Final

Source Water Assessment

for the

Forest Green Court Mobile Home Park Water System

Cecil County, Maryland

Prepared for:

Maryland Department of the Environment
Water Management Administration
Water Supply Program
1800 Washington Boulevard, Suite 625
Baltimore, Maryland 21230-1719

Prepared by:

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May 2003

Project No. 61726.01

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May 2003

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LIST OF ACRONYMS AND ABBREVIATIONS

AST	Aboveground Storage Tank
BMP	Best Management Practice
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CHS	Controlled Hazardous Substances
COMAR	Code of Maryland Regulations
CREP	Conservation Reserve Program
DWEL	Drinking Water Equivalent Level
ft	Foot/Feet
gal	Gallon(s)
gpd	Gallon(s) Per Day
gpm	Gallon(s) Per Minute
GPS	Global Positioning System
GWUDI	Ground Water Under Direct Influence
IOC	Inorganic Compound
L	Liter(s)
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
mg	Milligram(s)
MGS	Maryland Geological Survey
MHP	Mobile Home Park
NPDES	National Pollutant Discharge Elimination System
pCi	Picocurie(s)
PWSID	Public Water System Identification
SDWA	Safe Drinking Water Act
SDWR	Secondary Drinking Water Regulations
SOC	Synthetic Organic Compound
SWAP	Source Water Assessment Plan
SWPA	Source Water Protection Area

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

µg	Microgram(s)
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WHPA	Wellhead Protection Area

EXECUTIVE SUMMARY

EA Engineering, Science, and Technology was tasked to perform a Source Water Assessment for the Forest Green Court Mobile Home Park (MHP) water system in Cecil County, Maryland. This water system is identified as Public Water System Identification (PWSID) 0070217 by the Maryland Department of the Environment (MDE). EA has performed this study under Purchase Order No. U00P3200205, as authorized by MDE.

The required components of this report as described in Maryland's Source Water Assessment Plan (SWAP) are:

- Delineation of the area that contributes water to the source
- Identification of potential sources of contamination
- Determination of the susceptibility of the water supply to contamination
- Recommendations for protecting the drinking water supply

The source of the Forest Green Court MHP's water supply is the Port Deposit Gneiss, which is an unconfined crystalline rock aquifer. The Source Water Protection Area (SWPA) for the five ground-water supply and two unused wells was delineated using the watershed delineation method for fractured bedrock wells. The area of the SWPA is based on land topography, nearby streams, and a calculation of the total ground-water contributing area during a drought. The SWPA is approximately 158 acres and is generally biased in the upgradient direction.

Potential point and non-point sources of contamination within the assessment area were identified based on site visits, a review of MDE's databases, and a review of sewer service area and land use maps. Septic systems and above ground heating oil, diesel, and gasoline storage tanks were observed within the SWPA. Croplands account for a significant portion of the SWPA and can be considered non-point sources of contaminants. Well information and water quality data were also reviewed.

The susceptibility analysis for the Forest Green Court MHP water supply is based on a review of the water quality data, potential sources of contamination, aquifer characteristics, and well integrity. It was determined that the Forest Green Court MHP water supply is moderately susceptible to radon-222, and has a low susceptibly to volatile organic compounds, synthetic organic compounds, inorganic compounds, other radionuclides, and microbiological contaminants.

Recommendations to protect the ground-water supply include creating a SWPA protection team, resident awareness, and communication with county officials about future planning and land use.

1. INTRODUCTION

EA Engineering, Science, and Technology was tasked to perform a Source Water Assessment for the Forest Green Court Mobile Home Park (MHP) water system in Cecil, Maryland. EA has performed this study under Purchase Order No. U00P3200205, as authorized by the Maryland Department of the Environment (MDE).

The Forest Green Court MHP water system serves the community of Forest Green Court MHP in Cecil County. The water treatment plant and the supply wells for the system are located within the development. The Forest Green Court MHP water system serves a population of 191 with 82 connections. The water is supplied by five active and two unused wells (Figure 1).

1.1 GROUND-WATER SUPPLY SYSTEM INFORMATION

A review of the well data and sanitary surveys of the system indicates that well numbers 2, 3, 4, 5, 6, and 7 were drilled in 1975, 1978, 1984, 1985, 1995, and 1998, respectively, in accordance with the State's current well construction standards, which were implemented in 1973. Wells 1, 3, 5, 6, and 7 have pumping rates of 4.2, 17, 2.7, 5, 15, and 15 gallons per minute (gpm), respectively. Wells 2 and 4 have pumping rates of 1,600 and 3,300 gpd. According to the MDE Public Water Supply Inspection Report for the water system dated August 2002, Wells 6 and 7 are not used. Table 1 contains a summary of the well construction data.

TABLE 1. WELL INFORMATION

Source ID	Source Name	Permit No.	Total Depth (ft)	Casing Depth (ft)	Aquifer
1	Forest Green 1	CE710294	329	57	Port Deposit Gneiss
2	Forest Green 2	CE730998	300	39	Port Deposit Gneiss
3	Forest Green 3	CE732755	165	77	Port Deposit Gneiss
4	Forest Green 4	CE811339	250	80	Port Deposit Gneiss
5	Forest Green 5	CE940422	500	100	Port Deposit Gneiss
6	Forest Green 6 (Unused Well)	CE940556	500	42	Port Deposit Gneiss
7	Forest Green 7 (Unused Well)	CE942552	200	36	Port Deposit Gneiss
8	Forest Green 8 (New Well)	CE945911	520	100	Port Deposit Gneiss

Each of the wells was completed approximately 0.5 to 2 ft above grade. All of the wellheads were observed secure and in good repair.

According to the MDE Public Water Supply Inspection Report for the water system dated August 2002, the operator of the water system is Domenic R. Inglisa, who is also the owner of the mobile home park.

Currently, the raw ground water is treated with sodium hypochlorite (bleach) for disinfection. The chlorinated water is stored in five 120-gal retention tanks. In addition, iron removal is achieved with calcite filtration. The finished water, after calcite filtration, is stored in one 2,000-gal, one 4,800-gal, and one 5,200-gal hydropneumatic tanks prior to distribution. According to Mr. Inglisa, Wells 6 and 7 are on a separate treatment system than the rest of the wells. This treatment system is located at the end of Deer Run Parkway and, when operating, uses oxidation and filtration.

1.2 HYDROGEOLOGY

Cecil County has two distinct physiographic provinces, the Piedmont and the Atlantic Coastal Plain, divided by the Fall Line. In the northern third of the county, Precambrian to early Paleozoic crystalline igneous and metamorphic rock of the Piedmont province are exposed at the surface. In the southern two-thirds of the county, the crystalline rocks are overlain by Coastal Plain deposits consisting largely of unconsolidated pebbly sand, sand, sandy clay, and clay. The deposits form a wedge-shaped mass of materials that range in thickness from inches along the Fall Line to as much as 1,600 ft in the southeastern corner of the County (Overbeck et al. 1958).

The ground water used by the Forest Green Court MHP is from production wells drilled into the Port Deposit Gneiss. The Port Deposit Gneiss Formation is described as a "moderately to strongly deformed intrusive complex composed of gneissic biotite quartz diorite, hornblende-biotite quartz diorite, and biotite granodiorite, with all rocks foliated and some strongly sheared" [Maryland Geological Survey (MGS) 1968].

The source of the ground water in Cecil County is from precipitation in the form of rainfall or snow melt. The water table in the aquifer generally mimics the surface topography. The availability of ground water in the crystalline rock of the area depends on the nature and distribution of secondary openings resulting from fracturing and weathering. The yield of a well in crystalline rock depends primarily on the amount of fracture openings penetrated by the well. The well yield range of 43 wells in the Port Deposit Gneiss ranges from 2 to 100 gallons per minute (gpm) with 35 percent of the wells having well yields greater than 10 gpm. The range of

specific capacity, which relates well yield to drawdown, of 43 wells in the Port Deposit Gneiss range from less than 0.1 to 4.0 gallons per minute per foot of drawdown (Otton et al. 1988).

2. DELINEATION OF THE AREA CONTRIBUTING WATER TO SOURCE

For ground-water systems, a Wellhead Protection Area (WHPA) is considered to be the Source Water Protection Area (SWPA) for the system. Consistent with the recommended delineation in the Maryland SWAP (MDE 1999), the watershed drainage area that contributes ground water to the supply wells methodology was used.

This original delineation shape was then modified by accounting for surface water bodies, topography, significant land features, and by using a conservative calculation of total ground-water recharge during a drought. For conservative purposes, a drought condition recharge value of 400 gpd per acre (or approximately 5.4 inches per year) was used to estimate the total ground-water contribution area required to supply the wells.

For Forest Green Court MHP, the current Water Appropriation Permit issued by the MDE Water Rights Division is for an average of 23,300 gpd for the total of the seven wells. To determine the total ground-water contribution area during a drought, the following equation was used:

Recharge Area (acre) = Average Use (gpd)/Drought Condition Recharge (gpd/acre)

From the equation above, the total ground-water contributing area during a drought is approximately 58 acres. The delineated SWPA is approximately 158 acres (Figure 2), and is therefore adequate to meet the average daily ground-water usage during a drought.

3. INVENTORY OF POTENTIAL CONTAMINANTS WITHIN THE DELINEATED AREA

A field survey was performed on 6 November 2002 to confirm potential sources of contamination identified in MDE databases near the ground-water wells. These databases include the Comprehensive Environmental Response, Compensation, and Liability Act Information System (CERCLIS), which includes National Priority List (Superfund) sites, Maryland Registered Underground Storage Tank (UST) sites, Maryland Leaking Underground Storage Tank (LUST) sites, landfills, pesticide dealers, ground-water discharge permits, Colonial Tanks, and Controlled Hazardous Substances (CHS) generator sites.

During the field survey, other sources of potential contamination not in the MDE databases were noted and the location was surveyed using a Global Positioning System (GPS) receiver for mapping purposes (Figure 2).

3.1 POINT SOURCES

Septic system drain fields were observed onsite. Septic system discharge could contain contaminants if there is insufficient treatment of biological contaminants such as coliforms and inorganic compounds such as nitrogen. Septic system discharge could also contain contaminants that the systems were not designed to treat, such as solvents and fuels.

A canine kennel, Captain's Quarters, exists to the east of the SWPA and holds a National Pollutant Discharge Elimination System (NPDES) permit. Permitted discharge of contaminants from this nearby outfall has the potential to introduce contaminants such as nitrogen compounds and bacteria into the ground-water aquifer.

Several 275-gal above ground residential heating oil tanks (ASTs) were observed throughout the development. Failure of an AST may impact the ground water with petroleum hydrocarbons. However, the owner of the development discourages residents from utilizing heating oil due to the risk to ground water.

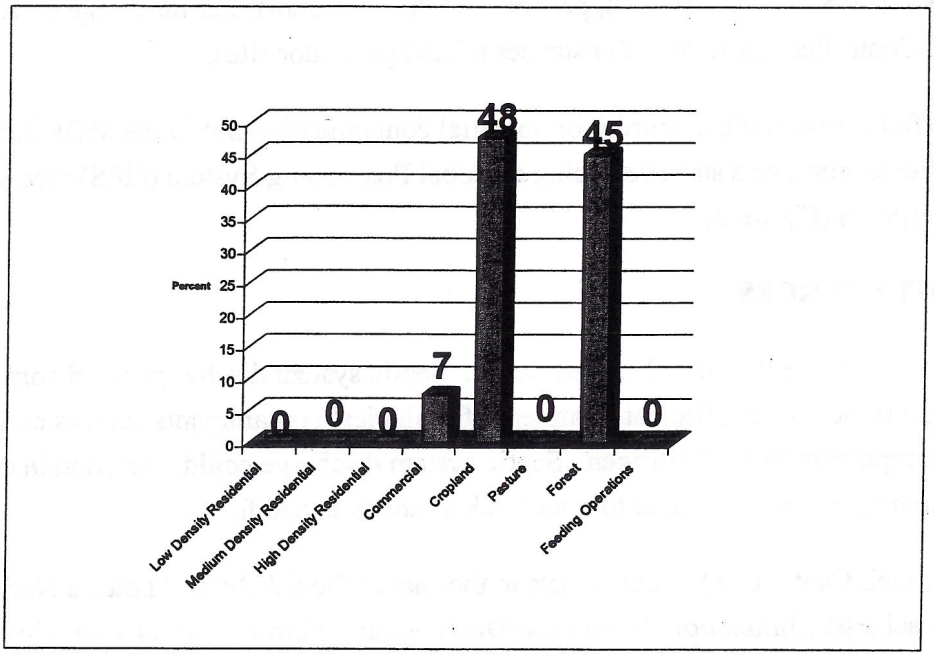
Diesel and gasoline ASTs exist in the vicinity of the owner's residence at the subject site. Mr. Inglisa has installed secondary containment structures around each of the fuel ASTs to protect the ground-water supply and environment. Failure of secondary containment devices in the event of a spill may impact the ground water with petroleum hydrocarbons.

The CSX railroad line that runs through the northern property boundary is a concern in the event of a petroleum or chemical spill that occurs within the SWPA (Figure 2).

3.2 NON-POINT SOURCES

Using the Maryland Office of Planning's 2000 Land Use/Land Cover map for Cecil County, potential non-point sources within the SWPA were also evaluated by land use designation (Figure 3). A summary of the percent and acreage of each type of land use is presented in the graphs below:

PERCENTAGE OF EACH LAND USE TYPE



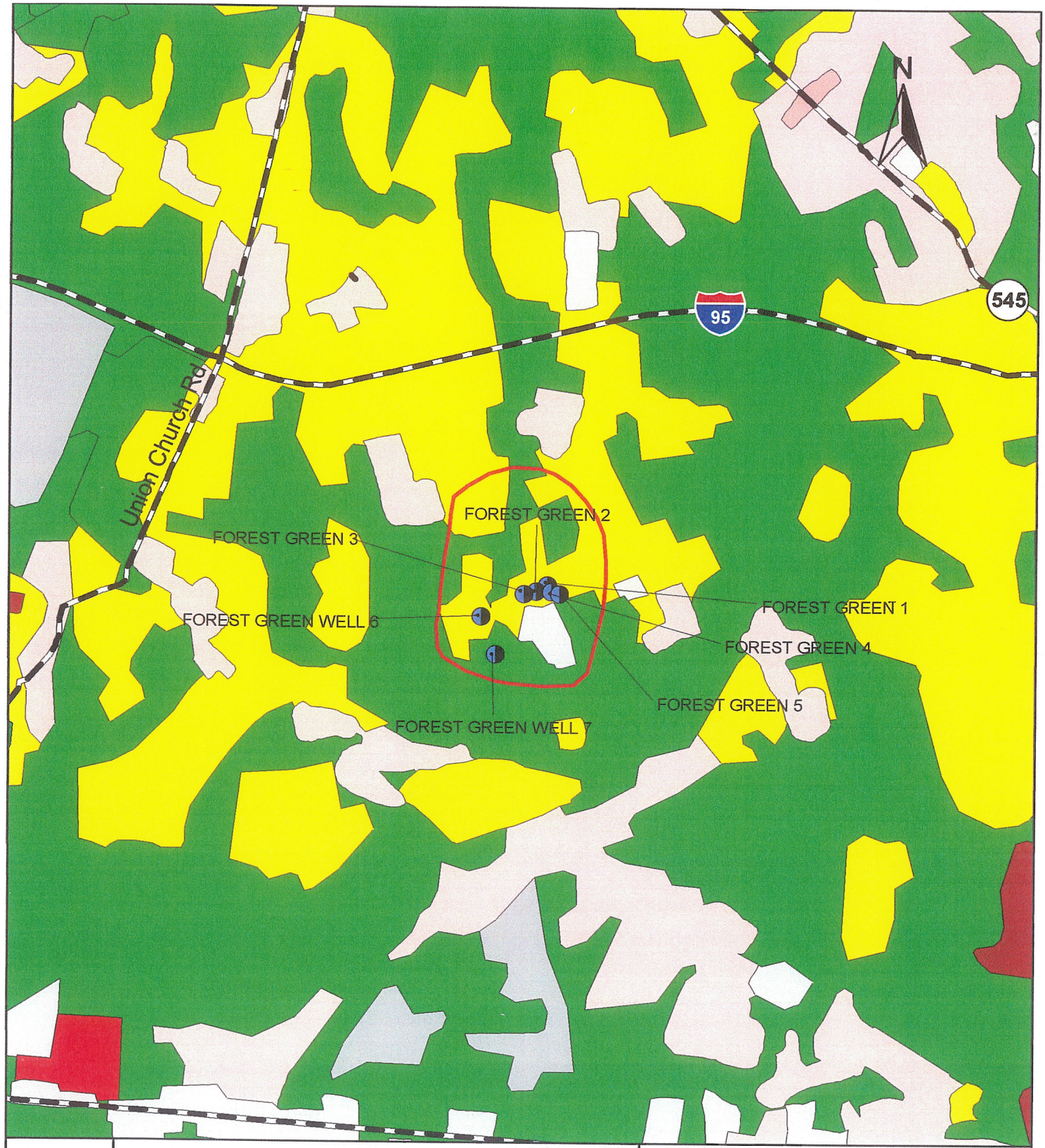


Figure 3. Forest Green Court MHP Land Use Map of the Source Water Protection Area

Source Water Assessment Program
2003

Scale: 1000 0 1000 2000 Feet

Source: Maryland Office of Planning, 2000.

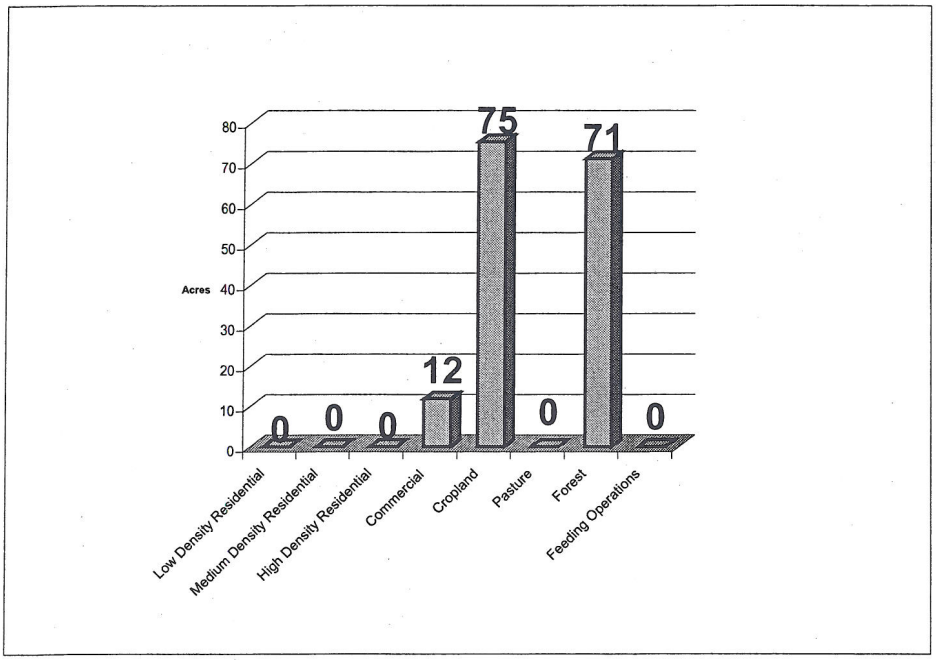
Legend:

- MHP Wells
- SWPA Boundary
- Major Roads

Land Use

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Industrial
- Extractive
- Cropland
- Pasture
- Forest

ACREAGE OF EACH LAND USE TYPE



From an interpretation of the figures above, cropland (75 acres) account for over one-half of the SWPA (158 acres). The use of fertilizers and pesticides on croplands is common. Therefore, there is potential for the migration of potential contaminants into the ground water.

Using the 1993 Maryland Office of Planning's Cecil County sewerage coverage, potential non-point sources from other septic system users in the SWPA were assessed (Figure 4). By overlaying the SWPA on the sewerage coverage layer in ArcView GIS, it was determined that approximately 80 percent of the SWPA does not have public sewer service, approximately 12 percent is either on public sewer service or is under construction, and approximately 8 percent is programmed for service within 5 years.

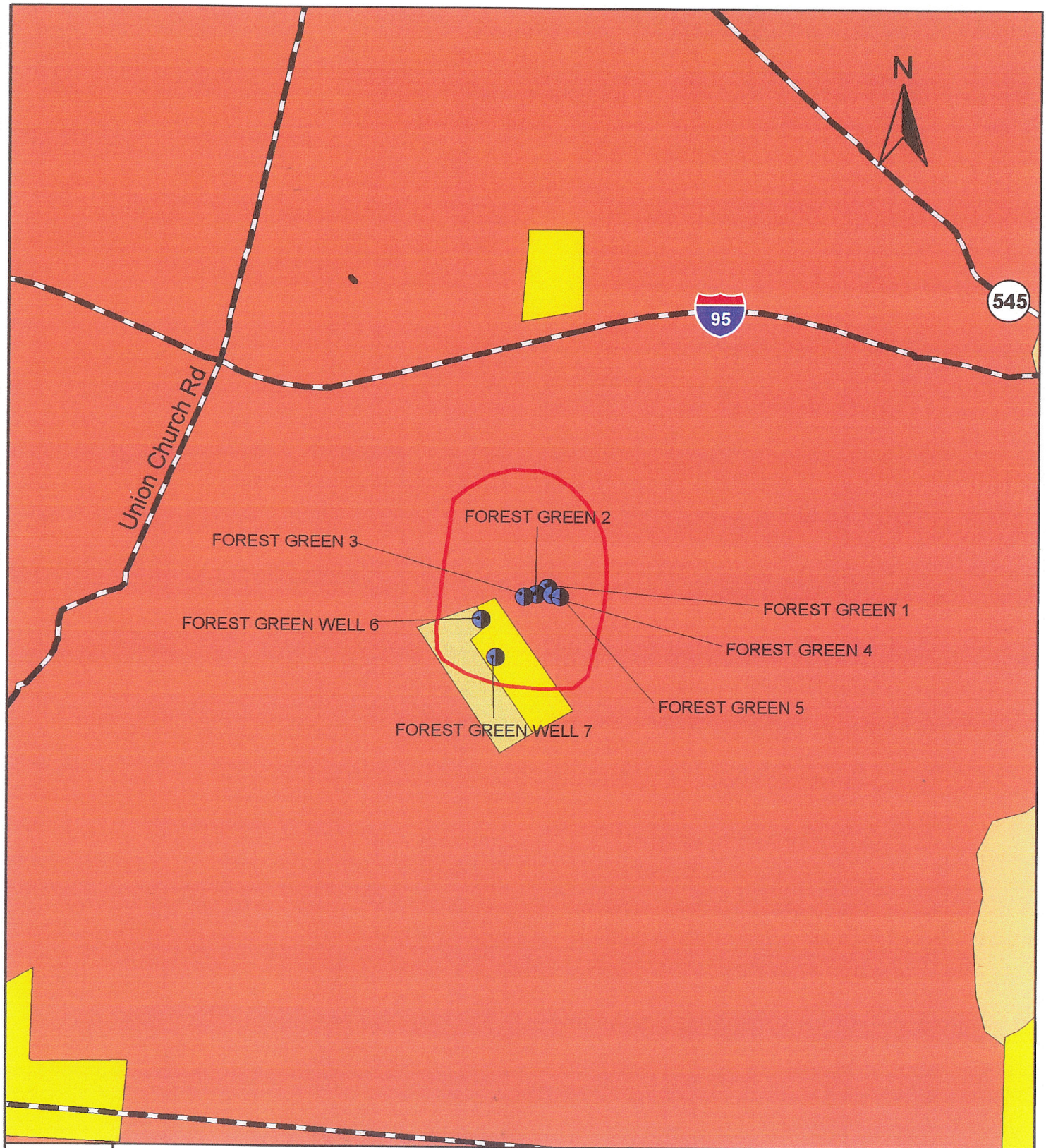


Figure 4. Forest Green Estates MHP Sewer Service Map of the Source Water Protection Area

Source Water Assessment Program
2003

Legend:

MHP Wells

SWPA Boundary

Major Roads

Sewer

No planned service area

Existing service area

Area programmed for service within 5 years

Area programmed for service within 5 to 10 years

Source: Maryland Office of Planning, 1993.

Scale: 1000 0 1000 2000 Feet

4. REVIEW OF WATER QUALITY DATA

Water quality data was obtained from the MDE Water Supply Program database of Safe Drinking Water Act (SDWA) contaminants. The results reported are for finished (treated) ground water (unless noted).

A review of the water quality data from 1990 to 2002 has been performed for Forest Green Court MHP's finished water samples. All detected compounds from ground-water samples collected are shown in Appendix A.

Ground-water analytical results were compared to 50 percent of the United States Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) or the USEPA Secondary Drinking Water Regulations (SDWR). If no MCL or SDWR is available, the Drinking Water Equivalent Level (DWEL) was substituted as recommended by the USEPA Office of Water.

4.1 GENERAL WATER QUALITY PARAMETERS

No general water quality parameters were reported in the ground-water samples above 50 percent of the comparison criteria.

4.2 VOLATILE ORGANIC COMPOUNDS

No volatile organic compounds (VOCs) were reported in the ground-water samples above 50 percent of the USEPA MCL.

The disinfection by-products bromodichloromethane, chloroform, and dibromochloromethane (commonly known as trihalomethanes) were reported in the water samples in August 1997 and April 2001 and individually ranged in concentration from 0.6 to 0.9 µg/L. Effective 1 January 2004, the MCL for total trihalomethanes will be 80 µg/L.

4.3 SYNTHETIC ORGANIC COMPOUNDS

No synthetic organic compounds (SOCs) were reported in the ground-water samples above 50 percent of the USEPA MCL.

Only one SOC, di(2-ethylhexyl)phthalate, was reported in the October 2000 water sample (1.1 µg/L). Di(2-ethylhexyl)phthalate is commonly found as a laboratory cross contaminant and has an MCL of 6 µg/L.

4.4 INORGANIC COMPOUNDS

No inorganic compounds (IOCs) were reported in the ground-water samples above 50 percent of the USEPA MCL. The highest reported concentration of nitrate was less than 1 mg/L.

4.5 MICROBIOLOGICAL CONTAMINANTS

No total or fecal coliform has been detected in ground-water samples of the water system's finished water from January 1997 to August 2002.

To assess the potential of Ground Water Under the Direct Influence (GWUDI) of surface water, ground-water sampling records (during dry and storm conditions) in MDE databases were assessed and information from Public Water Supply Inspection Reports were reviewed.

Surface water that directly recharges the aquifer through major fractures in rock does not pass through the soil overburden that both filters and contains beneficial microorganisms that break down potential contaminants. If significant variances in the ground water results from dry and storm conditions are observed, it is possible that the ground water is under the direct influence of surface water.

From an assessment of the results of the GWUDI sampling by MDE on 18 August 1998, the ground-water supply for Forest Green Court MHP is not under the direct influence of surface water.

4.6 RADIONUCLIDES

One radionuclide, radon-222, was reported above the more conservative proposed MCL of 300 picocuries per liter (pCi/L) in one water sample collected as shown in Table 2 below:

TABLE 2. SUMMARY OF RADON-222 ANALYSIS

Plant ID	Sample Date	Contaminant Name	Result	Unit
01	11-Oct-00	Radon-222	1,185	pCi/L

The MCL used for comparing detections of Radon-222 was 300 pCi/L. This MCL is a proposed MCL established by USEPA since there is no current MCL for this contaminant (USEPA 1999). However, if a State has a program to address the more significant risk from radon in indoor air, than 4,000 pCi/L can be used as an alternate MCL. For the purpose of this investigation, the more conservative number was utilized.

5. SUSCEPTIBILITY ANALYSIS

To evaluate the susceptibility of the ground-water source to contamination, the following criteria were used:

1. available water quality data
2. presence of potential contaminant sources in the SWPA
3. aquifer characteristics
4. well integrity
5. the likelihood of change to the natural conditions

The aquifer that supplies Forest Green Court MHP's drinking water is an unconfined aquifer.

For the Susceptibility Analysis in this report, rankings of "high," "moderate," and "low" susceptibility to contamination were utilized after a review of current information. However, other SWAP reports for the State of Maryland also utilized rankings of "is," "may be," and "is not" susceptible to contamination. For consistency between the ranking systems, the following details their equivalence. The ranking of "highly susceptible" is equivalent to "is susceptible," "moderately susceptible" is equivalent to "may be susceptible," and "low susceptibility" is equivalent to "is not susceptible."

5.1 VOLATILE ORGANIC COMPOUNDS

No VOCs were reported above 50 percent of the MCL.

The only VOC reported in any of the water samples analyzed were the likely chlorination disinfection by-products collectively known as trihalomethanes. The reported trihalomethanes could be the result of the disinfection process using sodium hypochlorite (bleach). The reported concentrations were well below the MCL of 100 µg/L.

While a gasoline storage tank was observed within the SWPA, the tank was observed to be in good condition and has secondary containment in the event of a release.

Based on the water quality data reviewed and the absence of observed or reported facilities that may cause VOC contamination in the SWPA, the water supply at Forest Green Court MHP has a low susceptibility to VOCs.

5.2 SYNTHETIC ORGANIC COMPOUNDS

No SOCs were reported in the ground-water samples above 50 percent of the USEPA MCL.

Only the SOC di(2-ethylhexyl)phthalate was reported in one water sample at a level well below the MCL, and is most likely the result of laboratory cross-contamination.

The only point sources that may impact the ground water with SOCs within the SWPA are from heating oil and a diesel tank observed onsite. The diesel tank also was observed to be in good condition with secondary containment.

The possible use of fertilizers, herbicides, and pesticides on croplands, which accounts for approximately 48 percent, within the SWPA can be considered a potential non-point source for SOCs. However, no SOCs common to pesticides and herbicides have been reported in any of the water samples submitted for analysis. Most SOCs also have a high affinity to sorb to soil particles and are not likely to infiltrate into the ground-water aquifer. From the well information, the soil overburden above the bedrock aquifer is approximately 25 to 100 ft thick.

Based on the water quality data reviewed, the absence of point sources of SOCs, and the relatively thick soil overburden, the water supply at Forest Green Court MHP has a low susceptibility to SOCs.

5.3 INORGANIC COMPOUNDS

No inorganic compounds, including nitrate, were reported above 50 percent of the MCL.

Approximately 80 percent of the SWPA is not served by public sanitary sewer systems and residential and commercial areas use septic systems, which can cause nitrate pollution in ground water. Also, a kennel exists to the east of the SWPA and is likely to produce nitrogen pollution from animal boarding activities. However, no concentrations of nitrate have been reported above 1 mg/L. This may be a result of degradation of nitrate by naturally occurring organisms within the relatively thick soil overburden.

Based on the water quality data reviewed, the lack of point sources of IOCs, and the relatively thick soil overburden, the water supply at Forest Green Court MHP has a low susceptibility to IOCs.

5.4 RADIONUCLIDES

Radon-222 was reported above the more conservative proposed MCL of 300 pCi/L in the water sample collected in October 2000.

While the presence of radon-222 is generally attributed to decay of naturally occurring minerals like uranium in the metamorphic rock aquifer (Bolton 1996), the concentration of radon-222 is

higher than the more conservative proposed MCL. However, this proposed rule is not enforceable and MDE is waiting for the USEPA's final rule to determine how radon will be regulated for public water systems (USEPA 1999). Based on the water quality review and the aquifer characteristics, the water supply at Forest Green Court is moderately susceptible to radon-222 and has a low susceptibility to other radionuclides.

5.5 MICROBIOLOGICAL CONTAMINANTS

No coliform bacterium has been detected in the water samples since 1997. From an assessment of GWUDI ground-water results by MDE, the ground-water supply for Forest Green Court MHP is not under the direct influence of surface water.

From documentation reviewed, six of the seven supply wells were constructed after 1973, the year that current well construction standards were required. All the wellheads were observed to be in good repair.

Based on the water quality review and the condition and construction of the wells, the water supply at Forest Green Court MHP has a low susceptibility to microbiological contaminants.

6. RECOMMENDATIONS FOR PROTECTING THE WATER SUPPLY

With the information contained in this report, Forest Green Court MHP has a basis for better understanding of the risks to its drinking water supply. Being aware of the SWPA, knowing potential contaminant sources, evaluating current and future development, working with agricultural producers and soil conservation agencies, and effective outreach and education are examples of management practices that will help protect the water supply.

Recommendations for the protection of the ground-water supply are intended for the mobile home park owner and its residents. Specific management recommendations for consideration are listed below.

6.1 PROTECTION TEAM

The management of the mobile home park should be aware of the SWPA limits and evaluate the possible effects to the quality of the ground water prior building or making any changes.

6.2 PUBLIC AWARENESS AND OUTREACH

The management of the mobile home park should consider discussing with property owners and businesses located within the SWPA activities that may have impacts to the ground water and its quality.

The management of the mobile home park should also consider sending pamphlets, flyers, or bill stuffers to its residents to educate them about the SWPA. An example pamphlet, "Gardening in a Wellhead Protection Area", is an example that is available from MDE. The residents should also be encouraged to notify the mobile home park management of any significant spills from gasoline or any other potentially hazardous substances.

Placing signs at the SWPA boundaries is an effective way to make the public aware of protecting their source of water supply, and to help in the event of spill notification and response.

The Executive Summary of this report should also be listed in the Consumer Confidence Report for the water system, and should also indicate that the report is available to the general public by contacting the MHP owner, the local library, or MDE.

6.3 PLANNING/NEW DEVELOPMENT

The mobile home park should also inform the Cecil County Health and Planning Departments of any concerns to future development or zoning changes of properties that are within the SWPA.

6.4 MONITORING

The management of the mobile home park should continue to monitor the ground water for all SWDA contaminants as required by MDE.

Annual raw water sampling for microbiological contaminants is a good way to check the integrity of the well.

Additional sampling for radiological contaminants (specifically radon-222) should be performed to monitor and document levels until the USEPA determines how to regulate the radionuclides in public water supplies.

6.5 CONTINGENCY PLAN

As required by the Code of Maryland Regulations (COMAR) 26.04.01.22, all water system owners are required to prepare and submit for approval a plan to provide safe drinking water under emergency conditions.

6.6 CHANGES IN USES

The management of the mobile home park should inform the Water Supply Program at MDE of any changes to pumping rates and when a change in the number of wells used is anticipated. Any changes to the pumping rate and/or the number of supply wells will affect the size and shape of the SWPA.

6.7 CONTAMINANT SOURCE INVENTORY UPDATES/INSPECTIONS

The management of the mobile home park should conduct its own survey of the SWPA to ensure that there are no additional potential sources of contamination.

A regular inspection and maintenance program of the supply wells should be considered to prevent a failure in the well's integrity, which may provide a pathway for contaminants to the aquifer.

Unused wells that are no longer connected to the distribution system should be abandoned and sealed as per COMAR 26.04.04.11. Unused wells can provide a pathway for contaminants to the aquifer.

Depressions around the wellheads should be filled and graded to prevent surface water ponding that may occur during rain events. This will help to prevent surface water infiltration into the well.

6.8 COOPERATIVE EFFORTS WITH OTHER AGENCIES

The management of the mobile home park may request the assistance of the University of Maryland Agricultural Extension Service, Soil Conservation Service to work with the nearby farmers to adopt Best Management Practices (BMPs) for cropland located within the SWPA.

The nearby farmers can also participate in the New Conservation Reserve Program (CREP) applicable to the cropland located within the SWPA. Government funding is available to qualified farmers equal to the cost and financial benefit of farming the area. The Natural Resources Conservation Service is responsible for determining the relative environmental benefits of each acre offered for participation.

7. REFERENCES

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3. Otton, E. G, R. E Willey, R. A McGregor, G. Achmad, S. N. Hiortdahl, J.M. Gerhart. 1988. *Water Resources and Estimated Effects of Ground-Water Development, Cecil County, Maryland.* United States Department of the Interior, Geologic Survey. Bulletin 34.

4. United States Environmental Protection Agency (USEPA). 2001. *A Small Systems Guide to the Total Coliform Rule.* Office of Water. EPA 816-R-01-017A. June.

5. United States Environmental Protection Agency (USEPA). 1999. *Proposed Radon in Drinking Water Rule.* Office of Water. EPA 815-F-99-006. October.

6. Maryland Geologic Survey (MGS). 1968. *Cecil County Geologic Map adapted from Maryland Geological Survey's Geologic Map of Maryland.*

SOURCES OF DATA

Water Appropriation and Use Database.
Public Water Supply Inspection Reports
Monitoring Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Maryland Office of Planning 2000 Harford County Land Use Map
Maryland Office of Planning 1993 Harford County Land Use Map
USGS Topographic 7.5 minute Quadrangle Map – 1992 North East, Maryland Quad
USGS Topographic 7.5 minute Quadrangle Map – 1992 Bay View, Maryland Quad
USGS Topographic 7.5 minute Quadrangle Map – 1992 Elkton, Maryland Quad
USGS Topographic 7.5 minute Quadrangle Map – 1992 Newark West, Maryland Quad

Appendix A

Detected Compounds in Ground-Water Samples

SUMMARY OF DETECTED COMPOUNDS IN FOREST GREEN COURT WATER SAMPLES				
Plant ID	**Sample Date**	**Contaminant Name**	**Result**	**Unit**
Volatile Organic Compounds				
01	14-Aug-97	BROMODICHLOROMETHANE	0.6	ug/L
01	03-Apr-01	BROMODICHLOROMETHANE	0.5	ug/L
01	14-Aug-97	CHLOROFORM	0.9	ug/L
01	03-Apr-01	CHLOROFORM	0.6	ug/L
01	14-Aug-97	DIBROMOCHLOROMETHANE	0.6	ug/L
Sythetic Organic Compounds				
01	11-Oct-00	DI(2-ETHYLHEXYL) PHTHALATE	1.1	ug/L
Inorganic Compounds				
01	01-Oct-93	BARIUM	0.103	mg/L
01	25-Nov-96	BARIUM	0.16	mg/L
01	09-Apr-98	BARIUM	0.18	mg/L
01	11-Oct-00	BARIUM	0.15	mg/L
01	01-Oct-93	FLUORIDE	0.23	mg/L
01	19-Sep-96	FLUORIDE	1.2	mg/L
01	25-Nov-96	FLUORIDE	0.16	mg/L
01	09-Apr-98	FLUORIDE	0.16	mg/L
01	11-Oct-00	FLUORIDE	0.17	mg/L
01	19-Sep-96	NITRATE	0.949	mg/L
01	16-Oct-00	NITRATE	0.06	mg/L
01	09-Apr-98	SODIUM	9.8	mg/L
01	11-Oct-00	SODIUM	9.64	mg/L
01	25-Nov-96	SULFATE	9.5	mg/L
01	09-Apr-98	SULFATE	10.6	mg/L
01	11-Oct-00	SULFATE	11.3	mg/L
General Water Quality Parameters				
01	25-Nov-96	pH	7.7	s.u.
Radionuclides				
00	11-Feb-97	GROSS BETA	1	pCi/L
01	11-Oct-00	RADON-222	1185	pCi/L

s.u. – standard units.