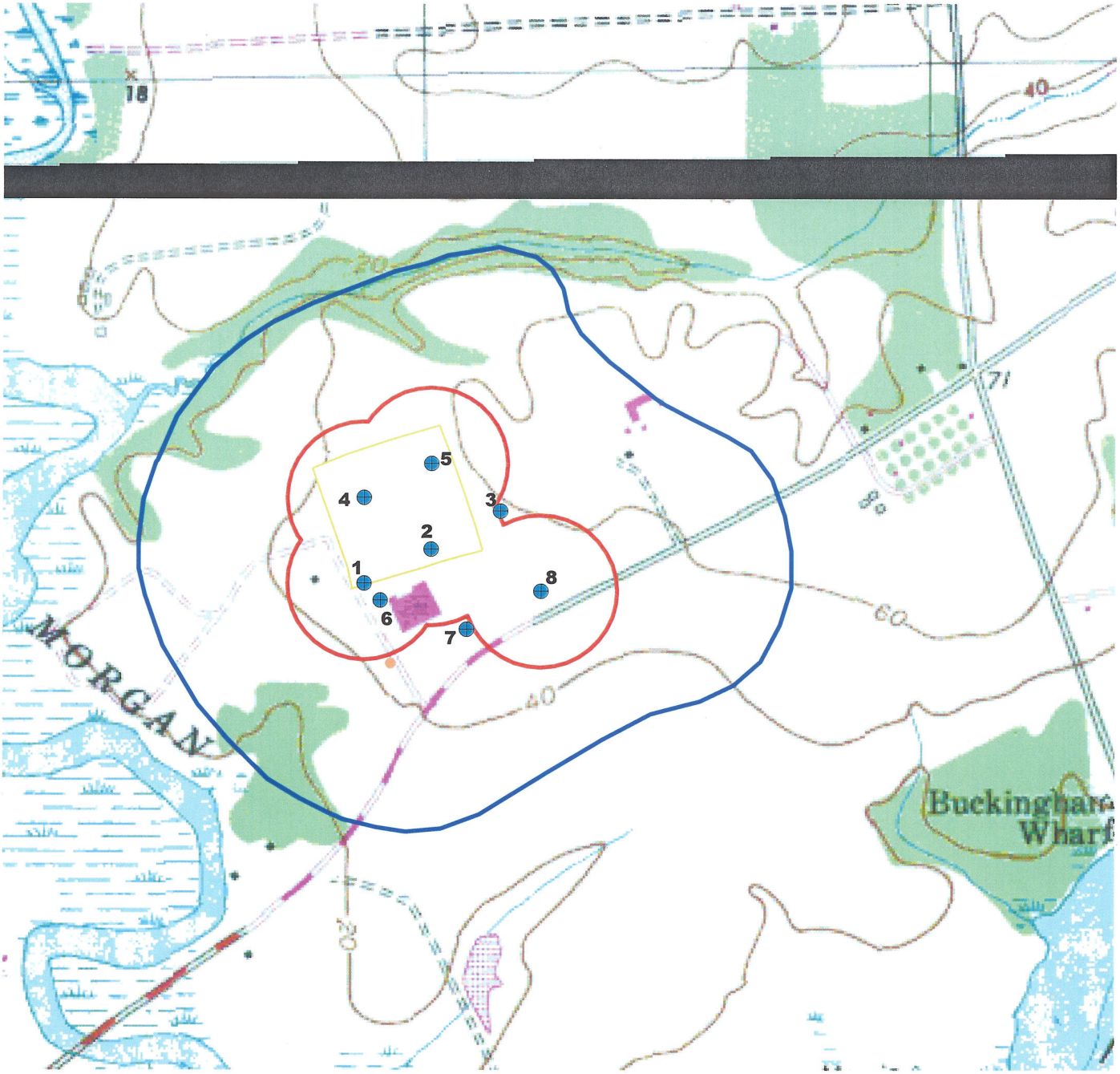

Figure 2. Wellhead Protection Area for Chestertown Foods with Potential Contaminant Sources

LEGEND

Supply Wells

Spray Irrigation Area

Wellhead Protection Area

1 yr Zone

10 yr Zone

1000 0 1000 Feet

N

Base Map: USGS 7.5 Minute Topographic Quadrangle - Chestertown

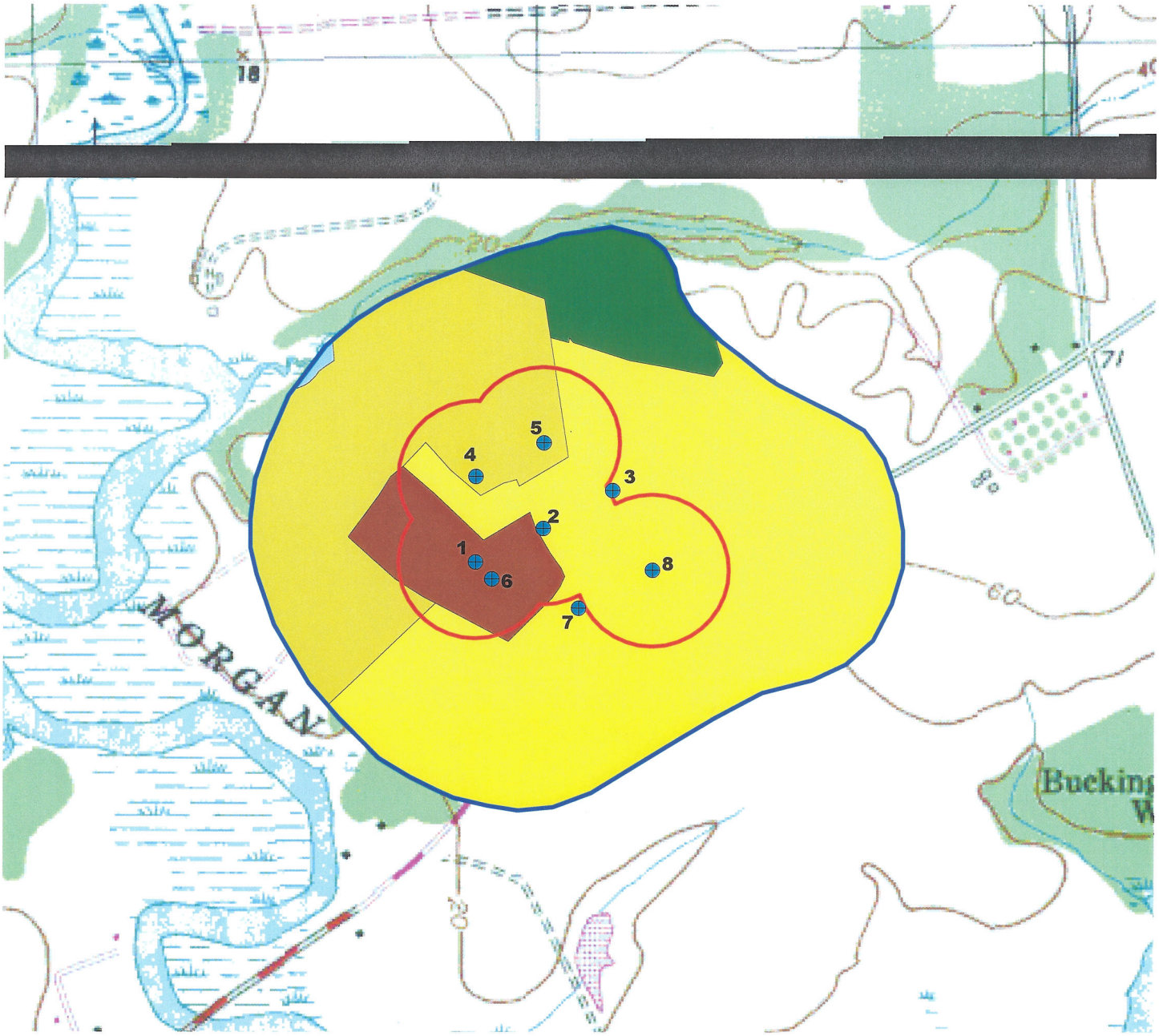

Figure 3. Land Use Map of Chestertown Foods Wellhead Protection Area

LEGEND

Land Use Categories
- Industrial
- Cropland
- Orchards
- Forest

- Wetlands

Wellhead Protection Area
- 1 yr Zone
- 10 yr Zone
- Supply Wells

1000 0 1000 Feet

N

Base Map: USGS 7.5 Minute Topgraphic Quadrangle - Chestertown
Land Use: MD Dept of Planning - Kent County (2000)