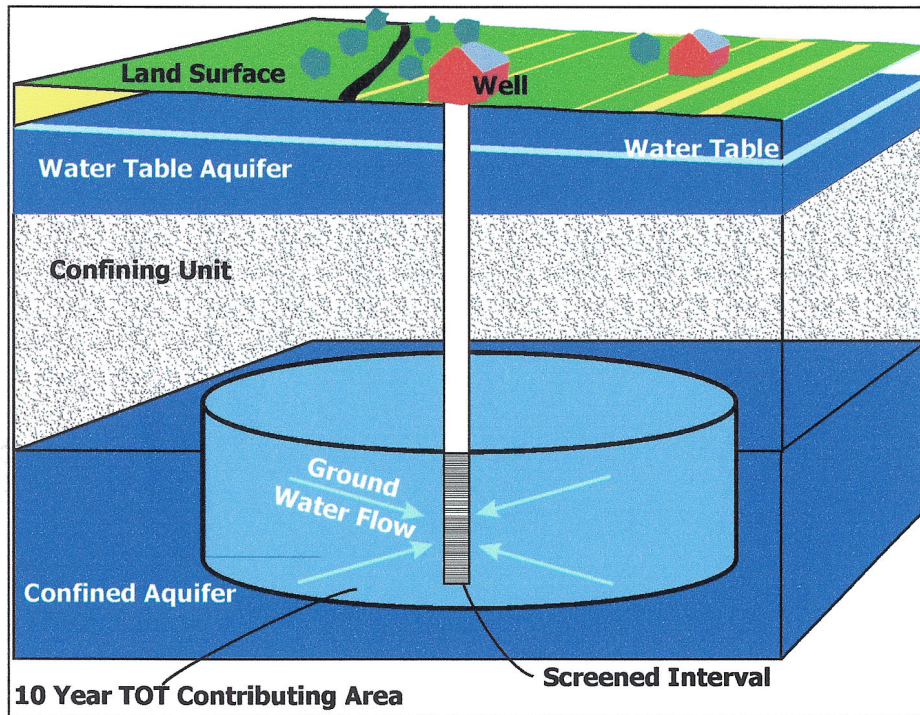


**SOURCE WATER ASSESSMENT
FOR THE TOWN OF ROCK HALL
KENT COUNTY, MD**



**Prepared By
Maryland Department of the Environment
Water Management Administration
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SUMMARY

The Water Supply Program has conducted a Source Water Assessment for the Town of Rock Hall. 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 area conclude this report.

The source of the Town of Rock Hall's water supply is a naturally protected confined aquifer in the Coastal Plain known as the Magothy aquifer. The Town uses one main well and two standby wells to obtain their drinking water. A source water assessment area was delineated based on the volume of aquifer needed to store the quantity of water pumped over 10 years. This method is in accordance with that developed in Maryland's SWAP. A survey to identify potential sources of contamination that might enter the assessment area was conducted based on site visits, database review and land use maps. Well information and water quality data were also reviewed.

The susceptibility analysis for Rock Hall's water supply is based on the water quality data, potential sources of contamination, aquifer characteristics, and well integrity. It was determined that Rock Hall's water supply is not susceptible to contamination. The few contaminants that were detected are compounds that are found to be naturally occurring in the aquifer.

Introduction

The Town of Rock Hall is located approximately 10 miles southwest of Chestertown in Kent County. The Town owns and operates a water system that serves 1600 people (Figure 1). One main well and two standby wells supply the system.

Well Information

A review of the well completion reports and sanitary surveys of the system indicate that the wells meet the State's well construction standards. The wells range in depth from 308 to 375 feet. Well No. 5 is the main supply well with Well Nos. 3 and 4 being used as standby wells. Table 1 contains a summary of the well construction data.

SOURCE ID	SOURCE NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	AQUIFER
01	ROCK HALL 4	KE730440	341'	268'	MAGOTHY FM
02	ROCK HALL 3	KE810289	308'	185'	MAGOTHY FM
03	ROCK HALL 5	KE811278	375'	280'	MAGOTHY FM

Table 1. Town of Rock Hall Well Information.

Rock Hall's wells draw water from the Magothy aquifer which is confined in this area. The Magothy Formation is about 60 feet thick and is composed of white to yellowish brown, fine to coarse-grained quartz sand and light to dark gray carboniferous silt-clay (Drummond, 1998). The sand and clay are interbedded and the wells are screened in the sandy layers. The Matawan confining unit, which is made up of clayey sediments, overlies the Magothy aquifer. In Well No. 5 this confining unit has a thickness of about 90 feet.

The ground water flow direction is toward the southwest at a gradient of about 0.0001 (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. A WHPA was originally delineated in 1994 for Rock Hall's well field using EPA's WHPA Code version 2.0 and assuming the aquifer to be semi-confined. But review of a new Maryland Geological Survey

(MGS) report (Drummond, 1998) and evaluation of well completion reports of the Town's wells indicate that the Magothy aquifer in the Rock Hall area is confined. Hence, the WHPA was delineated again using the methodology described in Maryland's Source Water Assessment Plan submitted for EPA approval in February 1999. For systems using an average of >10,000 gallons per day, the WHPA is a 10 year time of travel (TOT) zone of transport determined by using a volumetric equation (Florida Method):

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

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

Figure 1b is a conceptual illustration of the zone of transport for a confined aquifer.

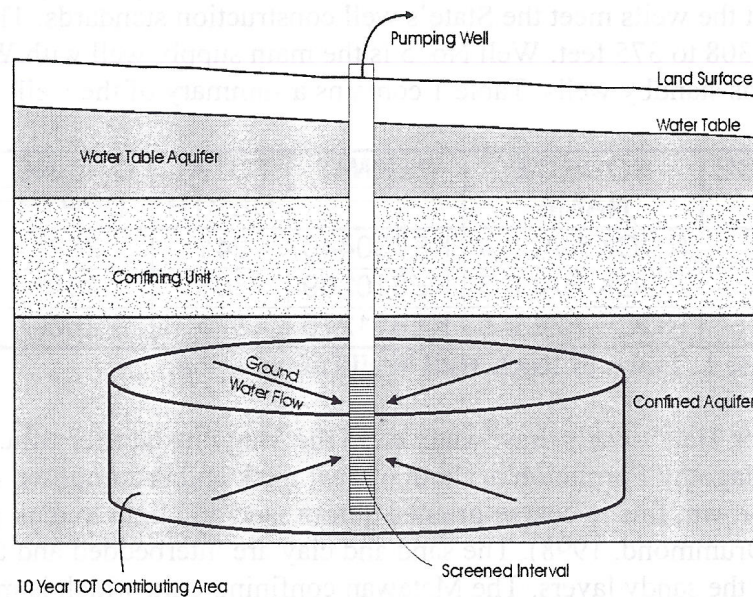


Figure 1b. Conceptual illustration of a zone of transport for a confined aquifer

The pumpage used for determining the WHPA was 230,000 gallons per day (11,223,262 ft³/yr) which is the permitted daily average quantity. Based on the lithology of the aquifer, a porosity of 30% was assumed for it. For Rock Hall's main supply Well No. 5, Q = 11, 223,262 ft³/yr; n = 0.30; H = 42ft; t = 10 yrs. Solving the above equation the calculated fixed radius r = 1684 ft.

Rock Hall's three wells are located within 100 feet of each other. Hence one circle with a radius of 1800 feet centered on the main producing Well No. 5 was delineated as the WHPA for the well field (figure 2). This larger than the calculated

WHPA would incorporate areas that would have to be assessed if the other two wells are used as the main supply wells. This WHPA has an area of 233.8 acres.

Potential Sources of Contamination

A field inspection of the WHPA to determine the potential for direct injection of contaminants to the Magothy aquifer was conducted. Several commercial facilities located in and around the WHPA were inspected – three local garages, a print shop, a boat repair business, and a combination equipment rental/laundry facility. Only one of them, a garage was located in the WHPA and had an open floor drain (figure2). No unused wells were found on the property. A notice of violation for unpermitted ground water discharges was issued to the garage. The garage owner has agreed to close the floor drain.

In addition, a review and consultation with the Waste Management Administration of the State's permitted facilities indicates that there is an underground storage tank site in the WHPA (figure 2). The tanks meet the State regulations.

Based on the Maryland Office of Planning's 1994 Land Use Map the land use within the WHPA is as follows:

LAND USE	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Low Density Residential	146.5	63
Commercial	43.2	18.5
Mixed Forest	31.8	14
Cropland	9.3	4

Table 2. Land Use Summary for the Rock Hall WHPA

Figure 3 shows the land use in and around the Rock Hall WHPA. A review of the 1995 Kent County Sewer Map indicates that the entire WHPA is in a sewer service area.

Water Quality

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 for finished (treated) water unless otherwise noted. The treatment currently used at Rock Hall is disinfection, pH adjustment for corrosion control, fluoridation, and coagulation, filtration and flocculation for iron removal.

MDE personnel discussed water quality issues and concerns with Mr. George Kendall, Water Superintendent for Rock Hall in October 1999. Mr. Kendall indicated that he did not have any water quality concerns or issues for the water supply.

A review of the monitoring or data since 1993 for Rock Hall's finished water indicates that the system's water supply currently meets the drinking water standards. No contaminant at or above 50% of the MCL was detected.

Inorganic Compounds (IOCs)

Nitrate was detected in Rock Hall's water supply at levels ranging from 0.02 to 0.5 ppm in six samples collected between 1993 and 1999. The Maximum Contaminant Level (MCL) for nitrate is 10 ppm.

Sodium was detected in raw water samples collected on 9/11/96 from Well No. 3 at 28.7 ppm; Well No. 4 at 31.4 ppm; and Well No. 5 at 24.4 ppm. A finished water sample collected that same day had sodium detected at 23.7 ppm. No MCL or secondary MCL has been established for sodium at present time. The sodium detected is believed to be a naturally occurring element in the aquifer sediments.

Barium was detected in raw water samples collected on 9/11/96 from Well No. 3 at 0.048 ppm; Well No. 4 at 0.047 pm; and Well No. 5 0.050 ppm. A finished water sample collected that same day had barium detected at 0.027 ppm. The MCL for barium is 2 ppm. Barium occurs naturally in the aquifer sediments.

Fluoride was detected at 1.5 ppm (11/8/95) and at 0.17 ppm (4/1/97). Fluoride is due to the addition of hydrofluorosilic acid for fluoridation of the water supply.

Lead was detected one time at 0.003 ppm on 9/11/96. The action level for lead is 0.15 ppm. The detection may have been due to improper flushing of the system prior to sample collection.

Sulfate was detected one time at 26.2 ppm on 4/1/97. Sulfate is an unregulated IOC and has a secondary MCL of 250 ppm. Sulfate is a naturally occurring compound in the aquifer sediments.

Volatile Organic Compounds (VOCs)

No VOCs have been detected in Rock Hall's water supply in any samples collected since 1993.

Synthetic Organic Compounds (SOCs)

No SOC's have been detected in Rock Hall's water supply in any samples collected since 1993.

Radionuclides

Gross alpha was detected at 1 pCi/L on 4/1/97. The MCL for gross alpha is 15 pCi/L. Gross beta was detected at 3 pCi/L (4/1/97) and at 4.28 pCi/L (8/26/98). The MCL for gross beta is 50 pCi/L. Gross alpha and gross beta are decay products of naturally occurring radioactive minerals in the aquifer sediments.

Microbiological Contaminants

No total or fecal coliform has been detected in Rock Hall's raw or finished water since 1993.

Susceptibility Analysis

The susceptibility analysis for Rock Hall's water supply is based on the following criteria: (1) water quality data, (2) potential sources of contamination, (3) aquifer characteristics, and (4) well integrity.

The aquifer that supplies Rock Hall's drinking water is confined and based on the well completion reports has a confining bed approximately 90 feet thick. This confining layer would prevent the flow of any surface contamination into the aquifer supplying Rock Hall. Only direct injection into the aquifer from point sources within the WHPA like underground injection wells or improperly abandoned wells could cause a potential contamination threat to the supply.

Inorganic Compound (IOCs)

The nitrate levels detected are well below the 50% MCL and are probably background levels found in the aquifer. There are sources of nitrate contamination in the WHPA that could impact the confined aquifer. Rock Hall's water supply is **not** susceptible to nitrate contamination.

Volatile Organic Compounds (VOCs)

No VOCs have been detected in Rock Hall's water supply since 1993. The two potential sources of VOC contamination identified in the WHPA (figure2), the UST and the open floor drain, could impact the surficial aquifer, not the deeper confined Magothy aquifer. Rock Hall's water supply is **not** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

No SOC's have been detected in Rock Hall's water supply since 1993. There are no sources of SOC contamination in the WHPA that could impact the confined aquifer. Rock Hall's water supply is **not** susceptible to SOC contamination.

Radionuclides

Gross alpha and gross beta radiation were both detected in Rock Hall's water supply at levels well below the 50% MCL for both these contaminants. The presence of these contaminants may be attributed to decay of naturally occurring minerals like uranium in the aquifer sediments. Rock Hall's water supply is **not** susceptible to radionuclides.

Microbiological Contaminants

Based on coliform sampling data and the aquifer characteristics, Rock Hall's water supply is **not** susceptible to microbiological contaminants.

Management of the WHPA

Form a Local Planning Team

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

Public Awareness and Outreach

- Pamphlets, flyers and bill stuffers sent to local residents, businesses, and farmers will help educate the general public about Wellhead Protection.
- Placing signs at the WHPA boundaries is a good way to make the public aware of protecting their source of water supply.

Monitoring

- The Town should consider radioisotope sampling of the water supply to determine its age
- Continue sampling as required by the Safer Drinking Water Act.
- Annual sampling for microbiological is a good check on well integrity.

Planning/New Development

- Continue to stress the importance of a Comprehensive Water and Sewer Plan to ensure that new development (residential and commercial) adjacent to the WHPA is sewerred, and that there are no discharges into the aquifer.

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 WHPA since it is affected by pumpage. It is recommended that Rock Hall contact the MDE Water Supply Program when an increase in pumpage is applied for or when new proposed wells are being considered.

Contaminant Source Inventory Updates/ Well Inspections

- Rock Hall should conduct its own detailed survey to ensure that there are no other potential sources of contamination within the WHPA. Updated records of new development within the WHPA should be maintained.
- Work with the County Health Department to ensure that there are no unused wells within the WHPA. Improperly abandoned wells can be a potential source to the aquifer.
- Water operation personnel should have a regular inspection and maintenance program for the wells to ensure their integrity and to protect the aquifer from surficial contamination.

REFERENCES

- Drummond, D. 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, 76 p.
- Maryland Department of the Environment, Public Drinking Water Program, 1994, A Wellhead Protection Plan for the Town of Rock Hall, 9 p.
- 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: Maryland Geological Survey Basic Data Report No. 20, 155 p.
- United States Environmental Protection Agency, Office of Ground-Water Protection, 1987, Guidelines for Delineation of Wellhead Protection Areas.

SOURCES OF DATA

Water Appropriation and Use Permit No. KE 71G004
Public Water Supply Inspection Reports
Monthly Operating Reports
Monitoring Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quad (Rock Hall 4/8/94)
USGS Topographic Map – Rock Hall Quadrangle
Maryland Office of Planning 1994 Land Use Map
Maryland Office of Planning 1995 Kent County Sewerage Coverage

FIGURES

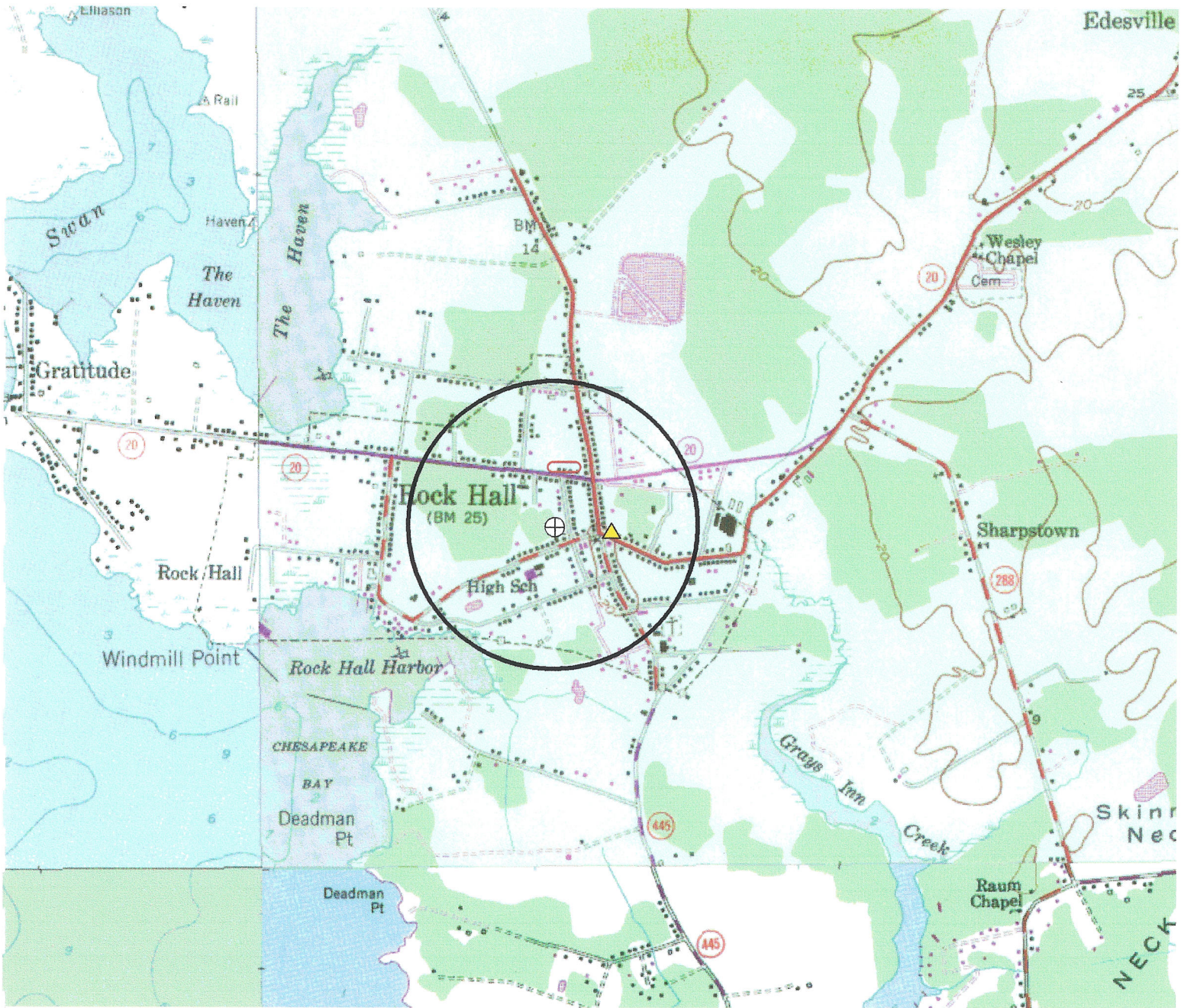






Figure 2. Rock Hall Wellhead Protection Area With Potential Contamination Sites



LEGEND

	Wellhead Protection Area		Ground Water Discharge
	Underground Storage Tank		Well Field

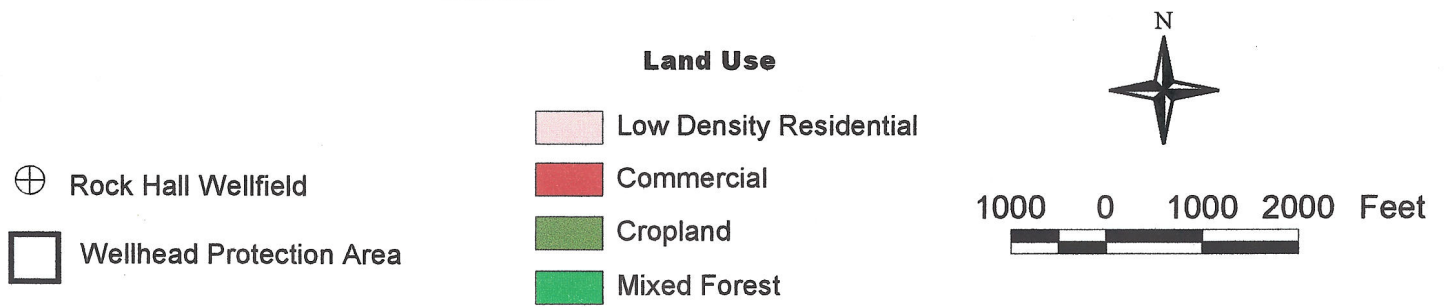


Base Map: USGS Topographic 7.5 Minute Quadrangle - Rock Hall, MD



Figure 3. Rock Hall Wellhead Protection Area and Land Use Map

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Source: MD. Office of Planning 1994 Land Use Map