SOURCE WATER ASSESSMENT
Edgemont Reservoir

for the

City of Hagerstown, Maryland

Prepared by
Maryland Department of the Environment
Water Management Administration
Water Supply Program
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MDE

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EXECUTIVE SUMMARY

The 1996 Safe Drinking Water Act Amendments require states to develop and implement source water assessment programs to evaluate the safety of all public drinking water systems. A Source Water Assessment (SWA) is a process of evaluating the vulnerability to contamination of source of public drinking water supply. This SWA was completed for Edgemont Reservoir. This reservoir in combination with Potomac River serves 75,000 people in Hagerstown, Funkstown, Williamsport, and the Town of Smithsburg.

Edgemont Reservoir is located along the eastern slope of South Mountain, in Washington County, a few miles above the Town of Smithsburg. The reservoir collects water from a watershed that is approximately 6.0 square miles and is situated in the northern boundary of Washington and Frederick counties. A rock-faced earthern dam was constructed in 1902 to create Edgemont Reservoir. In 1992-1993, major improvements were made to the dam and spillway at Edgemont. In 1997, the William H. Breichner Water Treatment Plant was constructed and the reservoir became a second source of drinking water for the City.

Potential sources of contamination for Edgemont Reservoir include non-point sources, including transportation, agriculture, on-site septic systems, wildlife, runoff from developed land and timber harvest operations.

The susceptibility analysis indicates that total/fecal coliform, protozoa, viruses and turbidity are the contaminants of most significant concern to the Edgemont Reservoir.

Several recommendations are included in Section I of this report. They include:

- Forming a local watershed protection planning team,
- Implementing a public awareness and outreach program,
- Monitoring raw water quality,
- Obtaining conservation easements for sensitive areas in the watershed,
- Conducting field surveys for identifying possible contaminant sources.

A. BACKGROUND

The 1996 Safe Drinking Water Act Amendments require states to develop and implement source water assessment programs to evaluate the safety of all public drinking water systems. A source Water Assessment (SWA) is a process for evaluating the vulnerability to contamination of the *source* of a public drinking water supply. The assessment does not address the treatment processes, or the storage and distribution aspects of the water system, which are covered under separate provisions of the Safe Drinking Water Act. The Maryland Department of the Environment (MDE) is the lead State agency in this source water assessment effort.

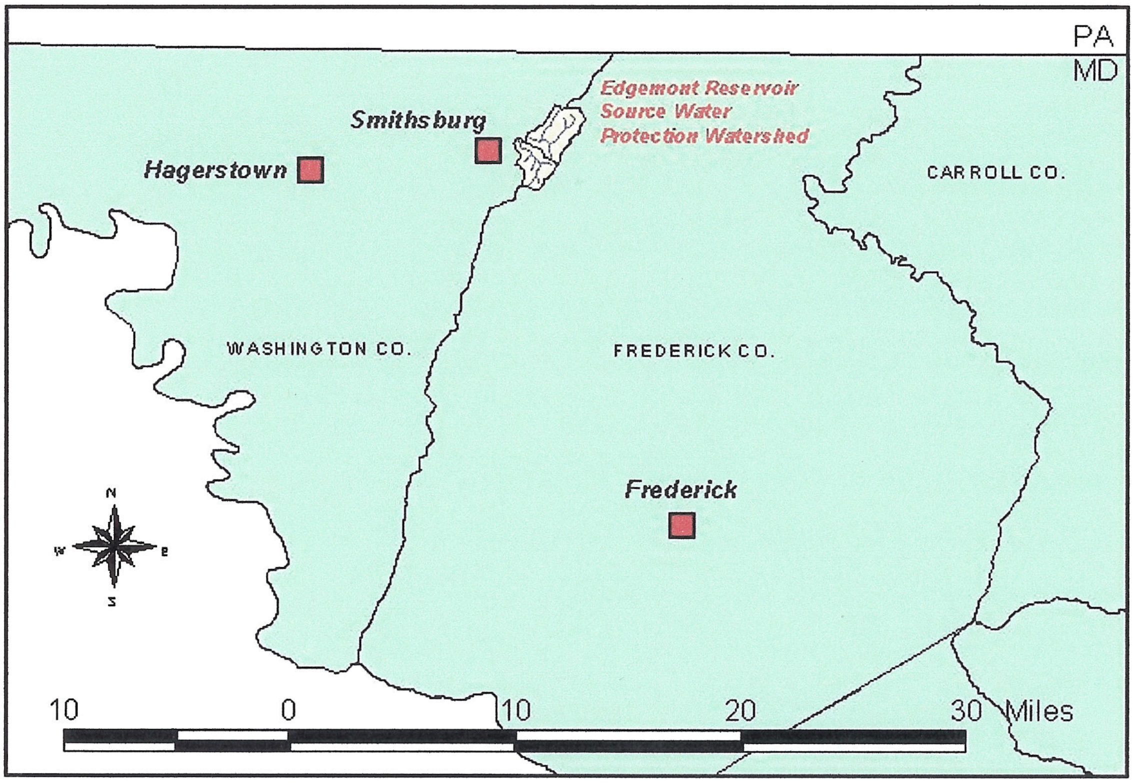
There are three main steps in the assessment process: (1) *delineating* the watershed drainage area that is likely to contribute to the drinking water supply, (2) *identifying* potential contaminants within that area and (3) *assessing* the vulnerability of the system to those contaminants. This document reflects all of the information gathered and analyzed required by those three steps. MDE looked at many factors to determine the vulnerability of this water supply to contamination, including the size and type of water system, available water quality data, the characteristics of the potential contaminants, and the capacity of the natural environment to attenuate any risk.

Maryland has more than 3,800 public drinking water systems. Approximately 50 of Maryland's public drinking water systems obtain their water from surface supplies, either from a reservoir or directly from a river. The remaining systems use ground water sources. Maryland's Source Water Assessment Plan was submitted to the Environmental Protection Agency in February 1999 and received final acceptance by the EPA in November 1999. A copy of the plan can be obtained at MDE's website, www.mde.state.md.us, or by calling the Water Supply Program at (410) 537-3714.

B. DEVELOPMENT OF THE EDGEMONT RESERVOIR WATER SUPPLY

Edgemont Reservoir is one of two drinking water sources for the City of Hagerstown. The reservoir is located along the eastern slope of South Mountain, in Washington County, a few miles above the Town of Smithsburg. Below is a figure depicting the general area:

Figure A. Map of General Area:



The Smithsburg Reservoir was the original source of water supply for the City of Hagerstown distribution system; the Washington County Water Company built it in 1881. This reservoir was located in Smithsburg on the site of the current William H. Breichner Water treatment plant, which today treats water from Edgemont Reservoir. In 1902, Edgemont Reservoir was created to increase capacity of the original plant facility and because of seasonal shortages in the Smithsburg Reservoir. The new reservoir collected water from both Warner Hollow Run and Raven Rock Run and provided an additional 100 million gallons for water supply.

The water system was purchased by the City of Hagerstown in 1908, and the city opened a new plant on the Potomac River for another additional source of drinking water. These two sources, the Potomac River and the "mountain source" as it was called, supplied water for the city and parts of the county until 1987. In response to the Safe Drinking Water Act, the water supply from Edgemont and Smithsburg reservoirs was curtailed because drinking water from surface supplies now required filtration; the original plant only provided for chlorination. In 1992-1993, major improvements were made to the dam and the spillway at Edgemont. About this time plans were finalized to construct a new water treatment plant with filtration to re-establish Edgemont Reservoir as a source of the city's drinking water. In 1997, the William H. Breichner Water treatment plant was put on-line and the reservoir again became a source of drinking water for the city (City of Hagerstown Brochure, 1997).

The Breichner plant has a design capacity of 4.8 million gallons per day (MGD), operates approximately 16 hours a day, and treats an average of 2.0 MGD of drinking water. The plant supplements drinking water that is produced by the R.C. Wilson Plant on the Potomac River. Combined, these two plants provide drinking water for approximately 75,000 people in Hagerstown, Funkstown, Williamsport, portions of Smithsburg, and several large industrial and institutional facilities, including the Maryland Correctional Facility. The Breichner plant is considered a "package plant" and treatment includes coagulation, chemical mixing, sedimentation, filtration, and disinfection (MDE CPE, 2000).

C. DESCRIPTION OF THE SURFACE WATER SOURCE

Edgemont Reservoir is located a little over a mile northwest from the Town of Smithsburg. The reservoir was created by the construction of a rock faced earthen dam in 1902 and had an approximate original volume of 100 million gallons. As stated above major improvements were made to the dam and spillway, to mitigate the effect of a "storm of the century", in 1992-1993. The spillway lies at an elevation of 929 feet mean sea level (MSL). The reservoir surface area covers 11 acres at full volume capacity, which has been estimated by the city to now be 85 million gallons. Because of the intake depth, at full capacity, there are 76.5 million gallons available for water supply. The safe yield of the reservoir was calculated to be 0.55 million gallons a day (Gannett Fleming, Inc., 1996). The reservoir has a maximum depth of approximately 52 feet.

Two streams, Warner Hollow Run and Raven Rock Run, which is also referred to as Little Antietam Creek on USGS topographic maps, feed the reservoir. Warner Hollow Run flows into the reservoir directly, after traveling approximately 2.5 miles from its headwater springs in the Harmon Gap area, on the western slope of South Mountain. Raven Rock Run is diverted into the reservoir by a small dam, where water is collected in a stone conversion box, and gravity fed into the bottom of the reservoir by a pipeline. The distance between the furthest headwater region and the diversion dam for Raven Rock is approximately 3 miles. Raven Rock Run has two discernable tributaries, and the confluence is approximately 0.8 miles above the diversion. There is no regular water release from the Edgemont dam, only overflow, so Warner Hollow Run effectively ends at the reservoir. During overflow conditions, the spillway sends water down to Raven Rock Run, below the diversion. The flow situation is similar at the Raven Rock diversion. Most of the water is diverted to the reservoir, with only high flow conditions cresting the dam. On several site visits, no water flow was observed below the diversion. However, during a storm flow sample collection, water was observed cresting the spillway. Both of these streams are part of the Antietam Creek watershed, which drains approximately 187 square miles of Maryland and Pennsylvania, and approximately 40% of Washington County (Washington County Water & Sewer Plan, 1994). The Little Antietam Creek, which includes Warner Hollow and Raven Rock Run, is classified by the State of Maryland as a Class III water body, which means that it has the requirement of Class I streams (swimmable and fishable), and that it also can support a naturally reproducing trout population. Warner Hollow and Raven Rock Run would be considered Class III-P, natural trout waters that are also used for water supply.

The source water protection area, or watershed, for Edgemont Reservoir encompasses approximately 5.95 square miles (3807 acres) of mostly steep forested land along the western flank of South Mountain. The watershed is almost entirely within Washington County, and the eastern watershed boundary, the highest elevation, follows the Washington/Frederick County boundary, and the crest of South Mountain (see Figure 1). Elevations along this ridge range from 1600 to 1800 feet MSL. Other significant "peaks" in the watershed include Buzzards Knob, which separates Raven Rock Run and Warner Hollow, and Raven Rock (~ 1700 MSL). Warner Hollow Run drains approximately 2.4 square miles of mostly forested land, while the Raven Rock Run sub-watershed is slightly larger, draining 3.5 square miles of mixed agriculture and forest. The source watershed is within the Blue Ridge Physiographic Province, which is mostly underlain by metamorphosed igneous and sedimentary rocks that are eroded remnants of an overturned anticlinorium (Duigon, 1991). The Harper, Weverton and Catoctin formations, all from the late Precambrian period, underlie the watershed.

The climate of Washington County is temperate and moderately humid. The mean annual temperature is 52.9 ° F and annual precipitation is approximately 38 inches. Weather in the area is influenced by the height and width of mountain barriers, which modify air masses moving eastward, and influence the character of the soil and vegetation (Slaughter, 1962). Rainfall measurements have been recorded at Edgemont (a small village northwest of the watershed), for hydrologic accounting of Little Antietam Creek at Leitersburg. At Edgemont, average precipitation is 41 inches a year, of which, approximately 3 inches (or 1.3 billion gallons) is surface runoff directly into streams, 11 inches as subsurface runoff (groundwater recharge), and 27 inches is lost to evapotranspiration (Duigon, 1991).

D. SOURCE WATER PROTECTION SITE VISIT

Personnel from the Maryland Department of the Environment's Water Supply Program visited the Hagerstown's water system on May 5, 1999 to discuss the assessment of the Edgemont Reservoir, and to describe the source water protection program. Main objectives of this site visit included: obtaining an accurate GPS location of the water supply intake, inspecting the integrity of the intake, and documenting water operator's source water concerns. A windshield survey of the immediate watershed vicinity was also undertaken, and further watershed survey trips have been made.

Intake Integrity

Hagerstown's intake is located approximately 40 yards out into the reservoir from the dam. There is a gated walkway to the intake tower, which is made of concrete. The intake is a single level structure; water is drawn from only one depth. There are two intake gates, each 3 by 3 foot, at an elevation of 884 MSL. These intakes are screened with ½ -inch mesh. From the intake, water flows by gravity 2 miles down to the Briechner Water Plant in two 12-inch pipes. Near the plant, the two pipes combine into a 24-inch main. In the plant there is a raw water strainer, which is manually flushed twice a year, or as needed (MDE CPE, 2000). The intake structure was re-built in 1993 and the water plant operators expressed no concerns with the intake structure.

The diversion of Rock Raven Run into the reservoir is a unique situation at Edgemont. As stated above, water is diverted from the stream by a cement collection structure, and a small 5-foot concrete dam pools water from Rock Raven. During normal flow conditions, most of the stream flow is diverted into the reservoir, and only during periods of increased flow (storms & snowmelt) does the stream crest the dam. There is a bar screen at the diversion box, which can become clogged by debris. Water flows from the diversion box by gravity into the bottom of the reservoir, near the intake tower. If water quality conditions in Raven Rock Run are degraded (due to a storm), the city is able to manually shut off the diversion at the small dam (Personal Communication, City Official).

Operator Concerns and Site Visit Observations
In addition to looking at the dam/intake structure and Rock Raven diversion, a watershed survey (by car) and a discussion with plant operators was undertaken to determine potential sources of contamination to the water source. Below is a list of concerns that may effect water quality in the reservoir. This list reflects operator concerns from the original meeting, and concerns listed in a survey form sent by MDE and returned by the water treatment plant operator. It also includes MDE site visit observations:
1. Livestock and agricultural runoff
2. Pesticide contaminants from orchard spraying
3. Unpaved roadways subject to erosion
4. Residential development in the watershed
5. Algae blooms are common.
6. Law Enforcement shooting range at head of reservoir.
7. Contaminated spring (fecal bacteria) along Raven Rock Rd (Route 491).

E. WATERSHED CHARACTERIZATION

Source Water Assessment Area Delineation Method
An important aspect of the source water assessment process is to delineate the watershed that contributes to the source of drinking water. A source water protection area is defined as the whole watershed area upstream from a water plant's intake (MDE – SWAP, 1999). Delineation of the source water area was performed by using ESRI's ArcView Geographic Information System (GIS) software, utilizing existing GIS data, and by collecting location data using a Global Positioning System (GPS). A GPS point location was taken at Edgemont's intake during the initial site visit and differentially corrected (for an accuracy of +/- 2 meters) at MDE. Once the intake location was established, the watershed was delineated based on existing MD Department of Natural Resources digital watershed data and MD State Highway Administration digital stream coverage. Digital USGS 7.5 topographical quad maps were also used to perform "heads up" digitizing, or editing, of watershed boundaries when needed.

General Characteristics
The watershed above Edgemont Reservoir is approximately 4.2 miles long (north-south) and 2 miles wide. The eastern watershed boundary follows the ridge of South Mountain, which trends southwest-northeast. The entire watershed encompasses 5.95 square miles (3807 acres) of forested land along the western slope of South Mountain, the western boundary of

the Blue Ridge. A majority of the residential and farmland above Edgemont Reservoir is located within the Raven Rock sub-watershed.

A large part of the watershed is owned by the City of Hagerstown. According to city officials, 1800 acres are owned in the watershed. MD Department of Natural Resource (MD DNR) geographic data shows that the city owns approximately 1550 acres above the reservoir. Portions of the South Mountain State Park, Catoctin Mountain National Park, and the historic Appalachian Trail are within the source watershed (see Figure 4). There are no large population centers in the watershed, only a few low-density residential areas like Warner Gap, Harmon Gap, and Pleasant Valley.

Based on the Maryland Department of Planning's 1997 land use data, the land within the entire Edgemont Reservoir's source watershed is as follows:

Table 1. Land Use Summary

Land Use	Total Area in Acres	Percent of Total Watershed
Residential	155.0	4.1
Cropland	610.9	16.0
Pasture	19.1	0.5
Forest	3008.6	79.0
Open Water	14.1	0.4

Table 2 is a breakdown of land use in each sub-watershed, Warner Hollow Run and Raven Rock Run. The data source is the same.

Table 2. Sub-Watershed Land Use

Land Use	Total Area in Acres	Percent of Total Watershed
Rock Raven Run		
Residential	128.1	5.6
Cropland	418.8	18.4
Pasture	19.1	0.8
Forest	1711.3	75.1
Total:	***2277.3***	
Warner Hollow Run		
Residential	26.9	1.8
Cropland	192.0	12.5
Forest	1297.3	84.8
Open Water	14.1	0.9
Total:	***1530.4***	

Based on Maryland Office of Planning's 2000 digital Property View for Garrett County, there are approximately 200 property parcels in the watershed. Of these, the largest tracks are owned by the city and the state. Property size averages approximately 19 acres per parcel. Using MD DNR protected land data, a property breakdown is summarized in Table 3.

Table 3. Property Summary

Property	Type	Total Area in Acres	Percent of Total Watershed*
City Watershed Property	Municipal	1550	41%
South Mountain State Park	State	214	6%
Catoctin Mountain Park	Federal	98	3%
Residences & Farms	Private	1945	51%

* Figures have been rounded

Localized Characteristics
A majority of the land surrounding the reservoir and the Raven Rock diversion, including significant portions of land just upstream from these areas, is forested and owned by the city (see Figure 3). The city does not permit any type of recreation on the reservoir, and has restrictions of "permitted" recreational activities on watershed owned property. There are several residences above the reservoir along Warner Gap Hollow Road, which becomes an unimproved road after passing the reservoir. These houses, as with all residences within the watershed, rely on septic systems to treat domestic sewage. Directly above the reservoir, and adjacent to Warner Hollow Run, is a target shooting range that is used by local law enforcement agencies. Buzzard Knob separates Warner Hollow and Raven Rock in the lower watershed. Forested slopes in this area are high and relatively undisturbed. The city maintains an unimproved road that leads from the reservoir to the Raven Rock Run diversion.

F. POTENTIAL SOURCES OF CONTAMINATION

Non-Point Pollution Sources
Without any urban areas in the watershed, Edgemont Reservoir is not threatened by urban non-point pollution runoff. Analysis of land use data, aerial photography, and watershed surveys show that the watershed does not contain any significant sources of contaminants associated with urban or commercial runoff, such as oil, grease, and toxic chemicals. This data also shows that the watershed is heavily forested with patches of agricultural land use. The EPA considers non-point agricultural runoff (nutrients, sediment, pesticides) the number one water quality impairment of lakes and streams in the United States. Non-point pollution sources associated with residential, agricultural, and forested land will be discussed below.

Residential Land
Residences in the watershed are not located within a sewer service area (or planned area), and rely on domestic septic systems. Septic systems, especially ones that are not working properly or fail, are potential sources of contamination by pathogenic protozoa, viruses, and bacteria. According to MD DOP 1997 land use data, only 4% of the watershed is used as residential land, with most located in the Raven Rock Run sub-watershed. Residences and farmsteads are spread throughout the watershed, but may not be depicted in the land use because of the 30-acre pixel limitation of the MD DOP data. Low-density classified areas are locales where there are several homes in the same vicinity. These depicted areas tend to be along major roads through both sub-watersheds. Most residences are located along Route

491 (Raven Rock Rd.), near Warner Gap, and in Pleasant Valley, along Route 77. It should be stated that while these areas are more concentrated with respect to housing in this watershed, they are not at all characteristic of high-density suburban development.

Agriculture

According to 1997 DOP land use data, almost 17% of the watershed is used for agricultural purposes (16% cropland, 0.5 % pasture). Land used to grow crops can be a source of nutrients (from fertilizer), and synthetic organic compounds (pesticides). Agricultural land can also be a source of sediment runoff from erosion. Most of the cropland in Washington County is used for hay production, followed by corns and soybeans. Washington County is the third leading producer of hay in the state (DOA Census of Agriculture, 1997). From 1992-1997, the number of Washington County farms using commercial fertilizer and pesticides remained relatively the same, but the amount of land applied with fertilizer and herbicide (to control weeds and grass) increased slightly by approximately 10,000 acres (each). In the Edgemont Reservoir watershed most of the farmland appears to be used in hay production, with some row cropping in the upper reach of the Raven Rock Run sub-watershed (check). Most of the land used for agriculture (440 acres) is within the Raven Rock Run sub-watershed (see Figure 2). Washington County is also the greatest supplier of apples and peaches in the state. There are numerous orchards in the Smithsburg-Edgemont area, some adjacent to the reservoir watershed. If these orchards are sprayed (especially by crop dusting planes), the spray has the potential to become airborne and settle into the reservoir and/or watershed.

Pastures used to graze livestock can be sources of pathogenic protozoa, viruses, and bacteria from animal waste; additionally animal waste from pastures can also contribute to excessive nutrient (nitrogen and phosphorous) loading. If livestock are allowed unfettered stream access, they can also contribute to stream bank erosion. According to 1997 Census of Agriculture inventories, Washington County ranks first in the number of hogs raised on farms, and second in both cattle and dairy cow populations. This is largely due in part to the large Hagerstown Valley, which is part of the eastern Great Valley, which is a highly utilized agricultural area. The source watershed, according to MD DOP data, only contains one significant pasture, which encompasses 15 acres. Additional livestock pastures were observed during subsequent watershed visits. A small dairy farm was observed in the headwater region of Raven Rock Run, and a hog farm also exists in this vicinity (Personal Communication, MDE Inspector and City Official).

Mining and Forestry

There are no active mines in the Edgemont Reservoir watershed. The Blue Ridge, including South Mountain, is not within any of Maryland's coal basins. Additionally, there are no limestone or gravel mines upstream of the reservoir.

A timber harvest operation can disturb 8-10% of the total work area by road building and creating landing sites. These areas, if not maintained, can contribute to erosion and sedimentation in receiving waterways. The City of Hagerstown has harvested trees from its property in the source watershed in the past. There is at least one logging road leading up from the reservoir into the watershed. Water plant officials have also expressed the desire to maintain a forestry management plan on city property (Source Water Survey, 1996). An organized forestry plan for the watershed would limit the potential damage that logging operations could have on the water quality of the reservoir. The MD DNR-Forestry Service could possibly help the city in this endeavor. There is no logging within South Mountain State Park and the Catoctin Mountain National Park. Sale of timber on Maryland state land follows strict guidelines to ensure against environmental degradation, and all permitted harvests on private land in Maryland must comply with state regulations and inspections.

Point Discharge Concerns
There are no permitted point sources of pollution within the Edgemont Reservoir watershed. Near the intersection of Route 491 and Pleasant Valley Road there is a spring adjacent to the road. This spring has been tested by the Washinton County Health Department and found contaminated with fecal coliform. Consequently, a sign has been in place warning people of the potential danger of drinking water from the spring. This spring discharges into Raven Rock Run, and can be considered a point source of bacterial contamination in the watershed.

Transportation Related Concerns
There are no major highways passing through the source watershed. Main transportation routes include Raven Rock Road (Route 491), Pleasant Valley Road, Ritchie Road, and MD Route 77, in the upper reaches of Warner Hollow sub-watershed. All of these roads have at least one stream crossing. The transportation of hazardous materials along these roads is probably uncommon, and limited to home heating oil, and other domestic products. With the exception of lower Route 491, most roads are a considerable distance from the reservoir proper. Route 491 follows Raven Rock Run through the lower hollow and is visible from the stream diversion site. Spills along this stretch could reach the stream, and reservoir, fairly quickly. Also of concern is the application of roadway salt to watershed routes in the winter, however, the water plant operator have not expressed any concern with elevated sodium concentration in the drinking water. The operators did comment that runoff from unimproved roads, which are common in the watershed, may contribute to increased turbidity during storm events.

Land Use Planning Concerns
A comparison between 1990 and 1997 DOP land use data shows the changes in watershed development during the 1990's. Land use percentages are tabled below:

Table 4. Land Use Change

Land Use	Percent of Watershed in 1990	Percent of Watershed in 1997
Residential	0.7	4.1
Cropland	16.4	16
Pasture	0.4	0.5
Forest	82.1	79
Open Water	0.4	0.4

Land use change in the Edgemont Reservoir watershed over the past few years has been minimal. Residential land use increased slightly, while forested land decreased. Forest land decreased by approximately 10 acres per year from 1990 to 1997. An additional 130 acres of residential land was depicted in the 1997 data, most of which is located in the Raven Rock sub-watershed. New residential development was centered along Route 491. Also, residential classified land made an appearance in the Harmon Gap-Pleasant Valley area in the Warner Hollow sub-watershed. Water plant operators were concerned with residential development within the entire watershed because of the new residence's dependence on septic systems, which can contribute to pathogenic organism contamination. Nutrient runoff concentrations are lower from forested land when compared to agriculture, urban, and residential development, so a decrease in forested cover within the watershed would not be beneficial to the reservoir's water quality. Residential development in the source watershed is not expected to skyrocket in the near future. The nature of the source watershed (i.e. steep and rugged) is not conducive to major development, and nearly half of the watershed is protected from land use change because of public land ownership (City of Hagerstown, federal and state government properties).

The percent of agricultural land did not significantly change from 1990 to 1997, and would not be expected to change much in the future. In Washington County as a whole, the number of farms has decreased slightly from 1992 to 1997, but the amount of acres used for cropland has remained relatively the same. The same is true for livestock farms; the number of farms raising beef cattle and dairy cattle has decreased but the animal populations have remained the same, hog farms have decreased, but the number of animals raised in the county slightly increased from 1992 to 1997 (DOA MD Census of Agriculture, 1997). Approximately 345 acres of farmland in the Edgemont Reservoir watershed are included in the Maryland Land Agricultural Preservation Fund, which designates farmland in preservation districts, promotes agricultural easements, and sometimes excludes land from farming (MD DNR, Merlin data). The current status of agricultural land in the watershed is not expected to change in the near future.

G. REVIEW OF WATER QUALITY DATA

Water quality data in the Edgemont Reservoir watershed is scarce, and most data reviewed for the assessment has been collected by MDE, or is part of the Safe Drinking Water Act requirements. An inquiry was made to the City of Hagerstown and Washinton County Health Department for additional data. In 1996, the final design criteria report for the new Breichner Water Plant included a summary of old raw water quality data. This data according to the consultants was provided by the city and will be used in the assessment. Several in-house sources of data have been reviewed; these include: William H. Breichner Water Plant - Monthly Operating Reports from the City of Hagerstown, MDE Water Supply Program's database for Safe Drinking Water contaminants, MDE TMDL data, and MDE bacteriological and *Cryptosporidium* data.

Monthly Operating Reports

Existing Plant Data – Raw Water

The City of Hagerstown is required to record and submit water quality data in a monthly operating report to MDE's Water Supply Program. These reports include some testing of the reservoir, or "raw" water. Turbidity, pH, and Alkalinity are the parameters tested daily when the plant is operating. Review of the data indicates that the reservoir usually has a very low turbidity and an acceptable pH. Turbidity is a measure of the waters "cloudiness" and is used as a surrogate indicator of pathogenic organisms, such as bacteria. In 2001, average turbidity in the reservoir was 2.0 NTU (Nephlometric Turbidity Units), and the maximum observed turbidity was 11.8 NTU in September 2001. According to water plant operators, turbidity usually ranges from 1 to 2.3, with a maximum observed daily value of 20 NTU. MDE took turbidity readings from the reservoir, Raven Rock Run, and Warner Hollow for the Potomac River Basin *Cryptosporidium* Project. This data will be presented in the susceptibility analysis. Over the same time period (2001), pH values in the reservoir averaged 7.3, and monthly averages ranged from 6.93 to 7.59, all within the acceptable secondary drinking water standard (6.5-8.5).

According to the data summarized in the 1996 Breichner Plant Final Design Criteria report, raw water turbidity from the reservoir averaged 2.5 NTU, from 942 samples collected in the late eighties and early nineties. The maximum observed turbidity was 65 NTU, but only 3% of the samples were above 10 NTU. The pH in the reservoir averaged 7.1 over this same time period (Gannett Fleming, 1996).

Regulated Testing

The City of Hagerstown is also required to test for regulated contaminants in its finished water supply produced at the Breichner Water Plant. A large number of these samples are collected by MDE and analyzed by the Department of Mental Health and Hygiene, or a private environmental laboratory. The data is reported to MDE's Water Supply Program. Tests for Synthetic Organic Compounds (SOCs), Volatile Organic Compounds (VOCs), and Inorganic Compounds (IOCs), are required on an annual basis. Starting below are tables of detected compounds only:

Inorganic Compounds
IOCs have been annually tested in drinking water for some time, depending on the contaminant. Most metals and nitrates have been tested regularly since 1977, but in 1993, nitrite and several other metals (such as selenium and thallium) were regulated. MDE's Water Supply database contains sample results since 1997, when Edgemont Reservoir was again used a source of drinking water for the city. Contaminant detections *only* are listed in Table 5.

Table 5. IOCs

Contaminant	MCL (mg/L)	Sample Date	Result (mg/L)
BARIUM	2	03-Dec-98	0.019
BARIUM	2	03-Nov-99	0.041
BARIUM	2	30-Nov-00	0.024
FLUORIDE	4	29-May-98	0.3
FLUORIDE	4	19-Apr-99	0.59
FLUORIDE	4	29-Nov-99	0.833
FLUORIDE	4	30-Nov-00	0.879

FLUORIDE	4	05-Apr-01	0.74
GROSS BETA	50	12-Nov-98	3
NICKEL	0.1	03-Nov-99	0.004
NITRATE	10	24-Feb-98	0.6
NITRATE	10	29-May-98	0.5
NITRATE	10	24-Feb-99	1.1
NITRATE	10	19-Apr-99	0.9
NITRATE	10	05-Apr-01	1.2
NITRATE	10	08-May-01	1.11
SULFATE	250*	29-May-98	23.6
SULFATE	250*	19-Apr-99	16.8

*National Secondary Standard

Synthetic Organic Compounds

Forty-three SOC contaminants have been monitored in finished drinking water since 1993. Several pesticides were regulated prior to this, but that data is not available for the assessment. Table 6 is a list of detections only in the Edgemont Reservoir water supply since 1997:

Table 6. SOCs

Contaminant	MCL (ppb)	Sample Date	Result (ppb)
2,4,5-T		19-Apr-99	0.49
DALAPON	200	29-May-98	0.83
DALAPON	200	27-Jul-98	0.13
DALAPON	200	19-Apr-99	0.65*
DALAPON	200	19-Apr-99	0.92
DALAPON	200	10-Sep-99	1.62
DI(2-ETHYLHEXYL) ADIPATE	400	13-Apr-00	0.6

*Raw water sample

Volatile Organic Compounds

VOCs were regulated in 1993, and several more were added for monitoring in 1998. There has not been a regulated VOC detection in the Breichner Plant water supply since testing began in 1997, however there have been three **unregulated** VOC detections, which are listed as follows:

Table 7. VOCs

Contaminant	Sample Date	Result ppb
CHLOROETHANE	27-Jul-98	3.6
METHYL-TERT-BUTYL-ETHER	07-Jul-00	1
METHYL-TERT-BUTYL-ETHER	07-Jul-00	1

In addition to the unregulated VOC detections, compounds known as Trihalomethanes (THMs) have been detected. THMs are the result of residual organic matter combining with chlorine during the disinfection process of water treatment. Below are results from THM detects at the point of entry from the Breichner Water Plant supply. Detections of the same sample are added (in the far right column) because THMs are regulated on a total concentration basis.

Table 8. THMs

Contaminant	Sample Date	Result ppb	TOTAL ppb
BROMODICHLOROMETHANE	19-Feb-98	0.9	
CHLOROFORM	19-Feb-98	29.8	30.7
BROMODICHLOROMETHANE	29-May-98	5.9	
CHLOROFORM	29-May-98	48.1	
DIBROMOCHLOROMETHANE	29-May-98	0.5	54.5
DIBROMOCHLOROMETHANE	27-Jul-98	0.7	
CHLOROFORM	27-Jul-98	29.6	
BROMODICHLOROMETHANE	27-Jul-98	5.7	36
BROMODICHLOROMETHANE	21-Jan-99	3	
CHLOROFORM	21-Jan-99	22.6	
DIBROMOCHLOROMETHANE	21-Jan-99	0.9	26.5
CHLOROFORM	19-Apr-99	15.4	
BROMODICHLOROMETHANE	19-Apr-99	3.5	18.9
CHLOROFORM	13-Apr-00	22.5	
BROMODICHLOROMETHANE	13-Apr-00	2.7	25.2
BROMODICHLOROMETHANE	15-Jun-00	6.2	
CHLOROFORM	15-Jun-00	38.4	
DIBROMOCHLOROMETHANE	15-Jun-00	0.5	45.1
CHLOROFORM	07-Jul-00	70.2	
BROMODICHLOROMETHANE	07-Jul-00	18	
DIBROMOCHLOROMETHANE	07-Jul-00	3.5	91.7

Source Water Assessment Bacteriological Sampling

MDE's Water Supply Program initiated a two-year bacteriological monitoring program for all surface water sources in the state to assist in the source water assessment. Sampling began in September 2000 with weekly samples taken from rivers and streams. Edgemont Reservoir supply sampling began in September 2000. This data is summarized in the Susceptibility Analysis section. Below is the data collected through early December 2001:

Table 9. Data Collected through early December 2001

Sample Date	Fecal Coliform (MPN/100ml)	Sample Date	Fecal Coliform (MPN/100ml)
09-Oct-00	50	14-May-01	13
24-Oct-00	17	29-May-01	23

13-Nov-00	2	11-Jun-01	17
27-Nov-00	2	25-Jun-01	2
04-Dec-00	4	03-Jul-01	7
18-Dec-00	300	16-Jul-01	17
08-Jan-01	6	06-Aug-01	17
23-Jan-01	30	27-Aug-01	80
12-Feb-01	4	10-Sep-01	23
27-Feb-01	2	24-Sep-01	170
06-Mar-01	2	09-Oct-01	22
19-Mar-01	2	22-Oct-01	4
02-Apr-01	4	03-Dec-01	4
23-Apr-01	4	07-Dec-01	2

Potomac River Basin *Cryptosporidium* Study

MDE has completed a 3-year study to determine the occurrence and concentrations of *Cryptosporidium* oocysts in the Potomac River and its tributaries. *Cryptosporidium* is a water-borne parasite that has been implicated in public health outbreaks. Edgemont Reservoir was selected as one of the sample sites. The data below (Tables 10 and 11) includes results for bacteria samples, turbidity, and *cryptosporidium*; the samples are all from base-flow conditions and were taken from the reservoir directly, at the Raven Rock Run diversion, and from Warner Hollow Run.

Table 10. Bacteria Summary (Baseflow)

Sample Location	Sample date	Turbidity	Fecal Coliform	E. Coli	Enterococcus
			MPN/100ml	MPN/100ml	MPN/100ml
Reservoir	08/31/01	4.3	14	7.6	88.6
Reservoir	10/16/01	3	152.6	69.3	12.3
Warner Hollow Run	11/01/01	0.3	<1	<1	4.3
Raven Rock Run	11/08/01	0.2	2.3	4.3	8.6

* Bacteria results are averaged from 3 replicate samples

Table 11. *Cryptosporidium* Results (Baseflow)

Sample Location	Sample date	*Cryptosporidium* oocysts		Viable/Infectious?
		Total	per liter	
Reservoir	08/31/01	10	> 1	Viable
Reservoir	10/16/01	10	1	NA
Warner Hollow Run	11/01/01	4	< 1	NA
Raven Rock Run	11/08/01	Negative	Negative	NA

NA = Not Analyzed; All samples were 3-gallons

The data shown below are the *cryptosporidium* during the storm flow condition. The samples for each location were analyzed to document the results furing the beginning (pre), peak- and recession (post) parts of the storm hydrograph. Much higher concentrations of *cryptosporidium* were found during storm event samples than during baseflow conditions, particularly in the stream samples. The concentrations measured during the beginning part of the storm were comparable to the levels found during the peak of the storm.

Table 11.1. Beginning (Pre) Storm Event *Cryptosporidium* Results

Sample Location	**Sample Date**	***Cryptosporidium Oocysts***		**Viable Infections**
		Total	**Per liter**	
Reservoir	01/24/2002	240	21	Viable
Reservoir	03/18/2002	264	23	Viable
Warner Hallow Run	07/26/2002	24	2	Viable
Raven Rock Run	07/26/2002	256	31	Viable

Table 11.2. Peak-Storm Event *Cryptosporidium* Results

Sample Location	**Sample Date**	***Cryptosporidium Oocysts***		**Viable Infections**
		Total	**Per liter**	
Reservoir	01/24/2002	331	29	Viable
Reservoir	03/18/2002	127	11	Viable
Warner Hallow Run	07/26/2002	23	2	Viable
Raven Rock Run	07/26/2002	309	27	Viable

Table 11.3. Recession (Post) Storm Event *Cryptosporidium* Results

Sample Location	**Sample Date**	***Cryptosporidium Oocysts***		**Viable Infections**
		Total	**Per liter**	
Reservoir	01/25/2002	81	7	Viable
Reservoir	03/19/2002	171	15	Viable
Warner Hallow Run	07/27/2002	Negative	Negative	NA
Raven Rock Run	07/27/2002	80	7	Viable

H. SUSCEPTIBILITY ANALYSIS

Each class of contaminants that were detected in the water quality data will be analyzed based on the potential they have of contaminating Hagerstown's Edgemont Reservoir intake. This analysis will identify suspected sources of contaminants, evaluate the natural conditions in the watershed that may increase or decrease the likelihood of a contaminant reaching the intake, and evaluate the impacts that future changes may have on the susceptibility of the intake. A summary of this analysis is found in the table at the end of this section.

Microbial Contaminants

Under current regulations, the City of Hagerstown is required to take total coliform samples each month of finished drinking water from the Breichner Water Plant. These bacteriological samples are collected at points in the distribution system. It would be difficult to use this data for the assessment because it does not adequately give an indication of contamination in both raw water supplies. Because of this lack of data, raw water bacteriological monitoring began in September 2000 at the plant. Below is a statistical summary of the data tabled previously in the WATER QUALITY REVIEW.

Table 12. Statistical Summary

Source	*No. of Samples*	*Fecal Coliforms*		
		Mean	**Median**	**Max**
Edgemont Reservoir	28	29.6	6.5	300

Fecal bacteria concentrations in the reservoir are relatively low but not insignificant. Samples from the Potomac River Basin *Cryptosporidium* Study show lower levels of bacteria, especially in the two "base" flow samples from Raven Rock and Warner Hollow Run than in the samples collected from the reservoir. Data from a 1996 report showed that fecal coliform concentrations from 164 samples averaged 44 colonies per 100 milliliters, with a maximum observed concentration of 2400 per milliliter. The data was from 1985-1987, and an unknown number of samples from February 1994, and October 1995.

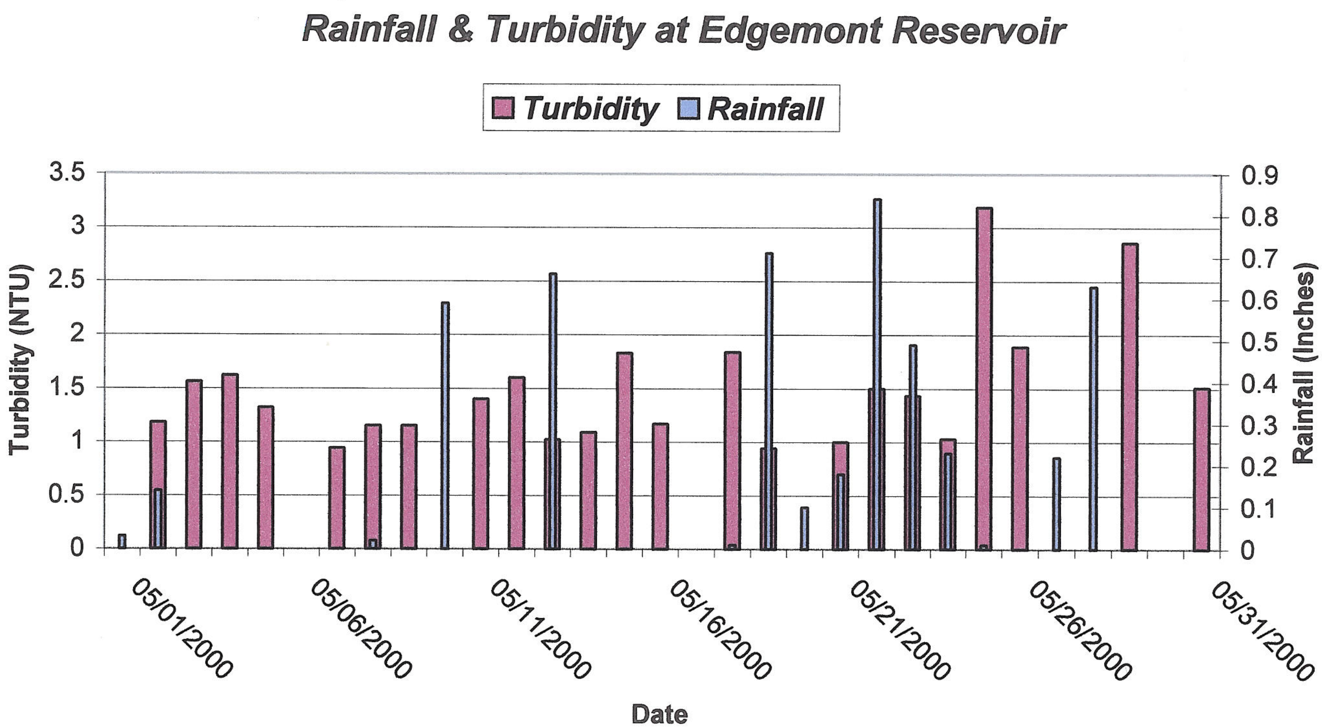
Streams which receive non-point source water runoff from pastures and concentrated livestock areas can have high concentrations of bacteria associated with eroding soil during periods of high flow. These bacteria can remain viable for long periods of time and attach to soil particles. During a storm, erosion of land surfaces may increase and previously eroded sediment in the streambed can be resuspended, leading to increased bacteria concentrations. Reservoirs, in general, can reduce the number of viable bacteria within a water body, but this is dependent on many environmental factors. From the data that is available, it appears that bacteria concentration in the reservoir, during "base" flow, maybe higher then in the two streams. In general, potential sources of non-point sources of pathogenic protozoa, viruses, and bacteria in the Edgemont Reservoir watershed include pasture (livestock), residential septic systems, and wildlife. Specifically, potential sources include the residential land upstream of the reservoir on septic, the contaminated spring along Raven Rock Road, cattle/dairy and reported hog farm in the upper Raven Rock sub-watershed. Additionally, wildlife, especially resident Canadian geese, which are frequently seen on the reservoir, may account for the slightly higher bacteria concentrations found in the reservoir during normal hydrologic conditions.

Species of *Giardia* and *Cryptosporidium* are believed to be fairly common in surface waters if the United States. High turbidity and elevated bacteria concentrations can be an indicator for the presence of these pathogens. Data from the Potomac River Basin *Cryptosporidium* Study suggests that contribution to the reservoir from the two feeder streams under baseflow conditions, is very low. Surrogate indicators, such as turbidity and fecal coliform, are generally at levels that do not characterize a water quality problem. MDE also collected storm flow c*ryptosporidium* samples for each location during pre-, peak- and post-storm events. Concentrations in the raw water from all samples are shown in Tables 11.1, 11.2 and 11.3. The review of base flow and storm flow data indicates that the Edgemont Reservoir is more susceptible to contamination by pathogenic organisms under storm flow conditions but is still susceptible under base flow conditions. Potential sources of these contaminants exist in the source watershed, and monitoring should continue after this assessment to ensure that future changes in the water quality of the reservoir are recognized.

Turbidity and Sediment
Highly turbid water can cause additional demands on water treatment plants and sediment can carry harmful microorganisms and compounds into drinking water supplies. Turbidity is used as a surrogate indicator for the presence of *Cryptosporidium* and *Giardia*, and increased water turbidity is indicative of elevated bacteria concentrations. Turbidity is caused by erosion of materials from the contributing watershed. Turbidity may be from a wide variety of materials, including soil particles and organic matter created by the decay of vegetation. During storm events and/or snowmelts surface runoff increases. Runoff during a storm event occurs when the rate of precipitation exceeds the rate of infiltration. As runoff increases during a storm and/or snowmelt, the increased flow of water can cause soil and other material to erode, raising the turbidity

The forested nature of Edgemont's watershed most likely mitigates the effect of storm events, evidenced by the fact that raw turbidity levels in the reservoir seldom rise to problematic conditions. In general, lakes and reservoirs provide longer water retention times, allowing the larger suspended solids and organic material that contribute to turbidity to settle out. During 2001, average monthly high turbidity for the reservoir was only 3.8 NTU. The next chart depicts the rainfall – turbidity relationship in the reservoir, from May 2000:

Chart 1. Rainfall & Turbidity



The chart above depicts turbidity levels in the reservoir and rainfall data from a weather station in Hagerstown. Rainfall in the region had little effect on turbidity levels in the reservoir; turbidity never rose above 3.5 NTU, even though substantial amounts of rain fell on consecutive days.

From discussions with water plant officials, it was understood that reservoir turbidity rarely exceeds 20 NTU, and that Warner Hollow Run, which is mostly forested (85%), does not usually contribute to increased sediment load and turbidity in the reservoir during storm events. Raven Rock Run, on the other hand, does experience higher turbidities due to storm events/snowmelt. City personnel may shut off the stream diversion if the reservoir is full, and/or turbidity increases in Raven Rock Run. The diversion pipe discharges water on the reservoir bottom, adjacent to the intake. When open, the quality of Raven Rock water directly impacts water taken by the intake. By shutting down, the city keeps turbid water from entering the reservoir supply.

When Edgemont Reservoir was constructed in 1902, the volume of water held behind the dam was estimated at 100 MG. Current estimates, by the city, have the current total volume (not the amount available for drinking water) at 85 MG, a difference of 15 MG. If these figures are correct then the reservoir has lost 15 percent of its capacity in 100 years, or 0.15 percent a year. This would indicate that sediment load to the reservoir has remained relatively low in the past century.

Potential sources of turbidity and sediment contamination in the watershed include natural erosion of stream banks, and runoff from cropland, pasture, and other impervious surfaces, such as driveways and roads. Future land use changes in the source watershed could increase the potential of turbidity and pathogen contamination in Edgemont Reservoir. Alteration of forested land could increase the amount of exposed land surface, which can lead to increased runoff and erosion. There has been some residential development in the watershed, though relatively minor, and agricultural land use has remained relatively constant. Land use in the watershed is not expected to change drastically in the future. If it does in fact remain unchanged, then turbidity and sedimentation of the reservoir should not be serious contamination issues.

Inorganic Compounds

- **Nutrients (Nitrate)**

Hagerstown's Breichner Plant has had 6 nitrate detections from 1998-2001. These concentrations have ranged from 0.6 to 1.2 mg/l, and have a mean detection concentration of 0.9 mg/l. All detections are well below the MCL of 10.0 mg/l. Sources of nitrates in the Edgemont Reservoir watershed include the 600+ acres of agricultural land (crops and pasture), residential septic systems, atmospheric deposition, and wildlife. Raven Rock Run may contribute more nutrient load to the reservoir because of the greater amount of agricultural land in the sub-watershed.

Most nitrogen and phosphorous nutrient species are not regulated under drinking water statutes, but they can contribute to nutrient over-enrichment (contamination) related problems, such as algae blooms, taste and odor problems, and increased THM precursors. According to city officials, algae blooms in the reservoir are a relatively common occurrence. Nutrient over-enrichment of a reservoir or lake is one factor in the incidence of alga blooms, and is usually associated with the amount of phosphorous available for biological production in a reservoir/lake. Nitrate samples are the only nutrient data available for the reservoir, and results are well below the drinking water standard. Consequently, Edgemont reservoir is not susceptible to nitrate contamination, even though algae blooms and possible taste and odor problems occur due to the loading of other unregulated nutrient species. More data would be needed to determine the current trophic status of the reservoir.

- **Trace Metals**

Regulated heavy metals are tested annually in the finished water produced at Hagerstown's Breichner water treatment plant, and since the early 1997 there have only been 4 detections. Barium, a relatively common heavy metal was detected three times, in 1998, 1999 and 2000. These detections were significantly lower than the MCL and 50% trigger. Barium is naturally occurring and does not pose a risk to the water source. In the 1999 IOC sample, a trace amount of Nickel was also detected, but the sample concentration was an order of magnitude below the maximum contaminant level. The shooting range above the reservoir may be the only potential source of metal contamination into the reservoir. Since there are no other significant sources of contaminants within the watershed, and sample detection has been infrequent with concentrations very low, Edgemont Reservoir is not susceptible to heavy metal contamination.

- **Radionuclides**

Radionuclides have been detected once in the Edgemont Reservoir supply. Gross Beta was detected at 3 piC/L, well below the regulated level of 50 piC/L. Gross Alpha and Beta are tested for once every four years at the water plant. No anthropogenic and/or significant natural sources are found in the Edgemont Reservoir source watershed. The reservoir is not susceptible to radionuclide contamination at this time.

- **Other Inorganic Compounds**

No sources of cyanide, asbestos, or fluoride were found within the source watershed. Fluoride samples from the plant data are well below the primary drinking water standard of 4mg/L. Fluoride found in the water supply is most likely from addition at the water plant. The intake is not susceptible to these contaminants.

Volatile Organic Compounds

Hagerstown is required to test finished drinking water for the presence of volatile organic compounds. Since 1997, there has not been any detection of regulated VOCs in the water supply. However, two unregulated compounds, chloroethane and methyl-tert-butyl-ether (or MTBE), have been detected. Chloroethane is a chemical intermediate, and is also used as a solvent. It can also found as an aerosol. MTBE is a common gasoline additive, which improves pollution from automobile exhaust. It is an extensively used chemical, and has been implicated in water contamination, especially groundwater, over the past few years. According to the MDE Water Supply database, the detection at Edgemont Reservoir (in both the raw and finished water) was the first and only detection of MTBE in a surface water system in Maryland. Potential sources of MTBE include leaking from aboveground and underground storage tanks, stormwater runoff, residential fuel usage, and atmospheric deposition. The levels detected of both contaminants were not significant from a health perspective nor have they been found in more than one sample. Sources of VOC contamination within the source watershed would include runoff from residential land, accidental spills, and residential fuel storage tanks. However, the lack of any substantial, or regulated, detections since 1997 along the absence of any significant potential sources in the watershed make Edgemont Reservoir not susceptible to regular VOC contamination at this time. The only significant threat of potential VOC contamination comes from a large spill.

Trihalomethanes (THMs) result from the reaction of naturally occurring organic matter with chlorine during the water treatment process. The use of disinfectants in water treatment, such as chlorine, are effective in controlling many microorganisms, but they react with natural organic and inorganic matter in source water and distribution systems to form potentially harmful Disinfection Byproducts (DBP), which include THMs. The EPA recently lowered the MCL from 100µg/l (ppb) to 80 µg/l for surface water systems serving more that 10,000 people. This rule applies to the City of Hagerstown. Seven samples from 1999 and 2000 taken from points in the Hagerstown distribution system were above the 80 µg/l MCL.

The most common THMs detected at the Breichner Water Plant are chloroform and bromodichloromethane. Organic material is widespread throughout the Edgemont Reservoir watershed, with almost 80% of the watershed composed of deciduous forest. The decay of naturally occurring organic matter, such as leaves and sediment, in the watershed increase the probability of THMs forming in the finished drinking water supply.

Under the new THM regulations, Hagerstown will be required to monitor its distribution system for compliance with the Total THMs standard and will employ enhanced treatment to reduce the amount of organic matter (measured as total organic carbon, TOC) during the water treatment process. Results of future testing will determine the need for further evaluation of the THM contamination.

Synthetic Organic Compounds

The Breichner Water Plant has had seven SOC detections since 1997. All of these detections were significantly lower than the MCL regulation and 50% trigger for each contaminant. The most common compound found, Dalapon, was detected five times from 1998-1999, and is a herbicide commonly used on right-of-ways and transportation corridors. Concentrations of Dalapon averaged 0.83 ppb, well below the MCL of 200 ppb. One sample, collected in 1999 was from the "raw water" and was 0.65 ppb. Di(2-ethylhexyl) Adipate is a resin commonly found in plastics. Its prevalence in plastics makes it a hard substance to sample and test. Because this compound appears in laboratory blanks when detected, the reported quantities are not likely reflective of levels in the environment, but rather laboratory artifacts. The only other compound detected in the finished drinking water was 2,4,5-T (Trichlorophenol) in 1999 at a concentration of 0.49 ppb. 2,4,5-T has been identified by the EPA as a product of the biodegradation of the pesticide Silvex. There is not an MCL for 2,4,5-T, but Silvex is regulated at 50 ppb MCL. Silvex is a herbicide that was applied to herbaceous weeds and woody plants, it can enter waterways through spraying or runoff from the land; it is very well adsorbed onto soil and degrades very slowly in water and sediment. All registered uses of Silvex were banned in 1985. Silvex may have been applied on residential lawns, a power line right-of-way, or for spraying nearby orchards in the past. However, since 1997 no Silvex detections occurred in the Edgemont water supply, and SOC samples from 2000 and 2001 did not detect any 2,4,5-T, or Silvex. A "raw water" SOC sample was also taken directly from the Edgemont Reservoir in 2000, and there were no

Susceptibility Analysis Summary Table - Edgemont Reservoir Intake

Contaminant	Water Quality (50% MCL Exceeded?)	Potential Sources	Natural Attenuation in Watershed	Evaluation of Change to Natural Conditions	Intake Integrity	Currently Susceptible?
Volatile Organic	N	Spills, Tanks	Y	P	N	N
Synthetic Organic	N	Agriculture, Spraying	Y	P	N	N
Heavy Metals	N	Natural Deposits	Y	P	N	N
Nitrate/Nitrite	N	Agriculture/Septic	Y	P	N	N
Fluoride	N	Natural Deposits	NA	P	N	N
Cyanide	N	None	Y	P	N	N
Asbestos	N	None	NA	P	N	N
Radionuclides	N	Natural Deposits	Y	P	N	N
Total/Fecal Coliform	Y	Agriculture/Septics	N	N	N	Y
Protozoa	I	Agriculture/Septics	N	N	N	Y
Viruses	I	Agriculture/Septics	N	N	N	Y
THMs	N	Organic Material	N	N	N	N
Turbidity	Y	Erosion, Storm Water	N	N	N	Y

KEY:

Water Quality:
Y = Yes, data shows that a sample was greater than 50% of the MCL
N = No sample data was found above 50% of the MCL
I = Insufficient data

Potential Sources
(List of Sources, point and non-point)

Natural Attenuation in Watershed
Y = Highly probable that contaminant type is attenuated under natural conditions in the watershed
N = Contaminant is not attenuated naturally in the watershed
U = Unknown

Evaluation of Change to Natural Conditions
N = Future changes in the natural conditions of the watershed will likely increase the susceptibility of this intake to the contaminant type
P = Future changes in the natural conditions of the watershed are **not** likely to increase the susceptibility of this intake to the contaminant type

Intake Integrity
Y = Intake is vulnerable, or adds to the susceptibility of contaminant type
N = Intake does not contribute to vulnerability of contaminant type

Currently Susceptible
Y = Yes
N = No

pesticide or any other SOC detections. At this time Edgemont's intake is not susceptible to SOC contamination.

I. RECOMMENDATIONS FOR A SOURCE WATER PROTECTION PROGRAM

With the information contained in this report, the City of Hagerstown hopefully has a new understanding of how to enhance the protection of their water supply. The city, state, and federal government own almost half of the area delineated for source water protection. Land use planning and preservation is very important to ensuring good source water quality in the future, which is the goal of source protection. Purchasing more property within the source watershed, becoming more involved with how these lands are managed, and keeping track of potential contaminant sources old and new, are just a few ways to accomplish this goal. Developing a source water protection plan for the Edgemont Reservoir intake is an underlying goal of this assessment. Specific management recommendations for consideration are:

Form a Local Watershed Planning Team

- A watershed group could greatly assist in any efforts to protect the Edgemont Watershed. Possible members would be officials from the City, Washington County Department of Health and Planning offices, local MD soil conservation district officers, MD DNR Forestry Officials, Catoctin National Park officials, and MDE.
- Goals of this group could include: increased citizen involvement in protecting the watersheds, start a volunteer stream monitoring group (like Save our Streams), support agricultural best management practices (BMPs), keep up to date on changes in the watershed, and to promote watershed protection among local residents.

Public Awareness and Outreach

- Future Consumer Confidence Reports need to provide a summary of this report and indicate that the entire report is available to the general public through the county library, contacting the City office, or by contacting the Water Supply Program at MDE.
- Road signs explaining to the public that they are entering a protected drinking watershed is an effective way of keeping the relationship of land use and water quality in the public eye, and help in the event of a spill notification and response.
- Include interested members of the public on the watershed planning team.

Planning

- The city should continue to work with MD DNR Forestry officials for guidance on future forestry harvests on city land, and implement a forestry management plan.
- Ensure that Edgemont Reservoir and the Appalachian Trail (through the watershed) continue to be listed as special planning areas in the Washington County Comprehensive Plan, and future plans.

Monitoring

- Continue to monitor for fecal coliform and/or E. coli in the reservoir now that the two-year MDE sponsored monitoring program is over.

- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE, including raw reservoir sampling when feasible.
- Conduct a survey on the use of pesticides and fertilizers on farm properties in the watershed, and find out the occurrence of spraying on nearby orchards.
- Monitor phosphorous and chlorophyll a concentrations in the reservoir to form a baseline of water quality and to determine the trophic state of the reservoir.
- Test for lead leaching from the gun range adjacent to the reservoir, and determine if the range is, or has the potential, to affect water quality.

Land Acquisition and Easements

- The availability of loans for purchase of land or easements for the purpose of protecting water supplies is available from MDE. Loans are offered at zero percent interest and zero points.
- The watershed group should work with the MD Department of Natural Resources in managing state lands associated with South Mountain State park.
- The watershed group should work the MD Department of Agriculture to promote best management practices and agricultural preservation districts and easements through the Maryland Land Agricultural Preservation Fund in the watershed, with the local Soil Conservation Service and local farmers.

Contaminant Source Inventory Updates

- The city, and/or the new watershed group, should periodically conduct detailed field surveys of each subwatershed to ensure there are no new potential sources of contamination.
- Update MDE on potential land use changes that may increase the susceptibility of the reservoir to contaminants.
- The watershed group should work with the Department of Health to document the condition of residential septic systems within the watershed.

REFERENCES

Duigon, Mark T. and James R. Dine, 1991. Water Resources of Washington County, Maryland MD Department of Natural Resources, Maryland Geological Survey, 109p.

Gannett Fleming, Inc., 1996. Smithsburg/Edgemont Water Treatment Plant – Final Design Criteria. Water Resources & Technical Division Harrisburg, PA, 10p. plus appendicesand design drawings.

MD Department of the Environment, 2000. Comprehensive Performance Evaluation of the City Hagerstown's William M. Breichner Water Treatment Plant, Smithsburg – Washington County, Maryland. Water Supply Program, 22p.

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

MD Department of Natural Resources, 2000. The 2000 Maryland Section 305(b) Water Quality Report. Resource Assessment Service, 244p.

Slaughter, Turbit H. and John M. Darling, 1962. The Water Resources of Allegany and Washington Counties. Bulletin 24 – Department of Geology, Mines and Water Resources, State of Maryland, 395p. plus plates and maps.

US Department of Agriculture, 1999. 1997 Census of Agriculture, Maryland State and County Data. National Agricultural Statistics Service, 367p.

Other Sources of Information and Data

MDE Water Supply Inspection Reports
MDE Water Supply reader file for the City of Hagerstown (PDWIS ID 0210010)
MDE Water Supply Program Oracle Database (PDWIS)
City of Hagerstown Monthly Operating Reports (MORs) and Self-Monitoring Reports
MD Department of Natural Resources Digital Orthophoto Quads for Washington and Frederick County
MD Department of Natural Resources, Protected Lands GIS database, from MERLIN.
Digital USGS Topographic 7.5-Minute Quadrangles, SureMaps Raster.

Maryland Office of Planning 1997 and 1990 Washington and Frederick County Land Use data
Maryland Office of Planning 1999 Property View Tax Map, Washington County.
EPA Chemical Fact Sheets, http://www.epa.gov/safewater/mcl.html

APPENDIX

Figure - 2
Land Use in the Edgemont Reservoir Watershed

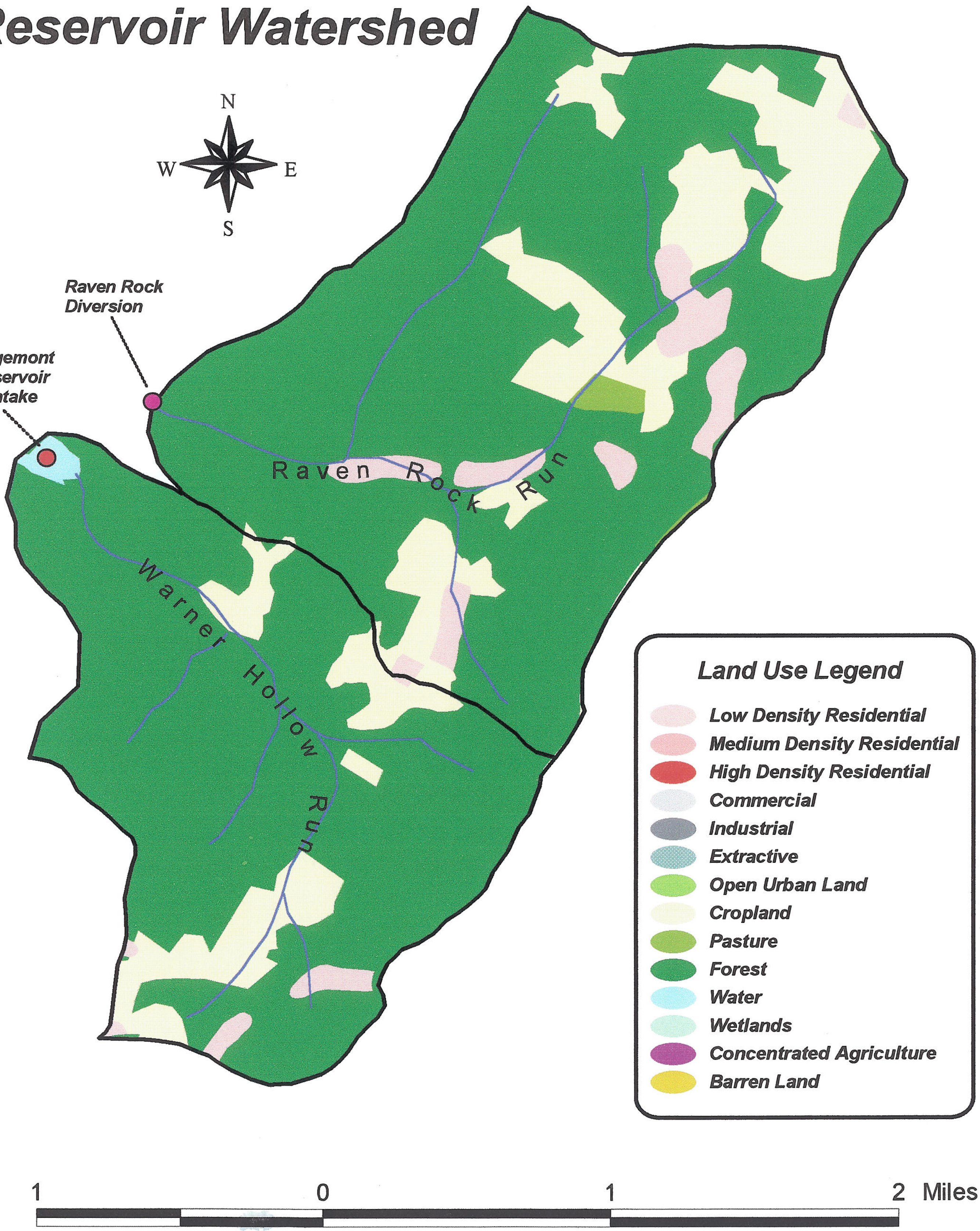


Figure - 3 Main Roads & Public Lands