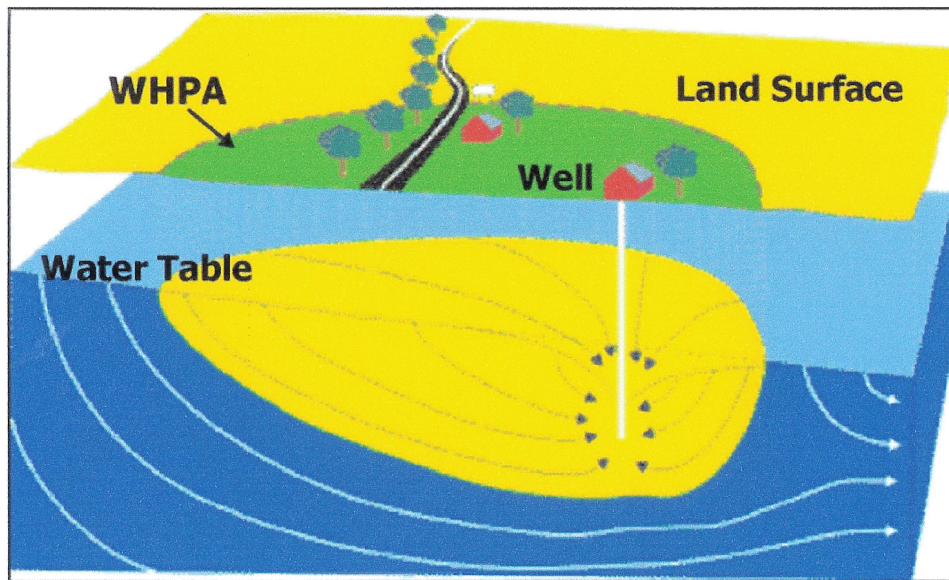


**Source Water Assessment
for the Libertytown East Water System
Frederick County, Maryland**



**Prepared By
Maryland Department of the Environment
Water Management Administration
Water Supply Program
December 2002**



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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the Libertytown East water system. The required components of this report as described in Maryland's Source Water Assessment Program (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 Libertytown East's water supply is an unconfined fractured-rock aquifer. The Source Water Assessment area was delineated by the WSP using U.S. EPA approved methods specifically designed for this source type.

Point sources of contamination were identified within the assessment area from field inspections, contaminant inventory databases, and previous studies. The Maryland Office of Planning's 2000 digital land use map for Frederick County was used to identify non-point sources of contamination. Well information and water quality data were also reviewed. An aerial photograph and a maps showing contaminant sources and land use within the Source Water Assessment area are included in the report.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the source water assessment area, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Libertytown East water supply is susceptible to some microbiological contaminants. This water supply is not susceptible to inorganic compounds, radiological contaminants, volatile organic compounds, synthetic organic compounds, and surface water microorganisms.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for the Libertytown East water system in Frederick County. The Libertytown East community is located approximately ten miles northeast of the City of Frederick. The water system serves a population of 86 people and has 32 service connections. Libertytown East currently obtains its water supply from two wells. The water system is owned and operated by the Frederick County Division of Utilities and Solid Waste Management.

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. The Libertytown East system obtains its water supply from two wells (Table 1). Additional wells have been drilled in the Liberty Village community on the south side of Route 26, but water quality issues precluded the use of those wells. The two production wells are located adjacent to residential properties on the north side of Route 26 (Fig. 1). A review of the well completion reports and sanitary surveys of Libertytown East's water systems indicate the wells were drilled after 1973 and should meet construction standards for grouting and casing. A summary of the well information is located in Table 1.

SOURCE ID	WELL NAME	PERMIT	TOTAL DEPTH	CASING DEPTH	YEAR DRILLED
01	WELL 1	FR-88-0903	100	21	1989
02	WELL 2	FR-88-0891	200	49	1989

Table 1. Libertytown East well information.

The Libertytown East water system has an appropriation permit to draw water from the Wakefield Marble and Ijamsville Formations for an average use of 15,700 gallons per day (gpd) and a maximum of 23,600 gpd in the month of maximum use. Based on the most recent pumpage reports, the average daily use was 3,272 gallons in 1999 and 4,057 gallons in 2000. The months of maximum use for the last two reported years were June 1999 and May 2000 with an average daily use of 4,435 and 4,862 gallons respectively. These amounts are only about 30% of the amount appropriated because only thirty-two of the total planned lots have been connected to the water system thus far.

HYDROGEOLOGY

Libertytown East lies in the heart of the Piedmont lowlands physiographic province of eastern Frederick County, which is characterized by gently rolling hills with some deeply cut valleys. This portion of the county is underlain by a series of meta-sedimentary and metavolcanic rocks that are structurally complex. The stratigraphic and structural relationships of these geologic units are poorly understood. Lenses of Wakefield marble layered with the metavolcanic Ijamsville, Sams Creek, and Libertytown formations are mapped at the surface and any of these formations are likely to be encountered in the subsurface. The Wakefield Marble is described as a white fine-grained formation with variations of pink, green, and blue variegated marbles. The metavolcanic formations are generally fine-grained phyllite and metarhyolite or massive to schistose metabasalt (Cleaves, et al., 1968). Based on driller's reports, the wells penetrate the marble, which is the most significant source of ground water in this area. The marble is an unconfined, fractured rock aquifer whose primary porosity and permeability are small due to compaction and re-crystallization associated with metamorphism of limestone sediments. Ground water moves principally through secondary porosity, fractures and joint openings, and is recharged by precipitation percolating through soil and saprolite. Due to dissolution of carbonate minerals in the marble fractures and joints are enlarged and can transmit water easily compared to typical fractured rock aquifers. When water-bearing fractures are encountered, large production wells are common in limestone and marble aquifers. A fracture trace analysis was completed in 1996 by RE Wright, Inc. in a well exploration project (Appendix A, Fig. 2). The wells in Libertytown East appear to be connected to these fractures.

Ground water systems in crystalline rock tend to be localized and flow is within topographic divides towards the nearest perennial stream (Bolton, 1998). The water table is generally in the saprolite, which is characterized by high porosity and thus, the amount of storage often depends on the thickness of the saprolite. Stream valleys tend to follow fracture traces and as a result wells drilled in draws and stream valleys tend to have higher yields than those on hilltops and slopes.

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, a Wellhead Protection Area (WHPA) is considered the source water assessment area for the system. The source water assessment area for public water systems using wells in fractured-rock aquifers is the watershed drainage area that contributes to the well. The area should be modified to account for geological boundaries, ground water divides, and by annual average recharge needed to supply the well (MD SWAP, 1999).

Hydrogeologic mapping identifies the physical and hydrologic features that control ground water flow (EPA, 1991). Hydrogeologic mapping was used to identify drainage basin boundaries, geologic features, and fracture traces that influence ground water flow. Fracture traces are surface expressions of vertical, closely spaced joints and

fractures in the bedrock below. Highly developed fracture systems in bedrock aquifers readily transmit water; thus fracture trace analysis is commonly used to locate high yield wells in fractured bedrock aquifers. A well intercepting a fracture, or fracture zone, will demonstrate a drawdown pattern that is greatest along the trace of the fracture(s). Fracture traces have been mapped in and around the Liberty Village property using aerial photography. This analysis shows two predominant fracture traces that intersect at the location of the two wells (Fig. 2). As described above the subsurface geology in this area is very complex, however the strike of the formations appears to coincide with the drainage patterns and fracture traces and it is likely that the lens of Wakefield marble that outcrops near the wells provides most of the ground water flow to the wells. The WHPA was delineated to include all of these features: 1) the extent of the fracture traces intersecting near the wells, 2) the outcrop of Wakefield Marble and 3) the watershed boundaries of the small creek that passes near the wells. The area was then modified to approximate an area needed to recharge the appropriated amount of 15,700 gpd, using an estimated drought-year recharge rate of 400 gpd/acre. The WHPA is approximately 98 acres and is shown in Figure 2.

POTENTIAL SOURCES OF CONTAMINATION

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

Point Sources

A review of MDE contaminant databases revealed no point sources of contamination within the WHPA (Fig.3). Several underground storage tanks (UST's) were noted near the WHPA (Table 2) and are mapped only because the area had a recent case of ground water contamination that impacted some potable wells serving individual homes in Libertytown near the intersection of Main Street and Route 550 (Fig. 3). A leaking underground storage tank (LUST) case was discovered in late 1999 and resolved in early 2000, and contaminated several nearby wells with petroleum products. Contaminants detected included benzene, naphthalene, and MTBE. The Libertytown East wells were monitored during this incident, but were not impacted by the contamination. Contaminated soil was removed from the site and it is believed that the remnants of the contaminated ground water will eventually discharge through the small tributary that drains on the west side of Route 550. Another UST was once located at the Libertytown wastewater plant, but the tank has been removed and is permanently out of use.

ID*	Type	Facility Name	Address	Comments
1	UST	Libertytown WWTP	Rte 75	Tank removed, permanently out of use
2	UST	M&N Quick Stop	12052 Main St.	1-6,000,1-4,000 gallon gasoline and 1-4,000 gallon diesel tanks
3	UST	Citgo/7-11	11922 Main St.	3-8,000 gallon gasoline tanks
4	LUST	Antique Store	Rte 550 and Main St.	Status = closed. Tanks removed, contaminated soil excavated and removed from site.

Table 2. Potential Contaminant Sources in and near Libertytown East WHPA

*See Figure 3.

Non-Point Sources

The Maryland Office of Planning's 2000 digital land use for Frederick County was used to determine the predominant types of land use in the WHPA (Fig. 4). The land use summary is given in Table 3. The majority of the WHPA is made up of cropland, with smaller proportions of forested, parks and residential areas.

Land Use Type	Total Acres	Percent of WHPA
Low-density Residential	6	6.0
Medium Density Residential	8	8.5
Open Urban Land (Parks)	11	10.9
Cropland	53	54.4
Forest	19	19.7
Water	0.5	0.5
Total	98	100

Table 3. Land Use Summary

Agricultural land may be associated with nitrate loading of ground water and also represents a potential source of SOCs depending on fertilizing practices and use of pesticides. Residential areas without sewer service may be a source of nitrate from septic systems. Additionally, residential areas may present a source nitrate and SOCs if fertilizers, pesticides, and herbicides are not used carefully in lawns and gardens.

The Maryland Office of Planning's 1996 digital sewer map of Frederick County shows that the most of the WHPA is not planned for sewer service (Fig. 5). The remaining areas, including the area immediately around the wells, have sewer service or are immediately planned for service. The area shown on Fig. 5 as "3 year planned" covers the Liberty East subdivision, which is currently served by the Libertytown wastewater plant. Table 4 summarizes the sewer service categories in the WHPA.

Service Category	Total Acres	Percent of WHPA
Existing Service	4	3.6
3 Year Planned Service	14	13.9
Unknown	2	2.1
Not Planned for Service	79	80.4
Total	98	100

Table 4. Sewer Service Area Summary

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database for Safe Drinking Water Act (SDWA) 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 greater than 50% of a MCL, this assessment will describe the sources of such a contaminant and if possible, locate the specific sources that are the cause of the elevated contaminant level. All data reported is from the finished (treated) water unless otherwise noted. The Libertytown East water system has one point of entry or plant, which has chlorination for disinfection and pH adjustment for corrosion control as its treatment.

A review of the monitoring data since 1993 for Libertytown East water indicates that the water supply meets drinking water standards. No contaminants were detected above 50% of an MCL. The water quality sampling results are summarized in Table 5.

Contaminant Group	No. of Samples Collected	No. of Samples above 50% of an MCL
Inorganic Compounds (except Nitrate)	4	0
Nitrate	7	0
Radiological Contaminants	5	0
Volatile Organic Compounds	9	0
Synthetic Organic Compounds	4	0

Table 5. Summary of Water Quality Samples

Inorganic Compounds (IOCs)

Inorganic compounds have not been detected above 50% of an MCL. Nitrate is the most commonly detected inorganic compound but levels in the water supply range from 2.7 to 3.8 ppm and average 3.2 ppm.

Radionuclides

A review of the data shows that no radionuclides were detected above 50% of an MCL. There is currently no MCL for Radon-222, however EPA has proposed an MCL of 300 pCi/L or an alternate 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. The EPA received many comments in response to their proposed rule, and promulgation may be delayed. Radon-222 results have been reported in Libertytown East below the lower proposed MCL.

Volatile Organic Compounds (VOCs)

A review of the data shows that VOCs have not been detected above 50% of an MCL. Disinfection byproducts grouped as trihalomethanes (THMs), Methyl-Tert-Butyl-Ether (MTBE), and Dichloroethane are the VOC's that have been detected, but at very low levels.

Synthetic Organic Compounds (SOCs)

The only SOC's detected were Di(2-Ethylhexyl)Phthalate for which the highest level reported was 0.7 ppb and Dalapon at 1.34 ppb. The phthalate contaminant is commonly found in laboratory blank samples and the method for analyzing this contaminant was just starting to be used in 1995 and had many false positive results. Dalapon is a herbicide used to control grasses in a wide variety of crops and is also registered for use in a number of non-crop applications such as lawns, drainage ditches, along railroad tracks, and in industrial areas. The MCL for Dalapon is 200 ppb.

Microbiological Contaminants

Raw water bacteriological data is available for each of the wells from evaluation for ground water under the direct influence of surface water (GWUDI). This data showed that the wells were not under the direct influence of surface water. The raw water quality was very good with very low turbidity and was free of fecal coliform. Some samples had total coliform present at very low levels.

SUSCEPTIBILITY ANALYSIS

The wells serving the Libertytown East water supply draw water from unconfined fractured-rock carbonate aquifers. Wells in unconfined aquifers are generally vulnerable to any activity on the land surface that occurs within the wellhead protection area. Therefore, continued monitoring of contaminants is essential in assuring a safe drinking water supply. The *susceptibility* of the source to contamination is determined for each group of contaminants based on the following criteria: 1) the presence of potential contaminant sources within the WHPA, 2) water quality data, 3) well integrity, and 4) the aquifer conditions. Table 6 summarizes the susceptibility of Libertytown East's water supply to each of the groups of contaminants.

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.

Inorganic Compounds

The water supply is **not** susceptible to inorganic compounds based on water quality data and lack of potential contaminant sources within the WHPA. There is some agricultural land and non-sewer residential areas in the WHPA that could present a source of nitrate, but based on water quality data these potential sources are not significantly impacting the water supply.

Radionuclides

The water supply is **not** susceptible to radionuclides. The source of radionuclides in ground water is the natural occurrence of uranium in rocks. Based on the low levels detected in the water supply, the aquifer is not a source of these contaminants in this area.

Volatile Organic Compounds

The water supply is **not** susceptible to contamination by VOC's. A potential source of VOC's was once present in the WHPA, but it is no longer an active site and is also down-gradient from the wells. Other potential sources are located nearby but outside of the WHPA. In addition, VOC's have not been detected in significant levels.

Synthetic Organic Compounds

The wells are **not** susceptible to synthetic organic compounds. SOC's were not detected in the water supply. A potential source of SOC's in the WHPA may be herbicide and pesticide use in agricultural areas. However, these contaminants have not been detected at significant levels.

Microbiological Contaminants

All three wells did not have fecal coliform bacteria in their raw water samples and were determined not under direct influence of surface water. Therefore, the wells are **not** susceptible to microbiological contaminants that may be present in surface water

such as *Giardia* and *Cryptosporidium*. Each of the wells did have low levels of total coliform bacteria, which are ubiquitous in the environment, and may be indicators of organisms with longer survival rates such as viruses. Without additional data however, it is not possible to determine whether or not the water supply is susceptible to viral contamination. The well is susceptible to total coliform bacteria but not fecal coliform bacteria.

Contaminant Group	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected Above 50% of MCL?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible?
Nitrate	YES	NO	NO	YES	NO
Inorganic Compounds (except nitrate)	NO	NO	NO	YES	NO
Radiological Compounds	NO	NO	NO	NO	NO
Volatile Organic Compounds	NO	NO	NO	YES	NO
Synthetic Organic Compounds	YES	NO	NO	YES	NO
Microbiological Contaminants	YES	YES*	NO	YES	YES – Total Coliform only

Table 6. Susceptibility Analysis Summary.

* There is no MCL for total coliform in raw water, presence is considered a violation in *finished* water samples.

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

With the information contained in this report the Frederick County Division of Utilities and Solid Waste Management is in a position to protect the Libertytown East water supply by staying aware of the area delineated for source water protection and evaluating future development and land planning. Specific management recommendations for consideration are listed below:

Form a Local Planning Team

- The Division of Utilities and Solid Waste Management should continue to work with the County Planning Department and Wellhead Protection committee to implement a County Wellhead Protection Ordinance. The committee should ensure that all interests in the community are represented, such as the water supplier, home association officers, the County Health Department, local businesses, developers, and property owners, and residents within and near the WHPA.
- A management strategy adopted by the Division and the County should be consistent with the level of resources available for implementation. MDE remains available to assist in anyway we can help the process.
- MDE has grant money available for Wellhead Protection projects, such as developing and implementing wellhead protection ordinances, digitizing layers that would be useful for wellhead protection (such as geology), and developing additional protection strategies. An application can be obtained by contacting the water supply program.

Public Awareness and Outreach

- The Consumer Confidence Report should list that this report is available to the general public through their county library, by contacting the Division or MDE.
- Conduct educational outreach to the facilities and the residents of the community focusing on activities that may present potential contaminant sources. Important topics include: (a) compliance with MDE and federal guidelines for heating oil and gasoline underground storage tanks, (b) appropriate use and application of fertilizers and pesticides, and (c) hazardous material disposal and storage.
- Road signs at the WHPA boundary are an effective way of keeping the relationship of land use and water quality in the public eye, and help in the event of spill notification and response.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Annual raw water bacteriological samples are a good test for well integrity.

Land Acquisition/Easements

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

Contingency Plan

- Libertytown East's Contingency Plan was submitted to MDE and approved in November 2001. COMAR 26.04.01.22 requires all community water systems to prepare and submit for approval a plan for providing a safe and adequate drinking water supply under emergency conditions.
- Develop a spill response plan in concert with the Fire Department and other emergency response personnel.

Contaminant Source Inventory Updates/ Inspections

- The Division should conduct their own field survey of the source water assessment area to ensure that there are no additional potential sources of contamination.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.

Changes in Use

- The Division is required to notify MDE if new wells are to be put into service. Drilling a new well outside the current WHPA would modify the area; therefore the Water Supply Program should be notified if a new well is being proposed.

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- Nutter, L.J. and E.G. Otton, 1969, Ground Water Occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56 pp
- U.S. Environmental Protection Agency, 1991, Delineation of Wellhead Protection Areas in Fractured Rocks: Office of Ground Water and Drinking Water, EPA/570/9-91-009, 144 pp.

OTHER SOURCES OF DATA

Water Appropriation and Use Permit FR1989G024
Public Water Supply Sanitary Survey Inspection Reports
MDE Water Supply Program Oracle® Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles for Libertytown
USGS Topographic 7.5 Minute Quadrangles for Libertytown
Maryland Office of Planning 2000 Frederick County Digital Land Use Map
Maryland Office of Planning 1996 Frederick County Digital Sewer Map

FIGURES

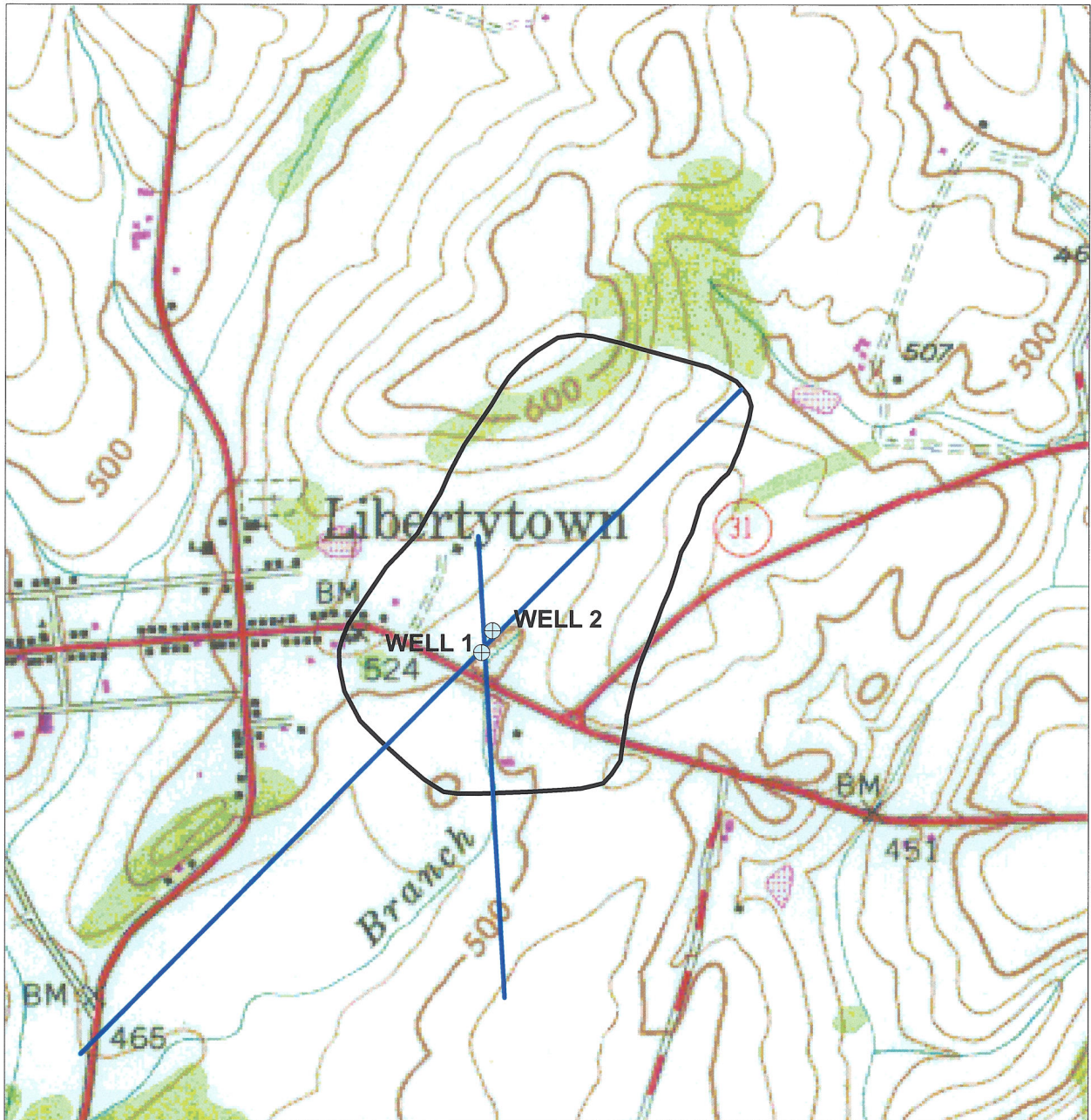
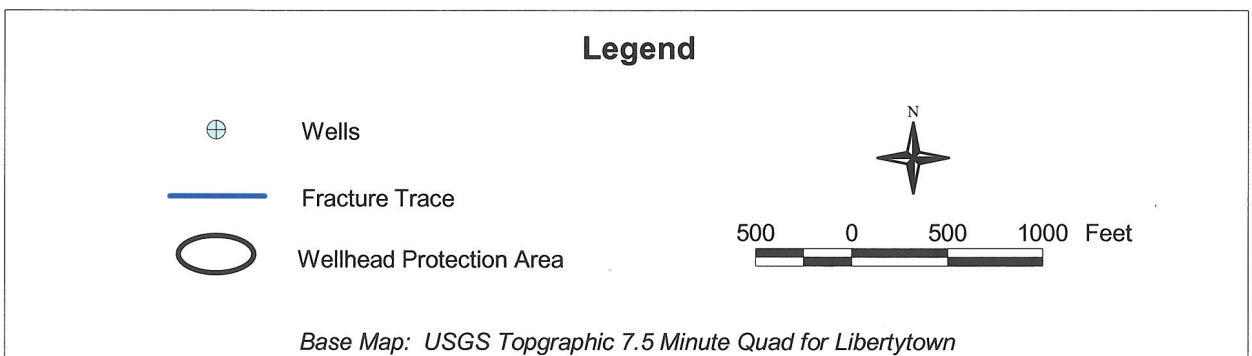


Figure 2. Libertytown East Wellhead Protection Area (WHPA).



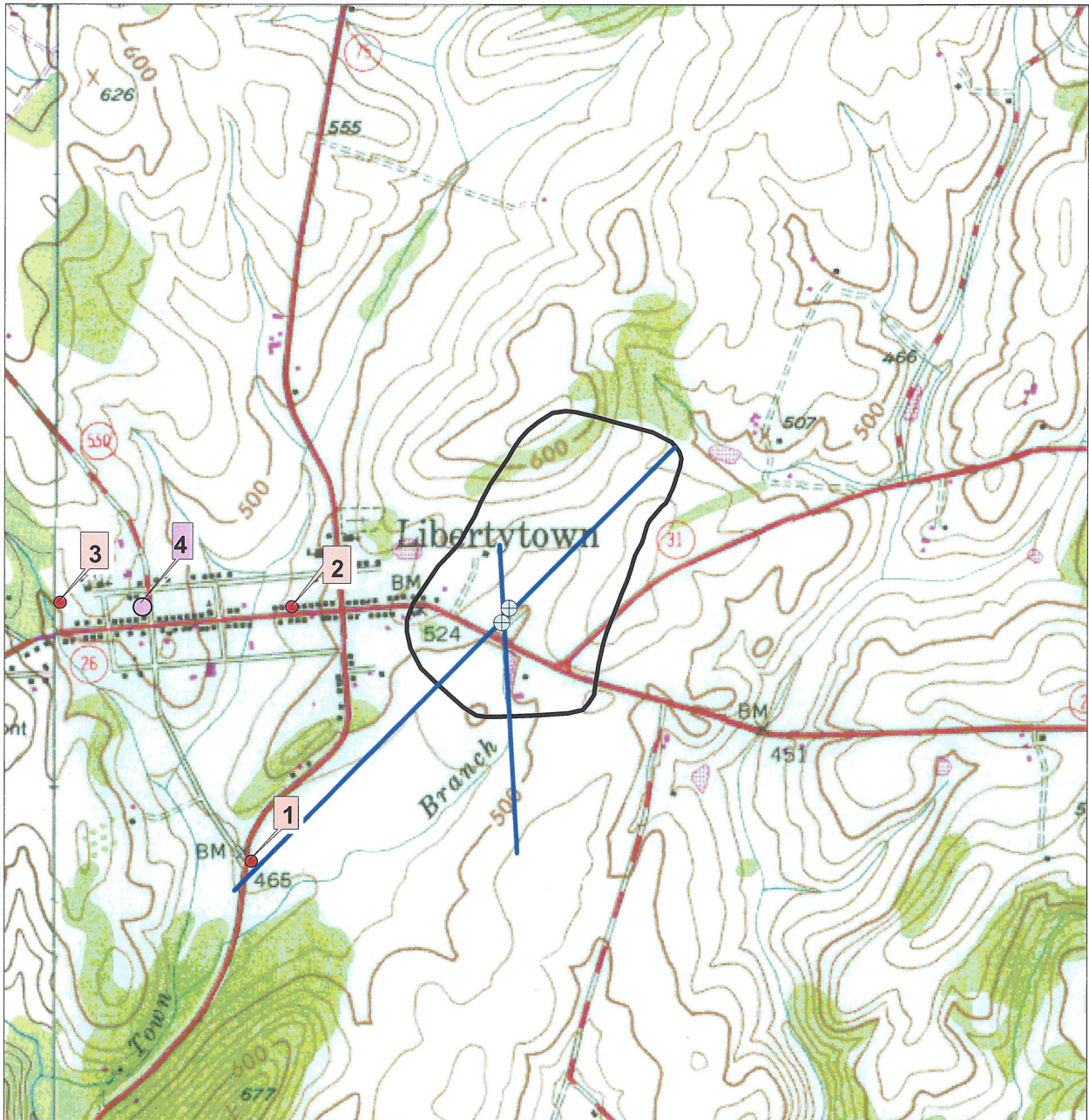
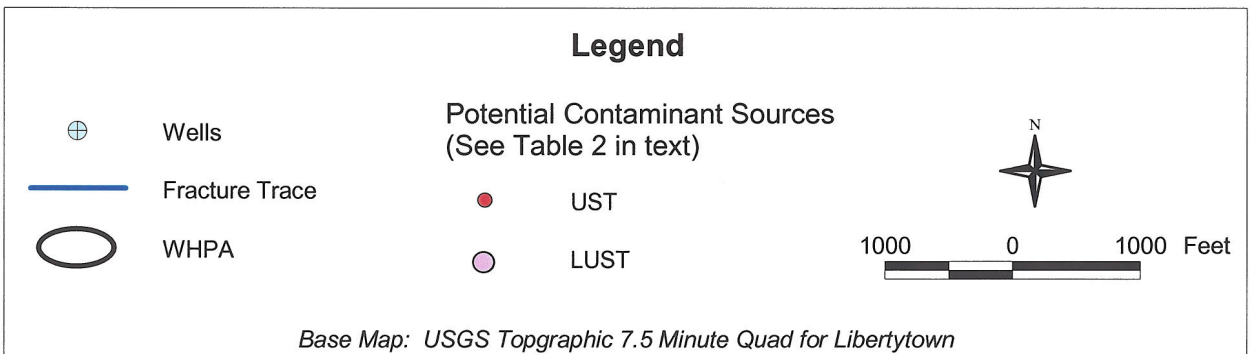


Figure 3. Libertytown East WHPA with Potential Contaminant Sources.



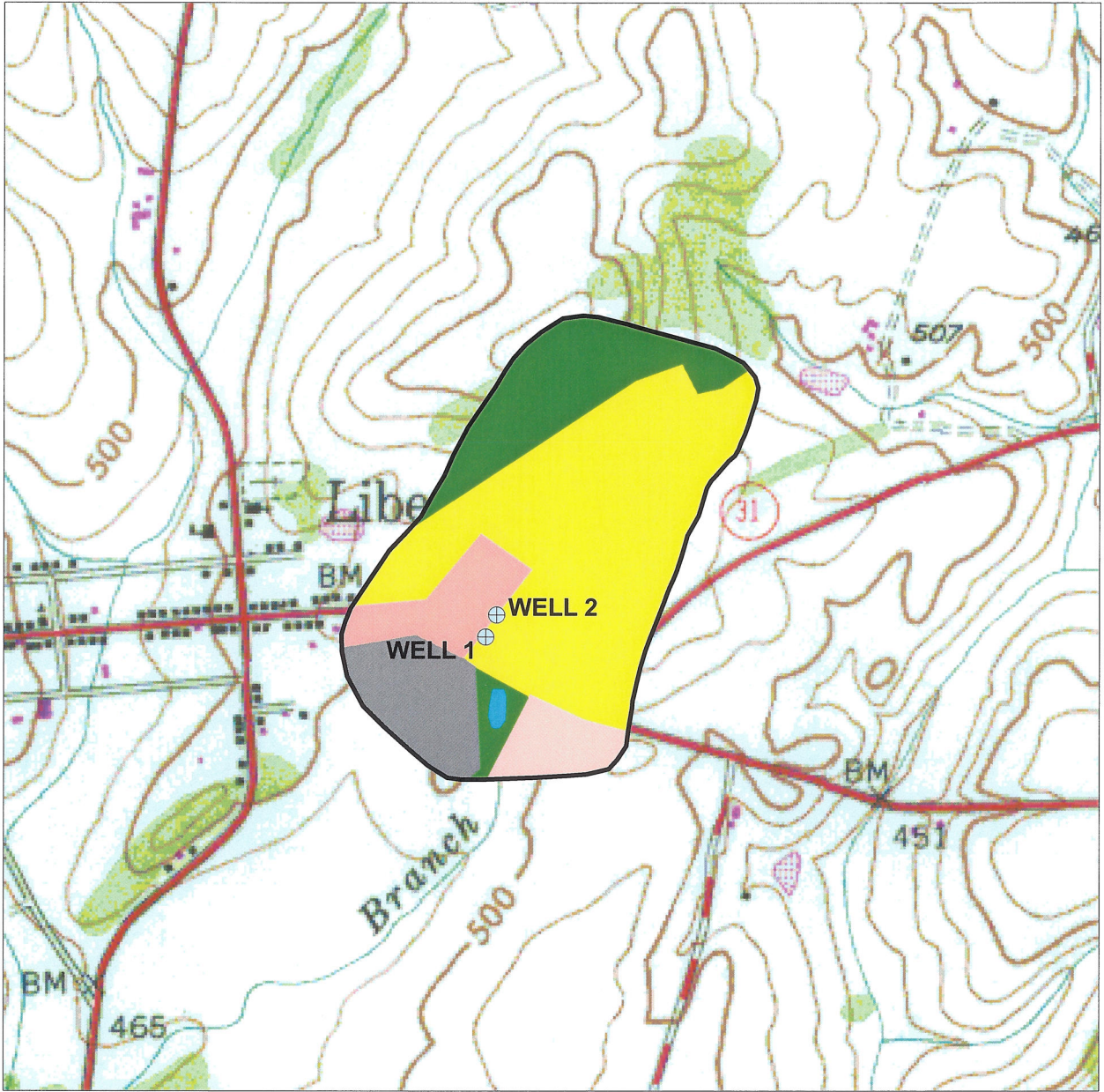
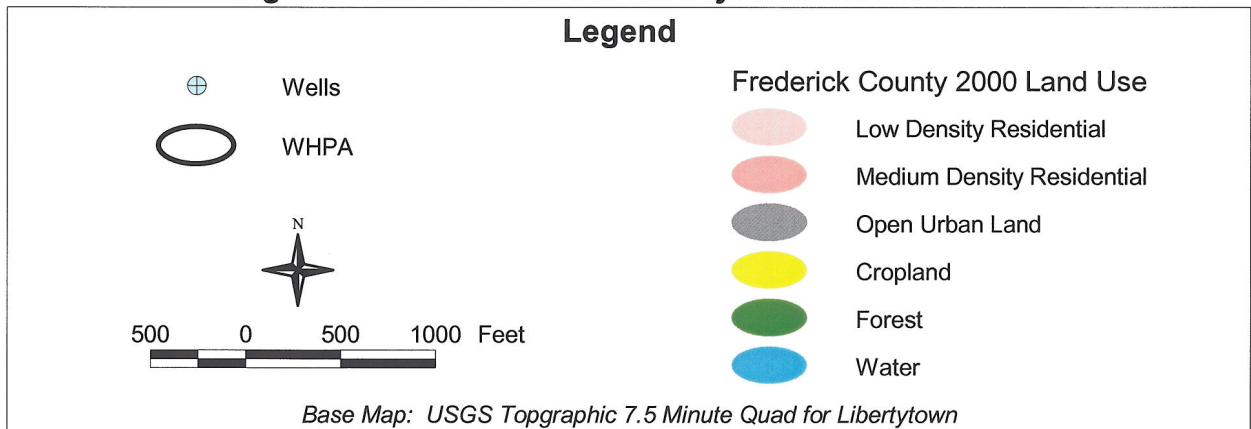


Figure 4. Land Use in the Libertytown East WHPA.



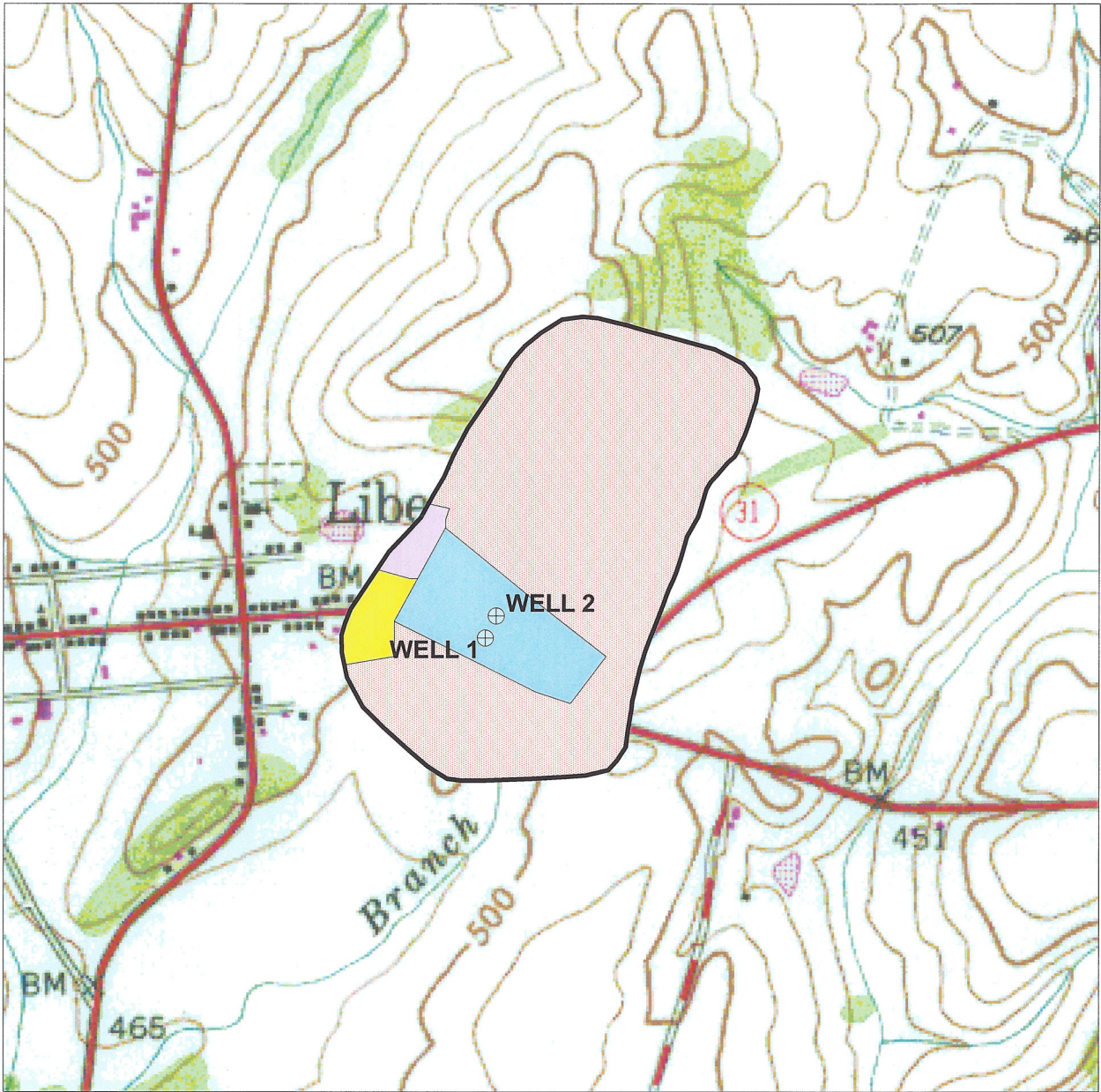
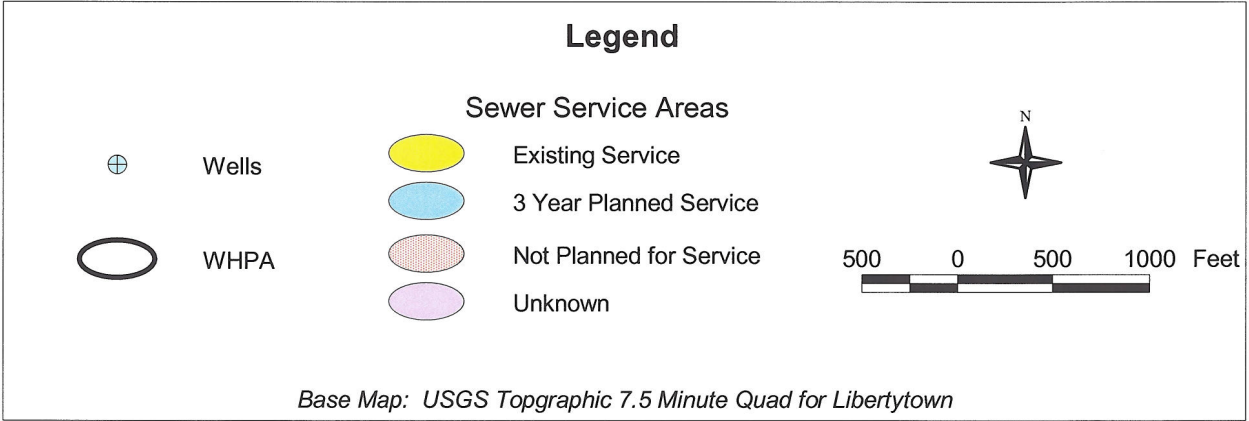
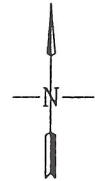








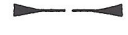
Figure 5. Sewer Service Areas in the Libertytown East WHPA.



APPENDIX



LEGEND

-  -LIBERTY VILLAGE SITE
-  -LIBERTYTOWN PARK
-  -POTENTIAL WELL SITE
-  -EXISTING WELL
-  -TOPOGRAPHIC WATERSHED BOUNDARY
-  -GEOLOGIC CONTACT
-  -GEOLOGIC FRACTURE TRACE

STRATIGRAPHIC COLUMN

SOURCE: CLEAVES, 1968

- lmr -LIBERTYTOWN METARHYOLITE
- wm -WAKEFIELD MARBLE
- if -IJAMSVILLE PHYLLITE

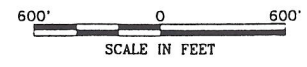
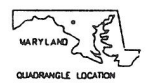



FIGURE 2
LIBERTYTOWN CO-HOUSING PARTNERSHIP
LIBERTYTOWN, MARYLAND

ENLARGED HYDROGEOLOGIC BASE MAP
LIBERTY VILLAGE & LIBERTYTOWN PARK

	drawn	checked	drawing no.
	MDS	JGH	97446-002-A
date	date		
10/04/98	12/22/98		
Total Environmental Solutions, Inc. total environmental solutions middletown, md cilton, md wesminster, md va beach, va			

NOTE: BASE MAP FROM LIBERTYTOWN, MD., USGS 7.5 MIN TOPOGRAPHIC QUADRANGLE (PHOTOREVISED 1971)