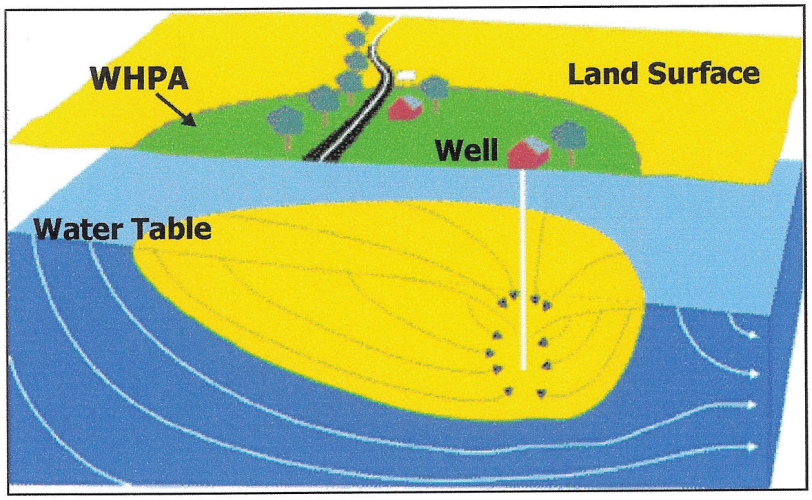
SOURCE WATER ASSESSMENT

FOR THE TOWN OF HURLOCK

DORCHESTER COUNTY, MD



Prepared By
Maryland Department of the Environment
Water Management Administration
Water Supply Program
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MDE

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SUMMARY

The Maryland Department of the Environment Water Supply Program (WSP) has conducted a Source Water Assessment for the Town of Hurlock. The major 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) an inventory of potential sources of contamination, and (3) determining the susceptibility of the water supply to contamination. Recommendations for management of the assessment areas conclude this report.

The Town of Hurlock's water supply is obtained from two different aquifers. Well Nos. 1 and 3 draw water from a shallow, unconfined aquifer in the Coastal Plain known as the Quaternary aquifer. Well No. 4 draws water from the deeper confined Piney Point aquifer. The Source Water Assessment areas for the Town's wells were delineated by the WSP using U.S. EPA's approved methods specifically designed for each source.

A survey to identify potential sources of contamination within the assessment areas was conducted based on site visits, database review, and land use maps. Well information and water quality data were also reviewed. Figures showing land use 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 of Hurlock's water supply is based on the water quality data, potential sources of contamination, aquifer characteristics, and well integrity. It was determined that Hurlock's water supply is susceptible to contamination by nitrates, volatile organic compounds (e.g. petroleum) and synthetic organic compounds (e.g. pesticides). The system is not susceptible to radionuclides or microbiological contaminants.

INTRODUCTION

The Town of Hurlock is located approximately 14 miles northeast of Cambridge in Dorchester County (see Figure 1). The Town's water supply system serves a population of 1700 and has about 388 connections. The water is supplied by three wells (Nos. 1, 3 and 4). The main supply wells are Nos. 3 and 4 with No. 1 being used as a backup supply. Wells Nos. 3 and 4 are blended together and treated prior to the water being pumped into the water distribution system. Another well (No. 2) which was used as a backup supply is no longer in-service. Figure 1 shows the location of the supply wells.

WELL INFORMATION

A review of the well completion reports and sanitary surveys indicate that the supply wells meet the State's well construction standards. Table 1 is a summary of the well construction data.

PLANT	SOURCE NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	AQUIFER
1	Hurlock 1 (Backup)	N/A	113	Not Available	Quaternary System
3	Hurlock 3	DO-73-1188	110	108	Quaternary System
3	Hurlock 4	DO-88-0269	568	490	Piney Point Formation

Table 1. Town of Hurlock Well Data

The yields of the wells range from 340 gallons per minute (gpm) to 600 gpm.

HYDROGEOLOGY

Hurlock's wells obtain water from two different aquifers. Well Nos. 1 and 3 draw water from the shallow unconfined Quaternary aquifer, with Well No. 4 drawing water from the deeper confined Piney Point aquifer (Table 1). The Quaternary sediments in Maryland are of fluvial and estuarine origin and are composed predominately of sand and gravel with some layers of silty clay and clay (Setzer et al, 1987).

At Hurlock, the thickness of the Quaternary aquifer is approximately 110 feet. Based on an aquifer test conducted in Hurlock (Rasmussen et al, 1957), the transmissivity of the Quaternary aquifer was determined to be 150,000 gallons per day per foot (20,053 ft^2 / day). The ground water flow direction is towards the southeast at an average gradient of 0.00015. The porosity of the aquifer was estimated to be 30% (Wilson, 1993).

The Piney Point Formation was deposited in a shallow marine environment and is composed of medium to coarse grained sand with interbedded layers of shell debris, fine sand and clay (Setzer et al, 1987). The confining unit above the Piney Point Formation is the Calvert Formation. It consists of silts and clays containing lenses of gray sand and shell beds (Williams, 1979). Based on the well log for Well No. 4, this confining unit has a thickness of about 195 feet.

The Piney Point aquifer in Hurlock has an approximate thickness of 75-80 feet. Based on data used for modeling this aquifer by the Maryland Geological Survey (Williams, 1979), the approximate transmissivity of the Piney Point aquifer at Hurlock is 750 ft^2 / day. The ground water flow direction is towards the southeast. An estimated porosity range of the aquifer is between 25% - 30% (Fetter, 1988).

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. Since Hurlock's water supply comes from two types of aquifers, each aquifer type was delineated separately.

Delineation Zones – Unconfined Aquifer Wells (see Figure 2):

According to Maryland's Source Water Assessment Plan document approved by EPA (MDE, 1999), systems using > 10,000 gallons per day (gpd) located in unconfined Coastal Plain aquifers are to be delineated using the EPA's WHPA Code ground water model. WHPAs for the wells utilizing the unconfined Quaternary aquifer were originally delineated in 1995 by MDE as part of a Wellhead Protection Plan for the Town of Hurlock. Based on pumpage records from 1994-1996, the daily average quantity of water pumped by Hurlock's Well No. 3 was 208,000 gpd (27,861 ft^3 / day). This was the quantity that was used for the original WHPA delineation. To determine if the original WHPA requires adjustment, pumpage records from 1998-1999 were reviewed. The daily average quantities of water pumped by Well No. 3 for the past two years was about 205,000 gpd. Therefore, no revision to the original WHPA delineated for Well No. 3 is necessary at this time. For Hurlock's Well No. 1, the backup well, 162,000 gpd (21,678 ft^3 / day) was used for the delineation. This quantity is based on the well yield (300 gpm) and a maximum daily time of operation of 9 hours. The resulting WHPA provides protection should the Town need to rely on Well No. 1 as a main source of water.

Zone 1: Zone 1 is the WHPA delineated using a 1year time-of-travel (TOT) criterion. Zone 1 serves as the first zone of protection. The one-year criterion was selected based on the maximum survival times of microbial organisms in ground water. Zone 1 WHPAs were produced for each of Hurlock's unconfined wells (Figure 2). Note that each of the Zone 1 WHPAs is circular with diameters ranging from 700 to 800 feet.

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 the ground water). Zone 2 provides adequate time for facilities outside the WHPA to address chemical contamination before it reaches the wells.

Zone 2 WHPAs were delineated for each of Hurlock's unconfined wells (Figure 2). Note that each of the WHPAs is circular with diameters ranging from 1,800 to 2,000 feet respectively. The combined area for each of the Zone 2 WHPAs is 134.5 acres.

Delineation Zone – Confined Aquifer Well (see Figure 2)

Based on the methodology described in Maryland's Source Water Assessment Plan (SWAP), wells drilled into confined aquifers in the Coastal Plain pumping an average of > 10,000 gpd are to be delineated using a volumetric equation referred to as "The Florida Method". The method is used to calculate the volume of aquifer needed to store the quantity of water pumped from the well for a 10-year period. The equation is as follows:

$$r = \sqrt{\frac{Qt}{\pi n H}}$$

where: r = calculated fixed radius (ft)
Q = pumping rate of well (ft^3 / yr.)
n = aquifer porosity (dimensionless)
H = length of well screen (ft)
t = time of travel (yr.)

The pumpage for Well No. 4 used for determining the WHPA is 280,000 gpd (13,663,102 ft^3 / yr.). This is the permitted daily average quantity determined by the MDE Water Rights Division. Based on the lithology of the aquifer, a porosity of 30% was assumed for it. The screen length of Well No. 4 is 78 feet. According to the SWAP document, a 10-year TOT will provide an adequate protection area for the assessment. For Hurlock's Well No. 4: Q = 13,663,102 ft^3 / yr.; n = 0.30; H = 78 ft; t = 10 yrs. Solving the above equation, the calculated fixed radius r = 1363 ft.

The confined aquifer WHPA is shown in Figure 2. This WHPA has an area of 134 acres. Note that the protection area for assessment purposes is located at the aquifer below the land surface. Diagram 1 is a visual illustration of the actual WHPA for confined aquifers in the Coastal Plain.

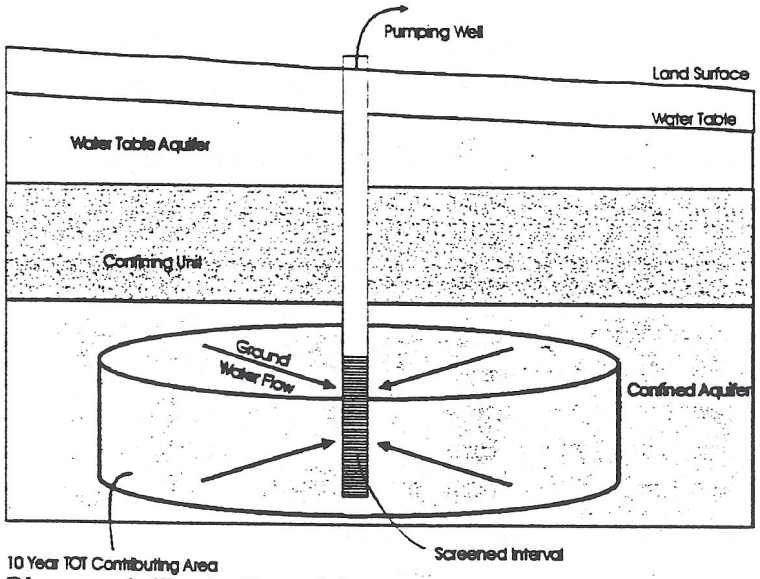

Diagram 1. Illustration of the WHPA for confined aquifers in the Coastal Plain

POTENTIAL SOURCES OF CONTAMINATION

Several potential point sources of contamination were identified in the 1995 Wellhead Protection study (MDE, 1995). That study included WHPAs for another large water user in Hurlock, the Allen Family Foods Inc. facility. The sources that are within the Hurlock WHPAs are included in this assessment. A separate detailed Source Water Assessment report is being prepared for the Allen Family Foods, Inc. facility.

For this assessment, MDE Waste and Water Management databases were reviewed, staff consulted, and field inspections conducted, to identify potential sources of contamination in and around the Hurlock WHPAs. In addition, on December 15, 1999, MDE staff completed a field survey of the Hurlock WHPAs and wells, and interviewed the Superintendent of Public Works for the Town of Hurlock, Mr. Frank Wright, regarding any water quality concerns and potential ground water contamination sources in the area. The primary water quality concern cited by Mr. Wright was high nitrate levels. This will be discussed in detail later in the report.

The contamination sources that were investigated include: Underground Storage Tanks (USTs), Leaking Underground Storage Tanks (LUSTs), ground water discharge permits, hazardous waste sites, ground water contamination sites, solid waste facilities, and pesticide dealers. Table 2 lists the facilities identified within the WHPAs and their potential source of contaminants. The potential contaminant group shown in Table 2 is volatile organic compounds (VOCs).

ID	TYPE	SITE NAME	ADDRESS	POTENTIAL CONTAMINANT
1	UST	E&L Market and Deli	100 South Main St.	VOC
2	UST	Exxon	Delaware & Railroad Ave.	VOC
3	LUST	CITGO (Formerly Hurlock Quick Shop)	Delaware & Railroad Ave.	VOC

Table 2. Potential contaminant point sources within Hurlock WHPAs (see Figure 2 for locations)

MDE's Oil Control Program investigated an UST site on 10/26/96 at the E&L Market and Deli (Case No. 97-0716DO). It was determined that the 3 USTs had leaking pipe connection fittings. The fittings were replaced and leak tested, repairs were completed, and the surrounding soils were inspected. No soil contamination was observed. The case was closed on 3/13/98 with no reported problems.

An UST site at the Hurlock Exxon was investigated for ground water contamination by the MDE Oil Control Program in 1994 (Case No. 95-0410DO). A test-boring program was initiated by the station owner to explore the soil and ground water conditions at the site. Six monitoring wells were installed to detect the presence of petroleum hydrocarbons in the ground water. Petroleum and kerosene tanks were removed and replaced by those meeting current state regulations. Surrounding contaminated soils have been remediated. Sampling results have shown a reduction of hydrocarbon detects over time. Therefore, the Oil Control Program closed the case on 9/24/99.

An open LUST case (No. 92-2173DO) is currently under investigation by the Oil Control Program at the Citgo Gas Station (formerly Hurlock Quick Shop) on Delaware and Railroad Avenues. Between 1995 and 1996, there was a kerosene release from a leaking pipeline that contaminated ground water. Monitoring wells were installed on-site and on-going remediation efforts are in-place.

Currently, there are no ground water discharge permits within Hurlock's WHPAs. A field inspection of the area within and near the WHPAs was conducted to determine the potential of any non-permitted ground water discharges to the Quaternary aquifer. Several commercial facilities located near the WHPAs were inspected – 3 food processing facilities, 4 vehicle repair facilities, an auto supply facility, a refrigeration repair company, an oil supply company, and the Town of Hurlock Waste Water Treatment Plant. One Notice of Violation (NOV) was issued to a vehicle repair facility for an open floor drain. The location of the facility is shown on Figure 2. The facility's drain was closed and sealed on February 12, 1999.

A review and consultation with other MDE Waste Management Administration Program files and personnel was conducted. Currently, there is no record of any hazardous waste sites, solid waste facilities, ground water contamination sites or pesticide dealers within the Hurlock WHPAs.

Pesticides and herbicides used in agriculture are potential non-point sources of contamination. The close proximity of Well No. 3 to nearby cropland has resulted in periodic detects of synthetic organic compounds (SOCs) at Plant No. 3. The town has expressed interest in purchasing the nearby farmland to help protect Hurlock's water supply (see Management Section). The location of the land is shown in Figure 1.

Based on the Maryland Office of Planning's 1997 Land Use Map, the land use within the unconfined WHPAs is as follows:

LAND USE	TOTAL AREA (Acres)	PERCENT OF WHPA
Low Density Residential	3.0	2
Medium Density Residential	75.6	56
Commercial	33.0	25
Industrial	0.5	<1
Cropland	22.4	17

Table 3a. Land use summary within WHPA Zone 2 for the unconfined wells

The land use within the confined aquifer WHPA is as follows:

LAND USE	TOTAL AREA (ACRES)	PERCENT OF WHPA
Medium Density Residential	53.7	40
Commercial	40.1	30
Industrial	1.8	1
Open Urban Land	1.4	1
Cropland	37.0	28

Table 3b. Land use summary within the WHPA for the confined well

The breakdown of land use within the WHPA Zones is shown in Figure 3. Note that within the Zone 1 WHPAs, the largest percentage of land use is medium density residential, followed by commercial, then agricultural land.

A review of the Maryland Office of Planning 1994 Dorchester County Sewerage Coverage Map shows that 100% of land area within the WHPA Zones is in the sewer service area (Figure 4).

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 data described is from the finished (treated) water unless otherwise noted. The treatment currently used at Hurlock is blending (Well Nos. 3 & 4), hypochlorination (Well No. 1) and gaseous chlorination (Well Nos. 3 & 4) for disinfection, and pH adjustment for corrosion control. The pH adjustment is through the addition of soda ash. A review of the monitoring data since 1994 for Hurlock's finished water indicates that the system's water supply meets the drinking water standards.

Inorganic Compounds (IOCs)

The water from Well Nos. 3 and 4 is blended to reduce the high nitrate levels from Well No. 3 with water low in nitrates from Well No. 4. The only inorganic compound that has been detected above the 50% maximum contaminant level (MCL) since 1994 is nitrate. Tables 4a and 4b summarize the nitrate detects above the 50% MCL since 1994 for Plant Nos. 1 and 3.

CONT.ID	CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
1040	NITRATE	10	04-Apr-94	5.6
1040	NITRATE	10	19-Sep-96	7.3
1040	NITRATE	10	14-Oct-98	6.8
1040	NITRATE	10	13-Apr-99	6.3

Table 4a. IOC results above 50% MCL for Hurlock Plant 1 (Well 1) finished water since 1994

CONT. ID	CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
1040	NITRATE	10	04-Apr-94	9.6
1040	NITRATE	10	22-Dec-95	7.8
1040	NITRATE	10	29-Apr-96	7.0
1040	NITRATE	10	12-Jun-96	6.9
1040	NITRATE	10	19-Sep-96	7.3
1040	NITRATE	10	04-Dec-96	6.9
1040	NITRATE	10	20-Feb-97	6.1
1040	NITRATE	10	20-Nov-97	7.0
1040	NITRATE	10	06-Feb-98	8.8
1040	NITRATE	10	12-Feb-98	10.7
1040	NITRATE	10	06-May-98	5.2
1040	NITRATE	10	30-Nov-98	6.3
1040	NITRATE	10	20-May-99	6.5
1040	NITRATE	10	26-Oct-99	7.6

Table 4b. IOC results above 50% MCL for Hurlock Plant 3 (Wells 3 & 4) finished water since 1994

The MCL for nitrate is 10 ppm. Prior to the addition of water supplied by Well No. 4, and the removal of Well No. 2 from the system, the average nitrate value between 1986 and 1990 was 8.8 ppm. Since 1994, the average nitrate value is 7.0 ppm.

Sodium was detected at Plant No. 3 at 110 ppm (4/29/96) and at 95.6 ppm (5/20/99). There is currently no MCL or secondary MCL established for sodium at this time. The source of the elevated sodium is from Well No. 4 in the Piney Point aquifer.

Barium was detected at Plant No. 3 at 0.18 ppm on 5/20/99. The MCL for barium is 2 ppm. Barium occurs naturally within the aquifer sediments.

Sulfate was detected at Plant No. 3 at 24.6 ppm (4/29/96) and at 18.1 ppm (5/20/99). Sulfate is an unregulated IOC and has a secondary MCL of 250 ppm. Sulfate is a naturally occurring compound within the aquifer sediments.

Fluoride was detected at Plant No. 3 at 1.1 ppm (12/22/95), at 0.93 ppm (4/29/96), and at 0.52 ppm (5/20/99). The secondary MCL for fluoride is 2 ppm. Fluoride treatment was previously used at Plant No. 3 through 1998. Currently, there is no fluoride treatment at Hurlock. Fluoride is naturally occurring within the deeper Piney Point aquifer sediments.

Volatile Organic Compounds (VOCs)

No VOC detects have been reported over the past six years of sampling data.

Synthetic Organic Compounds (SOCs)

The only SOC that has been detected above the 50% MCL since 1994 is alachlor. Table 5 summarizes the alachlor detects above the 50% MCL for the water plant for wells Nos. 3 and 4 since 1994.

CONT. ID	CONTAMINANT NAME	MCL (ppb)	SAMPLE DATE	RESULT (ppb)
2051	ALACHLOR	2	29-Apr-96	1.3
2051	ALACHLOR	2	21-Jan-97	1.2
2051	ALACHLOR	2	06-Feb-98	1.0
2051	ALACHLOR	2	12-Feb-98	1.3
2051	ALACHLOR	2	20-May-99	1.0

Table 5. SOC results above 50% MCL for Plant 3 (Well 3), finished water since 1994

The MCL for alachlor is 2 ppb. The Delaware Ave. water plant for Well Nos. 3 and 4 has been sampled regularly for alachlor since 1996. Dinoseb was detected from Well No. 3 at 1.8 ppb (11/7/96) and at 0.14 ppb (5/2/99). The MCL for dinoseb is 7 ppb. A pesticide survey conducted by MDE in September 1994 at Well No. 3 showed no pesticide detects.

Radionuclides

Gross alpha was not detected. Radon-222 was detected at Plant No. 1 on 4/4/94 at 175 pCi/L. At Plant No. 3, radon-222 was detected at 240 and 185 pCi/L (4/4/94), and at 195 pCi/L on 11/17/97. There is currently no MCL for radon-222, however EPA has proposed a MCL of 4,000 pCi/L. MDE is waiting for EPA's final rule to determine how radon will be regulated for public water systems.

Microbiological Contaminants

Ground Water Under Direct Influence of Surface Water (GWUDI) sampling was conducted for Well No. 3 on 9/8/98. The results were negative for the presence of total and fecal coliform.

SUSCEPTIBILITY ANALYSIS

Hurlock Well Nos. 1 and 3 draw water from an unconfined aquifer. In general, water supplies in unconfined aquifers are susceptible to contamination from land use activities. Therefore, continued routine monitoring of contaminants is essential in assuring a safe drinking water supply. For Well No. 4, the clayey confining unit above the confined aquifer provides natural protection from contaminant sources and land use activities on the land surface (Diagram 1). However, the potential for direct injection of contaminants into the Piney Point aquifer is possible if abandoned wells are not properly sealed. Based on field inspections, there are no known unsealed abandoned wells within Hurlock's WHPAs. Therefore, Well No. 4 is **not** susceptible to contamination from land use activities. The contaminant groups discussed below apply to Well Nos. 1 and 3 only.

The criteria that was used to conduct the susceptibility analysis is as follows: (1) evaluation of available water quality data, (2) review of the potential contaminant sources within the WHPAs, (3) evaluation of the aquifer characteristics, (4) evaluation of the well integrity, and (5) evaluation of the likelihood of change to the natural conditions.

Inorganic Compounds (IOCs)

The Town of Hurlock's water supply is susceptible to nitrate contamination. Nitrate levels have periodically exceeded the 50% MCL threshold since 1994 (Tables 4a and 4b). Sources of nitrate can generally be traced back to land use. Fertilization of agricultural fields and residential lawns, and on-site septic systems are non-point sources of nitrate in ground water. Figure 3 shows cropland present within close proximity to Well No. 3. The figure also reveals that the Town is surrounded by cropland in all directions. Nitrates present in the water source are thus more likely related to agricultural fertilizers rather than from septic systems because 100% of the developed land is sewered in this area.

Volatile Organic Compounds (VOCs)

Review of the sampling data reported since 1994 indicates that no VOCs have been detected at Hurlock. However, as discussed earlier, two UST sites and one LUST site exist within Hurlock's WHPAs (Figure 2). According to the MDE Oil Control Program, the two UST cases are now closed, and thus are no longer considered a potential threat to the environment. The LUST case is still under investigation by the Oil Control Program. Monitoring well data indicates that ground water flow is to the east-southeast toward Wrights Branch Creek (Figure 2). This is consistent with the regional ground water flow in this area (see Hydrogeology section). The lack of VOC detects in sampling results at Plant No. 3 indicate that VOCs do not appear to be moving towards the wells. The Oil Control Program reports that ground water quality at this site has improved over time.

Additional USTs and LUSTs exist outside the WHPAs along the Commercial and Industrial strip (Nealson Street and Route 307) to the east of Hurlock's wells (Figures 2 and 3). Increased water pumpage demands at the Town could increase the WHPA Zone boundaries east toward Nealson Street. In addition, active commercial

poultry operations to the west of the Well No. 3 WHPA are present, where further potential VOC threats may exist (Figure 3). Increased water demands may result in additional USTs and LUSTs being within the WHPA. Currently, there is a potential VOC contaminant source (open LUST case) present within the WHPA. Well No. 3 draws water from a shallow unconfined aquifer. Therefore, Hurlock's water supply **is** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

The current land use indicates that non-point sources exist within the WHPA that could potentially contaminate the water supply with SOCs. Pesticides and chemicals used in agricultural operations and residential lawns are a potential threat. Sampling results since 1994 indicate that alachlor has been detected at levels above the 50% MCL threshold at Plant No. 3 (Table 5). Dinoseb was also detected periodically at Well No. 3 (see Water Quality section). Alachlor and dinoseb are herbicides sprayed on cropland. Dinoseb is also used as an insecticide. The close proximity of Well No. 3 to cropland makes this water source a potential threat. In addition, residential land makes up 58% of the unconfined aquifer WHPA (Table 3a). The application of chemicals for residential lawn maintenance is also a potential SOC threat. Based on the available sampling data, aquifer characteristics, and potential non-point sources, Hurlock's water supply **is** susceptible to SOC contamination.

Radionuclides

No gross alpha radiation was detected in water samples at Hurlock. Radon-222 was detected for Hurlock's water supply at both Plants (see Water Quality Section). However, these results are less than 50% of the 4,000 pCi/L MCL currently under consideration by EPA. The source of radon in ground water can be traced back to the natural occurrence of uranium in rocks. Based on existing sampling data, Hurlock's water supply is **not** susceptible to radiological contaminants.

Microbiological Contaminants

The only surface water body remotely close to Hurlock production Well No. 3 is Wrights Branch Creek, located approximately 2,000 feet to the east (Figure 2). Based on coliform sampling data, Hurlock Well No. 3 was determined **not** to be susceptible to protozoans or bacteriological contaminants. The wells may be susceptible to viral contaminants, as these are much smaller, can survive longer, and may not be as effectively filtered by the aquifer as protozoans and bacteria. Future monitoring will be needed to determine susceptibility to viruses.

MANAGEMENT OF THE WHPA

Form a Local Planning Team

- The team should represent all of the interests in the community. The water supplier, elected officials, the County Health Department, local planning agencies, local businesses, developers, farmers and residents within and near the WHPA should work together to reach a consensus on how to protect the water supply.

Public Awareness and Outreach

- The Town of Hurlock has already taken some positive steps to protect their water supply. After the original Wellhead Protection Study was completed, the Town notified all its water customers about the study and placed signs at the WHPA boundaries.
- Pamphlets, flyers and bill stuffers sent to local residents, businesses, and farmers will help to educate the general public about Wellhead Protection. An MDE pamphlet entitled Gardening in a Wellhead Protection Area is such an example.

Cooperative Efforts with Other Agencies

- Develop a plan with the Town's fire department and other emergency response personnel concerning proper spill response to protect ground water, particularly along the major highways and railway lines.
- Request the assistance of the University of Maryland Agricultural Extension Service, the Soil Conservation Service to work with the farming community to adopt Best Management Practices (BMPs) for farmland located within the WHPAs.

Monitoring

- Monitoring wells were drilled at the UST and LUST sites located within the Town's WHPAs along Delaware and Railroad Avenues to determine the level and extent of VOC contamination. The Town should stay in contact with MDE's Oil Control Program for updates on existing and new LUST cases.
- Installation of monitoring wells at UST sites not regulated by MDE may be considered to ensure that VOC contamination does not migrate to the supply wells.
- Due to the close proximity of cropland to the WHPAs, it is recommended that the Town monitors the nitrate values closely and continue sampling for nitrates quarterly.
- Due to the periodic detects of herbicides in sampling results it is recommended that at least annual sampling for SOCs at Well No. 3 be continued. Based on existing data, the sample should be collected in the first quarter to reflect the time period of highest levels detected at the water plant.
- Continue the current sampling schedule of VOCs and periodic sampling of radiological contaminants and other IOCs.

- Annual sampling for microbiological contaminants is a good check on well integrity.

Planning / New Development

- Adopt a local land use ordinance in cooperation with Dorchester County Planning and Zoning Department to protect water quality. The State of Maryland Wellhead Protection Ordinance may be used as a template.
- Planners should address future land use and recharge preservation with consideration to Wellhead Protection.

Land Acquisition

- A loan application was sent by the Town to MDE regarding the Safe Drinking Water Act State Revolving Fund loan program to purchase approximately 3 acres of cropland adjacent to the Plant No. 3 well site (Figure 1). MDE has approved and allocated funding for this property to protect the water quality of Well No. 3. The final loan agreement between MDE and Hurlock remains to be executed. The Town should be commended for their continued efforts toward protecting their drinking water supply.

Contingency Plan

- COMAR 26.04.01.22 regulations require all community water systems to prepare and submit for approval a plan for providing a safe and adequate drinking water supply under emergency conditions.

Changes in Uses

- Any increase in pumpage or the addition of new wells to the system will require revision of the WHPAs since they are affected by pumpage. The Town is required to contact the MDE Water Supply Program when an increase in pumpage is applied for and when proposed new wells are being considered.

Contaminant Source Inventory Updates / Well Inspections

- The Town should conduct its own detailed survey to ensure that there are no other potential sources of contamination within the WHPAs. Updated records of new development within the WHPA should be maintained.
- The Town should continue its annual inspections of the supply wells for preventative maintenance purposes and to ensure their integrity.

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MDE Waste Management Sites Database
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USGS 7.5 Minute Series Topographic Map, Federalsburg Quadrangle
Maryland Office of Planning 1997 Dorchester County Land Use Map
Maryland Office of Planning 1994 Dorchester County Sewerage Coverage Map

Figures

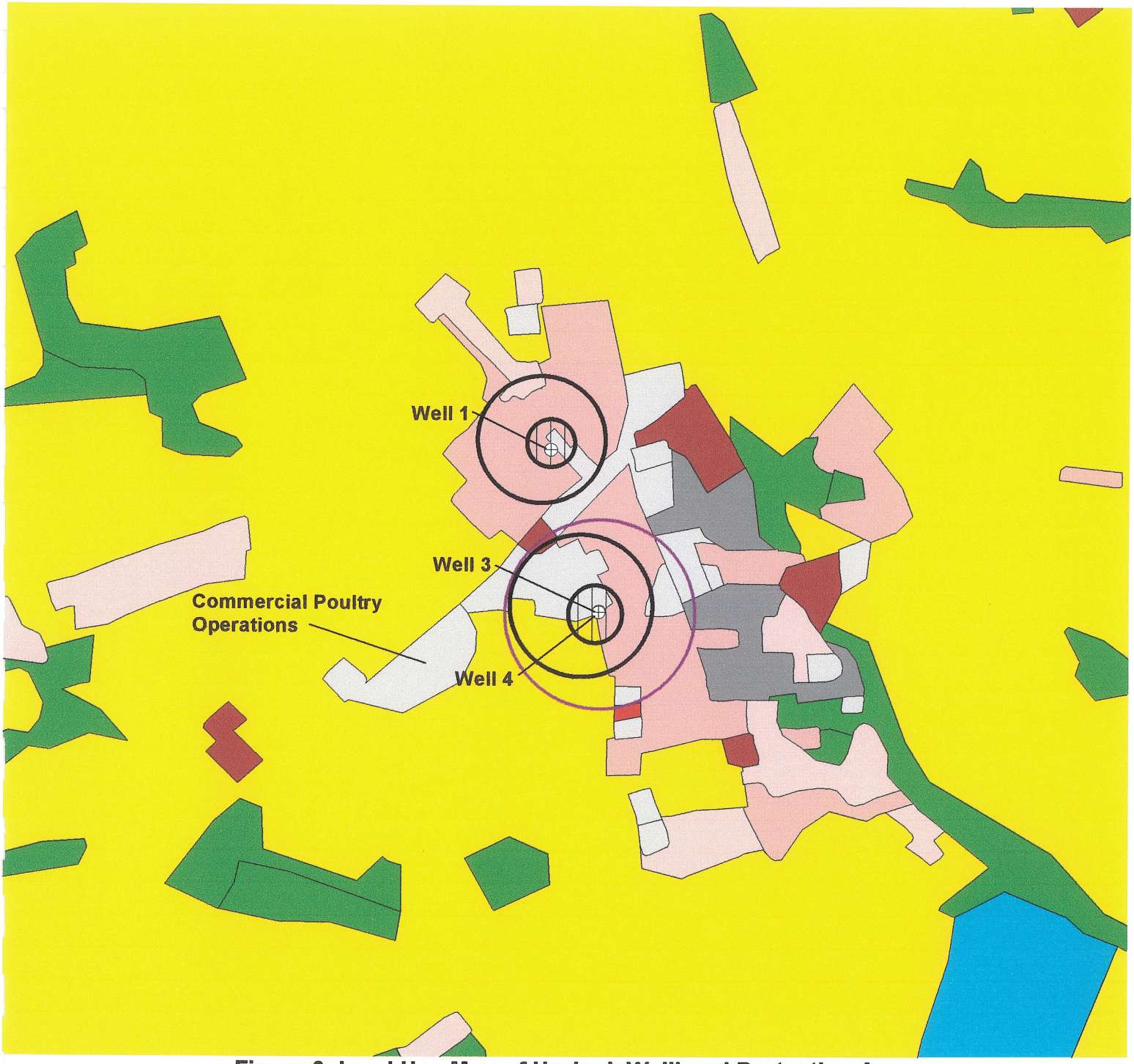

Figure 3. Land Use Map of Hurlock Wellhead Protection Areas

LEGEND

Land Use

- Low Density Residential
- Medium Density Residential
- Commercial
- Industrial
- Open Urban Land
- Cropland

Unconfined Aquifer WHPA Zones

- Zone 1
- Zone 2
- Confined Aquifer WHPA Zone
- Supply Wells

2000 0 2000 Feet

N

Source: MD Office Of Planning 1997 Dorchester County Land Use Map

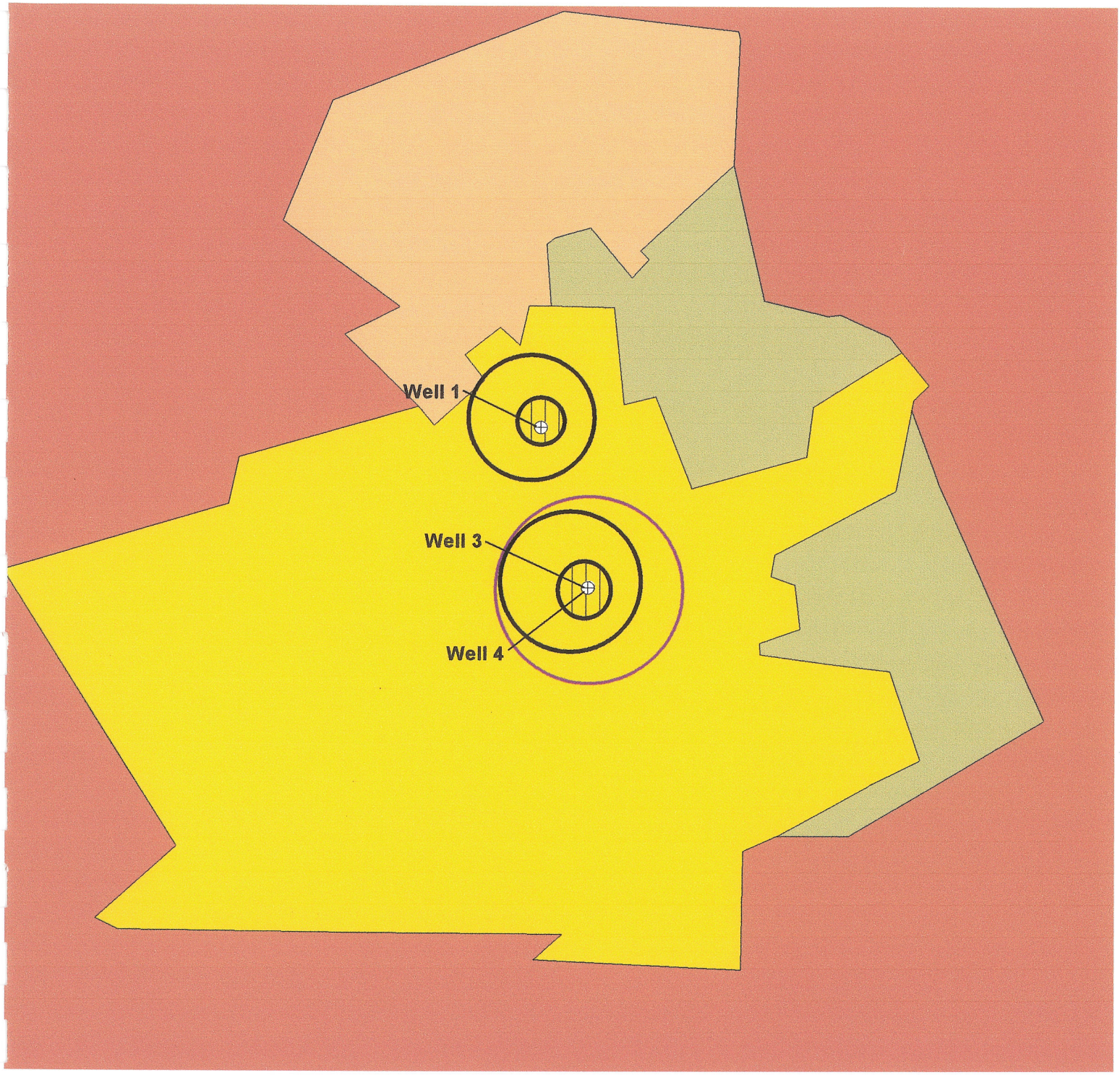

Figure 4. Sewer Service Area Map of Hurlock Wellhead Protection Areas

LEGEND

Sewerage Coverage
- No Planned Service Area
- Existing Service Area

Unconfined Aquifer WHPA Zones
- Zone 1
- Zone 2

Confined Aquifer WHPA Zone

⊕ Supply Wells

Source: MD Office of Planning 1994 Dorchester County Sewerage Coverage Map

2000 0 2000 Feet

N