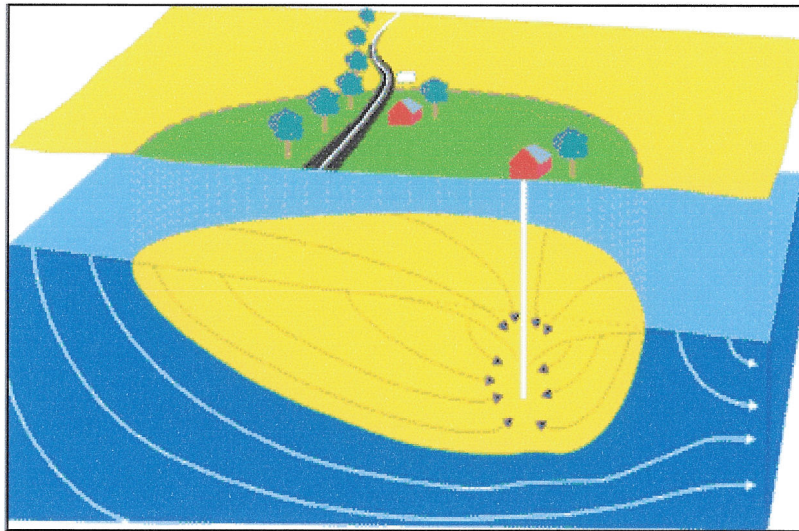


SOURCE WATER ASSESSMENT
for
N.I.H. Animal Center
MONTGOMERY COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
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TABLE OF CONTENTS

	Page
Summary.....	1
Introduction.....	2
Well Information.....	2
Table 1. N.I.H. Animal Center Well Information	
Hydrogeology.....	2
Source Water Assessment Area Delineation	3
Potential Sources of Contamination.....	3
Table 2. Potential Contaminant Point Sources within N.I.H. Animal Center's WHPA.	
Table 3. Land use summary for the N.I.H. Animal Center's WHPA	
Water Quality Data	5
Table 4. Summary of Water Quality Samples for the N.I.H. Animal Center's Water Supply.	
Table 5. Raw water bacteriological test results for GWUDI determination	
Susceptibility Analysis.....	7
Table 6. Susceptibility summary for N.I.H Animal Center's Water Supply	
Management of the WHPA.....	9
References.....	10
Other Sources of Data.....	10

Figures11

Figure 1. Location of N.I.H. Animal Center's Wells

Figure 2. Wellhead Protection Area for N.I.H. Animal Center with Potential Contaminants

Figure 3. Land Use within the N.I.H. Animal Center Wellhead Protection Area

SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for N.I.H. Animal Center. 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 N.I.H. Animal Center's water supply is an unconfined fractured rock aquifer, known as the New Oxford Formation. The system currently uses three 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 N.I.H. Animal Center'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 the one well (Well No. 1) formerly used by the N.I.H. Animal Center water supply is susceptible to microbiological contaminants like *Giardia* and *Cryptosporidia*. The other wells currently in use by the N.I.H. Animal Center (Well Nos. 2, 3 and 5) are not susceptible to microbiological contaminants. The water supply is not susceptible to contamination by inorganic compounds, volatile organic compounds and synthetic organic compounds. It maybe susceptible to naturally occurring radon, which is currently not, regulated for noncommunity nontransient water systems.

INTRODUCTION

The Water Supply Program has conducted a source water assessment for the N.I.H. Animal Center water supply located approximately 4 miles south west of Poolesville in Montgomery County (figure 1). The N.I.H. Animal Center water supply is considered a nontransient noncommunity (NTNC) water system, which is defined as a public water system that regularly serves at least 25 of the same individuals over six months per year. The facility owns and operates its water supply system and serves water to 100 employees.

WELL INFORMATION

The N.I.H. Animal Center is currently served water by three wells (Nos. 2, 3 and 5). Another well (No. 1) has been disconnected from the system and is not in use because it was determined to be ground water under the influence of surface water (GWUDI). 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 N.I.H. Animal Center water system indicates that Well Nos. 1,2 and 3 were drilled prior to 1973, when the State's well construction regulations went into effect, and may not be in compliance with current construction standards. Well No. 5 was drilled in 1992 and should meet current standards for grouting. Well information is shown in Table 1 below.

SOURCE ID	SOURCE NAME	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
01	NIH Well 1	MO049669	145	58	1962
02	NIH Well 2	MO670069	190	40	1966
03	NIH Well 3	MO049668	200	48	1962
04	NIH Well 5	MO882268	400	60	1992

Table 1. N.I.H. Animal Center Well Information.

The N.I.H. Animal Center has a Water Appropriation Permit that allows it to use an average of 80,000 gallons per day (gpd) and 105,000 gpd in the month of maximum use. The water is used for potable supply, sanitary facilities and cooling water. Based on reported pumpage for the past three years, the facility has been pumping an average of 101,000 gpd. During the site visit for this assessment the facility was notified about this pumpage and asked to review its use and apply for an increase to the current permitted daily average pumpage.

HYDROGEOLOGY

The N.I.H. Animal Center area lies in the Piedmont physiographic province and is underlain by the New Oxford Formation. The New Oxford Formation is an

unconfined, fractured rock aquifer and is composed of interbedded red to maroon shale, siltstone and sandstone. (Otton, 1981). In this type of setting, the underlying rocks have little primary porosity and ground water occurs in and is stored in bedding plane joints, faults and crevices. Ground water flow rates depend upon the openness of the fractures and their degree of interconnection. Unconsolidated overburden (saprolite) above the bedrock frequently has much greater primary porosity and permeability than the rock has, allowing additional ground water to be stored (Duigon, 1994)

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 source water assessment area for public water systems with an average appropriation amount of greater than 10,000 gpd and drawing from fractured-rock aquifers is the watershed area that contributes to the well. This area is modified by geological boundaries, ground water divides and by annual average recharge needed to supply the well (MD SWAP, 1999). The delineated WHPA represents the areas which contribute ground water to the wells. The total area of the N.I.H. Animal Center ^{WHPA is} about 222 acres, which is more than sufficient to support the daily permitted average and current pumpage under annual average recharge conditions.

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, ground water discharge permits, large scale feeding operations and Superfund sites. These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via discrete point location. Non-point sources of contamination are associated with certain types of land use practices such as the 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 as well as a field survey revealed three point sources of contamination in the WHPA. Figure 2 identifies three point sources within the WHPA and two in the vicinity of its boundary. The N.I.H. Animal Center is listed as a Controlled Hazardous Substance (CHS) Generator in MDE's contaminant database. The facility has a Surface Water Discharge (SWD) permit for discharge of treated wastewater. In addition, N.I.H staff identified three Underground Storage Tank (UST) sites where heating oil is stored. Potential contaminants are grouped as Volatile Organic Compounds (VOC), and Synthetic Organic Compounds (SOC), Microbiological Pathogens (MP), and Nitrate/Nitrite(NN).

ID	Type	Site Name	Address	Potential Contaminant	Comments
1	CHS	NIH Animal Center	Elmer School Rd	SOC, VOC, MP	
2	UST	NIH Animal Center	Elmer School Rd	VOC	Outside Bldg 101
3	UST	NIH Animal Center	Elmer School Rd	VOC	North of Bldg 107
4	SWD	NIH Animal Center	Elmer School Rule	MP, NN	Treated Wastewater
5	UST	NIH Animal Center	Elmer School Rd	VOC	Near Bldg 110

Table 2. Potential Contaminant Point Sources within N.I.H. Animal Center's WHPA (see figure 2 for locations).

Non-Point Sources

The Maryland Department of Planning's 2002 digital land use map for Montgomery County was used to determine the predominant types of land use in the WHPA (figure 3). Table 3 shows the land use categories within the N.I.H. Animal Center WHPA. The largest portion of the WHPA (75%) is mapped as commercial which is the area owned by N.I.H. Animal Center.

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Commercial	167.42	75.1
Cropland	48.26	21.7
Forest	7.23	3.2
Total	222.91	100.0

Table 3. Land Use Summary for the N.I.H. Animal Center WHPA.

Since the N.I.H. Animal Center deals with animal research, there are several areas where animals are fenced in and allowed to graze. These areas generate animal waste, which are sources of nitrate and can be sources of microbiological pathogens in ground water. Cropland is commonly associated with nitrate loading of ground water. Cropland also represents a potential source of SOCs depending on fertilizing practices and use of pesticides.

A review of the Maryland Department of Planning's 2002 Montgomery County Sewer Map indicates that there is no planned sewer service for the entire WHPA. N.I.H. Animal Center has wastewater treatment plant for treating waste generated by the facility. The treated wastewater is discharged into an unnamed tributary of Broad Creek. Some of the WHPA is outside the facility's property and may have onsite septic for wastewater disposal which can be sources of nitrate.

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 may be the cause of the elevated contaminant level. All data reported is from the finished (treated) water unless otherwise noted. The only treatment that the N.I.H. Animal Center water system currently has is gaseous chlorination for disinfection.

A review of the monitoring data since 1993 for the N.I.H. Animal Center 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 proposed MCLs for community water systems.

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	29	1	3	0	9	0	8	0	1	1*

Table 4. Summary of Water Quality Samples for the N.I.H. Animal Center Water Supply.

**based on proposed MCLs for community systems

Inorganic Compounds (IOCs)

The only IOC detected above 50% of the MCL was nitrate. The MCL for nitrate is 10 ppm and it was detected one time above 50% of the MCL at 6 ppm in a sample collected on January 13, 1994. The nitrate has been detected in the water supply since 1993 at levels below 50% of the MCL. The average of twenty-nine samples collected since 1993 is 2.0 ppm. Very low levels of barium, sodium and nickel have been detected. Barium has an MCL of 2, but sodium and nickel do not have an MCL

Volatile Organic Compounds (VOCs)

No VOCs above 50% of the MCL have been detected in N.I.H. Animal Center's water supply. The only VOCs that have been detected two times in the water supply were trihalomethanes (THMs). THMs are disinfection by-products that are the result of a reaction between chlorine used for disinfection and organic material found in the aquifer. The MCL for THMs is 80 ppb and is based on the total detections of four THMs tested. The total of the THMS detected in the water supply were 2.6 ppb and 0.8 ppb.

Synthetic Organic Compounds (SOCs)

No SOC's above 50% of the MCL have been detected in N.I.H. Animal Center's water supply. The only SOC detected one time was di(ethylhexyl)phthalate in a sample collected on April 21, 2005 at 0.9 ppb. The MCL for this SOC is 6 ppb. This SOC was also detected in the laboratory blank on the same date and therefore is not believed to represent N.I.H. Animal Center's water quality.

Radionuclides

Nontransient noncommunity systems are currently not regulated for radionuclides. The only radionuclide that has been tested one time is radon-222 on March 13, 2003. Radon was detected in this sample at 525 picoCuries/Liter. 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

Ground water under the influence of surface water (GWUDI) testing was conducted for the N.I.H. Animal Center wells. GWUDI testing requires collection and analysis of raw water samples for bacteria (total and fecal coliform). Total coliform bacteria were detected in all eleven raw water samples collected for Well No.1. Fecal coliform bacteria were detected in six of the raw water samples collected for Well No. 1. No coliform bacteria were detected in any of the raw water samples collected for the other wells. The results of the raw water bacteriological testing are shown in table 5.

SOURCE NAME	RAIN DATE	RAIN AMOUNT (INCHES)	REMARK	SAMPLE DATE	TOTAL COLIFORM (COL/100ML)	FECAL COLIFORM (COL/100ML)
NIH WELL 1	13-Nov-02	2.5	WET SAMPLE 1	13-Nov-02	1600	23
NIH WELL 1	1-Dec-02	0.5	WET SAMPLE 2	2-Dec-02	3.6	-1.1
NIH WELL 1	3-Feb-03	0.5	WET SET 1	3-Feb-03	3.6	-1.1
NIH WELL 1	3-Feb-03	0.5	WET SET 1	4-Feb-03	1.1	-1.1
NIH WELL 1	3-Feb-03	0.5	WET SET 1	5-Feb-03	23	-1.1
NIH WELL 1	3-Feb-03	0.5	WET SET 1	6-Feb-03	23	-1.1
NIH WELL 1	13-May-03	0.5	WET SET 2	13-May-03	16	1.1
NIH WELL 1	13-May-03	0.5	WET SET 2	14-May-03	23	1.1
NIH WELL 1	13-May-03	0.5	WET SET 2	15-May-03	23	3.6
NIH WELL 1	13-May-03	0.5	WET SET 2	16-May-03	23	23
NIH WELL 1	26-Aug-03	0	WET SAMPLE 3	26-Aug-03	1.1	1.1
NIH WELL 2	13-Nov-02	2.5	WET SAMPLE	13-Nov-02	-1.1	-1.1
NIH WELL 3	13-Nov-02	2.5	WET SAMPLE 1	13-Nov-02	-2	-2
NIH WELL 3	1-Dec-02	0.5	WET SAMPLE 2	1-Dec-02	-1.1	-1.1
NIH WELL 5	13-Nov-02	2.5	WET SAMPLE	13-Nov-02	-1.1	-1.1

Table 5. Raw bacteriological test results for GWUDI determination of the wells.

Negative values indicate no detections

SUSCEPTIBILITY ANALYSIS

N.I.H. Animal Center'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 non-carbonate rocks of 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 from microbial contamination. 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 5.

Inorganic Compounds (IOCs)

Nitrate was the only IOC detected above 50% of the MCL in N.I.H. Animal Center's water supply. Out of 29 samples analyzed, only one sample had results above 50% of the MCL. A review of the nitrate data shows a decreasing trend in the nitrate levels. The nitrate levels may be decreasing due to fewer animals in pens on the property. Also Well No.1, which was located directly downgradient of a sheep pen is now no longer in use.

Based on above analysis N.I.H. Animal Center's water supply is **not** susceptible to inorganic compounds.

Volatile Organic Compounds (VOCs)

No VOCs above 50% of the MCL have been detected in N.I.H. Animal Center's water supply since 1993. There are three potential sources of VOC contamination including the N.I.H. Animal Center in the WHPA (figure 2), but water quality data indicates that these sources have not had an impact on the water supply. Heating oil, which is stored in these USTs, is primarily non VOCs and less mobile than gasoline.

Based on the above discussion, N.I.H. Animal Center's water supply is **not** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

No SOC's have been detected in N.I.H. Animal Center's water supply. One potential point source of contamination may be the N>I.H. Animal Center (figure 2). Application of pesticides on facility property and cropland can be potential nonpoint 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, N.I.H. Animal Center's water supply is **not** susceptible to SOC contamination.

Radionuclides

Nontransient noncommunity systems are currently not regulated for radionuclides. . The only radionuclide detected was radon-222 at levels above the lower proposed MCL for radon for community water systems. Radon is a naturally occurring compound and is prevalent in ground water due to the radioactive decay of uranium bearing minerals in the bedrock (Bolton, 1996). No data is currently available for review of the other radionuclides

Based on the above analysis, N.I.H. Animal Center's **maybe** susceptible to radon.

Microbiological Contaminants

Based on raw water bacteriological data N.I.H. Animal Center's Well No. 1 was determined to be GWUDI. This well has been disconnected from the system and is no longer in service. There are several areas within the WHPA where animals are fenced in, as a result animal wastes may be a possible source of microbiological contaminants to ground water.

Based on the above discussion, N.I.H. Animal Center's Well No. 1 water supply is susceptible to microbiological contaminants like *Giardia* and *Cryptosporidia*, but Well Nos. 2,3 and 5 are not susceptible to microbiological contaminants.

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	NO	YES	NO	YES	NO
Inorganic Compounds (except nitrate)	NO	NO	NO	YES	NO
Volatile Organic Compounds	YES	NO	NO	YES	NO
Synthetic Organic Compounds	YES	NO	NO	YES	NO
Radionuclides (except radon)	MAYBE	NO DATA	NO	MAYBE	CANNOT BE DETERMINED
Radon	YES	YES	NO	YES	MAYBE*
Microbiological Contaminants (Well No.1)	YES	YES	NO	YES	YES
Microbiological Contaminants (Well Nos.2, 3 and 5)	NO	NO	NO	YES	NO

Table 6. Susceptibility Summary for N.I.H. Animal Center's water supply.

*based on proposed MCL for community systems

MANAGEMENT OF THE WHPA

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.
- Since N.I.H. Animal Center uses hazardous materials in its operations, ensure that best management practices are being implemented when handling these materials to prevent contamination of ground water.
- Should consider using above ground tanks secondary vaults for storing heating oil.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.
- Follow State well construction regulations to abandon and seal Well No. 1.

Monitoring

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.

Changes in Use

- Request an increase in water appropriation for N.I.H Animal Center based on pumpage reports for the past three years.

REFERENCES

- Bolton, David W., 1996, Network Description and Initial Water-Quality Data from a Statewide Ground-Water Quality Network in Maryland: Maryland Geological Survey Report of Investigations No. 60, 167 p.
- Dine, J. R., Adamski, J. C., and Tompkins, M. D., 1992, Hydrologic Data for Howard County: Maryland Geological Survey Basic Data Report No. 19 240 p.
- Dingman, R. J., and Meyer G. M., 1954, The Water Resources of Howard and Montgomery Counties: Maryland Department of Geology, Mines and Water Resources Bulletin 14, 260p.
- Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36 p.
- 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: MO1960G011
Public Water Supply Inspection Reports
MDE Water Supply Program Oracle Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles:
Poolesville SW and Sterling NW (1993)
USGS Topographic 7.5-Minute Poolesville Quadrangle
Maryland Department of Planning 2002 Montgomery County Land Use Map
Maryland Department of Planning 2004 Montgomery County Sewer Map

FIGURES

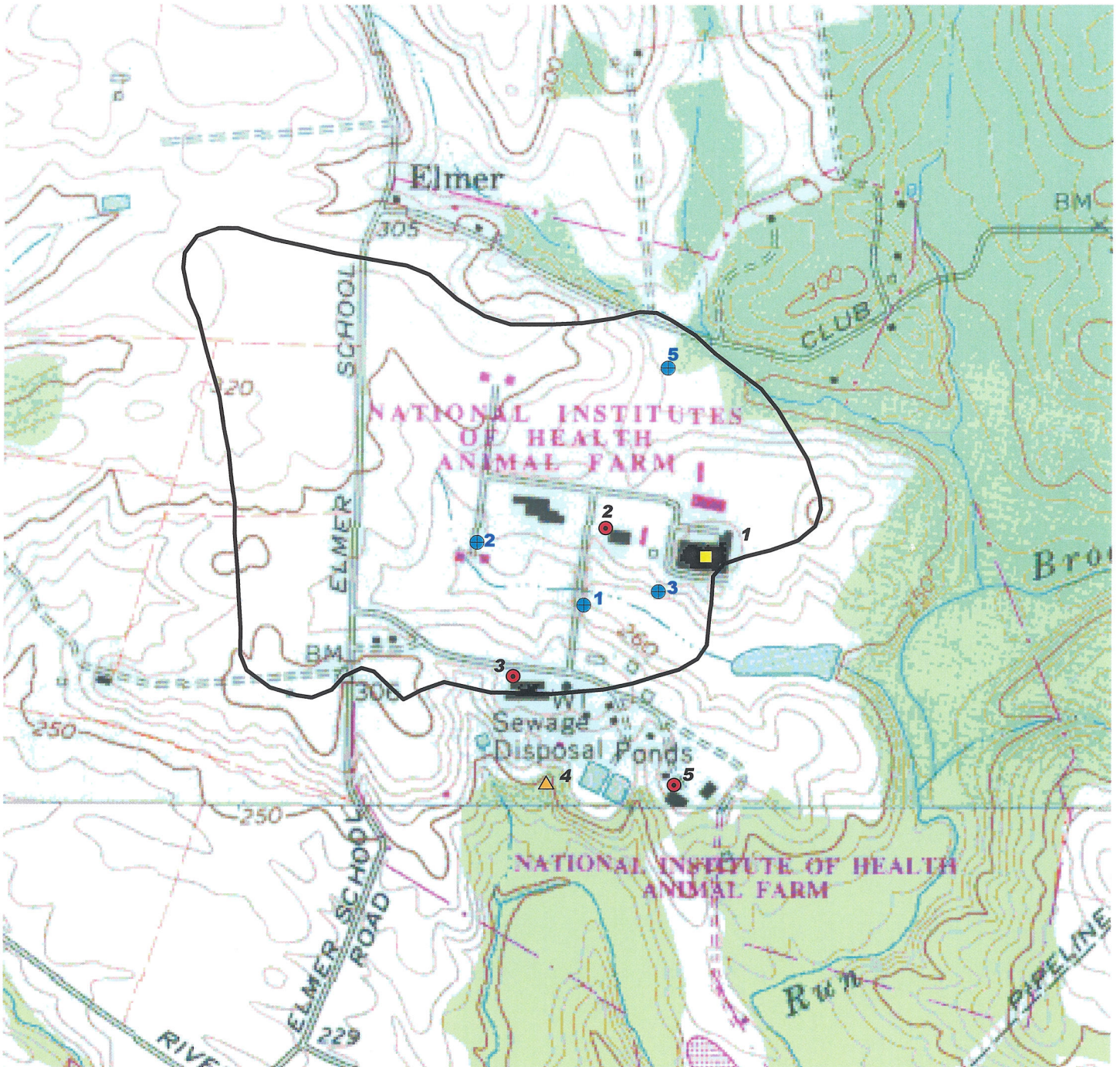
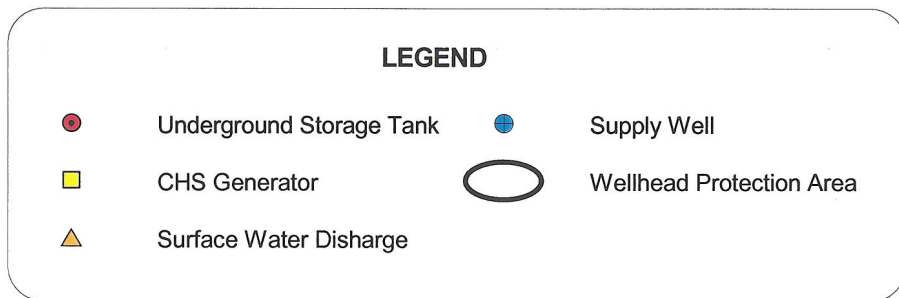


Figure 2. Wellhead Protection Area for N.I.H. Animal Center with Potential Contaminants



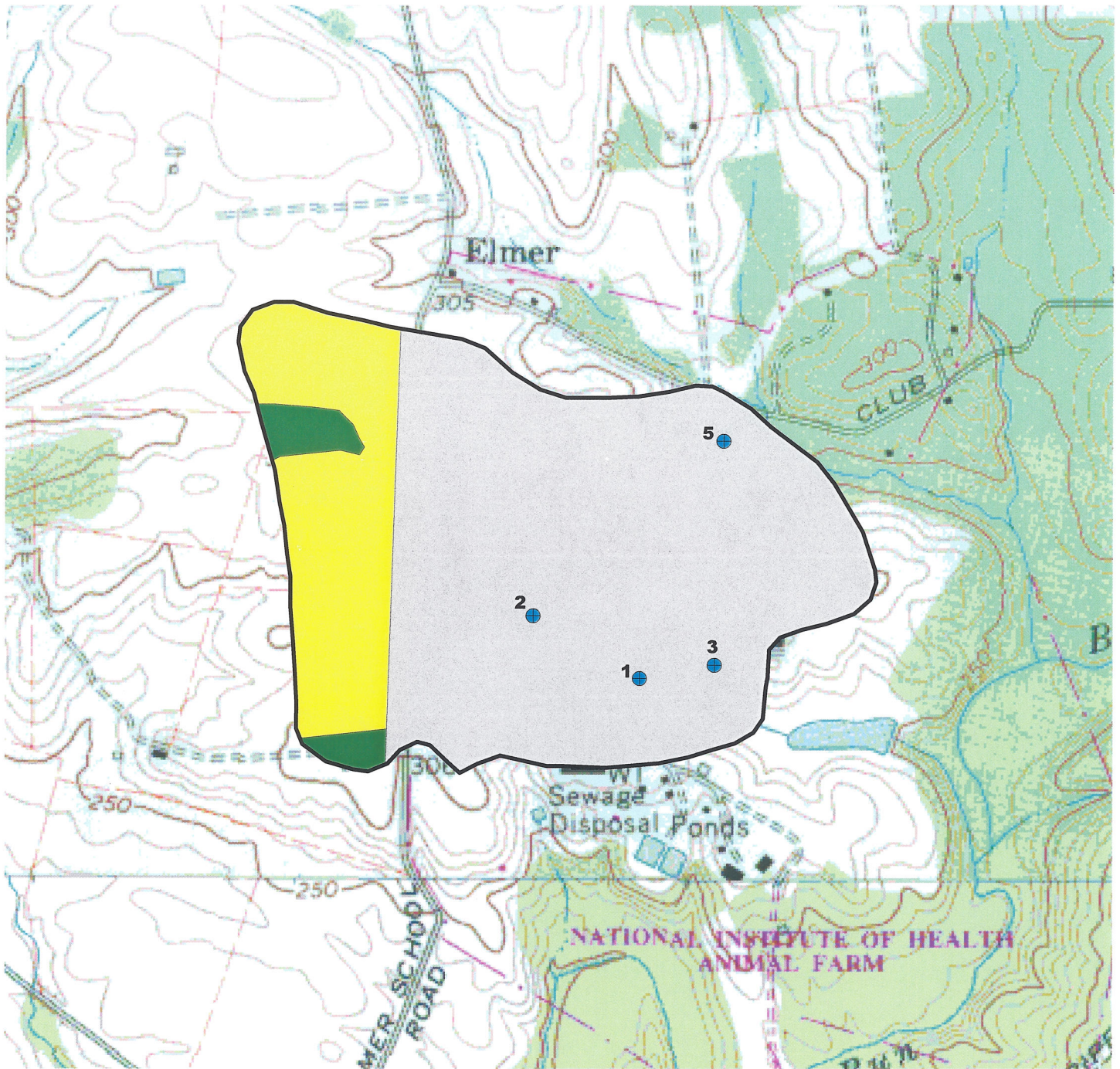
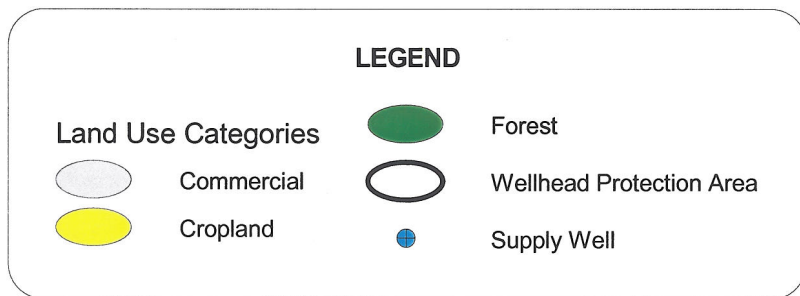


Figure 3. Land Use within the N.I.H. Animal Center Wellhead Protection Area



Base Map: USGS 7.5 minute Topographic Poolesville Quadrangle
 Source: MD Dept of Planning Land Use Map (2002)