SOURCE WATER ASSESSMENT

for

U.S. ARMY GARRISON
ABERDEEN PROVING GROUND (Edgewood Area)
Van Bibber Water Treatment Plant

Prepared By
Water Management Administration
Water Supply Program
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TABLE OF CONTENTS

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 of a source of public drinking water supply to contaminants. This SWA was completed for Winters Run which supplies water to the Van Bibber Water Treatment Plant (WTP). About 5,000 people in Edgewood area of Aberdeen Proving Ground, U.S. Army Garrison in Harford County rely on water obtained from Winters Run. Winters Run is also the source of water supply for the Town of Bel Air and the surrounding area.

Winters Run is a major tributary of the Bush River Watershed and its entire watershed is located in Harford County. The intake structure at the Van Bibber WTP collects water directly from Winters Run and flows by gravity to a wetwell. Water is then pumped to the head of the treatment plant to pass through a multi-barrier treatment process that includes coagulation, floculation, sedimentation, filtration and disinfection.

The source water protection area for Van Bibber WTP intake encompasses approximately 55 square miles (35,643 acres) of mixed land use. Approximately 34% of the watershed is used for agricultural purposes and 36% of the watershed is comprised of developed land (residential, commercial and industrial). The concentration of developed land is greatest along the Route 24 corridor.

Potential sources of contamination in Winters Run Watershed include point and non-point sources, including transportation, agriculture, on-site septic systems and runoff from developed areas. Non-point sources (agricultural and urban runoff) are the largest source of contaminations in this watershed. There are two active and two inactive industrial dischargers located within the watershed. The discharge from these minor facilities is not negatively impacting the water quality at the intake.

The susceptibility analysis indicates that turbidity, disinfection by product precursors and pathogenic microorganisms are the contaminants of most concern. High turbidity levels are associated with erosion and transport of sediment during storm flows. Additional sampling is needed to determine the contribution and sources of nutrients, algae and natural organic matter to the pool of disinfection byproduct precursors. The network of major roads (I-95 and Routes 24 and 40) and rail lines in close proximity to the Van Bibber intake make this water supply at a significant risk to being impacted by high salt concentrations during snowmelt and by a spill of hazardous materials.

Section 8.0 of this report lists specific recommendations for consideration in developing a source water protection plan. Providing critical information for implementing a source water protection for Winters Run is the ultimate goal of this assessment.

1.0 BACKGROUND

The 1996 Safe Drinking Water Act Amendments require states to develop and implement source water assessment programs to evaluate the potential for contaminants to affect the sources of all public drinking water systems. A Source Water Assessment (SWA) follows a process for evaluating the susceptibility of a public drinking water supply to contamination. The assessment does not address the treatment processes or the storage and distribution 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 SWA 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 susceptibility 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 (EPA) 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.

2.0 INTRODUCTION

The U.S. Army Garrison, Aberdeen Proving Ground is responsible for the management and operation of the Aberdeen Proving Ground (APG) installation. Aberdeen Proving Ground Garrison provides the necessary general, administrative and logistical support to over 50 tenant organizations and other government agencies located at this installation. APG is located in Harford County, Maryland and covers an area of over 72,500 acres of land and 44,000 acres of water. Aberdeen Proving Ground comprises two areas which are combined to form one U.S. Army post. The Aberdeen area of the Proving Ground is the home of Army Ordnance and the Edgewood area of Aberdeen Proving Ground (formerly the Edgewood Arsenal) is a home to such activities as the U.S. Army Chemical and Biological Defense Command.

The Van Bibber water filtration plant is owned and operated by the Department of the Army and serves approximately 5,000 people in Edgewood area of Aberdeen Proving Ground. The plant was designed for four million gallons per day (MGD) and has withdrawn water directly from Winters Run since 1942.

A. Description of Surface Water Supply Source
Winters Run drainage area is approximately 55 square miles above the Van Bibber Water Treatment Plant intake, located in western Harford County. Winters Run is a major tributary of Bush River Watershed and serves as a primary drinking water source for the Town of Bel Air and for the Edgewood portion of the Aberdeen Proving Ground. There are two main streams, the East Branch and West Branch, which drain the upper area of the watershed near the community of Jarrettsville.

The Winters Run Watershed, located in the Piedmont Plateau that also makes up the northern three-fourths of Harford County, is a very old upland dissected by many small streams and drainage ways. The underlying geologic formations are primarily metamorphic rocks, schist and gneiss, and lesser amounts of marble. The Soil Survey report in Harford County area indicates that the soil in the watershed area consists mainly of Legore-Neshaminy-Aldino association. The Legore series consists of deep, well drained, nearly level to steep soils on rolling to hilly uplands of the Piedmont Plateau. These soils formed by weathering in place from such dark-colored basic rocks as diabase and gabbro. The Neshaminy series formed in material deeply weathered in place from semi basic rocks or mixed basic and acidic rocks. They are on rolling to hilly uplands. Aldino series consists of moderately well drained, nearly level to moderately sloping soils on uplands of the Piedmont. They formed in material weathered from serpentine bedrock that is overlain by a layer of loamy material, possibly loess.

The Harford County area has a continental type climate with 41.5 inches of average annual rainfall. The month of highest average rainfall is August, and the month of lowest average rainfall is January.

B. Water Supply Development
The Edgewood area of APG depends on a 4.0 million gallon per day (MGD) water treatment plant, which started operation in 1942. The plant includes the conventional treatment processes of coagulation, flocculation, sedimentation, filtration and disinfection. The Edgewood area can also obtain water supply from an interconnection with the Harford County Abingdon Water System in case of emergency.

The intake structure is equipped with a bar screen and sump pump in order to keep clogging to a minimum. Water flows by gravity through a single 24-inch pipe to the plant's traveling screen just before the wet well. When the screen is in operation, it is backwashed with water from the clearwell; this water goes back into Winters Run. Alum, Chlorine and Caustic Soda are added prior to the flocculation basin to aid the treatment processes.

3.0 RESULTS OF SITE VISIT(S)

Water Supply Program (WSP) personnel conducted a site survey of Van Bibber's Plant water sources and other raw water facilities in order to accomplish the following tasks:

- To collect information regarding the locations of raw water sources and intakes by using Global Positioning System (GPS) equipment.

- To determine the general condition and structural integrity of intakes and other raw water facilities.
- To discuss source water issues and concerns with the APG Edgewood area water system operators.
- To conduct a windshield survey of the watershed and to document potential problem areas. Additional tours of the watersheds were taken on follow-up visits.

Concerns and Site Observations

- The intake of Van Bibber Water Treatment Plant is located on the bank of the Winters Run consisting of concrete vault with bar screen; the valves on 24" raw water line were not operable during the site visit.
- The County sewer line crosses the Winters Run and has experienced leakage in the past.
- Flooding occurs during heavy storms; flooding occurred during Hurricane Floyd.
- The operators reported that occasionally color changes in the Winters Run raw water from possible spills or illegal dumping into the stream.
- A propane gas storage and distribution company and also a large vegetable farm are located at the vicinity of the plant were mentioned as concerns by the water plant operators.

4.0 WATERSHED CHARACTERIZATION

Source Water Assessment Area Delineation Method (Surface Water)

An important aspect of the source water assessment process is to delineate the watershed area 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, 1999). Delineation of the source water area was performed by using ESRI's Arc View Geographic Information Software (GIS), utilizing existing GIS data, and by collecting location data using a Global Positioning System (GPS). GPS point locations were taken at the water source intake and differentially corrected (for an accuracy of +/- 2 meters) at MDE. Once the intake location was established, the contributing area was delineated based on existing Maryland Department of Natural Resources digital watershed data and Maryland State Highway Administration digital stream coverage. Digital USGS 7.5 topographical maps were also used to perform "heads up" digitizing or editing of watershed boundaries.

General Characteristics

The drainage area above the Winters Run intake encompasses approximately 55 square miles (35,643 acres) of mixed land use in Harford County. Maryland American Water Treatment Plant (WTP) and Van Bibber WTP intakes share the Winters Run Watershed. Figure 4.1 shows the land use within the Winters Run Watershed above the intake of Van Bibber Water Treatment Plant.

Based on the Maryland Department of Planning 2002 land use data, the land use distribution of Winters Run Watershed is summarized in Table 4.1.

Year 2002 Maryland Department of Planning (MDP) Land Use	Acres	Percent
Low-density residential	8,062	22.6%
Medium-density residential	2,423	6.8%
High-density residential	747	2.1%
Commercial/Industrial	1,784	5.0%
Open urban land	384	1.1%
Cropland	10,450	29.3%
Pasture	1,362	3.8%
Orchards/vineyards/horticulture	62	0.2%
Feeding operations	210	0.6%
Forest	10,044	28.2%
Barren land	10	0.0%
Water	55	0.2%
Wetlands	28	0.1%
Extractive	22	0.1%
GRAND TOTAL	**35,643**	**100%**

Table 4.1 Winters Run Watershed Land Use Distribution

5.0 POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are categorized as either point or non-point sources. Examples of point sources of contamination are landfills, industrial discharges, wastewater treatment plants and large scale animal feeding operations. These sites are generally associated with the discharge of significant volumes of wastewater at a particular location and are regulated through a discharge permit specific to the facility. Non-point sources of contamination are associated with certain types of land use practices such as the use of pesticides, application of fertilizers, tilling of fields, spreading of animal wastes, creating impervious surfaces, construction and earth disturbance. Non-point pollution is generally created as a result of rainfall carrying away nutrients, soil, chemicals, and microorganisms from the land surface to a receiving water body. Figure 5.1 depicts the roads and potential point contaminant sources in the Van Bibber Water Treatment Plant source water assessment area.

Non-Point Sources in the Watershed

According to Department of Planning 2002 land use data, 12,084 acres (approximately 34% of the watershed) are used for agricultural purposes (cropland, pastures and feeding operations). Land used to grow crops can be a source of nutrients (from fertilizer) synthetic organic compounds (herbicides) and sediment load. Pastures used as a recipient of animal waste and for grazing livestock are sources of nutrients and pathogenic protozoa (*giardia* and *cryptosporidium*), viruses and bacteria. Feeding operations are also a potential source of contaminants associated with animal wastes. Developed land (residential, commercial, industrial) accounts for 36% of Winters Run Watershed. Sediment, nutrients, pathogens (*giardia* and *cryptosporidium*), deicing compounds, and heavy metals are the most significant concerns from runoff in developed areas. Lawn and pavement in commercial and residential areas result in increased storm water velocity and when not adequately managed cause streambed and streambank erosion.

Point Sources in the Watershed

A review of MDE's municipal and industrial discharge permit programs indicates there are two active and two inactive industrial dischargers located within the source water assessment area (Figure 5-1).

One active discharge permit is for Tollgate Landfill. The site was used during the period from 1954 through 1987 as a municipal landfill. It is unlined and has no leachate collection system. Ground water monitoring has indicated the presence of organic contaminants. In an attempt to minimize the off-site migration of contaminated ground water, a line of ground water extraction wells have been placed along the western border of the site and between the landfill and Tollgate Road. The wastewater passes through a treatment system and the treated effluent is discharged through a drain line to a series of stormwater management ponds. Overflow from the pond discharges to an unnamed tributary to Winters Run. Currently, the maximum permitted discharge is 130,000 gallons per day, with effluent limits for BOD, COD, TOC, TSS and various chemical specific limits that are well below drinking water standards. The treatment for this ground water remediation system consists of pH adjustment, air stripping and carbon adsorption.

A review of daily monitoring report from January of 2000 through August of 2004 for the above facility shows that Tetrachloroethylene exceeded the limits once on June 30, 2004 and Total Organic Carbon exceeded twice on March 31, 2003 and September 30, 2003 respectively.

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal degreasing. Other names for Tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. The current drinking water standards for this chemical is 0.005 mg/L and the maximum limit for the Tollgate Landfill ground water treatment system set by the NPDES Permit is 0.0017 mg/L. The total organic carbon is a measurement of carbon dioxide produced from organics when water sample is atomized into a combustion chamber. The NPDES Permit limits for total organic carbon are established to be less than 1.0 mg/L.

The second active permit is for Mary Kisteau, a District Court and Multi-Service Center, an office building operated by the State of Maryland, Department of General Services. The permitted discharge consists of noncontact cooling water from the air conditioner unit and boiler blowdown from the heating system. Both units are located in the underground garage of the building. The NPDES Permit limits only measurement of discharge flow per unit each month and pH of the effluent should be between 6.0 and 9.0. The facility is currently in compliance with the requirements of the permit.

There are two inactive permits (Plaza Ford and Heritage Auto Mall) in the source water assessment areas. These facilities are discharging their wash water into the nearby sewer. There are no surface discharges from these sites.

There are 18 sewage pump stations and a network of sewer systems located at the lower half of the watershed that is served by public sewer (see Figure 5.1). Sewage overflow from the pump stations and leakage from the sewers may be potential sources of the contamination.

Transportation Related Concerns

Another potential source of contamination to the Winters Run intake is the network of transportation infrastructure including highways, railroads, roads, and petroleum and gas pipelines. Interstate-95 and routes 40, 1, 24, 152 and 165 are used heavily for commercial traffic and cross the major tributaries or the main stem of Winters Run. All of these routes, especially I-95, Route 40, Route 7 and the railroad pose potential spill danger because of their close proximity to the Van Bibber raw water intake.

Colonial Pipeline, an interstate carrier of petroleum products, crosses the Winters Run Watershed. Pipeline accidents and leaking of petroleum products can cause contamination of raw water with oil products and volatile organic compounds.

Land Use Planning Concerns

A comparison between 1994 and 2002 Maryland Department of Planning land use data are shown in Table 5.1.

Land Use	1994	2002	Percent Change
Barren land	136	10	-92%
Comercial	1,199	1,529	+28%
Cropland	12,586	10,450	-17%
Extractive	19	22	+16%
Feeding operations	223	210	-6%
Forest	11,058	10,044	-9%
High-density residential	608	747	+23%
Industrial	64	255	
Low-density residential	5,581	8,062	+44%
Medium-density residential	2,089	2,423	+16%
Open urban land	314	384	-22%
Orchards/vineyards/horticulture	49	62	+26%
Pasture	1,531	1,362	-11%

Table 5.1 Winters Run Watershed Land Use Data Comparison between 1994 and 2002

The most significant change is the increase in residential land use over the past eight years. This land use trend is also seen in other areas of Harford County. The loss of approximately 1,000 acres of forested land and approximately 2,300 acres of agricultural (cropland and pasture) land in Winters Run Watershed during this period and the increase in developed land (about 3,500 acres) remains the main land use concern. The entire Winters Run Watershed is located in Harford County. The comprehensive plan for the Town of Bel Air and Harford County's Master Plan are effective planning tools that provide direction for accommodating desirable growth while maintaining the quality of life. Local land use planning is an important component of source water protection.

6.0 REVIEW OF WATER QUALITY DATA

Several sources of water quality data were reviewed for APG Van Bibber Water Treatment Plant's source water assessment. These include MDE Water Supply Program's database for safe drinking water contaminants and monthly operating reports from the Van Bibber Water Treatment Plant.

Water quality data for Van Bibber was compared with the maximum contaminant levels (MCLs) set by the U.S. Environmental Protection Agency. MCLs are established to ensure that drinking water is safe for human consumption. If monitoring data shows that any contaminant is greater than 50% of a MCL for at least 10% of the available data points, a detailed susceptibility analysis will be performed for that contaminant and its potential sources.

Existing Plant Data

Van Bibber Water Treatment Plant's operators routinely test raw and treated water at the plant for various contaminants. MDE also periodically analyze samples of the raw and treated water for contaminants regulated under the Safe Drinking Water Act. Raw water samples are collected at the plant prior to treatment. Treated samples are collected after the water passes through the treatment plant.

Turbidity

Turbidity is described as a measure of cloudiness of water. It is used to indicate water quality and treatment effectiveness. Higher turbidity level is often associated with higher levels of disease causing microorganisms such as viruses, parasites and bacteria. Turbidity is measured in the raw water at the Van Bibber Water Treatment Plant on a continuous basis. The monthly summary statistics for each month during the year 2004 is presented in Table 6.1. For this period, the average daily turbidity was 13 nephelometric turbidity units (NTU), the minimum turbidity measured was 1 NTU, and the maximum turbidity measured was 284 NTU. Higher turbidity values are associated with rainfall, particularly high intensity storms that cause erosion and movement of sediment by Winters Run.

Date	Avg. Monthly Value Turb. NTU	Maximum Turbidity NTU	Minimum Turbidity NTU
January	4.0	30	2
February	15	76	3
March	8	93	2
April	14	84	3
May	11	70	4
June	28	284	3
July	21	99	2
August	13	116	2
September	13	88	2
October	4	9	2
November	9	105	2
December	12	95	1

Table 6.1 Van Bibber Plant Raw Water Turbidity for Year 2004

Inorganic Compounds (IOCs)

Van Bibber plant regularly tests for presence of nitrate and other inorganic compounds in finished drinking water. The treatment process will not remove dissolved inorganic ions, so finished water is generally reflective of raw water for these compounds. No inorganic contaminants exceeded 50% of an MCL. Sodium values are elevated above EPA's guidance of 20 mg/l for persons on a severely restricted diet of 500 mg/day of sodium. Naturally occurring levels of sodium are typically less than 10 mg/l. A particularly high concentration of 200 mg/l was measured in March of 2005. This may have been caused by the deposition of plowed snow contamination with road salt just upstream of the plant intake.

Table 6.2 APG Inorganic Chemcial Results from Van Bibber Water Treatment Plant

Contam Name	Sample Date	Result	Units	MCL
ARSENIC	02/08/1995	0.001	mg/L	0.01
ARSENIC	02/22/1996	0.001	mg/L	0.01
ARSENIC	02/10/1999	0.0007	mg/L	0.01
BARIUM	01/11/1994	0.034	mg/L	2
BARIUM	03/31/1994	0.017	mg/L	2
BARIUM	02/08/1995	0.025	mg/L	2
BARIUM	02/22/1996	0.03	mg/L	2
BARIUM	02/12/1997	0.031	mg/L	2
BARIUM	02/12/1998	0.02	mg/L	2
BARIUM	02/10/1999	0.023	mg/L	2
BARIUM	03/29/2000	0.025	mg/L	2
BARIUM	03/15/2001	0.025	mg/L	2
BARIUM	03/13/2002	0.022	mg/L	2
BARIUM	01/21/2003	0.031	mg/L	2
BARIUM	03/03/2004	0.029	mg/L	2
BARIUM	03/03/2005	0.062	mg/L	2
CHROMIUM	02/08/1995	0.039	mg/L	0.1
CHROMIUM	02/22/1996	0.001	mg/L	0.1
CHROMIUM	02/12/1997	0.0056	mg/L	0.1
CHROMIUM	02/12/1998	0.0011	mg/L	0.1
CHROMIUM	02/10/1999	0.001	mg/L	0.1
CHROMIUM	03/29/2000	0.0016	mg/L	0.1
CHROMIUM	03/03/2005	0.002	mg/L	0.1
FLUORIDE	09/07/1994	0.85	mg/L	4
FLUORIDE	02/08/1995	0.7	mg/L	4
FLUORIDE	02/08/1996	0.82	mg/L	4
FLUORIDE	02/22/1996	0.4	mg/L	4
FLUORIDE	02/12/1997	0.7	mg/L	4
FLUORIDE	07/09/1997	1	mg/L	4
FLUORIDE	02/12/1998	1	mg/L	4
FLUORIDE	02/10/1999	0.8	mg/L	4
FLUORIDE	03/29/2000	0.8	mg/L	4
FLUORIDE	03/15/2001	0.6	mg/L	4
FLUORIDE	05/07/2001	0.76	mg/L	4

Table 6.2 APG Inorganic Chemcial Results from Van Bibber Water Treatment Plant continued

Contam Name	Sample Date	Result	Units	MCL
FLUORIDE	03/13/2002	0.6	mg/L	4
FLUORIDE	04/09/2002	0.93	mg/L	4
FLUORIDE	01/21/2003	0.6	mg/L	4
FLUORIDE	04/22/2003	0.57	mg/L	4
FLUORIDE	03/03/2004	0.7	mg/L	4
FLUORIDE	03/03/2005	0.7	mg/L	4
MERCURY	02/12/1998	0.0009	mg/L	0.002
NICKEL	02/08/1995	0.001	mg/L	
NICKEL	02/22/1996	0.001	mg/L	
NICKEL	02/12/1998	0.0022	mg/L	
NICKEL	02/10/1999	0.0014	mg/L	
NICKEL	03/29/2000	0.0017	mg/L	
NICKEL	03/15/2001	0.0018	mg/L	
NICKEL	03/13/2002	0.0013	mg/L	
NICKEL	01/21/2003	0.0014	mg/L	
NICKEL	03/03/2005	0.004	mg/L	
NITRATE	02/10/1993	3.2	mg/L	10
NITRATE	04/20/1993	2.2	mg/L	10
NITRATE	08/16/1993	1.86	mg/L	10
NITRATE	10/05/1993	2.74	mg/L	10
NITRATE	03/31/1994	1.81	mg/L	10
NITRATE	06/29/1994	1.75	mg/L	10
NITRATE	09/07/1994	2.13	mg/L	10
NITRATE	02/08/1995	3.3	mg/L	10
NITRATE	02/08/1996	4	mg/L	10
NITRATE	02/22/1996	1.75	mg/L	10
NITRATE	02/12/1997	2.8	mg/L	10
NITRATE	07/09/1997	2.1	mg/L	10
NITRATE	02/12/1998	2.2	mg/L	10
NITRATE	02/10/1999	2.1	mg/L	10
NITRATE	03/29/2000	1.5	mg/L	10
NITRATE	03/15/2001	2	mg/L	10
NITRATE	05/07/2001	2.3	mg/L	10
NITRATE	03/13/2002	1.8	mg/L	10
NITRATE	04/09/2002	1.9	mg/L	10
NITRATE	01/21/2003	3.2	mg/L	10
NITRATE	04/22/2003	2.3	mg/L	10
NITRATE	03/03/2004	2.9	mg/L	10
NITRATE	03/03/2005	2.2	mg/L	10
NITRITE	07/09/1997	0.003	mg/L	1
SODIUM	07/09/1997	25.9	mg/L	
SODIUM	02/10/1999	28	mg/L	
SODIUM	05/07/2001	14.3	mg/L	

Table 6.2 APG Inorganic Chemcial Results from Van Bibber Water Treatment Plant continued

Contam Name	Sample Date	Result	Units	MCL
SODIUM	04/09/2002	19.8	mg/L	
SODIUM	01/21/2003	30	mg/L	
SODIUM	04/22/2003	21.6	mg/L	
SODIUM	03/05/2005	200	MG/l	
SULFATE	03/31/1994	33.3	mg/L	
SULFATE	02/08/1995	19	mg/L	
SULFATE	02/08/1996	15	mg/L	
SULFATE	02/22/1996	9.9	mg/L	
SULFATE	07/09/1997	24.5	mg/L	
SULFATE	05/07/2001	22.1	mg/L	
SULFATE	04/09/2002	25.5	mg/L	
SULFATE	03/03/2005	23	mg/L	

Synthetic Organic Compounds (SOCs)

SOC samples are collected by Van Bibber Water Treatment Plant operators and MDE. Table 6.3 is a summary of SOCs detected for the years 1993-2005. No synthetic organic compounds, other than di(2-ethylhexyl)phthalate exceeded 50% of an MCL. The laboratory concurrently runs quality control samples using organic free water with the samples from the water plant. This laboratory blank reports detections of di(2-ethylhexyl)phthalate at concentrations comparable to those reported from the water plant. Therefore, the detections of di(2-ethylhexyl)phthalate are not believed to be representative of the actual water quality. Low levels of some herbicides (atrazine, dalapon and simazine) were reported which is expected given the land use in the watershed.

Table 6.3 Synthetic Organic Compounds – Results from the Van Bibber Water Treatment Plant

Contam Name	Sample Date	Result	Units	MCL
ENDRIN	05/12/2004	0.04	ug/L	2
DALAPON	07/09/1997	0.32	ug/L	200
DALAPON	04/22/2003	1.34	ug/L	200
DALAPON	05/11/2004	0.69	ug/L	200
SIMAZINE	06/28/2000	0.1	ug/L	4
SIMAZINE	05/07/2002	0.1	ug/L	4
DI(2-ETHYLHEXYL) PHTHALATE	02/08/1996	4.58	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	05/01/2000	1.5	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	05/08/2002	1.4	ug/L	6
DI(2-ETHYLHEXYL) PHTHALATE	04/22/2003	0.9	ug/L	6

Table 6.3 Synthetic Organic Compounds – Results from the Van Bibber Water Treatment Plant

Contam Name	Sample Date	Result	Units	MCL
DI(2-ETHYLHEXYL) PHTHALATE	05/11/2004	0.2	ug/L	6
HEXACHLOROCYCLO-PENTADIENE	11/03/2004	0.1	ug/L	50
ATRAZINE	07/01/1999	0.1	ug/L	3
ATRAZINE	09/30/1999	0.1	ug/L	3
ATRAZINE	05/07/2002	0.3	ug/L	3
ATRAZINE	05/22/2003	0.1	ug/L	3
2,4-D	06/28/2000	0.0005	ug/L	70
2,4,5-TP (SILVEX)	04/22/2003	0.12	ug/L	50
PENTACHLOROPHENOL	04/22/2003	0.01	ug/L	1
ETHYLENE DIBROMIDE	09/07/2000	0.02	ug/L	0.05
ETHYLENE DIBROMIDE	05/09/2001	0.01	ug/L	0.05

Volatile Organic Compounds (VOCs)/Disinfection Byproducts (DBPs)

No volatile organic compounds other than disinfection byproducts have exceeded more than 50% of MCL in 10% or more of the collected samples. Table 6.4 shows the results of DBP monitoring in the distribution system. The DBPs are total trihalomethanes (TTHMs) and haloacetic acids (HAA5). The sum of concentration of four compounds: chloroform, bromochloromethane, dibromochloromethane, and bromoform comprise TTHMs. The sum of five compounds mono, di, and ti-chloroacetic acids, and mono- and di-bromoacetic acids comprise HAA5. In addition, organic carbon is monitored in raw and treated water. These date indicate that changes will be needed to Van Bibber Water Treatment Plant to consistently meet the current standards of 80.0 ug/L for total THM and 60.0 ug/L for HAA at all locations in the distribution system.

Table 6.4 Volatile Organic Compounds/Disinfection Byproducts Results from Van Bibber Water Treatment Plant (All results in ug/L)

Date	Location	Total Trihalo-methanes	Haloacetic acids
06/28/2000	BLDG E-6110 APG	77	84
06/28/2000	BLDG E-2100 APG	94	102
06/28/2000	ABERDEEN PROVING GROUNDS	113	143
06/28/2000	BLDG E-2100 APG	102	155
09/07/2000	BUILDING E 2100 ABDERDEEN GROUNDS	73	68
09/07/2000	BUILDING E 3857 ABDERDEEN GROUNDS	88	81
09/07/2000	BLDG E-5951 APG	97	4
09/07/2000	BLDG E-6110 APG	60	64
11/13/2000	EAWWTP APG	72	81
11/13/2000	BLDG E-5951 APG	76	3

Table 6.4 Volatile Organic Compounds/Disinfection Byproducts Results from Van Bibber Water Treatment Plant

Date	Location	Total Trihalo-methanes	Haloacetic acids
11/13/2000	BLDG E-6110 APG	48	64
11/13/2000	BLDG E-2100 APG	61	66
03/15/2001	BLDG E-6110 APG	27	41
03/15/2001	BLDG E-2100 APG	38	51
03/15/2001	EAWWTP APG	41	56
03/15/2001	BLDG E-5951 APG	52	32
05/09/2001	BLDG E-6110 APG	35	41
05/09/2001	U.S ARMY GARRISON	47	43
05/09/2001	BLDG E-5951 APG	71	23
05/09/2001	EAWWTP APG	49	49
09/28/2001	VAN BIBBER	31	38
09/28/2001	EAWWTP APG	16	21
09/28/2001	BLDG E-2100 APG	35	33
09/28/2001	BLDG E-5951 APG	47	0
02/27/2002		28	54
03/13/2002	EAWWTP APG	27	34
03/13/2002	EAWWTP APG	55	54
03/13/2002	BLDG E-5951 APG	78	22
03/13/2002	BLDG E-2100 APG	39	50
03/20/2002	BLDG E-5951 APG	72	
04/09/2002		39	39
08/14/2002		48	17
10/22/2002		66	29
01/21/2003	BLDG E-6110 APG	11	9
01/21/2003	BLDG E-2100 APG	14	14
01/21/2003	BLDG E-3857 APG	23	23
01/21/2003	BLDG E-5951 APG	55	
05/22/2003	BLDG E-6110 - WTP APG	55	71
05/22/2003	BLDG E-2100 APG	52	57
05/22/2003	BLDG E-3857 APG	80	63
05/22/2003	BLDG E-5951 APG	76	14
08/20/2003	BLDG E-6110 - WTP APG	78	68
08/20/2003	EAWWTP APG	161	91
08/20/2003	BLDG E-2100 APG	111	97
08/20/2003	BLDG E-5951 APG	120	2
11/21/2003	BLDG E-6110 - WTP APG	59	110
11/21/2003	BLDG E-2100 APG	69	163
11/21/2003	EAWWTP APG	56	60
11/21/2003	BLDG E-5951 APG	54	40
03/03/2004	BLDG E-3857 APG	24	23
03/03/2004	BLDG E-2100 APG	23	25

Table 6.4 Volatile Organic Compounds/Disinfection Byproducts Results from Van Bibber Water Treatment Plant

Date	Location	Total Trihalo-methanes	Haloacetic acids
03/03/2004	BLDG E-6110 – WTP APG	7	20
03/03/2004	BLDG E-5951 APG	43	21
05/12/2004	BLDG E-3857 APG	57	53
05/12/2004	BLDG E-5951 APG	59	46
05/12/2004	BLDG E-2100 APG	52	51
05/12/2004	BLDG E-6110 - WTP APG	44	44
08/30/2004	BLDG E-6110 - WTP APG		46
08/30/2004	BLDG E-5951 APG		6
08/30/2004	BLDG E-3857 APG		58
08/30/2004	BLDG E-2100 APG		57
08/30/2004	BLDG E-2100 APG	152	268
08/30/2004	BLDG E-3857 APG	139	108
08/30/2004	BLDG E-5951 APG	137	6
08/30/2004	BLDG E-6110 - WTP APG	104	180
11/03/2004	BLDG E-6110 - WTP APG	63	65
11/03/2004	BLDG E-5951 APG	76	21
11/03/2004	BLDG E-2100 APG	57	84
11/03/2004	BLDG E-3857 APG	71	77
03/03/2005	BLDG E-2100 APG	26	13
03/03/2005	BLDG E-6110 - WTP APG	19	14
03/05/2005	BLDG E-3857 APG	33	16
03/05/2005	BLDG E-5951 APG	38	10

7.0 SUSCEPTIBILITY ANALYSIS

Each class of contaminants was evaluated based on their potential for contaminating Winters Run. This analysis identified suspected sources, evaluated the natural conditions that may decrease or increase the likelihood of contaminants reaching the intake, and evaluate the impacts that future changes within the watershed may have on the susceptibility of the water intake.

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 generally 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, increasing suspended solids and raising the turbidity.

There are several factors in the watershed that can contribute to increased turbidity/sediment. Runoff from paved surfaces (residential and commercial developments) can increase the amount of flow in tributaries quickly which generally leads to stream bank erosion. Allowing cattle and other livestock unfettered to streams destroys protective vegetation along riparian areas where soils can runoff directly into a waterway. In addition, row cropping on steep slopes and forestry operations throughout the watershed may contribute to increased sediment and turbidity.

Because of occurrence of high turbidity during and after storms, the Van Bibber water system is susceptible to turbidity contamination.

Inorganic Compounds (IOCs)
Several inorganic compounds (IOCs) have been detected below the maximum contaminant level in the finished water from Van Bibber Water Treatment Plant. Van Bibber is not currently susceptible to IOC contamination. Experience in other urbanizing watersheds, however, has shown that both sodium and chloride levels increase with increased amounts of commercial land use and road miles per watershed. Ongoing monitoring with a focus during winter season is recommended for sodium and chloride.

Synthetic Organic Compounds (SOCs)
There are several SOC detects at the Winters Run plant, but all results are less than 50% of MCL, with the exception of one di(2-ethylhexyl)phthalate result of 4.5 ppb. Di(2-ethylhexyl)phthalate is a resin commonly used in plastics and is classified as a probable human carcinogen in the EPA Toxic Release Inventory. Its prevalence in plastics makes it a hard substance to sample and test. As explained in Section 6, the reported quantity is not believed to be reflective of the levels in the environment but rather laboratory artifact. The Van Bibber facility was determined not susceptible to regular SOC contamination. The possibility exists, however, that a spill of pesticides or other chemicals could impact the Winters Run water supply.

Volatile Organic Compounds (VOCs) and Disinfection Byproducts (DBPs)
As discussed in Section 7.0, no VOCs exceeded the 50% of MCL in at least 10% of the collected samples. The Van Bibber source is not susceptible to regular VOC contamination. The possibility exists, however, that a chemical spill, ruptured fuel tank or break in Colonial Pipeline could impact the Winters Run water supply.

Disinfection byproducts (DBPs) are formed when chlorine used in the water treatment process reacts with natural organic matter. The organic matter that reacts with chlorine includes various compounds; some of which are generated by the decay of vegetation (leaf litter), some from runoff from both developed and agricultural lands and some from algae growing in the stream. The relatively high levels of DBPs that occur in the distribution system at certain times are in part due to changes in raw water quality, including water temperature. Little raw water data, however, was available to discern why higher concentrations of DBPs were present at different times in the Edgewood Area distribution system. Due to high concentrations of DBPs observed in the treated water and the plentiful sources of organic matter in the watershed, the Van Bibber water system is considered susceptible to disinfection byproducts.

Microbiological Contaminants

Although there is no data available from Van Bibber Water Treatment Plant, the data from upstream facilities indicate that total coliform and fecal coliform bacteria are consistently present in the source water. Winters Run, like most surface water sources in Maryland, is potentially susceptible to these contaminants. The potential non-point sources of pathogenic protozoa, viruses and bacteria in the source water of Winters Run include runoff from pasture lands and animal feeding areas (e.g., barnyard areas), stormwater runoff from residential areas (pet wastes), failing residential septic system, sanitary sewer overflows and wildlife.

8.0 RECOMMENDATIONS FOR SOURCE WATER PROTECTION PLAN

This report is compiled based on the existing and available data from several sources. It provides general information as a first step towards establishing and implementing source water protection plan for Winters Run surface water source. Additional data may be needed to further understand the areas of concern or establishing specific source protection goals. The following list of recommendations are offered to begin a focused source water protection effort for the Winters Run Watershed.

- APG should join with the Town of Bel Air and Maryland American to form a local planning team for establishing and implementing an effective watershed protection program to protect Winters Run as a drinking water source.
- Establish clear and achievable goals, objectives and milestones to ensure the highest quality raw water.
- A well thought out plan for being notified of hazardous material spills, and strategy for responding is critical to ensuring safe water for the APG Edgewood area.
- Work with transportation officials regarding the placement of plowed snow and salt to reduce the impact at the water plant intake.
- Erect road signs in strategic locations to alert the public that they are entering a drinking water watershed.
- Begin monitoring for fecal coliform and *E. coli* in the raw water.
- To better understand the causes of the repeated high disinfection byproduct levels a sampling plan for Winters Run should be developed. MDE Water Supply Program would be interested in working with APG in developing such a plan.
- The watershed group should periodically conduct its own detailed field survey of the watershed to ensure there are no new sources of contaminants.
- The Harford County Soil Conservation District should continue to develop projects to reduce pathogens and nutrients from animal waste from entering upstream tributaries. Stream fencing and establishing forested riparian buffers are particularly helpful.

REFERENCES

Harford County Water and Sewerage Plan, 2002.

Maryland Department of the Environment (MDE), *Maryland's Source Water Assessment Plan*, Water Supply Program, February 1999.

Maryland Department of the Environment (MDE), Comprehensive Performance Evaluation of Van Bibber Water Treatment Plant, March 2002.

Soil Survey of Harford County Area, Maryland, U.S. Department of Agriculture, Soil Conservation Service, December 1975.

OTHER SOURCES OF INFORMATION AND DATA

EPA's *Guidance Manual for Source Water Assessments*
MDE Waste Management Sites Database
MDE Water Appropriation and Use Permits
MDE Water Supply Inspection Reports
MDE Water Supply Program Oracle Database
Van Bibber Water Treatment Plant Monthly Operating Reports (MORs) and Self Monitoring Reports

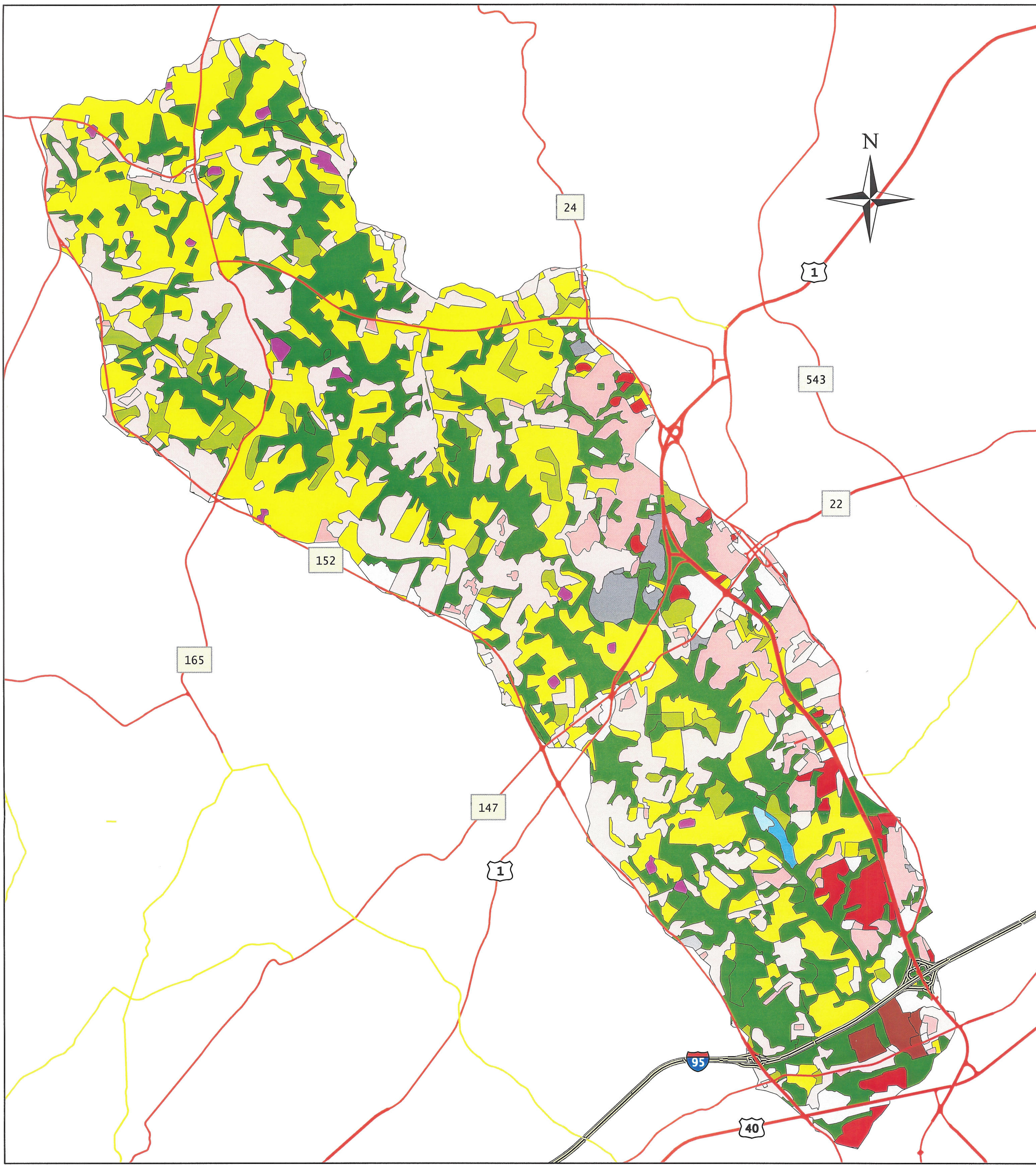
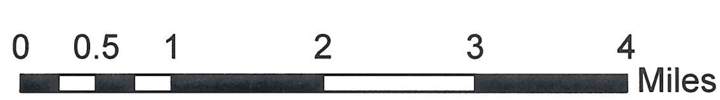


Figure 4.1 - 2002 MDP Land Use in the Winters Run Watershed



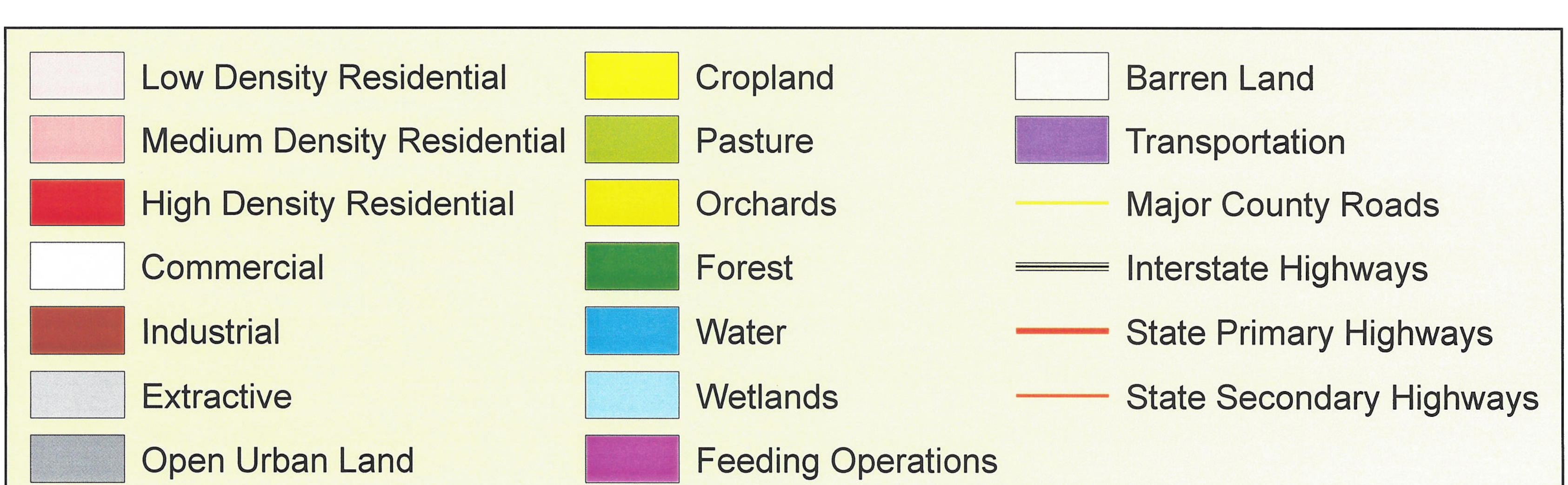


Figure 5.1 - Threats in the APG Winters Run Watershed