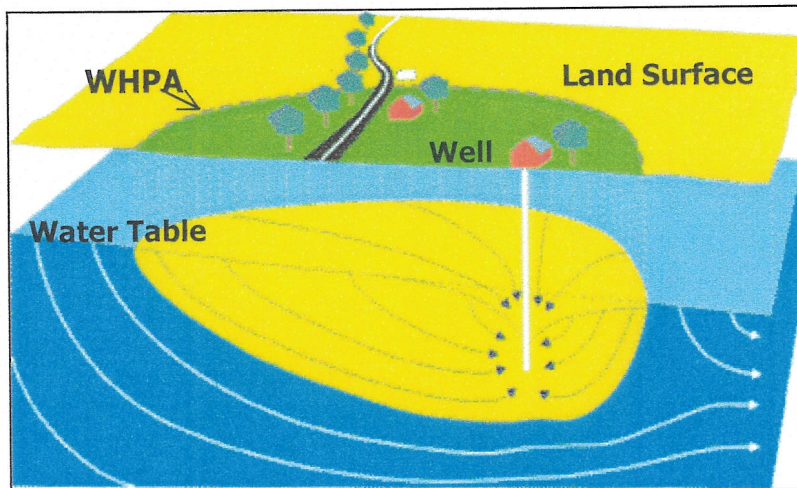


**SOURCE WATER ASSESSMENT**  
**FOR HILLANDALE MOBILE HOME PARK**  
**CARROLL COUNTY, MD**



**Prepared By**  
**Water Management Administration**  
**Water Supply Program**  
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## SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for Hillandale Mobile Home Park. 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 Hillandale Mobile Home Park's water supply is an unconfined fractured rock aquifer, known as the Upper Pelitic Schist of the Wisshickon Formation. The system currently uses four wells to obtain its drinking water. 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 Hillandale Mobile Home Park's 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 Hillandale Mobile Home Park's water supply is susceptible to contamination by nitrates, volatile organic compounds and radon, but not to synthetic organic compounds, microbiological contaminants, other inorganic compounds or other radionuclides.



## INTRODUCTION

The Hillandale Mobile Home Park is located about six miles southeast of the City of Westminster in Carroll County (figure 1). The mobile home park owns and operates its water supply system that serves 220 persons. The park is divided into two sections Hillandale II and I. Currently, Hillandale I is served by one well (No.1) and Hillandale II is served by two wells (Nos. 2 and 3). Hillandale II Well No. 1 recently went dry and is not in use. A new well for each section was recently drilled. These wells are being tested for required drinking water parameters prior to approval for public supply.

## 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. A review of well data and sanitary surveys of the water system indicates that Hillandale I Well No. 1 and Hillandale Well Nos. 1 and 2 were drilled prior to 1973, when the State's well construction regulations went into effect, and may not meet current construction standards. Hillandale Well No. 3 was drilled after 1973 and should meet construction standards for grouting and casing. The new wells drilled this year should also meet well construction standards. Well information is shown in Table 1 below.

PLANT ID	SOURCE ID	SOURCE NAME	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
01	01	Hillandale II Well No. 1	N/A	107	N/A	Prior to 1973
01	02	Hillandale II Well No. 2	N/A	90	N/A	Prior to 1973
01	03	Hillandale II Well No. 3	CL813493	300	95	1986
02	01	Hillandale I Well No.1	N/A	100	N/A	Prior to 1973

Table 1. Hillandale Mobile Home Park's Well Information.

The mobile home park has a Water Appropriation Permit that allows it to use an average of 14,000 gallons per day (gpd) and 16,000 gpd in the month of maximum use. Based on the reported pumpage between 1999 and 2001, Hillandale Mobile Home Park used an average of 12,560 gpd and 13,297 gpd in the month of maximum use.

## HYDROGEOLOGY

The Hillandale Mobile Home Park lies in the Piedmont physiographic province and is underlain by the Upper Pelitic Schist of the Wissahickon Formation. The Upper Pelitic Schist is an unconfined, fractured rock aquifer composed of albite-chlorite-muscovite quartz schist with sporadic thin beds of laminated micaceous quartzite (Cleaves, et al, 1968). In this type of setting, the underlying crystalline



rocks have negligible primary porosity and permeability and ground water is stored in and moves through fractures in the rocks. Ground water flow rates depend upon the openness of the fractures and their degree of interconnection. Unconsolidated overburden (saprolite) above the crystalline rock frequently has much greater primary porosity and permeability than the rock has, allowing additional ground water to be stored (Duigon, 1994). Ground water systems in crystalline rock tend to be localized and flow is within topographic divides towards the nearest perennial streams. (Bolton, 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 WHPA for Hillandale Mobile Home Park's water supply was delineated by the WSP. Hydrogeologic mapping was the method used for the delineation. This is the methodology recommended for fractured rock aquifers in the EPA approved Maryland's Source Water Assessment Plan (1999) for systems using an average of greater than 10,000 gpd from fractured rock aquifers.

It must be noted that another large public water system, Todd Village Mobile Home, is located adjacent to Hillandale and uses the same fractured rock aquifer as a source of water supply. Since the areas which contribute ground water to the wells for each system overlap a single larger WHPA was delineated for both systems. The delineated WHPA represents the recharge area for both Hillandale and Todd Village Mobile Home Park wells (figure 2). The WHPA is the watershed drainage area that contributes to the wells. The boundary of the WHPA is based on the ground water flow direction and ground water divides inferred from topography, ground water discharge areas and permitted withdrawal rates. The total area of the Hillandale Mobile Home Park WHPA is about 89 acres, which is sufficient to support the annual recharge needed to supply all the wells for both systems.

## **POTENTIAL SOURCES OF CONTAMINATION**

For this assessment, MDE Waste and Water Management databases and Carroll County's database were reviewed, and staff consulted, to identify potential sources of contamination in and around the WHPA. WSP staff conducted a field survey of the WHPA in March 2002 and met with Mr. Norman Rebert, owner of the water system, to discuss potential contamination sources and water quality concerns.

Onsite septic systems were the only potential contaminant sources in and around the WHPA (figure 2). Table 2 lists the sites and their potential types of contaminants. Potential contaminants are grouped as Nitrate/Nitrite (N) and Microbiological Pathogens (MP).

ID	Type	Site Name	Address	Potential Contaminant	Status
1	SEW	Gerstell Academy (under construction)	2604 Old Westminster Pike	NN, MP	Active
2	SEW	Todd Village Mobile Home Park	2636 Old Westminster Pike	NN, MP	Active
3	SEW	Todd Village Mobile Home Park	2636 Old Westminster Pike	NN, MP	Active
4	SEW	Todd Village Mobile Home Park	2551 Old Westminster Pike	NN, MP	Active
5	SEW	Todd Village Mobile Home Park	2551 Old Westminster Pike	NN, MP	Active

**Table 2. Potential Contaminant Sources within the WHPA (see figure 2 for locations).**

The Maryland Office of Planning's 2000 digital land use map for Carroll County was used to determine the predominant types of land use in the WHPA (figure 3). Table 2 shows the land use categories in the WHPA. A large portion of the WHPA is made of residential land (66%) followed by cropland (33%). It must be noted that about half the cropland is now part of a new school, Gerstell Academy that will be opening within six months.

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Low Density Residential	44.33	49.73
High Density Residential	14.30	16.05
Commercial	0.38	0.43
Cropland	30.05	33.72
Forest	0.06	0.07
Total	89.12	100.00

**Table 2. Land Use Summary for the WHPA.**

Residential areas may be a source of nitrates and SOC's if fertilizers and pesticides are not used carefully for lawns and gardens. Cropland is commonly associated with nitrate loading of ground water. Cropland represents a potential source of SOC's depending on fertilizing practices and use of pesticides.

A review of the Maryland Office of Planning's 1995 Carroll County Sewer Map indicates that the entire WHPA has no planned sewer service. Hence both Hillandale and Todd Village have onsite septic systems for waste disposal. Onsite septic systems may be potential sources of the nitrates and microbiological contaminants to the supply wells.



## 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 are the cause of the elevated contaminant level. All data reported is from the finished (treated) water unless otherwise noted. The only treatment that Hillandale Mobile Home Park currently uses is hypochlorination (post) for disinfection.

A review of the monitoring data since 1993 for Hillandale Mobile Home Parks water supply indicates that it meets the current drinking water standards. The water quality sampling results are summarized in Table 4. It must be noted that the radionuclide numbers used in this table include detections of radon-222 using the lower proposed MCL of 300 picoCuries/liter (pCi/L).

PLANT NO	Nitrate		SOCs		VOCs		IOCs (except nitrate)		Radionuclides	
	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	23	17	2	0	9	0	4		4	1
02	18	9	2	0	11	0	4	0	4	1

Table 4. Summary of Water Quality Samples for Hillandale Mobile Home Parks Water Supply.

### *Inorganic Compounds (IOCs)*

The only IOC detected above 50% of the MCL was nitrate. The MCL for nitrate is 10 ppm. The nitrate detections above 50% of the MCL in Hillandale Mobile Home Park's water supply are shown in Tables 5a and 5b.



PLANT ID	CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
01	NITRATE	10	7-Apr-93	5.6
01	NITRATE	10	14-Jan-94	7.03
01	NITRATE	10	27-Jan-94	6.3
01	NITRATE	10	21-Apr-94	6.48
01	NITRATE	10	24-Apr-95	6.7
01	NITRATE	10	14-Nov-95	6.8
01	NITRATE	10	13-Dec-95	7.32
01	NITRATE	10	20-Mar-96	7.65
01	NITRATE	10	9-Oct-97	5.25
01	NITRATE	10	3-Nov-97	5.28
01	NITRATE	10	1-Oct-98	5.03
01	NITRATE	10	9-Dec-98	7.97
01	NITRATE	10	9-Dec-98	7.15
01	NITRATE	10	4-Oct-00	5.03
01	NITRATE	10	4-Oct-00	5.11
01	NITRATE	10	10-Jan-01	7.7
01	NITRATE	10	24-Oct-01	5.68

Table 5a. Nitrate results above 50% of the MCL for the Hillandale II plant.

PLANT ID	CONTAMINANT NAME	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
02	NITRATE	10	12-Oct-93	6.15
02	NITRATE	10	5-Nov-96	7.11
02	NITRATE	10	7-Apr-97	7.95
02	NITRATE	10	9-Oct-97	8.17
02	NITRATE	10	3-Nov-97	8.3
02	NITRATE	10	1-Oct-98	7.5
02	NITRATE	10	8-Dec-98	6.8
02	NITRATE	10	4-Oct-00	5.03
02	NITRATE	10	24-Oct-01	5.52

Table 5b. Nitrate results above 50% of the MCL for the Hillandale I plant.

***Volatile Organic Compounds (VOCs)***

No VOCs above 50% of the MCL have been detected in Hillandale Mobile Home Park's water supply since 1993. The only VOC detected was methyl-tert-butyl-ether (MTBE). Currently, MTBE does not have an MCL but has a taste and odor threshold of 20 ppb. MTBE has only been detected at the Hillandale I plant and levels appear to be rising. It was initially detected in December 1997 at 0.8 ppb and again in January 2001 at 1.5 ppb and November 2001 at 4 ppb.

### ***Synthetic Organic Compounds (SOCs)***

No SOC's have been detected in Hillandale Mobile Home Park's water supply.

### ***Radionuclides***

No radionuclides above 50% of the existing MCLs have been detected in Hillandale Mobile Home Park's water supply. Radon-222 was detected on June 1996 at Hillandale Plants I and II at 2375 pCi/L and 3620 pCi/L, respectively. At present there is no MCL for radon-222, however EPA has proposed an MCL of 300 pCi/L and an alternate MCL 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.

### ***Microbiological Contaminants***

Raw water samples were collected and tested for bacteria from Hillandale II Well Nos. 1, 2 and 3 to determine whether these sources are ground water under the influence of surface water (GWUDI). The wells were classified as moderate risk wells to GWUDI and required one wet weather (at least 0.5 inch rainfall) sample. None of the samples for these wells had any positive coliform. The WSP has requested raw water sampling for Hillandale I Well No. 1, since data is not available for it.

## **SUSCEPTIBILITY ANALYSIS**

Hillandale Mobile Home Park's wells obtain water from an unconfined fractured-rock 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.

In the Piedmont region, if a well is constructed properly with the casing extended to competent rock and with sufficient grout, the saprolite serves as a natural filter and protective barrier. Properly constructed wells with no potential sources of contamination in their WHPA should be well protected from contamination. The susceptibility of the water supply to the various types of contaminants is summarized in Table 6.

### ***Inorganic Compounds (IOCs)***

Nitrate has been detected in Hillandale Mobile Home Park's water supply above 50% of the MCL (tables 5a & 5b). Sources of nitrate can generally be traced to land use. Onsite septic systems are non-point sources of nitrate in ground water.



Fertilization of cropland and residential properties are also non-point sources in ground water. A large portion of the WHPA (53%) is residential land which does not have public sewer. A review of the nitrate monitoring data indicates that there are no increasing or decreasing trends in nitrate levels for Hillandale Mobile Home Park's water supply.

Based on the above analysis, Hillandale Mobile Home Park's water supply is susceptible to nitrate contamination but is **not** susceptible to other inorganic compounds.

#### ***Volatile Organic Compounds (VOCs)***

MTBE has been detected in Hillandale Mobile Home Parks water supply since 1997. MTBE is used as an additive to gasoline for cleaner burning. A major road passes through the middle of the WHPA. Runoff from the road may be a source of the MTBE. No known USTs or leaking USTs have been detected in and around the WHPA. A review of the MTBE data indicates that the concentration of MTBE in the water supply appears to be increasing (see water quality section). Levels below 10 ppb are usually not associated with leaking petroleum tanks.

Based on the above analysis, Hillandale Mobile Home Park's water supply is susceptible to VOC contamination.

#### ***Synthetic Organic Compounds (SOCs)***

No SOC's have been detected in Hillandale Mobile Home Parks water supply. Application of pesticides in residential properties and cropland can be sources of SOC's. But so far, due to combination of proper application, aquifer and well characteristics no SOC's have been detected in the water supply.

Based on the above analysis, Hillandale Mobile Home Parks water supply is **not** susceptible to SOC contamination.

#### ***Radionuclides***

No radionuclides above 50% of the MCL have been detected in Hillandale Mobile Home Parks water supply. Radon-222 has been detected at levels higher than 50% of the one of the higher proposed MCLs. Radon is prevalent in ground water due to the radioactive decay of uranium bearing minerals in the bedrock (Bolton, 1996).

Based on the above analysis, Hillandale Mobile Home Parks water supply is susceptible to radon but **not** to other radionuclides.

#### ***Microbiological Contaminants***

Based on raw water bacteriological data Hillandale II Well Nos.1, 2 and 3 were determined not to be under the direct influence of surface water. Hence these wells are **not** susceptible to any microbiological contaminant present at the surface including *Giardia and Cryptosporidium*. Raw water bacteriological data



is not available for Hillandale I Well No. 1, therefore susceptibility determinations to microbiological contaminants cannot be made for this well at the present time.

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	YES	NO	NO	YES	YES
Synthetic Organic Compounds	NO	NO	NO	YES	NO
Radionuclides (except radon)	NO	NO	NO	YES	NO
Radon	YES	YES	NO	YES	YES
Microbiological Contaminants	YES	NO*	NO	YES	NO*

\*except for Hillandale I Well No. 1

Table 6. Susceptibility Summary for Hillandale Mobile Home Park's water supply.

## MANAGEMENT OF THE WHPA

### *Form a Local Planning Team*

- The team should represent all the interests in the community like the owners and operators of both Hillandale and Todd Village Mobile Home Parks, residents, other property owners in the WHPA, and Carroll County Planning and Health Departments.
- MDE has grant money available for countywide Wellhead Protection projects.

### *Public Awareness and Outreach*

- The Consumer Confidence Report should include a summary of this report and information that this report is available to the general public through their county library, or MDE.
- Placing signs at the WHPA boundaries is a good way to make the public aware of protecting their source of water supply. The County has placed signs at

WHPA boundaries along several county roads and may be able to assist in this effort.

#### ***Cooperative Efforts with Other Agencies***

- Farmers can participate in the New Conservation Reserve Program (CREP) applicable to the cropland located within a WHPA. 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.

#### ***Monitoring***

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Complete the required raw water bacteriological testing for Hillanale 1 Well No. 1 for determining whether it is under the influence of surface water.

#### ***Land Acquisition/Easements***

- Loans are available for the purchase of property or easements for the protection of the water supply. Eligible property must lie within the designated WHPA. Loans are currently being offered at zero percent interest and zero points. Contact the WSP for more information.

#### ***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 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.

#### ***Contaminant Source Inventory/Well Inspection***

- The system owners should review the potential sources of contaminants within the WHPA and update them if necessary, including a consideration of historical uses.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.
- Wells that are not planned for use anymore should be abandoned according to State well construction standards.

## REFERENCES

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- U.S. Environmental Protection Agency, 1991, Delineation of Wellhead Protection Areas in Fractured Rocks: Office of Water and Drinking Water, EPA/570/9-91-009, 144 p.

## OTHER SOURCES OF DATA

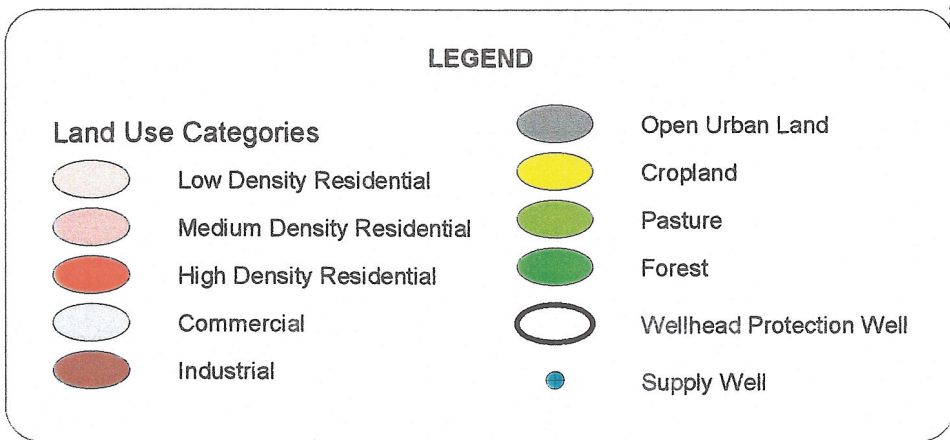
Water Appropriation and Use Permit: CL1970G001  
Public Water Supply Inspection Reports  
MDE Water Supply Program Oracle Database  
MDE Waste Management Sites Database  
Carroll County WHP Database  
Department of Natural Resources Digital Orthophoto Quarter Quadrangles:  
Westminster SE and Finksburg NE  
USGS Topographic 7.5 Minute Winfield and Littlestown Quadrangles  
Maryland Office of Planning 2000 Carroll County Land Use Map  
Maryland Office of Planning 1995 Carroll County Sewer Map



## FIGURES



**Figure 3. Land Use Map of the Hillandale and Todd Village Mobile Home Park Wellhead Protection Area**



*Base Map: Maryland Office of Planning  
2000 Land Use Map of Carroll County*