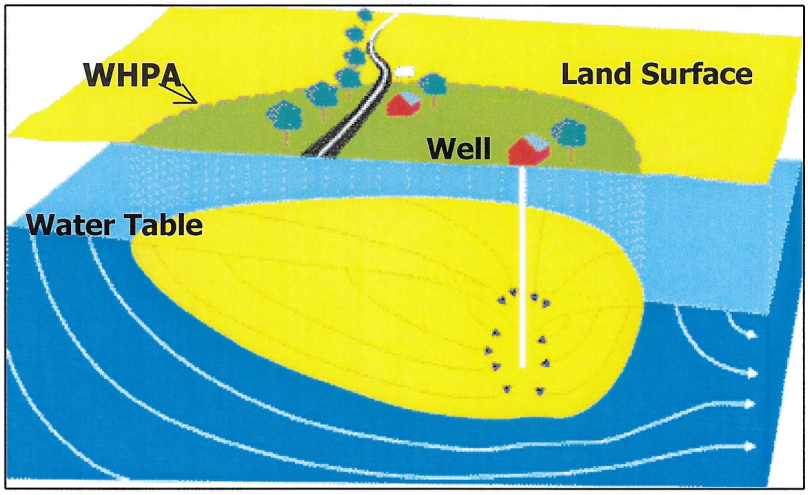
SOURCE WATER ASSESSMENT

FOR THE TOWN OF MANCHESTER

CARROLL COUNTY, MD



Prepared By
Water Management Administration
Water Supply Program
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MDE

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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the Town of Manchester. 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 Manchester's water supply is an unconfined fractured rock aquifer, known as the Upper Pelitic Schist. The system currently uses nine wells and two springs to obtain its drinking water. The Source Water Assessment Area was delineated by the Carroll County Bureau of Water Resources Management and 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 Manchester's water supply is based on a review of the water quality data, potential sources of contamination, aquifer characteristics, and well and spring integrity. It was determined that all of Manchester's water supply sources are susceptible to contamination by nitrates, volatile organic compounds, and radon, but not to synthetic organic compounds, other radionuclides or inorganic compounds. It was also determined that all of Manchester's water supply sources are not susceptible to protozoans except for Huppman Spring and Crossroads Well 1. In addition, Bachman Rd., Patricia Ct. and Walnut St. Wells and Hillside and Huppman Springs are susceptible to total coliform.

INTRODUCTION

The Town of Manchester is located about 8 miles northeast of Westminster in Carroll County (figure 1). The Town owns and operates its water supply system that serves a population of about 3100. Currently, the water is supplied by nine wells and two springs located in various sections of the Town (figure 1). The water from these sources is pumped to and treated at nine treatment plants located in the vicinity of the sources. The Town will be connecting three new wells (Ferrier Rd. Well Nos. A, B and C) once it receives a certificate of potability from the Water Supply Program for their use for public supply.

SOURCE INFORMATION

Source information was obtained from the Water Supply Program's database, site visits, well completion reports, sanitary surveys, and inspection reports and published reports. A review of well data and sanitary surveys of Manchester's water system indicates that all the wells were drilled after 1973 when the State's well construction regulations went into effect and should meet construction standards for grouting and casing. The Town used to rely mainly on springs for its water supply. The requirements of the Surface Water Treatment Rule mandated the testing of all the Town's water supply sources to determine whether they were under the influence of surface water. Raw water bacteriological testing of the sources indicated that Route 27 Spring, Water St. Spring and the Upper Springs of the Walnut St. Spring system were determined to be ground water under the influence of surface water (GWUDI). As a result, the Town has disconnected these sources from the system. Hillside Spring which is part of the Walnut Springs system was determined not to be GWUDI from initial testing. The Town has made improvements to the Huppman Spring and is currently retesting its raw water for surface water influence. It soon plans to make improvements to the Hilliside Spring and conduct more testing upon completion of the project. Table 1 contains a summary of the source data.

The yields of the wells currently being used range from 16 gallons per minute (gpm) to 85 gpm. Manchester has a four Water Appropriation Permits that allow the Town to use an average of 565,700 gallons per day (gpd) and 864,400 gpd during the month of maximum use. Based on reported pumpage for the past year (2003), the Town used an average of 258,100 gpd and 287,200 gpd in June, which was the month of maximum use. The water use below the appropriated amounts may be attributed to the water use restrictions that the Town has imposed on its water users.

PLANT ID	SOURCE ID	SOURCE NAME	PERMIT NO	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED
06	01	Route 30 Well	CL812456	293	30	1985
04	02	Bachman Rd. Well	CL733684	250	72	1975
02	03	Holland Drive Well	CL738001	100	48	1979
07	04	Patricia Ct. Well	CL738746	200	44	1980
08	06	Crossroads 1 Well	CL882877	263	48	1992
09	07	Crossroads 2 Well	CL881367	200	92	1990
01	13	Walnut St. Well	CL816577	250	20	1989
01	14	Hillside Spring	N/A	N/A	N/A	N/A
01	15	Huppman Spring	N/A	N/A	N/A	N/A
10	16	Manchester Farms Well	CL738744	204	41	1980
12	17	Ferrier Rd. Well B*	CL941668	400	60	1999
12	18	Ferrier Rd. Well C*	CL943119	455	63	2001
12	19	Ferrier Rd. Well A*	CL943120	400	81	2001
11	20	Hallie Hill Well	CL930067	300	83	1995

Table 1. Manchester Source Information.
*Future Well

HYDROGEOLOGY

The Manchester area lies in the Piedmont physiographic province and is located on a major watershed divide which generally follows Route 30 through Town, between the Gunpowder River and Middle Potomac River basins. The Manchester area is mainly underlain by schist and phyllite, which have been mapped as the Upper Pelitic Schist or Marburg Formation and are part of the Wissahickon Group. Recently they have also been mapped as the Gillis Formation. A narrow northeast trending band of metavolcanic rock, known as the Sams Metabasalt is also present in the northwest section of Manchester. Only the Bachman Well is in this rock type. The geology and rock in the Manchester area result in unconfined, fractured rock type aquifers.

Weathering of the schist, phyllite, and metabasalt results in clayey overburden material known as saprolite, below which is fractured bedrock. In the Manchester area saprolite thickness ranges from 0 feet to over 100 feet in the valleys. In this type of aquifer, most of the ground water is stored in the saprolite and ground water flow is through fractures in the rock. 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 Manchester's water supply was delineated by the Carroll County Bureau of Water Resource Management as part of the County Water Resources Ordinance development (R. E. Wright, 1989). An area for the proposed Ferrier and Thomas Wells was delineated by the WSP. Hydrogeologic mapping was the method used for the delineations. This is the methodology recommended for fractured rock aquifers in the EPA approved Maryland's Source Water Assessment Plan (1999).

The Manchester WHPA consists of nine smaller WHPAs (figure 2). These WHPAs are based on the watersheds in which the wells and springs are located. The delineated WHPAs represent the areas which contribute ground water to the wells and springs. These areas are based on "capture areas" as estimated from available field testing data, hydrologic flow systems, and ground water availability estimates, in combination with the hydrogeological characteristics of the aquifer (R. E. Wright, 1989). One of the areas does not have any supply sources. This was originally delineated when for the Route 27 spring when it was in use. The total area of the Manchester WHPA is 1,490 acres.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are classified as either point of 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. The WSP conducted a joint field survey of the WHPA in June 2002 with the Town's Water Operators.

Point Sources

A review of MDE and Carroll County contaminant databases as well as the field survey revealed several point sources of contamination in and adjacent to the WHPA. Figure 2 identifies Underground Storage Tanks (UST) sites, Auto Repairs Shop (AUTO) and a Leaking Underground Tank (LUST) site as potential point sources of contamination. Table 2 lists the facilities identified and their potential types of contaminants. The contaminants are based on generalized categories and often the potential contaminant depends on the specific chemicals and processes being used

or which had been used at the facility. The potential contaminants are not limited to those listed. Potential contaminants are grouped as Volatile Organic Compounds (VOC) and Heavy Metals (HM).

Several of the facilities with USTs (these are * in table 2)) have had their tanks replaced with newer ones due to leaks or non-compliance with current State tank regulations. Other facilities that had USTs have had them permanently removed (eg Manchester Supply, Manchester Volunteer Fire Station) due to leaks or other non-compliance issues. Newer tanks are less likely to leak due to new construction standards, however leaks are still possible in underground tanks and piping systems. Routine testing of these systems reduce their potential for leaks to be undetected for long periods of time. But because they are located in the subsurface, leaks can go undetected and still create water quality impacts.

ID	Type	Site Name	Address	Potential Contaminant	Status
1	UST*	Rohrbaugh Charter Service Inc.	3395 Main St.	VOC	1 tank, 2 tanks removed
2	UST	Sheetz # 177	3281 Main St.	VOC	4 tanks
3	UST	Manchester Elementary School	3224 York St.	VOC	1 tank
4	UST	Manchester Auto Parts	3102 Main St.	VOC	Several tanks
5	UST	Grace Bible Church	3250 Charmil Dr	VOC	1 tank
6	UST	Renfro Hilltop Service	2330 Hanover Pike	VOC	Several tanks
7	AUTO*	Certified Auto Repair Service, Inc.	3272 Main St.	VOC, HM	Active
8	AUTO	Manchester Motors	3037 Hanover Pike	VOC, HM	Active
9	AUTO	Caltrider's Garage	2900 Hanover Pike	VOC, HM	Active
10	LUST	Old Bus Depot	Off York Street	VOC	Tank removed

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

Non-Point Sources

The Maryland Office of Planning's 1997 digital land use map for Carroll County was used to determine the predominant types of land use in the WHPA (figure 3). A large portion of the WHPA is made of residential land (48%) followed by cropland (31%). Some of the cropland shown on the 2000 land usemap is now being developed into residential lots for new homes.

LAND USE CATEGORIES	TOTAL AREA (acres)	PERCENTAGE OF WHPA
Low Density Residential	289.25	19.41
Medium Density Residential	407.69	27.36
High Density Residential	12.14	0.81
Commercial/Institutional	30.36	2.04
Cropland	459.28	30.82
Pasture	37.96	2.55
Forest	205.35	13.78
Feeding Operations	48.07	3.23
Total	1490.10	100.00

Table 3. Land Use Summary for the Manchester WHPA.

Agricultural land (cropland, pasture and feeding operations) is commonly associated with nitrate loading of ground water. Cropland represents a potential source of SOCs depending on fertilizing practices and use of pesticides. In addition, pasture and feeding operations may be potential sources of microbiological pathogens due to animal wastes. Residential areas may be a source of nitrates and SOCs if fertilizers and pesticides are not used carefully for lawns and gardens. Commercial areas are associated with facilities that may have point sources of contamination as described earlier.

The Maryland Office of Planning's 1995 Carroll County Sewer Map, shows that 30% of the Manchester WHPA is not planned for sewer service (figure 4). Table 4 summarizes the sewer service categories in the WHPA. Categories showing future services (within 2 to 6 years) may now have service, since the map is based on 1995 data.

SEWER SEVICE AREA	TOTAL AREA (acres)	PERCENTAGE OF WHPA
No Planned Service	448.13	30.08
Existing Service	300.95	20.21
Service within 2 to 6 years	540.55	36.25
Service within 10 years	200.47	13.46
Total	1,490.10	100

Table 4. Sewer Service Area Summary for the Manchester WHPA.

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 Manchester water system currently has 9 points of entry or plants all of which have ph adjustment and hypochlorination (post) for treatment except for the Bachman Well plant which only has hypochlorintation. . The purpose of the pH adjustment is for corrosion control and the hypochlorination is for disinfection.

A review of the monitoring data since 1993 for Manchester's water supply indicates that it meets the current drinking water standards. The water quality sampling results are summarized in Table 5. Radionuclide numbers used in this table include detections of radon-222 using proposed MCLs.

	Nitrate		SOCs		VOCs		IOCs (except nitrate)		Radionuclides	
PLANT ID	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	45	44	3	0	49	3	8	0	3	1
02	32	30	6	2	8	0	7	0	3	2
04	36	10	3	1	6	0	8	1	2	1
06	46	46	4	1	6	0	7	0	3	2
07	47	47	3	0	11	0	7	0	3	1
08	17	1	5	0	9	0	8	0	2	1
09	3	1	1	0	8	0	1	0	1	1
10	6	6	2	0	10	0	4	0	1	1
11	4	4	1	0	1	0	1	0	1	1

Table 5. Summary of Water Quality Samples for Manchester's Water Supply

Inorganic Compounds (IOCs)

Nitrate was detected above 50% of the MCL at all the plants. The MCL for nitrate is 10 ppm. The nitrate detections above 50% of the MCL in Manchester's water supply are shown in tables 6a – 6h. The trend of the nitrate values is discussed in the susceptibility analysis section. In addition, mercury was detected above 50% of the MCL one time at the Bachman Well plant (table 6c). The MCL for mercury is 2 parts per billion (ppb).

PLANT ID	SAMPLE DATE	RESULT (ppm)
01	5-Apr-93	5.6
01	5-Oct-93	6.6
01	11-May-94	5.7
01	10-Aug-94	6.6
01	10-May-95	7
01	9-Aug-95	6.8
01	10-Oct-95	7.4
01	8-Nov-95	6.6
01	22-Feb-96	5.1
01	8-May-96	5.3
01	7-Aug-96	6
01	7-Nov-96	5.7
01	24-Apr-97	5.5
01	27-May-97	5.7
01	21-Aug-97	5.9
01	20-Nov-97	6
01	13-May-98	6.2
01	26-Oct-98	7.4
01	12-Nov-98	8.45
01	21-Jan-99	7.63
01	8-Apr-99	8.1
01	8-Apr-99	8.63

PLANT ID	SAMPLE DATE	RESULT (ppm)
01	23-Jul-99	9.67
01	23-Jul-99	8.02
01	7-Oct-99	7.84
01	7-Oct-99	7.8
01	5-Jan-00	9.08
01	5-Jan-00	8.28
01	4-Apr-00	7.2
01	5-Apr-00	6.55
01	5-Apr-00	7.58
01	17-Jan-01	8.16
01	17-Jan-01	7.9
01	17-Jan-01	8.16
01	17-Jan-01	7.9
01	23-Aug-02	9.08
01	23-Aug-02	9.08
01	23-Aug-02	8.71
01	23-Aug-02	8.71
01	20-Nov-02	7.63
01	20-Nov-02	7.96
01	27-Mar-03	5.58
01	23-Apr-03	10.4
01	10-Dec-03	6.34

Table 6a. Nitrate results above 50% of the MCL for Manchester Plant 1 (Walnut St.).

PLANT ID	SAMPLE DATE	RESULT (ppm)
02	5-Apr-93	6.6
02	5-Oct-93	5.4
02	11-May-94	8
02	10-Aug-94	5.8
02	10-May-95	5.4
02	9-Aug-95	7.7
02	10-Oct-95	5.4
02	8-Nov-95	5.1
02	22-Feb-96	6.3
02	8-May-96	5.2
02	3-Jun-96	8.6
02	7-Aug-96	5.2
02	7-Nov-96	5.2
02	24-Apr-97	6.1
02	27-May-97	6.1

PLANT ID	SAMPLE DATE	RESULT (ppm)
02	20-Nov-97	5.1
02	13-May-98	7.57
02	26-Oct-98	5
02	12-Nov-98	6.69
02	21-Jan-99	5.39
02	8-Apr-99	5.9
02	23-Jul-99	5.79
02	7-Oct-99	5.51
02	5-Jan-00	6.02
02	5-Apr-00	5.51
02	31-Oct-00	5.6
02	17-Jan-01	6.04
02	17-Jan-01	6.04
02	20-Nov-02	7.78
02	10-Dec-03	5.19

Table 6b. Nitrate results above 50% of the MCL for Manchester Plant 2 (Holland Dr.).

PLANT ID	CONTAMINANT	MCL (ppm)	SAMPLE DATE	RESULT (ppm)
04	NITRATE	10	5-Oct-93	5
04	NITRATE	10	11-May-94	5.3
04	NITRATE	10	10-May-95	5.1
04	NITRATE	10	9-Aug-95	5
04	MERCURY	0.002	16-Oct-95	0.001
04	NITRATE	10	16-Oct-95	5.1
04	NITRATE	10	12-Nov-98	5.66
04	NITRATE	10	21-Jan-99	5.11
04	NITRATE	10	8-Apr-99	5.28
04	NITRATE	10	7-Oct-99	5.35
04	NITRATE	10	3-Oct-00	5.42

Table 6c. IOC results above 50% of the MCL for Manchester Plant 4 (Bachman Rd.).

PLANT ID	SAMPLE DATE	RESULT (ppm)
06	10-May-95	8.6
06	9-Aug-95	5.2
06	10-Oct-95	7.9
06	8-Nov-95	7.6
06	22-Feb-96	9.6
06	8-May-96	7.6
06	7-Aug-96	7.7
06	7-Nov-96	7.8
06	24-Apr-97	8.4
06	27-May-97	8.5
06	21-Aug-97	7.4
06	20-Nov-97	7.2
06	13-May-98	9.13
06	28-Oct-98	7.7
06	12-Nov-98	9.96
06	5-Jan-00	9.96
06	5-Apr-00	7.86
06	12-Jul-00	8.83
06	12-Jul-00	8.83

PLANT ID	SAMPLE DATE	RESULT (ppm)
06	3-Oct-00	8.7
06	31-Oct-00	8
06	17-Jan-01	8.59
06	17-Jan-01	8.59
06	10-Apr-01	9.15
06	5-Jul-01	9.5
06	22-Oct-01	9.62
06	28-Jan-02	8.03
06	18-Apr-02	10
06	18-Apr-02	10
06	05-Jul-02	9.6
06	23-Aug-02	8.71
06	03-Oct-02	9.62
06	03-Oct-02	9.62
06	27-Mar-03	11.8
06	23-Apr-03	10.4
06	06-May-03	12.3
06	Jun-03	11.7
06	16-Jul-03	11.8

Table 6d. Nitrate results above 50% of the MCL for Manchester Plant 6 (Route 30).

PLANT ID	SAMPLE DATE	RESULT (ppm)
07	5-Apr-93	7.3
07	5-Oct-93	6.4
07	11-May-94	7.5
07	10-Aug-94	7.1
07	10-May-95	6.9
07	9-Aug-95	7.4
07	16-Oct-95	7.3
07	8-Nov-95	6.9
07	22-Feb-96	7.8
07	8-May-96	6.5
07	7-Aug-96	7.5
07	7-Nov-96	7.6
07	24-Apr-97	7.4
07	27-May-97	7.3
07	21-Aug-97	6.6
07	20-Nov-97	6.9
07	13-May-98	8.13
07	28-Oct-98	7.6
07	12-Nov-98	8.94
07	21-Jan-99	7.69
07	8-Apr-99	8.43
07	23-Jul-99	9.67
07	7-Oct-99	7.16
07	7-Oct-99	7.16
07	5-Jan-00	9.88
07	5-Apr-00	6.57
07	12-Jul-00	8.56
07	12-Jul-00	8.56
07	3-Oct-00	9.96
07	31-Oct-00	7.7
07	17-Jan-01	8.52
07	17-Jan-01	8.52
07	10-Apr-01	7.12
07	5-Jul-01	8.51
07	22-Oct-01	8.42
07	28-Jan-02	8.52
07	18-Apr-02	8.86
07	18-Apr-02	8.86
07	05-Jul-02	9.96
07	23-Aug-02	9.08
07	03-Oct-02	7.68
07	03-Oct-02	7.68
07	07-Jan-03	9.3
07	23-Apr-03	9.1
07	27-May-03	9.47
07	16-Jul-03	9.07
07	22-Oct-02	9.08

Table 6e. Nitrate results above 50% of the MCL for Manchester Plant 7 (Patricia Ct.).

PLANT ID	SAMPLE DATE	RESULT (ppm)
08	15-Jun-00	5

Table 6f. Nitrate results above 50% of the MCL for Manchester Plant 8 (Crossroads 1).

PLANT ID	SAMPLE DATE	RESULT (ppm)
10	16-Jun-95	8
10	18-Apr-01	7.9
10	15-Aug-01	7.88
10	12-Aug-02	7.5
10	20-Nov-02	7.19
10	10-Dec-03	5.54

Table 6g. Nitrate results above 50% of the MCL at Manchester Plant 10 (Manchester Farms).

PLANT ID	SAMPLE DATE	RESULT (ppm)
11	27-Dec-02	6.6
11	27-May-03	5.41
11	16-Jul-03	6.15
11	22-Oct-03	6.73

Table 6h. Nitrate results above 50% of the MCL at Manchester Plant 11 (Hallie Hill).

Volatile Organic Compounds (VOCs)

The only VOC detected above 50% of a MCL was dichloroethylene. The MCL for dichloroethylene (DCE) is 7 ppb. The VOC detections above 50% of the MCL in Manchester's water supply are shown in Table 7 below.

PLANT ID	CONTAMINANT NAME	MCL (ppb)	SAMPLE DATE	RESULT (ppb)
01	1,1-DICHLOROETHYLENE	7	15-Sep-99	4.5
01	1,1-DICHLOROETHYLENE	7	15-Feb-00	3.8
01	1,1-DICHLOROETHYLENE	7	4-Apr-00	4.6

Table 7. VOC results above 50% of the MCL for Manchester's Water Supply.

The most recent results for dichloroethylene for Plant 1 have been between 0.7 and 1.1 ppb. Since 1990, several other VOCs have also been detected, but at levels well below 50% of their MCLs. Plant 1 (Walnut Street) had the most VOC detections. In addition to DCE, trichloroethylene (TCE), toluene and methyl-tert-butyl-ether (MTBE) were detected at Plant 1. The MCL for TCE is 200 ppb and it was detected between 0.4 and 25.8 ppb. The MCL for toluene is 1000 ppb and it was detected once at 0.7 ppb. MTBE does not currently have an MCL but a taste and odor threshold of 20 ppb. MTBE was detected at levels between 0.6 to 68 ppb. In addition, disinfecton byproducts known as trihalomethanes (THMs) were also detected at Plant 1. The total of the THM levels ranged from 0.6 and 2.5 ppb. The current MCL for regulated systems is 80 ppb for the total of all the THMs. Disinfection byproducts are the result of a reaction between chlorine used for disinfection and organic material in the water supply.

Plant 2 (Holland Dr.) had two detections of MTBE at 1.1 ppb. Plant 7 (Patricia Ct.) had detections of carbon tetrachloride (0.6 ppb), chloroform (1.8 ppb) and MTBE (0.5 – 0.9 ppb). Plant 8 (Crossroads 1) had detections of DCE (0.7 ppb) and TCE (5.1 ppb). No VOCs have been detected at Plant 4 (Bachman Rd.), Plant 6 (Route 30), Plant 9 (Crossroads 2) and Plant 10 (Manchester Farm).

Synthetic Organic Compounds (SOCs)

The only SOC detected at or above 50% of the MCL was di(2-ethylhexyl) phthalate. Table 8 shows the levels of these SOC detections and their respective MCLS. A review of the SOC results indicated that the phthalate

was found in the laboratory blanks and therefore these results are not interpreted to represent actual water quality, except for the high levels found in Plant 2. The Town resampled the raw and finished water for pthhalate at Plant 2 in December 2002, and found no detections of this SOC.

PLANT ID	CONTAMINANT NAME	MCL (ppb)	SAMPLE DATE	RESULT (ppb)
01	DI(2-ETHYLHEXYL) PHTHALATE	6	10-Oct-95	8.96
02	DI(2-ETHYLHEXYL) PHTHALATE	6	10-Oct-95	9.54
06	DI(2-ETHYLHEXYL) PHTHALATE	6	10-Oct-95	9.64
04	DI(2-ETHYLHEXYL) PHTHALATE	6	16-Oct-95	5.51
02	DI(2-ETHYLHEXYL) PHTHALATE	6	28-Nov-01	38.3

Table 8. SOC results above 50% of the MCL for Manchester's Water Supply

The only other regulated SOC that was detected one time at 4.4 ppb at the Holland Drive plant was di(2-ethylhexyl)adipate . The MCL for this SOC is 400 ppb. A review of the sampling data indicated that it was detected in the blank and does not represent water quality.

Radionuclides

No radionuclides above 50% of the MCL were detected in Manchester's water supply. Radium-222 was detected at levels of concern. 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. Table 9 shows the results of radon-222 at or above 50% of the proposed MCLs.

PLANT ID	CONTAMINANT NAME	PROPOSED MCL (pCi/L)	SAMPLE DATE	RESULT (pCi/L)
01	RADON-222	300/4000	4-Apr-00	2020
02	RADON-222	300/4000	11-Mar-97	5285
02	RADON-222	300/4000	06-Nov-02	4500
06	RADON-222	300/4000	10-Dec-96	4215
06	RADON-222	300/4000	06-Nov-02	5000
07	RADON-222	300/4000	10-Dec-96	6200
07	RADON-222	300/4000	06-Nov-02	5050
08	RADON-222	300/4000	10-Sep-97	415
09	RADON-222	300/4000	12-Aug-02	4000
10	RADON-222	300/4000	12-Aug-02	2945

Table 9. Radon-222 results above 50% of the proposed MCLs for Manchester's Water Supply.

Gross alpha and gross beta radiation were detected at levels well below 50% of their respective MCLs of 15 pCi/L and 50 pCi/L. Gross alpha was detected at levels ranging from 2 to 3.1 pCi/L. Gross beta was detected at levels ranging from 2 to 3 pCi/L.

Microbiological Contaminants

Raw water samples were collected and tested for bacteria from all the wells and springs except for Crossroads Well 1 to determine whether these sources are ground water under the influence of surface water (GWUDI). The WSP is waiting for GWUDI sampling data from Crossroads Well 1 and two sets of wet weather samples from the Huppman Springs. The results of the bacteriological tests are shown in Table 10. Negative values in this table indicate absence of any coliform in the sample.

SOURCE NAME	RAIN DATE	RAIN AMOUNT	REMARK	SAMPLE DATE	TOTAL COLIFORM (COL/100ml)	FECAL COLIFORM (COL/100ml)
RT 30 (WELL 6)	28-Nov-93	4.3	WET SET 1	28-Nov-93	0	0
RT 30 (WELL 6)	28-Nov-93	4.3	WET SET 1	29-Nov-93	0	0
RT 30 (WELL 6)	28-Nov-93	4.3	WET SET 1	30-Nov-93	0	0
RT 30 (WELL 6)	28-Nov-93	4.3	WET SET 1	1-Dec-93	0	0
RT 30 (WELL 6)	21-Mar-94	.65	WET SET 2	22-Mar-94	0	0
RT 30 (WELL 6)	21-Mar-94	.65	WET SET 2	23-Mar-94	0	0
RT 30 (WELL 6)	21-Mar-94	.65	WET SET 2	24-Mar-94	0	0
RT 30 (WELL 6)	21-Mar-94	.65	WET SET 2	25-Mar-94	0	0
RT 30 (WELL 6)	5-Apr-94	0	DRY	5-Apr-94	0	0
RT 30 (WELL 6)	2-Jun-94	0	DRY	2-Jun-94	0	0
RT 30 (WELL 6)	18-Jul-94	.5	WET SET 3	18-Jul-94	0	0
RT 30 (WELL 6)	18-Jul-94	.5	WET SET 3	19-Jul-94	0	0
RT 30 (WELL 6)	18-Jul-94	.5	WET SET 3	20-Jul-94	0	0
RT 30 (WELL 6)	18-Jul-94	.5	WET SET 3	21-Jul-94	0	0
RT 30 (WELL 6)	24-Oct-94	.5	WET SET 4	24-Oct-94	0	0
RT 30 (WELL 6)	24-Oct-94	.5	WET SET 4	25-Oct-94	0	0
RT 30 (WELL 6)	24-Oct-94	.5	WET SET 4	26-Oct-94	0	0
RT 30 (WELL 6)	24-Oct-94	.5	WET SET 4	27-Oct-94	0	0
RT 30 (WELL 6)	17-May-95	0	DRY	17-May-95	0	0
BACHMAN RD (WELL 4)	28-Nov-93	4.3	WET SET 1	28-Nov-93	0	0
BACHMAN RD (WELL 4)	28-Nov-93	4.3	WET SET 1	29-Nov-93	0	0
BACHMAN RD (WELL 4)	28-Nov-93	4.3	WET SET 1	30-Nov-93	0	0
BACHMAN RD (WELL 4)	28-Nov-93	4.3	WET SET 1	1-Dec-93	0	0
BACHMAN RD (WELL 4)	21-Mar-94	.65	WET SET 2	22-Mar-94	0	0
BACHMAN RD (WELL 4)	21-Mar-94	.65	WET SET 2	23-Mar-94	0	0
BACHMAN RD (WELL 4)	21-Mar-94	.65	WET SET 2	25-Mar-94	0	0
BACHMAN RD (WELL 4)	21-Mar-94	.65	WET SET 2	26-Mar-94	0	0

Table 10. Raw water bacteriological test results for Manchester's sources.

SOURCE NAME	RAIN DATE	RAIN AMOUNT	REMARK	SAMPLE DATE	TOTAL COLIFORM (COL/100ml)	FECAL COLIFORM (COL/100ml)
BACHMAN RD (WELL 4)	5-Apr-94	0	DRY	5-Apr-94	0	0
BACHMAN RD (WELL 4)	2-Jun-94	0	DRY	2-Jun-94	0	0
BACHMAN RD (WELL 4)	18-Jul-94	.5	WET SET 3	18-Jul-94	0	0
BACHMAN RD (WELL 4)	18-Jul-94	.5	WET SET 3	19-Jul-94	0	0
BACHMAN RD (WELL 4)	18-Jul-94	.5	WET SET 3	20-Jul-94	0	0
BACHMAN RD (WELL 4)	18-Jul-94	.5	WET SET 3	21-Jul-94	0	0
BACHMAN RD (WELL 4)	24-Oct-94	.5	WET SET 4	24-Oct-94	6	0
BACHMAN RD (WELL 4)	24-Oct-94	.5	WET SET 4	25-Oct-94	5	0
BACHMAN RD (WELL 4)	24-Oct-94	.5	WET SET 4	26-Oct-94	6	0
BACHMAN RD (WELL 4)	24-Oct-94	.5	WET SET 4	27-Oct-94	80	0
BACHMAN RD (WELL 4)	17-May-95	0	DRY	17-May-95	0	0
HOLLAND DR (WELL 2)	28-Nov-93	4.3	WET SET 1	28-Nov-93	0	0
HOLLAND DR (WELL 2)	28-Nov-93	4.3	WET SET 1	29-Nov-93	0	0
HOLLAND DR (WELL 2)	28-Nov-93	4.3	WET SET 1	30-Nov-93	0	0
HOLLAND DR (WELL 2)	28-Nov-93	4.3	WET SET 1	1-Dec-93	0	0
HOLLAND DR (WELL 2)	21-Mar-94	.65	WET SET 2	22-Mar-94	0	0
HOLLAND DR (WELL 2)	21-Mar-94	.65	WET SET 2	23-Mar-94	0	0
HOLLAND DR (WELL 2)	21-Mar-94	.65	WET SET 2	24-Mar-94	0	0
HOLLAND DR (WELL 2)	21-Mar-94	.65	WET SET 2	25-Mar-94	0	0
HOLLAND DR (WELL 2)	5-Apr-94	0	DRY	5-Apr-94	0	0
HOLLAND DR (WELL 2)	2-Jun-94	0	DRY	2-Jun-94	0	0
HOLLAND DR (WELL 2)	18-Jul-94	.5	WET SET 3	18-Jul-94	0	0
HOLLAND DR (WELL 2)	18-Jul-94	.5	WET SET 3	19-Jul-94	0	0
HOLLAND DR (WELL 2)	18-Jul-94	.5	WET SET 3	20-Jul-94	0	0
HOLLAND DR (WELL 2)	18-Jul-94	.5	WET SET 3	21-Jul-94	0	0
HOLLAND DR (WELL 2)	24-Oct-94	.5	WET SET 4	24-Oct-94	0	0
HOLLAND DR (WELL 2)	24-Oct-94	.5	WET SET 4	25-Oct-94	0	0
HOLLAND DR (WELL 2)	24-Oct-94	.5	WET SET 4	26-Oct-94	0	0
HOLLAND DR (WELL 2)	24-Oct-94	.5	WET SET 4	27-Oct-94	0	0
HOLLAND DR (WELL 2)	17-May-95	0	DRY	17-May-95	0	0
PATRICIA CT (WELL 7)	28-Nov-93	4.3	WET SET 1	28-Nov-93	160	0
PATRICIA CT (WELL 7)	28-Nov-93	4.3	WET SET 1	29-Nov-93	172	9
PATRICIA CT (WELL 7)	28-Nov-93	4.3	WET SET 1	30-Nov-93	34	0
PATRICIA CT (WELL 7)	28-Nov-93	4.3	WET SET 1	1-Dec-93	10	0
PATRICIA CT (WELL 7)	21-Mar-94	.65	WET SET 2	22-Mar-94	7	0
PATRICIA CT (WELL 7)	21-Mar-94	.65	WET SET 2	23-Mar-94	3	0
PATRICIA CT (WELL 7)	21-Mar-94	.65	WET SET 2	24-Mar-94	5	0
PATRICIA CT (WELL 7)	21-Mar-94	.65	WET SET 2	25-Mar-94	4	0

Table 10 (continued). Raw water bacteriological test results for Manchester's sources.

SOURCE NAME	RAIN DATE	RAIN AMOUNT	REMARK	SAMPLE DATE	TOTAL COLIFORM (COL/100ml)	FECAL COLIFORM (COL/100ml)
PATRICIA CT (WELL 7)	5-Apr-94	0	DRY	5-Apr-94	0	0
PATRICIA CT (WELL 7)	2-Jun-94	0	DRY	2-Jun-94	0	0
PATRICIA CT (WELL 7)	18-Jul-94	.5	WET SET 3	18-Jul-94	0	0
PATRICIA CT (WELL 7)	18-Jul-94	.5	WET SET 3	19-Jul-94	0	0
PATRICIA CT (WELL 7)	18-Jul-94	.5	WET SET 3	20-Jul-94	0	0
PATRICIA CT (WELL 7)	18-Jul-94	.5	WET SET 3	21-Jul-94	0	0
PATRICIA CT (WELL 7)	24-Oct-94	.5	WET SET 4	24-Oct-94	0	0
PATRICIA CT (WELL 7)	24-Oct-94	.5	WET SET 4	25-Oct-94	0	0
PATRICIA CT (WELL 7)	24-Oct-94	.5	WET SET 4	26-Oct-94	0	0
PATRICIA CT (WELL 7)	24-Oct-94	.5	WET SET 4	27-Oct-94	0	0
PATRICIA CT (WELL 7)	17-May-95	0	DRY	17-May-95	0	0
CROSSROADS 2 (WELL 9)	15-Jun-00	0	DRY	15-Jun-00	-1	-1
WALNUT ST (UPPER SPRING)	21-Mar-94	.65	WET SET 1	22-Mar-94	0	0
WALNUT ST (UPPER SPRING)	21-Mar-94	.65	WET SET 1	23-Mar-94	0	0
WALNUT ST (UPPER SPRING)	21-Mar-94	.65	WET SET 1	24-Mar-94	0	0
WALNUT ST (UPPER SPRING)	21-Mar-94	.65	WET SET 1	25-Mar-94	0	0
WALNUT ST (UPPER SPRING)	5-Apr-94	0	DRY	5-Apr-94	0	0
WALNUT ST (UPPER SPRING)	2-Jun-94	0	DRY	2-Jun-94	0	0
WALNUT ST (UPPER SPRING)	18-Jul-94	.5	WET SET 2	18-Jul-94	2	0
WALNUT ST (UPPER SPRING)	18-Jul-94	.5	WET SET 2	19-Jul-94	0	0
WALNUT ST (UPPER SPRING)	18-Jul-94	.5	WET SET 2	20-Jul-94	0	0
WALNUT ST (UPPER SPRING)	18-Jul-94	.5	WET SET 2	21-Jul-94	0	0
WALNUT ST (UPPER SPRING)	17-May-95	0	DRY	17-May-95	0	0
WALNUT ST (UPPER SPRING)	2-Mar-00	0	DRY	2-Mar-00	-1	-1
WALNUT ST (UPPER SPRING)	12-Sep-00	0	DRY	12-Sep-00	3.1	-1
WALNUT ST (UPPER SPRING)	22-Feb-01	0	DRY	22-Feb-01	5.3	-1
WALNUT ST (UPPER SPRING)	21-Mar-01	2.1	WET SET 3	23-Mar-01	2	-1
WALNUT ST (UPPER SPRING)	21-Mar-01	2.1	WET SET 3	24-Mar-01	2	-1
WALNUT ST (UPPER SPRING)	21-Mar-01	2.1	WET SET 3	25-Mar-01	5.3	-1
WALNUT ST (UPPER SPRING)	21-Mar-01	2.1	WET SET 3	26-Mar-01	3.1	-1
WALNUT ST (WELL 1)	2-Mar-00	0	DRY	2-Mar-00	-1	-1
WALNUT ST (WELL 1)	12-Sep-00	0	DRY	12-Sep-00	28.8	-1
WALNUT ST (HUPPMAN SPRING)	22-Feb-01	0	DRY	22-Feb-01	-1	-1
WALNUT ST (HUPPMAN SPRING)	21-Mar-01	2.2	WET SET 1	23-Mar-01	17.8	-1
WALNUT ST (HUPPMAN SPRING)	21-Mar-01	2.2	WET SET 1	24-Mar-01	20.7	-1
WALNUT ST (HUPPMAN SPRING)	21-Mar-01	2.2	WET SET 1	25-Mar-01	-1	-1
WALNUT ST (HUPPMAN SPRING)	21-Mar-01	2.2	WET SET 1	26-Mar-01	4.2	-1

Table 10 (continued). Raw water bacteriological test results for Manchester's sources.

SOURCE NAME	RAIN DATE	RAIN AMOUNT	REMARK	SAMPLE DATE	TOTAL COLIFORM (COL/100ml)	FECAL COLIFORM (COL/100ml)
MANCHESTER FARMS(WELL10)	25-Apr-01	0	DRY	25-Apr-01	-1	-1
MANCHESTER FARMS(WELL10)	21-May-01	.55	WET SET 1	21-May-01	-1	-1
MANCHESTER FARMS(WELL10)	21-May-01	.55	WET SET 1	22-May-01	-1	-1
MANCHESTER FARMS(WELL10)	21-May-01	.55	WET SET 1	23-May-01	-1	-1
MANCHESTER FARMS(WELL10)	21-May-01	.55	WET SET 1	24-May-01	-1	-1
MANCHESTER FARMS(WELL10)	30-Jun-01	0	DRY	30-Jun-01	-1	-1
MANCHESTER FARMS(WELL10)	4-Aug-01	.55	WET SET 2	4-Aug-01	-1	-1
MANCHESTER FARMS(WELL10)	4-Aug-01	.55	WET SET 2	5-Aug-01	-1	-1
MANCHESTER FARMS(WELL10)	4-Aug-01	.55	WET SET 2	6-Aug-01	-1	-1
MANCHESTER FARMS(WELL10)	4-Aug-01	.55	WET SET 2	7-Aug-01	-1	-1
HALLIE HILL WELL	13-Jan-03	0	DRY	13-Jan-03	-1	-1
FERRIER RD WELL A	6-Nov-03	0.5	WET	7-Nov-03	-1	-1
FERRIER RD WELL B	6-Nov-03	0.5	WET	7-Nov-03	-1	-1
FERRIER RD WELL C	6-Nov-03	0.5	WET	7-Nov-03	-1	-1

Table 10 (continued). Raw water bacteriological test results for Manchester's sources.

SUSCEPTIBILITY ANALYSIS

Manchester's wells obtain water from an unconfined fractured-rock aquifer. Wells in unconfined aquifers are generally vulnerable to contaminants present on the land surface that occurs within a 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 to microbial contamination. Properly constructed wells with no potential sources of contamination in their WHPA should be well protected from contamination.

Inorganic Compounds (IOCs)

Nitrate has been detected in all of Manchester's water treatment plants above 50% of the MCL except for Plant 9 (Crossroads 2 Well). Sources of nitrate can generally be traced to land use. Fertilization of cropland and residential properties are non-point sources in ground water. Onsite septic systems are also sources of nitrate in ground water. A large portion of the

WHPA was cropland in the past and is now being converted to residential land and nearly all the areas within the town limits are served by public sewer.

A review of the nitrate monitoring data for Manchester's water supply shows that nitrate levels appear to be increasing for Plants 1 (Walnut St.), 6 (Route 30) and 7 (Patricia Ct.). The nitrate levels exceeded the MCL for Plant 1 in April 2003, but has fallen below those levels in recent samples (table 6a). The nitrate levels for Plant 6 has exceeded the MCL since March 2003 and continued to do so the next four months (table 6d). Figure 5a shows the nitrate trend four the springs and well tied in with Plant 1. The Route 30 well has been shut down since then and the Town is trying to work with the adjacent farmer and the Soil Conservation District to reduce nitrate inputs into the soil. Figure 5b represents shows the nitrate trend in this well. All the other plants do not show significant increase or decrease in overall nitrate levels just seasonal variations.

Based on the above analysis, Manchester's water supply is susceptible to nitrate contamination.

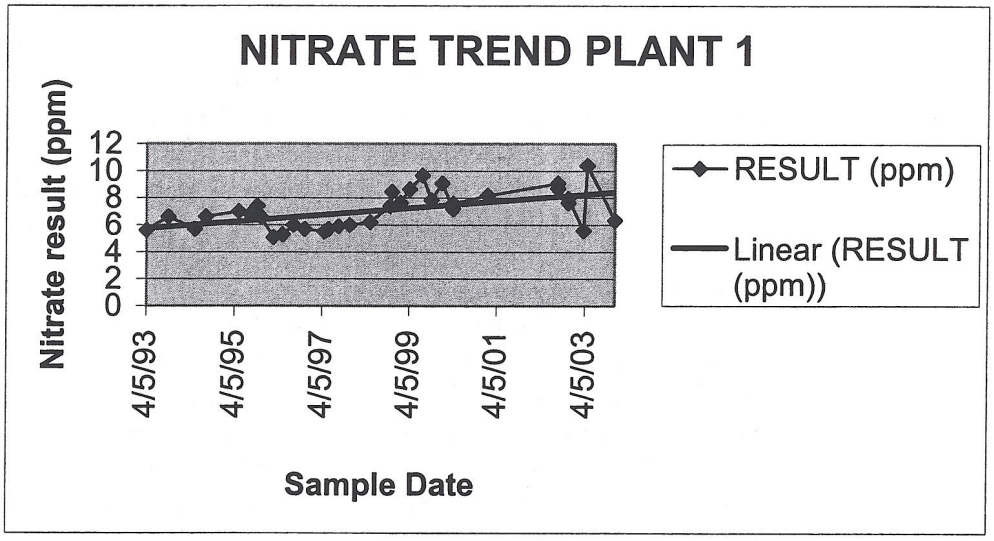


Figure 5a. Nitrate trend for Plant 1 (Walnut Street).

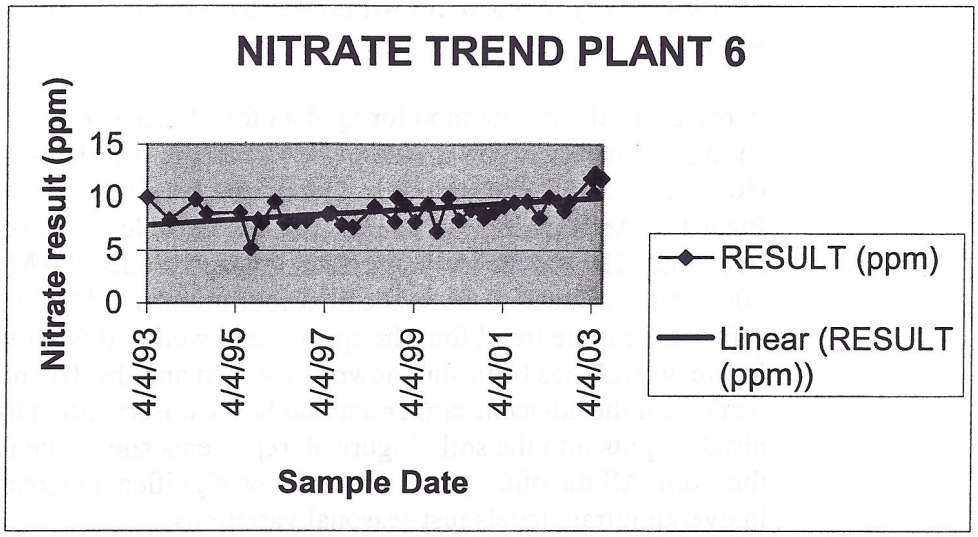


Figure 5b. Nitrate trend for Plant 6 (Route 30).

The only other IOC that was detected one time at 50% of the MCL was mercury in 1995, at Plant 4 (Bachman Rd.). Mercury has not been detected since then in Manchester's water supply. Mercury is used in batteries, light bulbs, switches and other control equipment. Based on the water quality results since 1995, Manchester's water supply is **not** susceptible to inorganic compounds other than nitrate, based on the water quality. There are a few sources of metals in the WHPA, but none of these sources discharge them into ground water or store them underground. Hence the contaminants are unlikely to impact ground water.

Volatile Organic Compounds (VOCs)

Dichloroethylene (DCE) is the only VOC that has been detected in Manchester's water supply (Walnut St. Plant) at above 50% of the MCL (table 7). DCE is used in the production of plastics. The source of the DCE maybe plastic piping or other plastic material that may be in contact with the water. MTBE has been detected in 6 of the sources since 1996. MTBE has been detected at levels above the threshold for taste and odor of 20 ppb in Plant 1 (Walnut St.). Investigation of the WHPA for the Walnut St. plant sources by MDE's Oil Control Program and the Town indicated that the most likely source of the MTBE was a leaking UST at an old bus depot site. The tank was removed and site cleaned, which has resulted in decrease in MTBE levels from peak of 68 ppb to 0.9 ppb. MTBE is used as an additive to gasoline for cleaner burning. VOCs at low levels have been detected at Plant 2 (Holland Dr.), 7 (Patricia Ct.) and 8 (Crossroads 1). Part of Manchester's commercial area lies in the WHPA and several potential sources of VOCs are present in the WHPAs for all the Town wells. Several commercial facilities have had their USTs removed due to leaks or noncompliance with the State's tank regulations (table 2). Currently there

are no known cases of ground water contamination due to leaking USTs, and all the facilities are in compliance with the State's regulations

Based on the above analysis, Manchester's water supply **is** susceptible to contamination by VOCs.

Synthetic Organic Compounds (SOCs)

The only SOC detected above 50% of the MCL in Manchester's water supply was phthlate, which was also found in the laboratory blanks. Since e high levels of phthalate were found in Plant 2 the WSP requested the Town to sample both raw and treated water at this plant. The Town completed this sampling in December 2002 and no pthalate was detected in either sample.

No point sources of SOCs are present in the WHPA. Cropland and residential land make up a large portion of the Manchester WHPA (table 3) and improper application of pesticides for crop production or landscaping can be potential non point sources of SOC contamination. Sampling data has shown no detections of any pesticides so far.

Pending the results of resampling of phthalate Manchester's water supply **is not** susceptible to contamination by SOCs.

Radionuclides

No radionuclides above 50% of the MCL were detected in Manchester's water supply. Radon-222 has been detected above 50% of the proposed MCLs of 300 and 4000 pCi/L (table 9). The source of these radionuclides can be traced to the natural occurrence of uranium and thorium in the bedrock. 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, Manchester's water supply **is** susceptible to radon but **not** to other radionuclides.

Microbiological Contaminants

Based on raw water bacteriological data (table 10) Manchester's water supply sources currently being used except for Crossroads Well 1 and Huppman Spring were determined not to be under the direct influence of surface water. GWUDI sampling for this well is being completed and will have to be evaluated prior to making a final determination. Huppman Spring sampling data needs further evaluation and review prior to making a final determination on its being under the influence of surface water. With the exception of Huppman Spring and Crossroads Well 1, all the Manchester sources that have been tested are **not** susceptible to any microbiological contaminant present at the surface including *Giardia* and *Cryptosporidium*. But the bacteriological data (table 10) indicate

detections of total coliform in the Bachman Rd., Patricia Ct. and Walnut St. Wells, as well as Hillside and Huppman Springs. Wet weather sampling data indicate extremely high levels of total coliform in Huppman Springs as well as one detection of fecal coliform (table 10). Due to the presence of coliform, the Bachman Rd., Patricia Ct. and Walnut St. Wells as well as the Hillside and Huppman Springs **are** susceptible to total coliform. Further evaluation of raw water sampling data and further investigation is necessary to make a determination whether Huppman Spring and Crossroads Well 1 are susceptible to *Giardia* and *Cryptosporidium.*

MANAGEMENT OF THE WHPA

Form a Local Planning Team

- The team should represent all the interests in the community. The Town Council, the Town Utilities Department, Carroll County Planning and Health Departments, residents, farmers, local businesses, and developers should work to reach a consensus on how to protect the water supply.
- MDE has grant money available for 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 by contacting the Town or MDE.
- Conduct educational outreach to facilities that may present potential contaminant sources. Important topics include: (a) compliance with MDE and federal guidelines for USTs, (b) best management practices, (c) chemical storage and (d) appropriate use and application of fertilizers and pesticides.
- 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 county roads.

Cooperative Efforts with Other Agencies

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

Planning/New Development

- Manchester should work closely with the Carroll County Water Resource Planning to conduct site review of new developments prior to approval of the developments to ensure water supply source protection.

- Manchester should encourage and support County adoption of the Performance Standards and Management Criteria for Water Resource Management that was developed by the County and approved by MDE.
- Manchester should also consider a local ordinance for protection of its water supply.

Monitoring

- Closely monitor nitrate levels at Plants 1, 6 and 7 and adopt strategies to address excessive nitrate levels in the WHPAs for the sources. Work with the farmer adjacent to Route 30 well and the local Soil Conservation District to adopt best management practices to lower the nitrate load to soil and ground water.
- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Annual raw water bacteriological testing is a good check for well integrity.
- Follow up previous intermittent positive coliform results by conducting detailed well and spring inspections to evaluate their integrity.
- Complete the required GWUDI testing for Crossroads Well 1 and Huppman Springs.

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 Town 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 sources 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

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.

Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36 p.

Meyer, G., and Beall, R. M., 1958, The Water Resources of Carroll and Frederick Counties: Department of Geology, Mines and Water Resources Bulletin 22, 355p.

Nutter, L. J., and Otton, E. G., 1969, Ground-Water Occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56p.

R. E. Wright Associates, Inc., 1988, Phase II Report Carroll County Water Resources Study Volumes I and II.

R. E. Wright Associates, Inc., 1989, Recommended Water Resource Management Standards, Criteria, and Administrative Procedures.

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 Permits: CL1966G012, CL1966G112, CL1995G046
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: Manchester SE, and Linesboro SW
USGS Topographic 7.5 Minute Littlestown and Linesboro Quadrangles
Maryland Office of Planning 2000 Carroll County Land Use Map
Maryland Office of Planning 1995 Carroll County Sewer Map

FIGURES

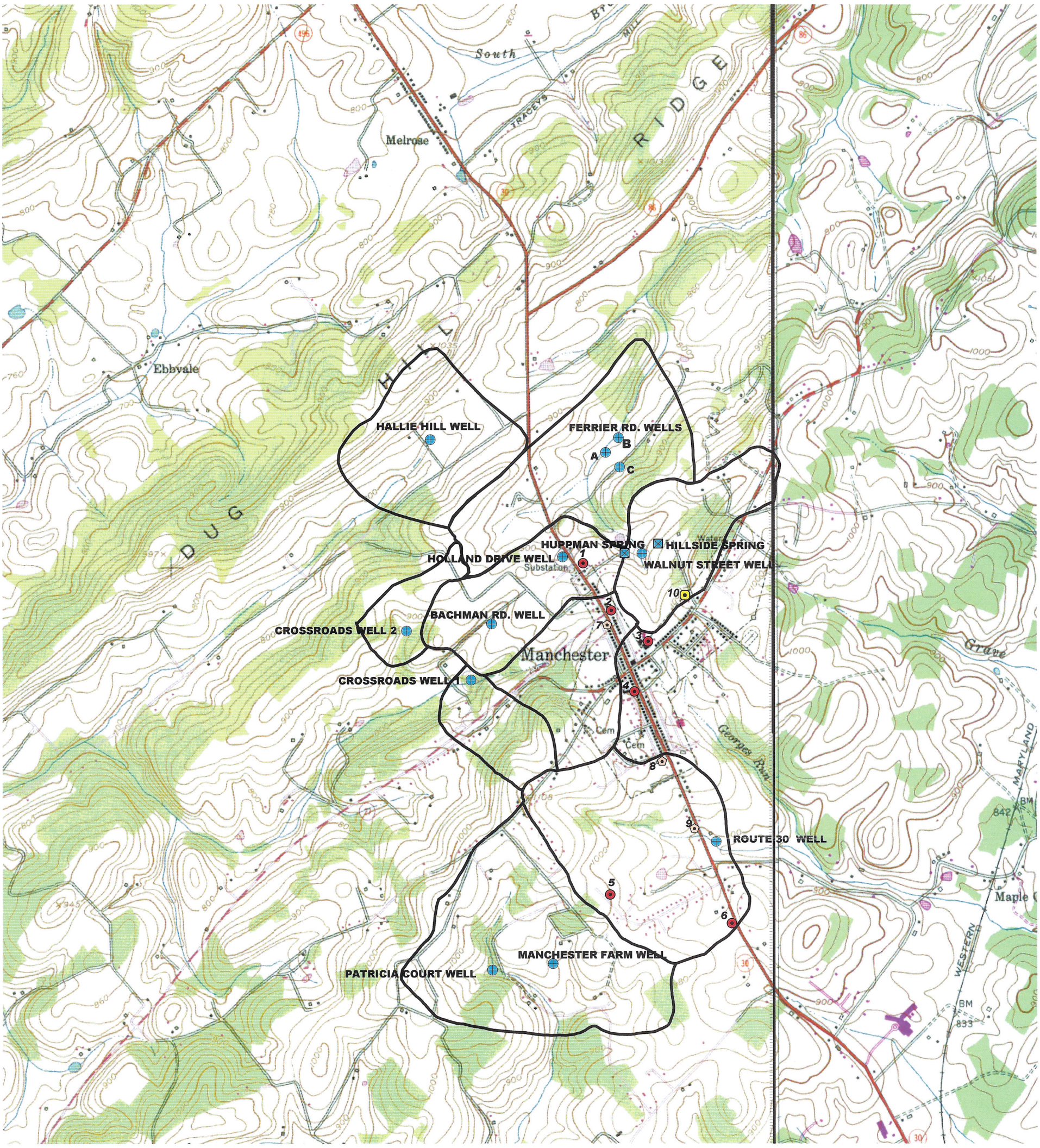


Figure 2. Manchester Wellhead Protection Area with Potential Contaminant Sources

LEGEND

- Underground Storage Tanks
- Leaking Underground Storage Tank
- Auto repair Shops

Water Supply Sources

- Well
- Spring
- Wellhead Protection Area

2000 0 2000 4000 Feet

N

Base Map: USGS 7.5 Minute Topographic Quadrangles: Linesboro and Littlestown

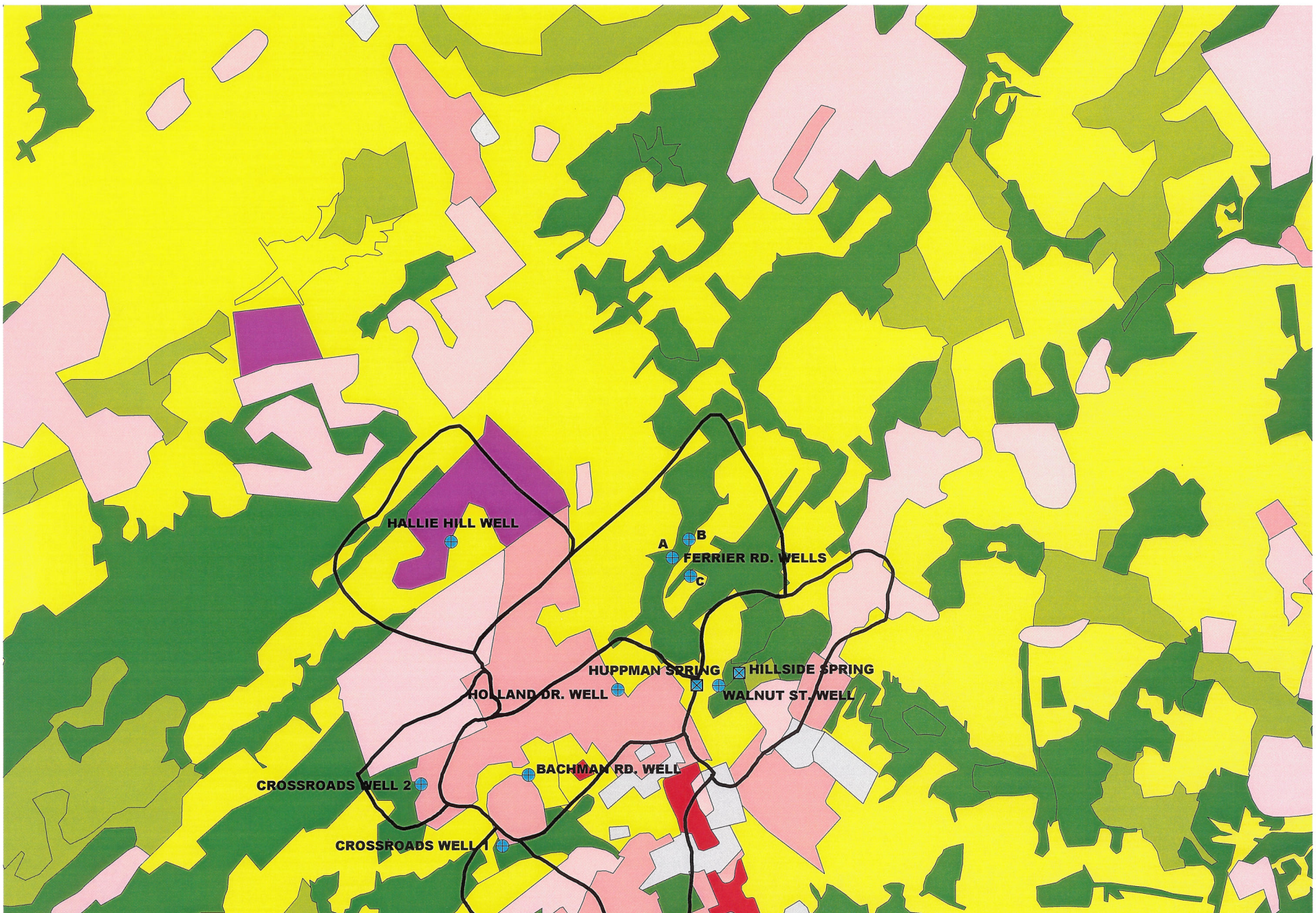
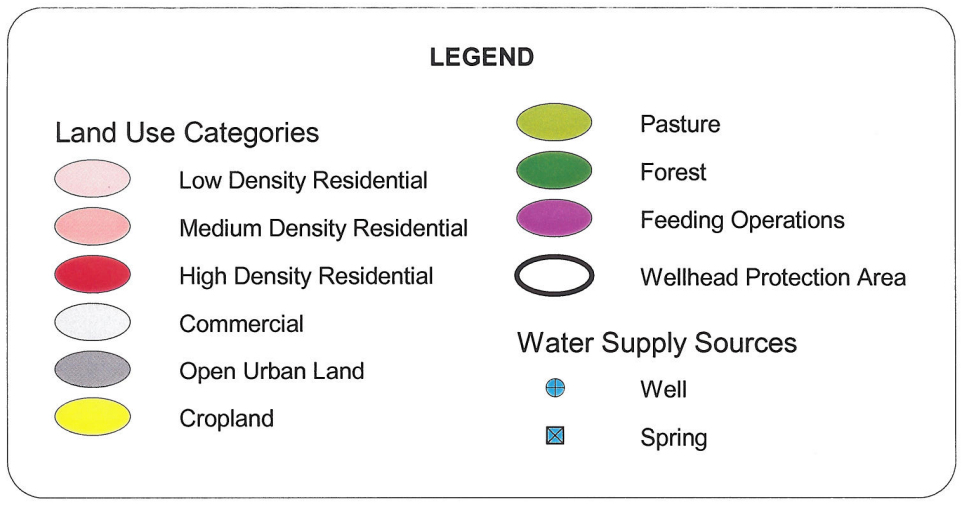
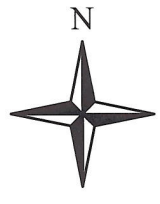


Figure 3. Land Use Map of the Manchester Wellhead Protection Area





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

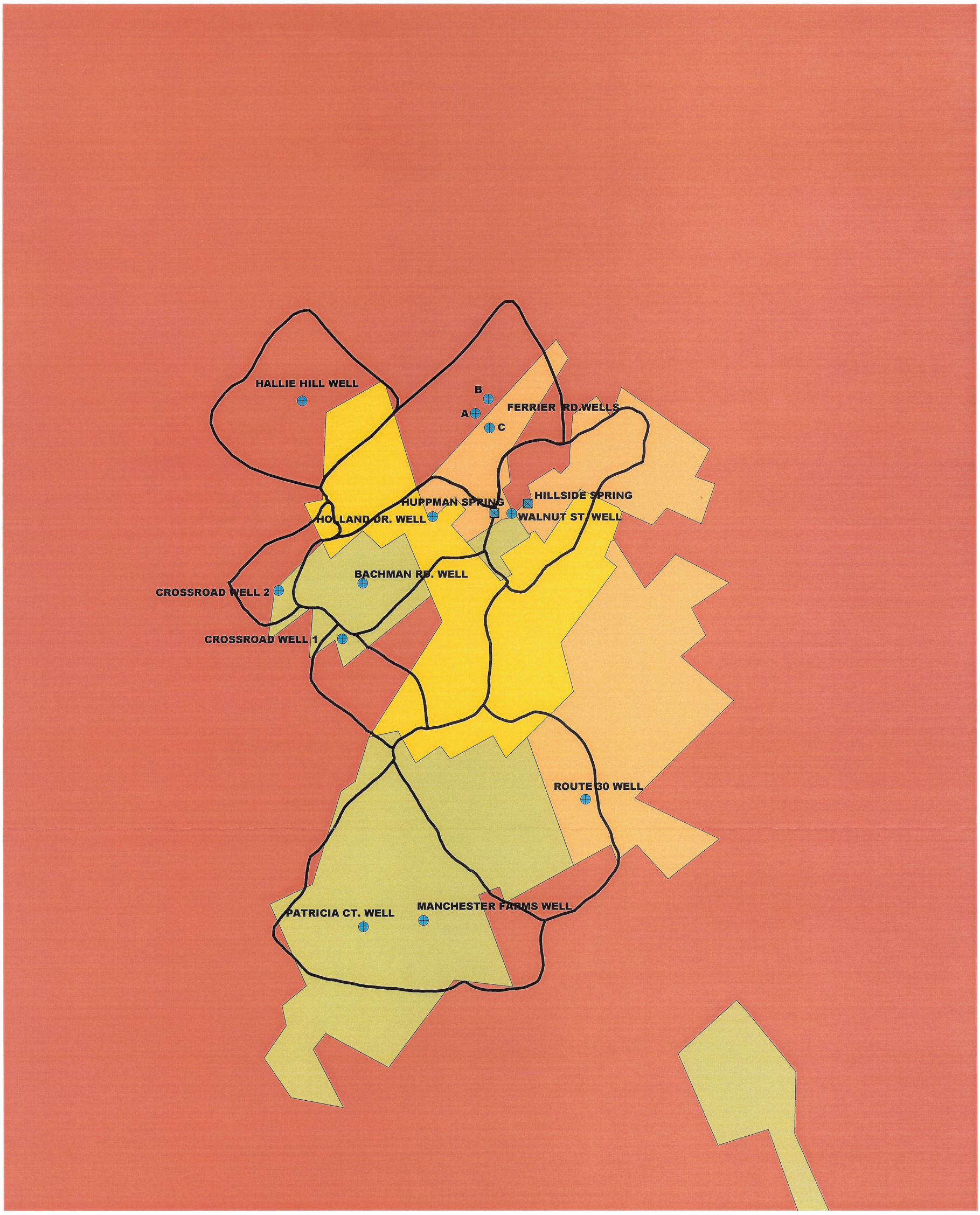


Figure 4. Sewer Service Area Map of the Manchester Wellhead Protection Area

Base Map: Maryland Office of Planning 1995 Carroll County Sewer Map