SOURCE WATER ASSESSMENT

For the Midland-Lonaconing Water System

Photo of Midland-Gilmore Reservoir

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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 3,700 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. MDE has until May of 2003 to complete assessments for all of the public drinking water sources in the state. 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 410-631-3714.

chlorine, alum, soda ash, potassium permanganate, and a polymer. The plant at the Midland-Gilmore reservoir has twice the capacity as the other two Midland-Lonaconing plants (Koontz and Charlestown), and produces approximately 0.288 million gallons of drinking water a day. This production includes the pumping of the three existing wells. In a 1990 MD Department of Natural Resources (DNR) study, the safe yield of the Midland-Gilmore reservoir was estimated to be 0.105 million gallons a day. This figure does not take into account the supplemental flow of well water into the reservoir. The Charlestown plant produces approximately 0.128 million gallons a day, and in 1990 its safe yield was calculated 0.97 million gallons per day without supplemental well water. Koontz reservoir also produces approximately 0.128 millions of drinking water a day, and had a safe yield of 0.72 million gallons a day in1991 without additional well water (Carski, Per.comm and file).

All three reservoirs have experienced periods when inadequte volume was available to meet systems demands, the latest occurring during the late summer drought of 1999. The Midland-Lonaconing system has a long history of water shortages. This was exacerbated by a leaky distribution system and failure of high level shut-off switches that prevented the new plants from adequately meeting the systems demands. In turn, long-term boil water advisories were issued due to the necessary supplementing of unfiltered water directly from the reservoirs to meet demand. To address water shortages, pumping of well water into the reservoirs has increased and a permanent connection with the City of Frostburg's water supply was established as a backup. In addition, leaks in the distribution system are being repaired and high level shutoffs have been connected.

C. DESCRIPTION OF SURFACE SOURCES

Midland-Gilmore Reservoir

The Midland-Gilmore reservoir is one of three reservoirs maintained and operated by the Town of Lonaconing in western Allegany County, Maryland. All of the reservoir watersheds are part of the Georges Creek river basin, which eventually flows into the North Branch of the Potomac River at the town of Westernport. The Midland-Gilmore reservoir was created by the construction of an impoundment on Elklick Run, a tributary on the eastern flank of Georges Creek valley. Elklick Run is a free-flowing mountain stream, and its headwaters form along the ridge of Dans Mountain. Approximately 480 yards above the reservoir, Elklick Run splits into two branches one heading northeast towards Dans Rock the other southwest. The northeast branch (the main stem) of Elklick Run travels approximately two river miles from its source to the reservoir. This branch's headwaters are located at an altitude of 2600-2700 feet above sea level (asl) in the Dans Mountain Wildlife Management Area (WMA). There is no stream gage on Elklick Run, but stream flow was estimated in 1994 as part of a Department of Natural Resources inquiry to determine re-filling rates of the Midland-Lonaconing Reservoirs. Estimated average flow into the reservoir was 3.8 cfs, or a total of 2767 acre-feet a year. A 1990 study areally proportioned daily flow from a previous study to estimate an average daily flow of 3.4 cfs, 7 day 10 year high 38.3, and 7 day 10 year low of 0.12 cfs. (DNR/MDE, 1990).

The source water protection area for the Midland-Gilmore watershed encompasses 2.45 square miles (1569 acres) of mostly forested land above the reservoir (see Figure 1). The source water protection area is located in the steep mountainous side of Georges Creek valley, and is part of the Appalachian Plateau physiographic province. The source water protection watershed begins at the reservoir dam (elevation of 1880 feet asl) located on Bushkirk Hollow Rd and extends up to the ridge of Dans Mountain. The ridgeline of Dans Mountain trends southwest to northeast with elevation ranging from 2,560 feet asl to 2,895 feet asl at Dans Rock in the extreme northeast corner of the watershed.

Midland-Gilmore reservoir was created in 1930 by construction of a 229-foot crest dam across Elklick Run. The teardrop shaped reservoir has a surface area of 1.28 acres. In a 1990 MDE/DNR report, the volume of the reservoir was reported as 4.03 million gallons, or 12.37 acre-feet. Previous reports have stated that the reservoir volume was 7 million gallons (DNR, 1985). The dam was completed in 1930; the original volume may have decreased due to sedimentation. Elevation at the spillway is 1,880 feet asl. The depth to the bottom of the dam is between 20-22 feet (RKK, 1990).

In addition to the flow of Elklick Run, the reservoir volume has been supplemented by water from three wells located in the vicinity of the water treatment plant. Recently (May2000), however, this has changed, and now well water is pumped directly into the plant for treatment. The two original wells (USGS #Al-Cb-1 and USGS #Al-Cb-4) are 500 feet deep and 1350 feet deep respectively, and tap the Conemaugh Formation. The Conemaugh Formation is composed of interbedded argillaceous limestone, claystone, shale, siltstone, sandstone and coal. It outcrops on the western slope of Dans Mountain, and is the most heavily used aquifer for water supply in the Georges Creek basin. Both of the original wells are artesian, and Well #Al-Cb-4 is located 4000 feet upstream of the reservoir adjacent to Elklick Run. The 1990 report conservatively estimated the pump rate of well #Al-Cb-1 at 120 gallons per minute (gpm), or an artesian flow of 30 gpm. Well #Al-Cb-4 had an artesian flow of 20 gpm (DNR/MDE, 1990). A new 200-ft well was drilled in 1991 adjacent to the reservoir that has a pumping rate of 150 gallons per minute.

The Georges Creek Basin has a temperate climate that is moderately humid. The average annual temperature varies with the elevation above sea level. The City of Frostburg (2,075 feet mean sea level) has an annual average temperature of 51°F, while the town of Westernport (900 feet mean sea level) has an average annual temperature of 54°F. Annual precipitation in the Georges Creek basin averages between 37.4-41.8 inches (30 yr average-1960-1990, MARFC). Of the average (38-42) inches of rain that fall on the basin each year, approximately 27 inches (or 64%) is evaporated or transpired back into the atmosphere. That leaves a remaining 15 inches of water which is either absorbed into the ground (and becomes ground water) or runs directly off the land into streams (DNR, 1990).

Charlestown Reservoir

Charlestown reservoir is another of the three reservoirs maintained and operated by the Town of Lonaconing in western Allegany County, Maryland. All of the reservoir watersheds are part of the Georges Creek river basin, which eventually flows into the North Branch of the Potomac River at the town of Westernport. The Charlestown reservoir was created by the construction of an impoundment on a tributary of Jackson Run, a stream on the eastern flank of Georges Creek valley. Jackson Run is a free-flowing mountain stream, and its headwaters form along the western ridge of Dans Mountain. Jackson Run also has a northern tributary that converges with the main stem below the hamlet of Charlestown and the reservoir. The southernmost tributary is formed by the convergence of two smaller tributaries approximately 835 yards above the reservoir (see map). Both of these tributary headwaters are located approximately 2400 feet above sea level (asl) and both travel 1 (western) to 1.2 (eastern) miles downstream before converging to form the main southern stem of Jackson Run. A 1990 study areally proportioned daily flow to estimate an average daily flow of 4.46 cubic feet per second (cfs), 7 day 10 year high 50.4 cfs, and 7 day 10 year low 0.16 cfs (DNR/MDE, 1990). Buffalo Coal Co. performed a hydrologic impact assessment as a mining permit requirement and collected data indicated an average flow of 2.3 cfs on the southern tributary near the site of the mining operation.

The source water protection area for the Charlestown Reservoir watershed encompasses 2.29 square miles (1464.6 acres) of mostly private land above the reservoir (see Figure 4). The source water protection area is located in the steep mountainous side of Georges Creek valley, and is part of the Appalachian Plateau physiographic province. The source protection area starts at the reservoir dam located at the end of Jackson St. and extends up to the ridge of Dans Mountain. The ridgeline of Dans Mountain within the watershed trends southwest to northeast with elevations ranging from 2,720 ft to 2,820 ft.

Charlestown reservoir was created in 1930 by construction of a 185-foot crest dam across Jackson Run. The reservoir has a surface area of 1.06 acres and is buffered on all sides by forest. In a 1990 DNR/MDE report, the volume of the reservoir was reported as 3.55 million gallons. Previous reports have stated that the reservoir volume was 5 million gallons (DNR, 1981). Like the other Midland-Lonaconing reservoirs, the dam was constructed in 1930. A decrease in volume may be attributable to sedimentation. Elevation at the dam spillway is 1,760 ft, and the depth to the bottom of the dam is 22 feet (RKK, 1990).

In addition to the flow of Jackson Run, the reservoir volume is supplemented by water from two wells located in the vicinity of the Charlestown water plant. Two wells, construction permits AL-88-0245 and AL-94-0661, are 546 ft and 505 ft respectively, and tap the Conemaugh Formation. See the DESCRIPTION OF MIDLAND-GILMORE RESERVOIR SOURCE above for information on the Conemaugh Formation. These are relatively new wells and were not included in the 1990 DNR/MDE report on water resources in Georges Creek. According to well completion reports, wells AL-88-0245 and AL-94-0661 have respective pumping rates of 75 and 120 gallons per minute. However, town officials only have one well attached to a pump at this time. Well water is pumped directly into the Charlestown Reservoir.

See the DESCRIPTION OF MIDLAND-GILMORE RESERVOIR SOURCE above for general information on the climate and rainfall characteristics for Charlestown reservoir and the Georges Creek Basin.

Koontz Reservoir

The Koontz reservoir was created by the construction of an impoundment on Koontz Run, a tributary on the western flank of the Georges Creek valley. Koontz Run is a small mountain stream that runs north-south along the side of Big Savage mountain, and has two discernable tributaries, the westernmost being the longer main stem. The small tributary enters the main stem of Koontz Run approximately one mile above the reservoir. The distance between Koontz Run's headwaters and the reservoir is approximately 2.3 miles. The headwaters are located at an altitude of 2550-2600 feet (mean sea level), and the run drops approximately 550 ft before entering into the reservoir. There is no stream gage on Koontz Run above the reservoir, but average daily stream flow was estimated to be 4.3 cubic feet per second in a 1990 study. The 7 day 10 year high and low flow were also proportioned, and were estimated to be 48.5 cfs and 0.16 cfs, respectively (DNR/MDE, 1990).

The source water protection area for the Koontz reservoir watershed encompasses 2.03 square miles (1300 acres) of forested land above the reservoir (see Figure 7). The source water protection area is located in the steep mountainous side of Georges Creek valley, and is part of the Appalachian Plateau physiographic province. The diamond-shaped watershed begins at the dam, which is located at the end of unimproved Beechwood Rd. The watershed follows the main ridge of Big Savage Mountain on the western side, and an elevated ridge off of Savage Mountain on the eastern side. Elevations along Big Savage Mountain's main ridge reach up to 2900 feet above msl, but elevation is slightly lower on the eastern edge of the watershed.

Koontz reservoir is rather narrow and has a surface area of 0.5 acres. Banks along the reservoir are steeper than at the other two Midland-Lonaconing reservoirs. The reservoir was created in 1930 by the construction of a 115-ft long dam. In a 1990 MDE/DNR report, the volume (storage capacity) of the reservoir was reported as 1.82 million gallons. A previous report listed the volume of Koontz reservoir at 2.5 millions gallons (DNR, 1985). Elevation at the spillway of the dam is 2050 feet msl. The maximum depth of the reservoir at the dam is approximately 22 feet (RKK, 1990).

Koontz reservoir's volume is also supplemented with groundwater from two wells located adjacent to the reservoir. The two wells, construction permits Al-01-1429 drilled in 1953 and Al-00-9415 drilled in 1952, are 1,276 ft and 378 ft respectively, and tap the Conemaugh Formation. See the DESCRIPTION OF MIDLAND-GILMORE RESERVOIR SOURCE above for information on the Conemaugh Formation. According to well completion reports, wells Al-01-1429 and Al-00-9415 have respective pumping rates of 300 and 120 gallons per minute. However, both of these wells are without pumps and water enters directly into the reservoir through artesian flow. An emergency well, Al-94-0553, was drilled in 1998 for use as an emergency backup. Its pumping rate at the time of drilling was 30 gallons per minute. All wells at the Koontz reservoir/plant flow directly into the reservoir.

See the DESCRIPTION OF MIDLAND-GILMORE RESERVOIR SOURCE above for general information on the climate and rainfall characteristics for Koontz reservoir and the Georges Creek Basin.

D. SOURCE WATER PROTECTION SITE VISITS

Personnel from Maryland Department of the Environment's Water Supply Program visited the Midland-Lonaconing system on April, 7 1999 to the discuss the assessment of Midland-Lonaconing's reservoirs and describe the source water protection program. Main objectives of the site visit included: obtaining a 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 watershed was also undertaken. Each reservoir will be discussed separately in the following section:

Midland-Gilmore Reservoir

Intake Integrity

The water intake for Midland-Gilmore reservoir is located adjacent to the dam four feet off of the reservoir bottom. It is a screened single concrete intake pipe, with a manual shut off valve. There is also a manual valve that allows water through the spillway continuing the flow of Elklick Run. The screen is not prone to clogging, and is cleaned when the reservoir is emptied every few years (pers. Comm, Town of Lonaconing). Water is gravity fed from the intake to a pump vault below the dam and then pumped into the plant. Total distance from intake to plant is approximately 40-50 yards. The bottom intake was not discernable on the day of the visit, but it was replaced in 1993 suggesting that is in proper working order. The operators did not express any concerns regarding the intake. The dam was refaced in 1991 and riprap was added below the dam overflow.

Concerns and Site Visit Observations

In addition to looking at the intake and immediate land around the reservoir, 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 preliminary list of concerns that may effect the quality of water in the reservoir. This list reflects operator concerns and MDE site visit observations:

1. Natural erosion of stream banks in the watershed.
2. Increased turbidity during rainfall events and snowmelts.
3. Overflow of storm water culvert.
4. Recent residential development in the watershed.

Charlestown Reservoir

Intake Integrity

The water intake at Charlestown reservoir is very similar to the Midland-Gilmore reservoir intake. It is located adjacent to the dam approximately four feet off of the reservoir bottom. It is single level intake structure with a screened concrete pipe. The intake has a manual down valve, and there is a manual valve to release water through a spillway. The screen is not prone to clogging, and is cleaned when the reservoir is emptied every couple of years. Water is gravity fed through the intake into a pump vault where well water is mixed, and then pumped into the treatment plant approximately 25-yards away. The intake was not discernable on the day of the visit (or subsequent visits), but it was replaced in 1993, and has been observed by the MDE system engineer, suggesting that its in proper working order. The operator did not express any concerns regarding the intake.

Concerns and Site Visit Observation

In addition to looking at the intake and immediate land around the reservoir, 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 preliminary list of concerns that may effect the quality of water in the reservoir. This list reflects operator concerns and MDE site visit observations (multiple visits):

1. Mining operation on border of watershed.
2. Sediment buildup in headwater of the reservoir, estimated 25% loss.
3. Past forestry harvest.
4. Abandoned surface mine.

Koontz Reservoir

Intake Integrity

The water intake at Koontz reservoir is similar to the intakes at the other two Midland-Lonaconing plants. It is located adjacent to the dam approximately four feet off of the bottom of the reservoir. The intake is a screened single concrete pipe with a manual shut off valve.

According to operators at the plant the screen is not prone to clogging, and is cleaned out every few years when the reservoirs are drained. Water is gravity fed into the water treatment plant located approximately 75 yards down hill from the reservoir. Operators expressed no other concerns with the intake.

Concerns and Site Visit Observation

In addition to looking at the intake and immediate land around the reservoir, multiple visits were made to the watershed (by car and foot) and a discussion with plant operators was undertaken to determine potential sources of contamination to the water source. Below is a preliminary list of concerns that may effect the quality of water in the reservoir. This list reflects operator concerns and MDE site visit observations:

1. Storm water overflow from an old mining drainage ditch.
2. Natural erosion along stream banks, including one bank of reservoir.
3. High turbidity in reservoir after rain/snow melts.
4. Extensive abandoned mine land in watershed.
5. Forestry harvest.
6. Potential future mining concern.

E. WATERSHED CHARACTERIZATION

Source Water Assessment Area Delineation Method

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 ArcView Geographic Information Software (GIS), utilizing exsisting GIS data, and by collecting location data using a Global Positioning System (GPS). GPS point locations were taken at each water source intake during site visits and differentially corrected (for an accuracy of +/- 2 meters) at MDE. Once intake locations were established, watersheds were delineated based on exsisting MD Department of Natural Resources digital watershed data and MD 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.

Midland-Gilmore Reservoir

General Characteristics

The source water protection area for the Midland-Gilmore watershed encompasses 2.45 square miles (1569 acres) of mostly forested land above the reservoir. Although there are two discernable tributaries to Elklick Run the watershed was not segmented because of the relatively small total area. The smaller, southwest branch, primarily drains forested land under private ownership. The northeast branch watershed contains forested land and some agriculture land use. In its upper reaches, the northeast branch is buffered by the Dans Mountain WMA. (see Figure1.)

Land-Use Characteristics

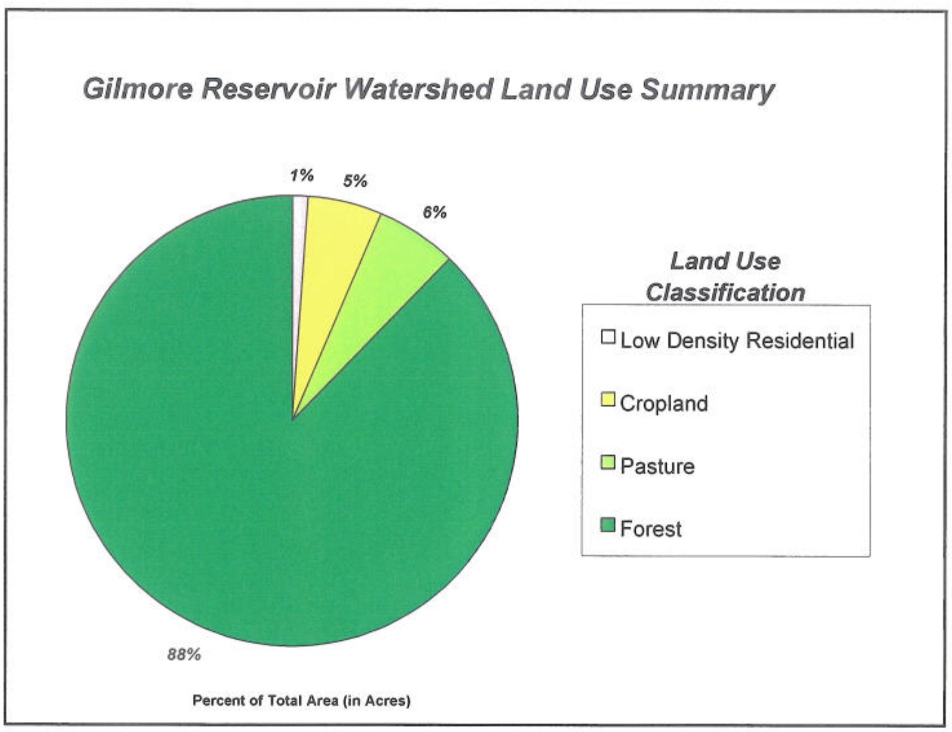
Based on the Maryland Office of Planning's 1997 Land Use data, the land use within Midland-Gilmore's source watershed is as follows:

Table 1. Land Use Summary

Land Use	Total Area in Acres	Percent of Total Watershed
Low Density Residential	15	1%
Cropland	84	5%
Pasture	91	6%
Forest	1379	88%

Chart 1. Land Use Summary

See Figure2. Midland-Gilmore Land Use

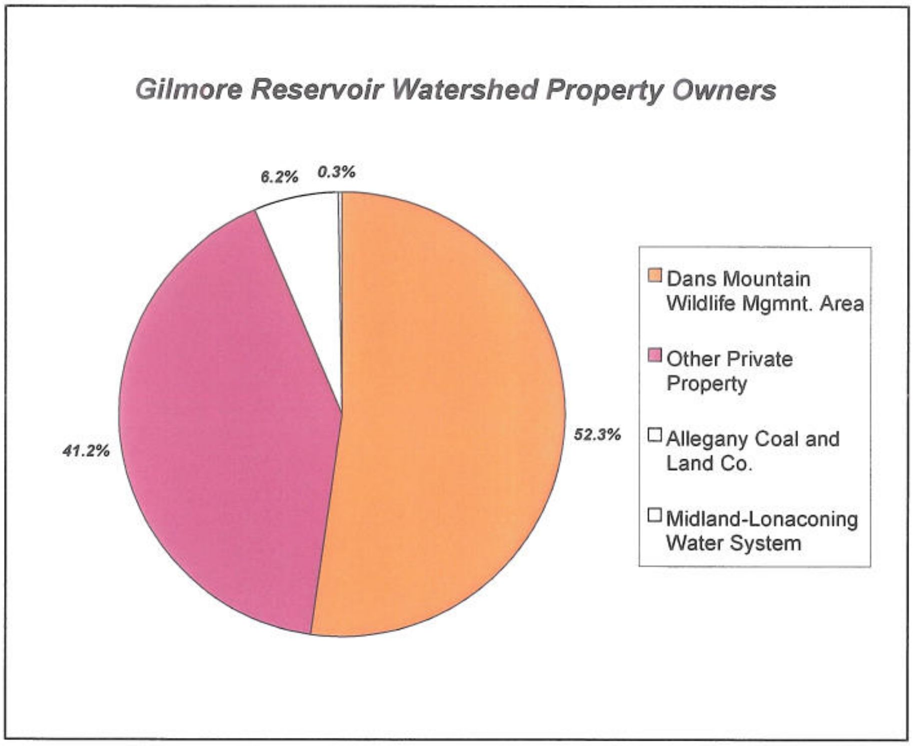


Based on the Maryland Office of Planning's 1999 Property View, there are approximately 26 landowners in the watershed, including the State of Maryland and the Town of Lonaconing. The property breakdown is as follows:

Table 2. Property Ownership

Property	Type	Total Area in Acres	Percent of Total Watershed
Dans Mountain WMA	State Land	821	52%
Other Private Property	Private	646	41%
Allegany Coal and Land Co.	Private (Company)	97	6%
Town of Lonaconing	Municipal	5	<1%

Chart2. Property Ownership



<u>Localized Characteristics</u>

The Town of Lonaconing owns the property surrounding the Midland-Gilmore reservoir. Most of the Town's property above the dam and adjacent to the reservoir is forested (approximately 5.3 acres). The Town does not allow any form of recreation (fishing, boating, swimming, etc.) in the reservoir or on the surrounding property. The Allegany Land and Coal Company own 97 acres in the watershed immediately above the Town's property and reservoir; also Elklick Run flows directly through the company's property. There are a few houses (on septic) along Bushkirk Hollow Rd. which follows the northeast branch of Elklick Run. Bushkirk Hollow Rd eventually turns into an unimproved road that leads up to several private properties that are farmed and/or used for pasture.

Charlestown Reservoir

General Characteristics

The source water protection area for the Charlestown watershed encompasses 2.29 square miles (1464.6 acres) of mostly private land above the reservoir (see Figure 4). There are two discernable tributaries to Jackson Run above the reservoir. The watershed will not be segmented for analysis because of the relative small total area of the watershed. Both small tributaries begin adjacent to a distinguishable hill located in the middle of the watershed, and flow through previously harvested forest for approximately 1-1.2 miles before converging above the reservoir. Both tributaries drain primarily new growth forest/shrub, and there is a large pasture in the middle of the headwater region.

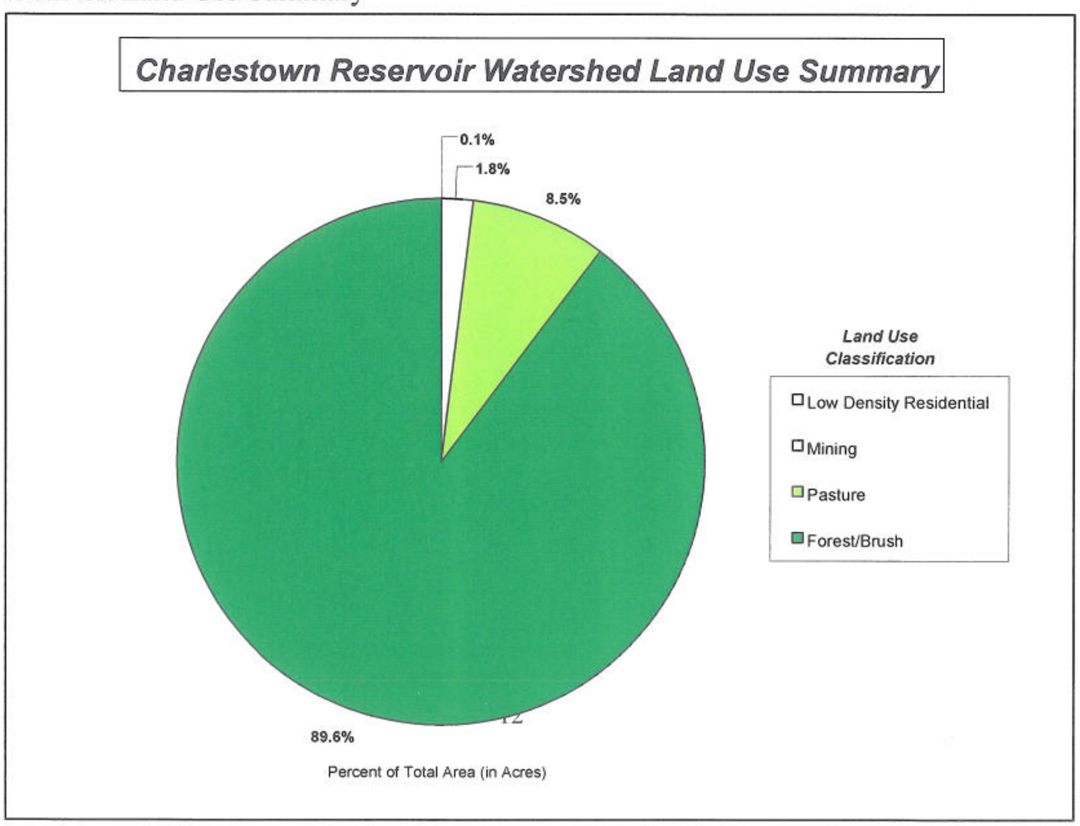
Land-Use Characteristics

Based on the Maryland Office of Planning's 1997 Land Use data, the land use within the Charlestown source watershed is as follows:

TableX. Land Use Summary

Land Use	Total Area in Acres	Percent of Total Watershed
Low Density Residential	2	0.1%
Mining	26	2%
Pasture	124	9%
Forest/Brush	1312	89%

ChartX. Land Use Summary



Based on the Maryland Office of Planning's 1999 Property View most of the land in the Charlestown watershed is privately owned. There are approximately 13 landowners in the watershed, including several individuals, mining corporations, and the Evans Realty CO, Inc. Below is the breakdown of private and state land in the watershed:

TableX. Approximate Property Ownership

Property	Type	Total Area in Acres	Percent of Total Watershed
Dans Mountain WMA	State	300	20.5%
Barton Mining CO	Private	338	23.1%
Private Property	Private & Commercial	826.6	56.4%

Localized Characteristics

According to the Maryland Office of Planning 1999 Property maps, the property surrounding Charlestown reservoir is owned by the Evans Realty Co, Inc. The town of Midland-Lonaconing's property begins just below the dam where the water treatment plant is located. The town does not allow any form of recreation (fishing, boating, and swimming) in the reservoir. The reservoir is heavily forested along its entire perimeter and there are no residences or farms located immediately above the reservoir.

Koontz Reservoir

General Characteristics

The source water protection area for the Koontz reservoir watershed encompasses 2.1 square miles (1360 acres) of sloping land above the reservoir. The source area watershed shares a watershed boundary with the Klondike system's water source, Woodland Run. There is a small tributary to the main stem of Koontz Run, discernable on a USGS 7.5 quad; however, the watershed is not segmented because of the relatively small total area. The source watershed is mostly forested, and a substantial portion of Koontz Run's upper reach flows adjacent to, or inside of, the Savage River State Forest.

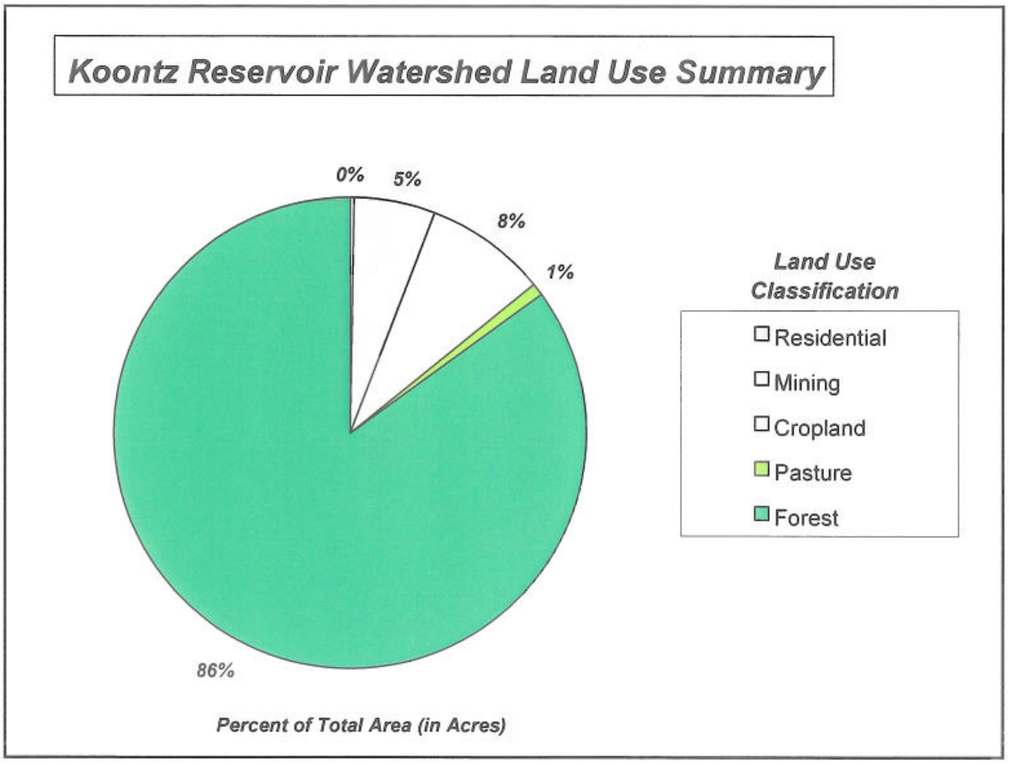
Land-Use Characteristics

Based on the Maryland Office of Planning's 1997 Land Use data, the land use within the Koontz reservoir watershed is as follows:

TableX. Land Use Summary – Koontz

Land Use	Total Area in Acres	Percent of Total Watershed
Low Density Residential	4	<1%
Mining	74	5%
Cropland	113	8%
Pasture	12	1%
Forest	1158	85%

ChartX. Koontz Land Use Summary



Based on the Maryland Office of Planning's 1999 Property View most of the land in the Koontz watershed is privately owned. Below is the breakdown of private and state land in the watershed:

TableX. Property Ownership – Koontz Reservoir

Property	Type	Total Area in Acres	Percent of Total Watershed
Private Property	Private	854.5	63%
Town of Lonaconing	Municipal	6.5	< 1 %
Savage River State Forest	State Land	500	37%

Localized Characteristics

The Town of Lonaconing owns approximately 6.5 acres of land surrounding the reservoir and a portion of Koontz Run. Koontz Run is buffered by forest on the Town's property for approximately 550 yards above the reservoir. The reservoir is buffered on three sides by steep sloping forest. In fact, most of the land immediately above the reservoir is forested, but there are portions of old reclaimed mine areas in close proximity (northeast of) the reservoir. The Town does not allow any form of recreation (fishing, boating, swimming, etc.) in the reservoir or the surrounding property. There are no residences or farms located immediately above the reservoir.

F. SIGNIFICANT SOURCES OF CONTAMINATION

Midland-Gilmore Reservoir

Non-point Concerns

Almost 90% of the Midland-Gilmore reservoir watershed is forested and protected from urban non-point pollution runoff. Analysis of land use maps and satellite photography (Figure 3) show that Elklick Run is buffered by forest along most of its course down to the reservoir. A watershed survey re-enforced this analysis. However, there is residential and agricultural land along the vicinity of Bushkirk Hollow Rd as it passes through the watershed.

The houses located above the reservoir are not located in a sewer service area and rely on septic systems. Septic system failure, resulting in a sewage discharge the creek was a concern in a 1986 MDE Sanitary Survey of the watershed. In 1986, the Allegany County Department of Health tested the septic systems of two houses and found no discharge violations. The potential for discharge from improperly working septic systems is a concern due to the age of some systems, their proximity to the creek, and the relatively steep slopes adjacent to Elklick Run. Failing septic systems pose a potential source of contamination by pathogenic protozoa, viruses, and bacteria.

According to the 1997 MOP Land Use, 11% percent of the watershed is used for agricultural purposes. This is concentrated west of Bushkirk Hollow Rd. and the main stem of Elklick Run. (see map). Application of fertilizers and pesticides on cropland could result in potential sources of nitrates and Synthetic Organic Compounds (SOCs) to the water supply. However, the buffer of forest surrounding Elklick Run may help mitigate any such threat. Approximately 65 acres of pasture is used to raise cattle in the northeast section of the watershed. According to the 1986 MDE Sanitary Survey, the pasture has been in use for over a hundred years, and in 1986 the farm had fifty head of cattle. In general, pastures may be potential sources of pathogenic protozoa, viruses, and bacteria from animal waste.

On MDE's site visit, operators expressed concern over a storm water culvert (ditch) that has the potential to overflow into the reservoir. The culvert drains runoff from the residential area adjacent to Bushkirk Hollow Rd, travels underneath the road and discharges just below the dam. Intense rain, or snowmelt could flood the area adjacent to the reservoir and result in an overflow (into Gilmore reservoir). During strong rainfall events, trash is frequently observed in the creek and reservoir (pers. Comm, Town of Lonaconing). On a site visit, MDE officials noticed illegal dumping on a steep ravine along the river, adjacent to a turnout on Bushkirk Hollow Rd in Dans Mountain WMA (state land). Residential (and roadway) stormwater runoff can be a source of petroleum products, pathogenic organisms, and high turbidity in the water supply. Natural erosion along stream banks, another concern of Midland-Lonaconing officials, also contributes to the high turbidities observed in the reservoir during and after rainfall events.

Dans Mountain Wildlife Management Area, a state owned resource, occupies a majority of the Midland-Gilmore watershed. While this forested tract of land is instrumental in protecting the water supply, it also contributes natural organic material to the reservoir that can lead to the production of trihalomethanes in finished drinking water.

Point Discharge Concerns

There are no sources of point discharge pollution (ex. NPDES permit) in the Midland-Gilmore Reservoir watershed.

Transportation Related Concerns

Bushkirk Hollow Rd. is the only paved transportation corridor in the watershed, and turns into an unimproved road approximately one mile above the reservoir. Runoff from the lower portion of the road into a culvert ditch was mentioned previously as a potential source of contamination. Transportation of any significant amount of contaminant along this road is likely limited to home heating oil. Above the reservoir is an unimproved access road that crosses through Elklick Run. A small sandbag dam has been constructed to prevent washout of the road. There is an old access road leading directly down to the reservoir that was used in the past to remove sediment accumulation at the mouth of Elklick Run. This access road is also unimproved. There is also at least two other primitive forest roads through the watershed according to the maps.

Land Use Planning Concerns

A comparison between 1990 and 1997 MOP land use data shows small changes in watershed land development. Land use percentages are tabled below:

Table 3.

Land Use Type	Percent of Watershed in 1990	Percent of Watershed in 1997
Forest	90%	88%
Low Density Residential	NA	1%
Cropland	6%	5%
Pasture	4%	6%
Extractive (Mining)	<1%	NA

* Calculations were based on Acres

Subtle differences in agricultural land use suggest that this land has remained unchanged for quite some time and will probably continue being productive. Evidence of the fact is the pasture that has raised cattle for over a hundred years. The difference in forest cover is also minimal. However, mining and logging permits are not excluded from state WMAs. In the future, this could become a management issue for the heavily forested Dans Mountain WMA, which occupies the largest percentage of land in the watershed. At this point it is unknown if logging has occurred in the watershed.

The appearance of a quantifiable percentage (1%) of residential land use in 1997 supports operator's statements concerning recent development. Although there were residences in the watershed in 1990, the data did not depict any substantial (low-density) development. This is most likely due to the MOP's map scale of 30-acre pixels. It should be noted that recent residential development is comparably small. However, proximity to the reservoir along with the potential of more buildup in the future could cause impairments to the reservoir.

A very small portion of land in 1990 was mined for resources in the northeastern portion of the watershed. There was no discernable land used for extractive mining in 1997. The Georges Creek basin has a long history of coal mining in Maryland. According to current estimates by MDE's Bureau of Mines, the basin contains 41% (354 million tons) of the most recoverable resources in the state (the highest percentage). The most common method used to extract coal in the basin is strip mining. Strip mining can have deleterious effects on water quality, such as reducing pH, increasing the concentration of metals and sulfate, and increasing surface runoff and erosion. When proper controls are implemented negative impacts can be minimized. Review of abandoned mine maps show that no strip coal mining has occurred in the Midland-Gilmore reservoir watershed (DNR, 1990). However, according to the MDE Bureau of Mining, there is an old abandoned deep mine located along the main stem of Elklick Run. In a Bureau of Mines Abandoned Mine Reclamation Report (1979), the deep well was referenced as having exposed acidic material and discharging acidic water. Currently, this deep mine is not discharging low-pH water (Bureau of Mines per.com.). With existing reserves of coal in the general area there is the potential for future mining in the Midland-Gilmore watershed.

Charlestown Reservoir

Non-point Sources

Like the Midland-Gilmore watershed, Charlestown reservoir is mostly forested and protected from urban non-point pollution runoff. Analysis of land use maps and satellite photography show that both branches of Jackson Run are buffered by forest. However, a significant amount of this "forest" is actually brush and immature trees growing on land that was previously logged. Residential land use in the watershed is insignificant, and only includes scattered houses along Jackson Mountain Rd. and a farm with a large pasture.

A significant portion of the watershed was clear-cut approximately 10 years ago. This previously logged area is clearly visible from the northern ridge of the watershed looking south. The land between the two tributaries of Jackson Run was logged along with an extensive area in the eastern tributary's watershed. Improper forestry practices can increase the amount of sediment load in streams; leading to potential turbidity and pathogen problems at water intakes. Increased turbidity levels were observed during 1990 clear-cutting operations (MDE Memorandum, DEC7,1992 Lonaconing File). MDE officials were concerned with logging in the Charlestown watershed in 1992, and wrote the Allegany County Board of Zoning Appeals to object a proposed logging permit. Concern centered on the fact that the logging site was close to the reservoir and water at the old plant was unfiltered. The permit was eventually granted.

However, there are not any current logging operations in the watershed, and litter cover/re-growth in the watershed is established in the previously logged areas. Logging may have contributed to non-point source pollution sporadically in the past, but is not a factor at this time.

According to 1997 MOP Land Use data, 9% of the watershed is used for pasture. A majority of this pasture is located in the headwater region between both tributaries (see map). In general, pastures may be potential sources of pathogenic protozoa, viruses, and bacteria from animal waste. At this time it is not known what type of livestock or how many are grazed in these pastures.

There is one active surface mine in the watershed. It is referred to as the Phillips Mine site, MDE permit SM-92-422 granted April 1994, and is located partially in the watershed along the northern boundary approximately 750 yards above the reservoir. The discharge point for this mine into Jackson Run is located below the reservoir, and runoff is collected into a storm water discharge pond. All of the mined land in the watershed drains into this pond deliberately due to landscaping by the coal company. This site was last inspected by MDE compliance personnel in June of 2000 and found to be satisfactory (in light of permit).

This area has been previously strip mined in the past. There have been at least two other permits granted to mine around the same hilltop, and pre-regulation mining in the area was probable. Maryland Office of Planning 1997 land use data shows that approximately 26 acres, or two percent of the watershed is mined. A good portion of this area has been recently reclaimed. According to permit records, shrubs were planted in 1997, and trees in 1998. Reclaim efforts were also undertaken in 1994 and1996.

According to an old MDE Bureau of Mine's inventory of abandoned mine land, there is a extensive abandoned strip mine that runs along the western flank of the watershed. According to MDE personnel the coal left in this seam is burning (per.comm, MDE Bureau of Mines). In addition, there are four old deep mines located at the end of this abandoned strip mine (see map). Surface mining and abandoned mine land can have negative impacts on water quality. Acid mine drainage can lower the pH of streams, and active mines have the potential to increase the amount of sediment runoff into waterways.

Point Discharge Concerns

There are no permitted discharges located within the source water protection area. A storm water pond from the mining operation is located in the watershed, but the discharge is carried below the reservoir. There hasn't been any water quality violations associated with the permit SM-92-422. There is no discharge from the four old deep mines located in the western edge of the watershed (Figure 6).

Transportation Related Concerns

Jackson Mountain Road runs along and passes through the western edge of the watershed for approximately 0.5 miles, and is the only paved road in the watershed. Transportation of any significant amount of any contaminant along this road is probably rare. The road is also a considerable distance from the reservoir, and is never closer than 0.2 miles to the western Jackson Run tributary as it passes through the watershed. Analysis of topographic maps and aerial photography show several unimproved roads in the watershed. Roads built for logging and mining operations have the potential to increase erosion and lead to higher sediment load in streams. In a 1979 MDE Bureau of Mines' report, haul roads were found to have erosion problems in the area which is currently strip-mined.

Land Use Planning Concerns

A comparison between 1990, 1994, and 1997 MOP land use data shows recent changes in watershed land development. Land use percentages are tabled below:

TableX.

Land Use Type	Percent of Watershed in 1990	Percent of Watershed in 1994	Percent of Watershed in 1997
Forest	89.6%	88.7%	89.6%
Pasture	7.9%	8.5%	8.5%
Mining	2.5%	2.8%	1.8%
Low Density Residential	NA	NA	0.1%

There has been very little change in land use activity in the Charlestown reservoir watershed since 1990. The appearance of a small percentage of low-density residential land use is minimal, and the residences in question are on the extreme western edge of the watershed. The potential for future residential development in the watershed is probably low, due to the absence of paved roads and steep slopes. Forest and pasture have remained fairly constant in the watershed, while mining has fluctuated in the 1990's.

The potential exists for future forestry harvest operations in the Charlestown watershed. A majority of the forested land is privately owned, and in the early 1990's a large portion of land was logged. Past practices along with an abundance of wood resources could make logging an important land management issue in the future.

The Georges Creek basin has a long history of coal mining in Maryland. Review of abandoned mine maps shows that significant portions of the Charlestown reservoir watershed have been strip mined, and the presence of deep mines indicate a long history of mining. With existing reserves of coal in the general area and a majority of land ownership by private individuals or corporations, such as Barton Mining Co., Georges Creek Land Co., and Winner Brothers Coal, there is potential for future mining in the Charlestown reservoir watershed. According to town officials, Barton Mining Co. is planning to strip mine in the upper watershed.

Koontz Reservoir

Non-point Concerns

The Koontz reservoir watershed is similar to the other Lonaconing reservoir watersheds in that it is heavily forested, 85% of the land use, and shares a similar condition of non-point source pollution. Like Charlestown, Koontz does not have a substantial amount of residential development in the watershed. Analysis of land use maps, satellite photography, and field surveys shows that most of Koontz Run is buffered by forest. However, there are a few non-point source concerns in the watershed.

Less than 1% of the watershed is residential (low density) according to MOP data. This area is located along Avilton-Lonaconing Rd (Figure 8). There are also several residences located in the watershed directly above the reservoir according to town officials and property maps. These residences are not depicted on the MOP's map scale of 30-acre pixels. Houses in the watershed are not in a sewer service area, and rely on septic systems. Information on the condition of these septic systems is unknown, but failing septic tanks can be a potential source of contamination by pathogenic bacteria, protozoa, and viruses.

According to 1997 MOP Land Use data, 9% of the watershed is used for agricultural purposes (8% cropland, 1% pasture). Cropland can be the source of nutrients (from fertilizer) and synthetic organic compounds (from pesticide application). Most cropland in Garrett County is used for oat and hay production (U.S DOA Census of Agriculture, 1997). In a June 2000 field survey, 1997 MOP cropland in the northeastern portion of the watershed appeared to be used for hay production or lay idle. These fields are buffered by forest from the main stem of Koontz Run. The small, unnamed tributary passes within 250 ft of one of these fields, and its headwaters form along the edge of this field. Cropland in the western portion of the watershed, along Avilton-Lonaconing Rd., is also most likely used for oat or hay production. According to the land use data, the one pasture located in the watershed is just below Detmold Hill (Figure 8). Pastures may be potential sources of pathogenic protozoa, viruses, and bacteria from animal waste.

There are no active mine operations in the Koontz Reservoir watershed at the current time, but the watershed has a past history of surface and deep mining. Most of the land identified in the 1997 MOP land use data as "mining or extractive" is actually reclaimed or abandoned mine land. There are at least three old permitted mines in the watershed, the last permit granted in 1988. MDE personnel inspected a very large portion of reclaimed and abandoned mine land on the eastern edge of the watershed (refer to pictures in Appendix). Mining for a portion of this ridge was permitted in 1988, and reclamation commenced after completion. MDE Bureau of Mines approved the reclamation effort in March 1999, which consisted of grass cover and locust tree plantings. However, there are properties in forfeiture of bond left un-reclaimed on the ridge, some partially inside the watershed. A substantial amount of land on the ridge is left partially vegetated with erosion problems and exposed spoil material.

Another permitted surface mine, that was fully reclaimed, is located below Avilton-Lonaconing Rd. on the western edge of the watershed. This area is actually classified as cropland in 1997 MOP land use data, and was confirmed during a watershed field survey. The third permitted site was a deep mine located in the Savage River State Forest. The mine has been abandoned, but its condition is not known at this time. Acid mine drainage and erosion are two potential consequences of abandoned mine land; both can lead to negative impacts on water quality.

Forestry harvest has occurred in the watershed as recently as the summer of 2000, and it is believed, due to the existence of old logging roads, that forested land in the watershed has been logged in the past. Improper forestry practices can increase the amount of sediment load in streams leading to potential turbidity and pathogen problems at water intakes. A permit was granted to the Koontz Coal Company, by the Soil Conservation District in April 2000, to clear cut approximately 365 acres in the Koontz Run, Woodland Creek, and Squirrel Neck Run watersheds. Between June and July 2000, approximately 108 acres located in the Koontz reservoir watershed were harvested (see map). MDE personnel visited this site in August 2000 after the completion of the clear cut. This was in response to a complaint from Town officials concerning high turbidity in the reservoir after rain events. After the visit and a review of rainfall/turbidity data, the most likely cause of the extremely high turbidity was a severe rainstorm coupled with a delay in mulching and grass seeding an exposed haul road.

Point Discharge Concerns

There are no sources of point discharge pollution (e.g. NPDES permit) in the Koontz Reservoir watershed.

Transportation Concerns

Avilton-Lonaconing Rd. is the only improved road that passes through the watershed. A fairly traveled route, it is one of the main roads leading out of the Georges Creek valley above Town of Lonaconing. Transportation of significant amounts of contaminants is probably uncommon. However, because of the steep curvy grade it is a high-risk road for spills as it passes through the watershed. There is a substantial amount of forest buffer between the road and the reservoir, but the slope down to the reservoir is very steep. Analysis of topographic maps and satellite photos, along with field surveys, show that there are several unimproved roads throughout the watershed. These roads, most likely logging or mining roads, may contribute to erosion problems. Off-road recreational vehicles have been observed along the eastern ridge of the watershed.

Land Use Planning Concerns

A comparison between 1990 and 1997 MOP land use data shows the recent changes in watershed land development. Land use percentages are tabled below:

TableX.

Land Use Type	**Percent of Watershed In 1990**	**Percent of Watershed In 1997**
Low Density Residential	NA	< 1%
Mining	5%	5%
Cropland	9%	8%
Pasture	1%	1%
Forest	85%	85%

There are no zoning laws in Garrett County to prohibit development, however, land use change over the past several years in the Koontz Reservoir watershed have been minimal. This would not be expected to change in the near future. Currently, the Savage River State Forest protects 500 acres of the reservoir's watershed and a majority of the watershed is relatively inaccessible due to steep slopes and the absence of roads. The appearance of a very small percentage of residential land use (MOP 1997 data) in the western edge of the watershed located along Avilton-Lonaconing Rd. appears insignificant, and the potential of increased residential development in the watershed is unlikely.

The Georges Creek basin has a long history of coal mining in western Maryland. Review of abandoned mine maps and topographic maps show that extensive surface mining occurred on the western and eastern ridges of the watershed, however, upper reaches of the watershed appear to be non-impacted. Big Savage Mountain is located above the main coal seams located at lower elevations in the Georges Creek basin. In 1990, land on the eastern ridge of the watershed was actively surface mined. Most of this same land classified as mining in 1997 is now abandoned or reclaimed. Currently, there are active mines in the adjacent Squirrel Neck Run watershed. According to officials there is interest (by property owner) in surface mining the area recently logged. This area, and any other land located adjacent to Koontz Run, could cause potential water quality problems if surface mined, including increased runoff, sediment load, and lowering the pH of the reservoir. Future mining permits for this watershed should be reviewed carefully and in the context of protecting Koontz Run as a source of drinking water (see Source Water Protection Recommendations).

With over 85% of its watershed forested, Koontz Reservoir is susceptible to pressure from logging. Impacts from forestry harvest are minimized when appropriate sediment and runoff controls are implemented, as evidenced by MDE personnel on a field survey of recently clear-cut land in the Koontz watershed. However, as with mining permits, applications for future forestry permits in the Koontz watershed should be reviewed carefully (see Source Water Protection Recommendations).

F. REVIEW OF WATER QUALITY DATA

Water quality data was reviewed from the Water Supply Program's database for Safe Drinking Water Contaminants. Data from the water source and water plant will be compared with Maximum Contaminant Levels (MCLs). If any monitoring data is greater than 50% of an MCL, a detailed analysis susceptibility analysis will be performed for that contaminant and its probable source. MDE is unaware of other water quality data collected from the Midland-Lonaconing reservoirs. Unfortunately, this review will rely mostly on plant data. Plant data reflects the combined quality of water from streams entering the reservoirs and water added from the various wells feeding them. For purposes of this review, all contaminant detects in plant data will be listed below. Most data reported is from finished (treated) drinking water unless otherwise noted.

Midland-Gilmore Reservoir

<u>Existing Plant Data</u>

Midland-Lonaconing is required to perform water quality tests on the drinking water it produces at each plant. They are required to submit operating reports to MDE, which includes some water testing of the reservoir, or "raw water." Turbidity (cloudiness of the water), alkalinity, pH, and iron and manganese are the parameters tested daily in the reservoirs. Review of this data indicates that reservoir (water) is subject to periods of high turbidity. Usually short term, these levels can often exceed 50 NTU, the highest recorded reading of 100 NTU occurred in August 1996. Concentrations of iron and manganese often approach and sometimes exceed the National Secondary Drinking Water Regulations (NSDWR). The pH of the reservoir is relatively stable, and is well within the 6.5-8.5 secondary standard for drinking water. There were no inorganic or organic compounds that exceeded 50% of the MCL in any sample.

Inorganic Compounds (IOCs)

The Gilmore plant regularly tests for the presence of nitrate in finished drinking water. Below is a summary of nitrate testing:

TableX. Nitrates

Contaminant Name	MCL	Sample Date	Result
Nitrate	10 (ppm)	02/22/1993	0.4
Nitrate	10	07/15/1993	0.45
Nitrate	10	12/17/1993	0.49
Nitrate	10	12/29/1994	0.2
Nitrate	10	10/05/1995	0.2
Nitrate	10	03/28/1995	0.5
Nitrate	10	05/10/1995	0.5
Nitrate	10	05/16/1995	0.5
Nitrate	10	06/26/1996	0.2
Nitrate	10	06/13/1998	0.1
Nitrate	10	04/29/1999	0.5
Nitrate	10	06/08/2000	0.2

***Finished water detects since 1993 at the Gilmore plant's point of entry.**

Volatile Organic Compounds (VOCs)

Data is from the plant's MDE VOC reports. Below is a summary of past VOC detects from 1989-2000:

TableX. VOCs

Contaminant Name	MCL (ppb)	Sample date	Result (ppb)
Benzene	5	09/15/1992	0.8
p-Dichlorobenzene	75	09/15/1992	2.9
Carbon Tetrachloride	5	12/07/1989	0.4

Below is a summary of other contaminants tested from 1993 to the present:

TableX. Other Contaminants

Contaminant	Tested	Last Date Tested	Detects?	50% of MCL
Fluoride**	Yes, Annually	06/08/2000	No	NA
Heavy Metals	Yes, Annually	06/08/2000	No	NA
Cyanide	No (waiver)	NA	NA	NA
Radionuclides	Yes	08/24/2000	Yes	No
Asbestos	No (waiver)	NA	NA	NA

***Gross Alpha and Gross Beta**
****Fluoride has a NSDWR, 2.0mg/L.**

Charlestown Reservoir

Existing Plant Data

Midland-Lonaconing is required to perform water quality tests on the drinking water it produces at each plant. They are required to submit operating reports to MDE, which includes some water testing of the reservoir, or "raw water." Turbidity (cloudiness of the water), alkalinity, pH, and iron and manganese are the parameters tested daily in the reservoirs. Review of monthly operating reports show that the Charlestown reservoir is also subject to periods increased of turbidity and consistently high concentrations of iron and manganese in the reservoir. The average pH of the reservoir is well within the 6.5-8.5 secondary standard for drinking water.

Inorganic Compounds (IOCs)

The Charlestown plant regularly tests for the presence of nitrate in finished drinking water. Below is a summary of nitrate testing:

TableX. Nitrates

Contaminant Name	MCL (ppm)	Sample Date	Result (ppm)
Nitrate	10	02/22/1993	1.7
Nitrate	10	06/14/1993	1.3
Nitrate	10	07/15/1993	1
Nitrate	10	12/17/1993	0.49
Nitrate	10	12/29/1994	0.5
Nitrate	10	03/28/1995	0.9
Nitrate	10	05/16/1995	0.9
Nitrate	10	02/26/1996	1
Nitrate	10	06/12/1997	1.1
Nitrate	10	07/25/1997	0.8
Nitrate	10	04/29/1998	0.8
Nitrate	10	04/14/1999	1.2
Nitrate	10	05/04/2000	0.9

Average detection levels of Nitrate since 1993 are 1.0 ppm (mg/L) at the Charlestown plant's point of entry into the water system. Only two other inorganic compounds have been detected in Charlestown's drinking water since 1993, and are listed below:

TableX. Other Inorganic Detects

Contaminant Name	MCL (ppm)	Sample Date	Result (ppm)
Barium	2	05/16/1995	0.1
Nitrite	1	02/26/1996	0.002

Volatile Organic Compounds (VOCs)

Data is from the plant's MDE VOC reports. Below is a summary of past VOC detections from 1989-2000:

TableX. VOCs

Contaminant Name	MCL (ppb)	Sample Date	Result (ppb)
Ethylbenzene	700	01/05/1996	2.4
Total Xylenes	10,000	01/05/1996	2.2

Below is a summary of Total THM detects at the Charlestown plant:

TableX. THMs

Contaminant Name	Future MCL (ppb)*	Sample Date	Result (ppb)
Total THMs	80	10/20/1992	6.3
Total THMs	80	05/26/1994	5.8
Total THMs	80	12/07/1994	4
Total THMs	80	01/05/1996	9.6
Total THMs	80	06/25/1997	9.9
Total THMs	80	04/29/1998	17.6
Total THMs	80	04/14/1999	6.3
Total THMs	80	05/04/2000	0.8

*** Current MCL is 100 ug/L (ppm)**

See Note under Midland-Gilmore THM table.

Synthetic Organic Compounds (SOCs)

Data is from the plant's MDE SOC reports. Below is a summary of SOCs detected at the Charlestown water plant:

TableX. SOCs

Contaminant Name	MCL (ppb)	Sample Date	Result (ppb)
Dalapon	200	05/16/1995	0.47
Dalapon	200	04/29/1998	0.18

Dalapon	200	04/14/1999	0.32
Dalapon	200	04/14/1999	0.32*
Di(2-Ethylhexyl)phthalate	6	05/16/1995	3.69 b
Di(2-Ethylhexyl)phthalate	6	02/26/1996	0.5 b
Di(2-Ethylhexyl)phthalate	6	04/14/1999	0.5 b*
Di(2-Ethylhexyl)phthalate	6	07/15/1999	0.5 b
Di(2-Ethylhexyl)phthalate	6	07/15/1999	1.6 b*
Di(2-Ethylhexyl)phthalate	6	05/04/2000	0.5 b*
Di(2-Ethylhexyl)adipate	400	05/16/1995	0.6 b

b - Also detected in blank.
* - Raw water sample

Below is a summary of other contaminants tested from 1993 to the present:
TableX. Other Contaminants

Contaminant	Tested	Last Date Tested	Detects?	50% of MCL
Radionuclides*	Yes, Once/4yrs	08/24/2000	Yes	No
Fluoride**	Yes, Annually	05/04/2000	No	NA
Heavy Metals	Yes, Annually	05/04/2000	No	NA
Cyanide	No (waiver)	NA	NA	NA
Asbestos	No (waiver)	NA	NA	NA

***Gross Alpha and Gross Beta**
****Fluoride has a NSDWR, 2.0mg/L.**

Koontz Reservoir

Existing Plant Data
Midland-Lonaconing is required to perform water quality tests on the drinking water it produces at each plant. They are required to submit operating reports to MDE, which includes some water testing of the reservoir, or "raw water." Turbidity (cloudiness of the water), alkalinity, pH, and iron and manganese are the parameters tested daily in the reservoirs. The Koontz reservoir shares similar water quality characteristics with the other two Midland-Lonaconing reservoirs; periods increased of turbidity and consistently high concentrations of iron and manganese. The average pH of the reservoir is well within the 6.5-8.5 secondary standard for drinking water

Inorganic Compounds (IOCs)
The Koontz plant annually tests for the presence of nitrate in finished drinking water. Below is a summary of nitrate testing:

TableX. Nitrate

Contaminant Name	MCL (ppm)	Sample Date	Result (ppm)
Nitrate	10	02/22/1993	0.5
Nitrate	10	07/15/1993	0.31
Nitrate	10	12/17/1993	0.56

Nitrate	10	12/29/1994	0.4
Nitrate	10	03/25/1995	0.5
Nitrate	10	05/16/1995	0.4
Nitrate	10	02/26/1996	0.7
Nitrate	10	06/25/1997	0.3
Nitrate	10	04/29/1998	0.4
Nitrate	10	04/06/1999	0.4
Nitrate	10	05/04/2000	0.6

Detection levels of Nitrate since 1993 average 0.5 ppm (mg/L) at the Koontz plant's point of entry into the water system.

Volatile Organic Compounds (VOCs)

There have not been any VOC detects in the Koontz plant's finished water since testing began in 1989, except for Trihalomethanes (THM). Below is a summary of THM detects:

TableX. THM Detects

Contaminant Name	Future MCL (ppb)*	Sample Date	Result (ppb)*
Total THMs	80	10/20/1992	21.3
Total THMs	80	05/26/1994	5.2
Total THMs	80	08/03/1994	36.1
Total THMs	80	01/05/1996	5.2
Total THMs	80	06/25/1997	13
Total THMs	80	04/29/1998	19.3
Total THMs	80	04/06/1999	6
Total THMs	80	05/04/2000	6

*** Current MCL is 100 ug/L (ppm)**

THM detection at the plant has averaged 14.0 ppb since 1992. This average is well below 50% of the MCL, but several samples had higher concentrations, although not quite reaching the 50% trigger.

Synthetic Organic Compounds (SOCs)

Data is from the plant's MDE SOC reports. Below is summary of SOCs detected at the Koontz water plant:

Contaminant Name	MCL (ppb)	Sample Date	Result (ppb)
Dalapon	200	05/16/1995	0.47
Dalapon	200	06/25/1997	0.59
Dalapon	200	04/06/1999	0.23
Dalapon	200	05/04/2000	0.26
Di(2-Ethylhexyl) Phthalate	6	05/16/1995	0.92 b

Di(2-Ethylhexyl) Phthalate	6	02/26/1996	0.77 b
Di(2-Ethylhexyl) Phthalate	6	04/06/1999	0.7 b
Di(2-Ethylhexyl) Phthalate	6	07/06/1999	0.7 b
Di(2-Ethylhexyl) Phthalate	6	07/06/1999	1.3 b*
Di(2-Ethylhexyl) Phthalate	6	05/04/2000	0.6
2,4-D	70	04/06/1999	0.96

Below is a summary of other contaminants tested from 1993 to the present:
TableX. Other Contaminants

Contaminant	Tested	Last Date Tested	Detects?	50% of MCL
Radionuclides*	Yes, Annually	05/04/2000	Yes	No
Fluoride**	Yes, Annually	05/04/2000	No	NA
Heavy Metals	Yes, Annually	05/04/2000	No	NA
Cyanide	No (waiver)	NA	NA	NA
Asbestos	No (waiver)	NA	NA	NA

***Gross Alpha and Gross Beta**
****Fluoride has a NSDWR, 2.0mg/L.**

G. SUSCEPTIBILITY ANALYSIS

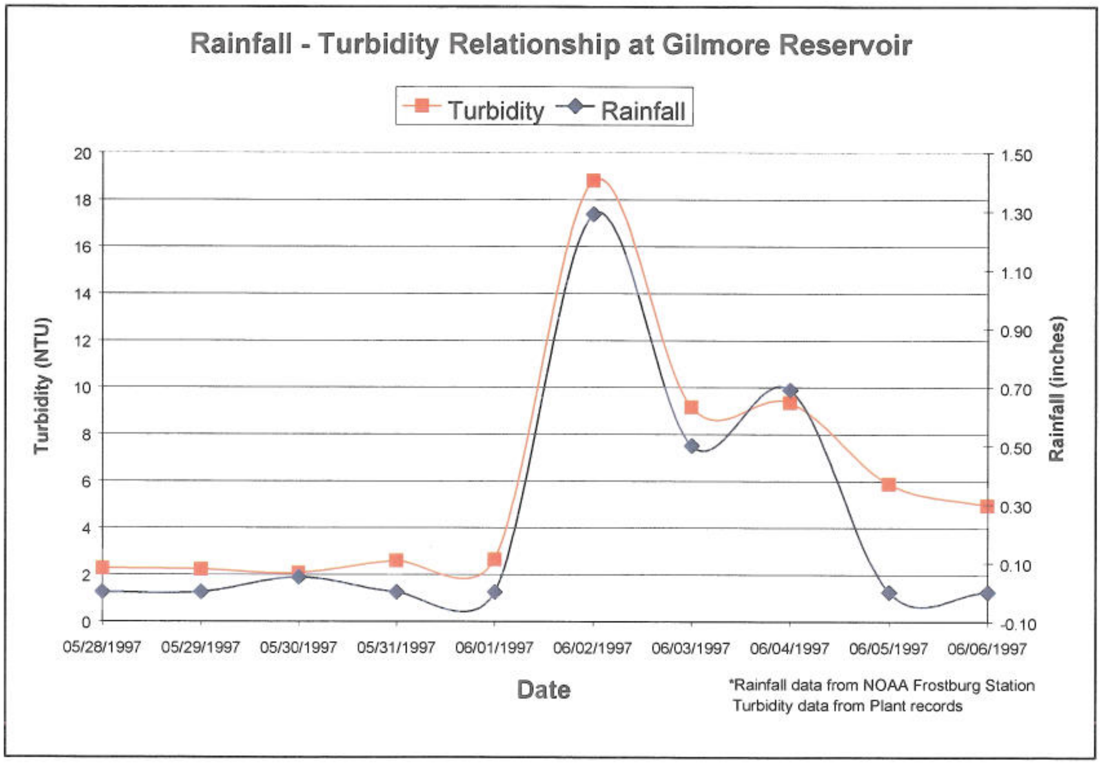
Each class of contaminants that were detected in the water quality data will be analyzed based on the potential they have of contaminating Midland-Gilmore reservoir. The analysis will identify suspected sources of contaminants, evaluate the natural conditions in the watershed that may increase or decrease the likelihood of a contaminant entering the reservoir, and evaluate the impacts that future changes may have on the susceptibility of the reservoir.

Midland-Gilmore Reservoir

Turbidity

Average turbidity in the reservoir for the past five years (1996-current) is approximately 4.6 NTU. Excessive turbidity can interfere with water treatment and can carry harmful microorganisms into drinking water supplies. The highest turbidity recorded in the reservoir, 100 NTU, occurred in August of 1996. Higher turbidity results from storm events, snowmelt, and by the addition of well water that when oxidized in the reservoir increases the iron and manganese concentrations. The turbidity problem in Midland-Gilmore reservoir is most likely caused by increased runoff during storm events. Storm events can quickly increase the turbidity of the reservoir. An example of a storm's effect on turbidity is shown below:

Chart3. Turbidity-Rainfall Relationship



A significant amount of rainfall can increase the turbidity at the plant's intake within a 24-hour period. This re-occurring situation has caused operational problems at the Gilmore plant, and high turbidity events have resulted in numerous violations and boil-water advisories. The Midland-Gilmore system has received 35 violations for exceeding finished water turbidity limits since 1990. The system was in violation of turbidity standards for most of 1992-1993, and has been in violation as recently as February 2000.

The main source of turbidity contamination is most likely erosion from stream banks along Elklick Run. During one rain event, turbidity was measured in both tributaries just above the confluence. Continuous readings were measured for approximately 15 minutes, and the main stem turbidity ranged from 5.5-8.4 NTU. Turbidity on the southwest stem averaged around 1.5 NTU. Analysis of land use data and satellite spot images show that the main stem is comparatively closer to Bushkirk Hollow Rd, adjacent housing, and open agricultural land in the upper reaches of the watershed. This may contribute to more runoff during storm events resulting in increased erosion and higher turbidity. The access road that crosses Elklick Run and the access road to the reservoir, both unimproved, may also contribute. Overflow directly into the reservoir from the storm water drainage culvert along Bushkirk Hollow Rd. is also another potential source of turbidity contamination during storm events.

The watershed is 88% forested and Elklick Run is almost entirely buffered by forest. However, plant data shows that increases in turbidity occur frequently. There are a few factors that probably enhance the runoff/turbidity effect during storm events. For one the watershed is relatively small, and the slopes adjacent to Elklick Run are steep, and with a 740 ft. drop from its headwaters to the reservoir (less than 2 miles), quick travel times would be expected, especially during storms. Also, the ability of the reservoir to mitigate a high turbidity runoff event is limited by its relatively small capacity, especially during low supply shortages.

Future land use changes in the Midland-Gilmore watershed could increase the potential of turbidity contamination in the reservoir. Loss of forest in the watershed would likely lead to an increase in runoff during storm events. Development along Bushkirk Hollow Rd is a concern because of its proximity to the reservoir and the stream. An increase in runoff could make storm water overflows from the culvert into the reservoir more common. Allegany Coal and Land Co. owns 97 acres in the watershed presumably for mineral resources. The property is directly above the reservoir and changes made to the land could potentially lead to increased runoff and turbidity. Dans Mountain WMA provides a great benefit to the water quality of the reservoir but future management of the land should limit or exclude regulated mining and/or logging. Recovery of the mineral and forest resources on any property in the watershed could potentially increase runoff, and raise the potential for turbidity contamination in the reservoir.

The intake at Midland-Gilmore does not increase the susceptibility of the reservoir to turbidity, but suspended sediment (which contributes to turbidity) eventually settles to the bottom of the reservoir where the intake is located. This potentially extends the period of time that the Gilmore plant's intake draws water with high turbidity. The Midland-Gilmore supply is susceptible to elevated turbidity

Inorganic Compounds

Concentrations of iron in the groundwater of the Georges Creek region tend to be high, exceeding the recommended drinking water limit of 0.3 mg/l (National Secondary Drinking Water Regulation, or NSDWRs). Manganese concentrations are also high and often exceed the recommended limit of 0.05 mg/L (NSDRW). When well All-Cb-1 was drilled and tested in 1951, its iron concentration was 0.64 mg/L and manganese 0.30 mg/L (Slaughter, 1962). Until recently, well water was pumped directly into the reservoir and mixed with the surface water during times of low reservoir volume. The average concentrations of iron and manganese in the reservoir, over the past five years, are 0.40 mg/l and 0.28 mg/l respectively. The highest concentrations tended to occur in June-July, and during this period iron occasionally exceeded 1.0 mg/L. The summer increase in concentration levels is most likely due to low flow conditions in Elklick Run that lead to the pumping of well water into the reservoir. The approximate amount of water pumped from the wells is not known since there are no meters. There is also an artesian well 4000 feet above the reservoir that flows directly into Elklick Run. This well may also contribute to higher iron and manganese levels. Elevated concentrations of manganese and iron in a drinking water supply cause aesthetic and nusiance effects such as taste and odor problems and fixture staining, but are not necessarily public health concerns.

Nitrates can enter the water supply as runoff from fertilizer use, leaching from septic tanks, atmospheric deposition, and erosion of natural deposits. Although nitrate has been found in the supply, no detects were close to the 50% MCL trigger (see tableX). Levels of nitrate in the reservoir are not expected to be much higher than finished water results because conventional water treatment plants, including the Gilmore plant, do not remove nitrates. Potential sources of nitrate include the eleven- percent of the watershed that is used for agricultural purposes, as either farmland or pasture, and to a lesser degree septic systems from residences along Bushkirk Hollow Rd. Unless livestock numbers or agricultural land use increases, it is unlikely that nitrate concentrations will increase in the future. The Midland-Gilmore supply is not susceptible to nitrate contamination.

Volatile Organic Compounds (VOCs)

There has never been a VOC detect within 50% of the MCL in the Midland-Gilmore plant's water supply. There have been only three VOC detects since 1989. Illegal dumping was observed along a pullout on Bushkirk Hollow Rd. However, the very small amount of compound detected, along with the rarity of detects for the past 11 years make regular VOC contamination in the reservoir unlikely. Reports are turned in annually by Midland-Lonaconing and there have not been any detects at the Gilmore water plant since 1992. The Midland-Gilmore supply is not susceptible to VOC contamination.

Trihalomethanes (THMs) result from the reaction of naturally occurring organic matter (in the reservoir) with chlorine during the water treatment process. The most common THMs detected in the Gilmore water supply are chloroform and bromodichloromethane. Currently, the EPA sets a MCL of 0.1 mg/L (ppm) for Total THMs, but this level is scheduled to change in 2001 and 2003. The new MCL for systems serving 10,000 persons or less is 80 μg/L (ppb) starting in 2003. This rule will apply to Midland-Lonaconing. Comparing results with the future standard (Table?) shows that while THMs are regularly detected in the water supply, they do not currently exist in concentrations high enough to pose a health risk, and therefore the Gilmore plant is not susceptible to THMs. A further investigation into THMs is not warranted at this time.

Synthetic Organic Compounds (SOCs)

Two SOCs have been detected at the Gilmore water plant, but all results are less than 50% of the MCL. Di(ethylhexyl)phthalate (DEHP) is a resin commonly used in plastics, and is classified as a probable human carcinogen in the EPA's Toxic Release Inventory. Its prevalence in plastics makes it a hard substance to sample and test. Because this compound apperas in all samples and as a contaminant in each laboratory blank, the reported quantities are not reflective of levels in the environment, but rather laboratory artifacts. Dalapon is a herbicide commonly used on right of ways and transportation corridors. There is a power line right of way in the Gilmore watershed that is adjacent to the reservoir and runs between Bushkirk Hollow Rd. and Elklick Run. Runoff from the right of way might contain detectable levels of the herbicide. Runoff from the storm water culvert may also be a source of Dalapon. However, detects of dalapon at the Gilmore plant are less than 1% of the 200ppb MCL. The Gilmore plant is not susceptible to contamination by SOCs.

Cyanide, Flouride, and Asbestos

Cyanide was given a statewide waiver (testing is not required) because the water treatment process changes the compound. Cyanide undergoes a breakdown during chlorination and free cyanide is not stable under ambient reservoir conditions. Asbestos is given a waiver because aquifers near the water supply are not considered sources of the contaminant. Natural asbestos is associated with ultramafic rock, which is only found in portions of Baltimore County, MD. Flouride is tested annually at the Midland-Gilmore plant, but has not been detected in the finished water supply. In 1994, fluoride was detected in an unidentified artesian well at one of the Midland-Lonaconing plants. The result, 0.14 mg/L, was significantly less than the 2.0 mg/L MCL. There are no obvious potential sources of fluoride in the Gilmore watershed.

Heavy Metals

Regulated heavy metals are tested annually in the finished water produced at the Gilmore plant, and since 1993 there has not been any contaminant detection. Currently, there are no potential sources of these contaminants in the watershed, and unless a mining operation is undertaken in the future, heavy metal contamination is unlikely. The potential for heavy metal contamination does exist however, because the Georges Creek basin contains a majority of the state's coal reserves.

Radionuclides

Radionuclides have been detected once in the water supply, but were well below 50% of the MCL. Gross Alpha and Gross Beta are tested once every four years at Midland-Lonaconing. Without the presence of any natural sources radionuclides are not expected to be at high enough levels to contaminate the surface water supply.

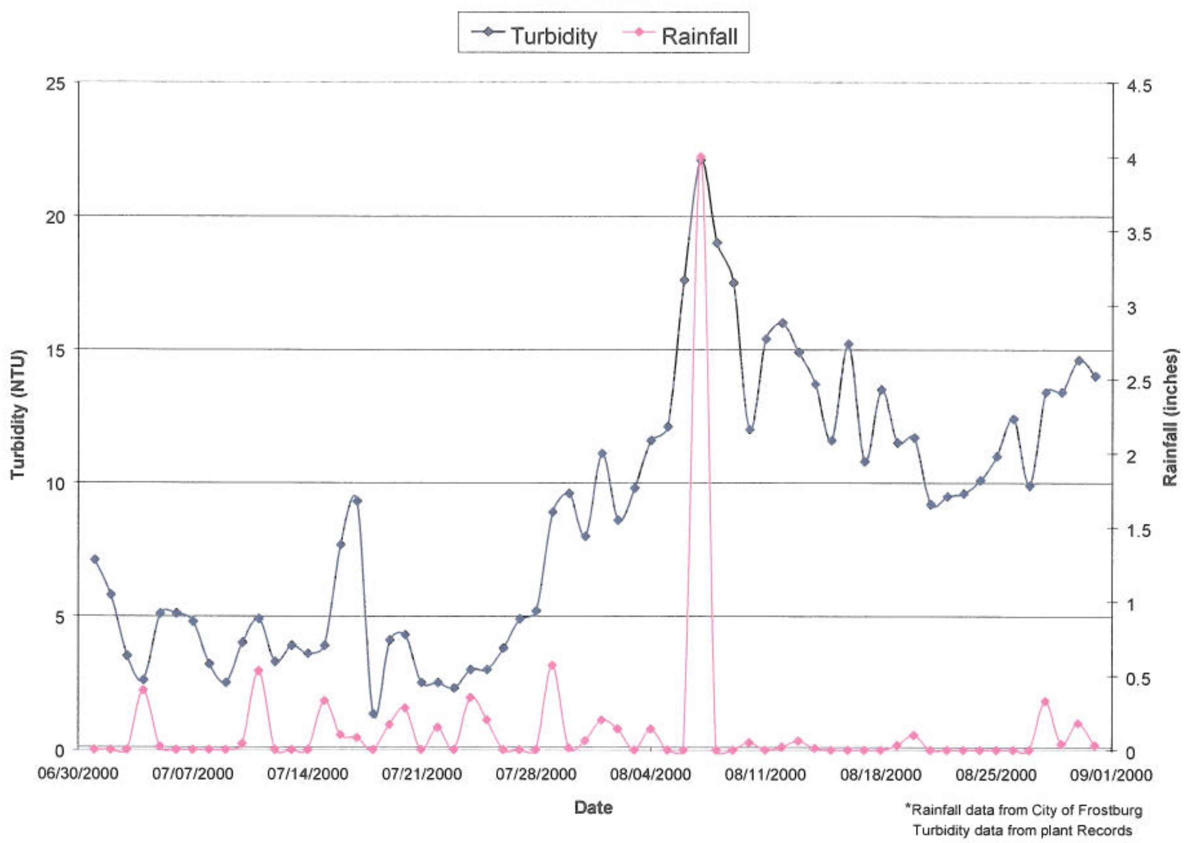
Charlestown Reservoir

Turbidity

Average turbidity in the Charlestown reservoir over the last two years is approximately 4.3 NTU. However, like Midland-Gilmore reservoir, Charlestown is subject to periods of high turbidity, usually as the result of storm events or snowmelt. The graph below depicts plant turbidity data from July-September 2000; it is an example of the rainfall-turbidity relationship in the reservoir.

Review of plant records and discussion with town officials indicate that periodic increases of

Rainfall - Turbidity Relationship at Charlestown Reservoir



turbidity in the reservoir have been and continue to be a common occurrence. High turbidity can interfere with water treatment and is correlated with high levels of pathogenic microorganisms. This re-occurring situation has caused operational problems at the Gilmore plant, and high turbidity events have resulted in numerous violations and boil-water advisories. The Midland-Gilmore system has received 35 violations for exceeding finished water turbidity limits since 1990. The system was in violation of turbidity standards for most of 1992-1993, and has been in violation as recently as February 2000.

With over 85% of the watershed semi-forested, runoff from storm events would not expected to be significant. Isolated areas may contribute to the overland flow-erosion-sediment load cause and effect relationship. Field survey and analysis of aerial photography point to (current) potential sources of erosion from storm runoff. These could include small patches of exposed land in the forest, access roads with stream crossings, old haul roads from logging/mining activity, agricultural land located in the headwaters, and a transmission line right of way. Past sources of erosion-turbidity occurrence include logging operations (MDE Memorandum, DEC7,1992 Lonaconing File) and surface mines. One coal company has, in the past, dredged the head of Charlestown reservoir to remove sediment accumulated from mining operations.

The heavily forested watershed likely attenuates most rainfall reducing runoff and erosion. However, like the Midland-Gilmore watershed, there are a few factors that may contribute to erosion from potential sources and increased turbidity events at Charlestown. With a relatively steep gradient from headwaters to reservoir, the travel time and velocity of storm water runoff is heightened. The small size of the watershed also contributes to this situation. During storm events, the ability of the reservoir to mitigate turbid water is limited due to its small (volume) capacity.

Future land use changes in the Charlestown watershed could increase the potential of turbidity contamination in the reservoir. Alteration of forested land could increase the amount of exposed surfaces that can lead to erosion. Almost 80% of the watershed is privately owned, with large tracts owned by land companies such as the Evans Realty Co. and Barton Mining Co. Historically, mining and logging have been common activities in the Charlestown watershed. While there are permits and regulations in place to limit the amount of erosion and sediment runoff from these practices, the potential for contamination exists. Dans Mountain WMA provides a great benefit to the water quality of the reservoir but future management of the land should limit or exclude regulated mining and/or logging. Recovery of the mineral and forest resources on any property in the watershed could potentially increase runoff, and raise the potential for turbidity contamination in the reservoir.

The intake at Charlestown does not increase the susceptibility of the reservoir to turbidity, but suspended sediment eventually settles to the bottom where the intake is located. This could extend the period of time that the Charlestown intake draws water with high turbidity.

Inorganic Compounds

Concentrations of iron and manganese in the groundwater of the Georges Creek region tend to be high. Iron and Manganese levels in the Charlestown reservoir are frequently above the NSDWR limits discussed in the Midland-Gilmore susceptibility analysis. Over the past two years iron and manganese levels have averaged 0.32 mg/L and 0.25 mg/L respectively, both above the NSDWR recommended drinking water limits. Like Midland-Gilmore, levels tend to be highest in the summer, most likely the result of decreased stream flow and an increase in the percentage of well water in the reservoir. The reason for these high levels has been the systems reliance on pumping well water into the reservoir to supplement flow from Jackson Run, usually in the summer when reservoir levels are low. High concentrations of manganese and iron in a drinking water supply cause aesthetic effects such as taste and odor problems, but are not necessarily public health concerns.

Nitrates can enter the water supply as runoff from agricultural land, leaching from septic tanks, atmospheric deposition, and erosion of natural deposits. Nitrate has consistently been detected in the water supply, but detected concentrations have been well below 50% of the MCL trigger (see tableX). Nitrate concentration in the reservoir would not be expected to be much higher than supply concentration detects, because conventional plants, like Charlestown, do not remove nitrogen in treatment processes. Besides deposition and natural sources, potential sources of nitrate in the Charlestown watershed include the 124 acres used for pasture. Unless numbers of livestock or agricultural land use increases, nitrate concentrations should not increase in the future.

Volatile Organic Compounds

Since 1989, there have been only two VOC detects in the Charlestown water supply, and both detected concentrations were notably below 50% of the MCL trigger (see tableX). Potential sources of VOCs can be leaching of underground gas tanks or the dumping of hazardous waste. There have not been any detects in the water supply since 1996, and regular VOC contamination in the reservoir is highly unlikely. The only potential risk of VOC contamination in the watershed is limited to spill events and future leaking of domestic petroleum tanks. Reports of spills and regular monitoring, already conducted by Midland-Lonaconing, should alert officials to VOC contamination in the future.

Trihalomethanes (THMs) result from the reaction of naturally occurring organic matter (in the reservoir) with chlorine during the water treatment process. The most common THMs detected in the Charlestown water supply are chloroform and bromodichloromethane. Currently, the EPA sets a MCL of 0.1 mg/L (ppm) for Total THMs, but this level is scheduled to change in 2001 and 2003. The new MCL for systems serving 10,000 persons or less is 80 μg/L (ppb) starting in 2003. This rule will apply to Midland-Lonaconing. Comparing results with the future standard (Table?) shows that while THMs are regularly detected in the water supply, they do not currently exist in concentrations high enough to pose a health risk. A further investigation into the source of disinfection byproducts, organic matter that combines with residual chlorine to form THMs, is not warranted at this time.

Synthetic Organic Compounds

SOC detects have been rather common at the Charlestown water plant, but all results are below 50% of the MCL. Di(ethylhexyl)phthalate (DEHP) is a resin commonly used in plastics, and is classified as a carcinogen in the EPA's Toxic Release Inventory. Its prevalence in plastics makes it a hard substance to sample and test. DEHP was detected in a sample in 1995 at a concentration of 3.69 ppb (within 50% of the 6 ppb MCL) however, it was also found in the sample blank. All DEHP detections in the Charlestown water supply are questionable because of its presence in all of the control sample blanks. Dalapon is a herbicide commonly used on right of ways and transportation corridors. Potential sources of this contaminant include Jackson Mountain Rd and a major transmission line running through the watershed. However, detects of Dalapon at the Charlestown plant have been significantly lower that the 50% trigger for the 200ppb MCL. This may reflect the watershed's ability to attenuate the pesticide runoff, or concentrations of this pesticide are characteristically low because sampling does not occur directly after application and/or a storm event. There is also concern over laboratory error in past Dalapon detects after reviewing test results. See Recommendations for Source Water Protection Plan.

Cyanide, Flouride, and Asbestos

Cyanide was given a statewide waiver (testing is not required) because the water treatment process changes the compound. Cyanide undergoes a breakdown during chlorination and free cyanide is not stable under ambient reservoir conditions. Asbestos is given a waiver because aquifers near the water supply are not considered sources of the contaminant. Natural asbestos is associated with ultramafic rock, which is only found in portions of Cecil, Howard, and Baltimore County, MD. Flouride is tested annually at the Midland-Gilmore plant, but has not been detected in the finished water supply. In 1994, fluoride was detected in an unidentified well at one of the Midland-Lonaconing plants. The result, 0.14 mg/L, was significantly less than the 2.0 mg/L MCL. There are no obvious potential sources of fluoride in the Charlestown watershed.

Heavy Metals

Regulated heavy metals are tested annually in the finished water produced at the Charlestown plant, and since 1993 there has been only one contaminant detection. Barium, a relatively common heavy metal, was detected in 1996 at a concentration of 0.1ppm, well below the 50% MCL trigger. Potential surface mine impacts include the lowering of pH, which increases the solubility of heavy metals. Based on the IOC detect data over the past ten years, and the absence of mine discharge in the watershed, Charlestown is not currently susceptible to heavy metal contamination. The potential for future heavy metal contamination does exist however, because the Georges Creek basin contains a majority of the state's coal reserves.

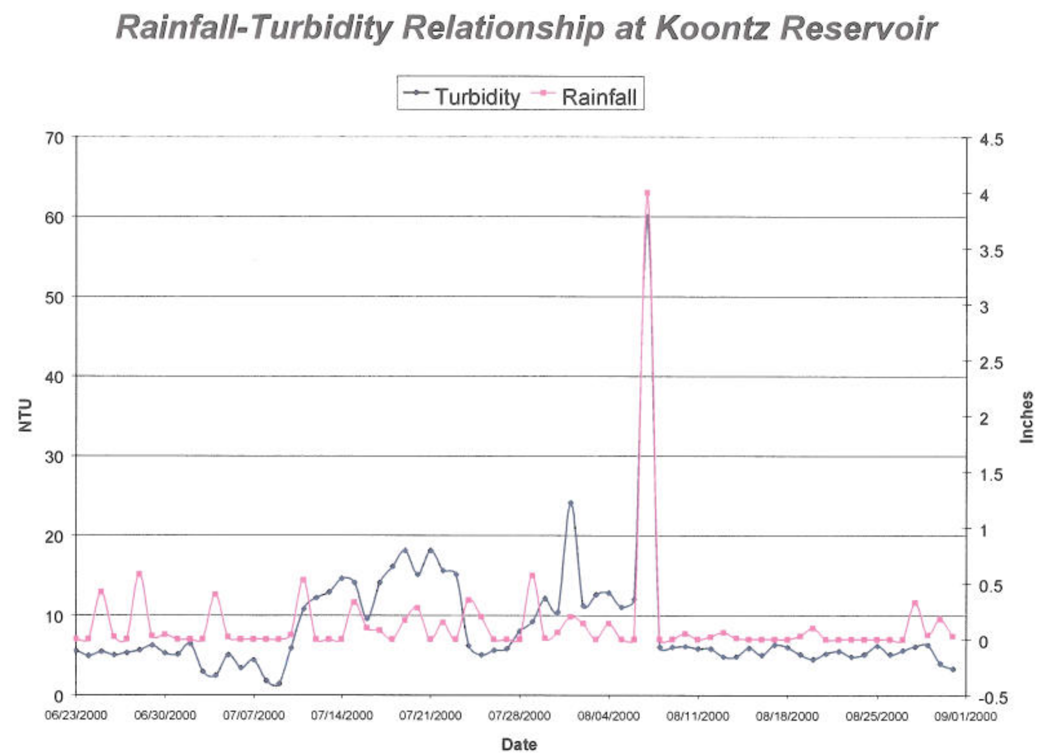
Radionuclides

Radionuclides have been detected once in the water supply, but were well below 50% of the MCL. Gross Alpha and Gross Beta are tested once every four years at Midland-Lonaconing. Without the presence of any natural sources radionuclides are not expected to be at high enough levels to contaminate the surface water supply. Charlestown reservoir is not susceptible to radionuclide contamination.

Koontz Reservoir

Turbidity

Average turbidity in the Koontz reservoir over the past two years has averaged 5.0 NTU, heightened by the 22 NTU average turbidity for January 1999. Like the other two Midland-Lonaconing reservoirs, Koontz is subject to periods of high turbidity, usually the as the result of a storm event or snowmelt. The graph below depicts plant turbidity data from a portion of the summer 2000; it is an example of the rainfall-turbidity relationship in the reservoir.



Koontz reservoir shares common turbidity characteristics with the other two reservoirs in the system. It has a history of periodic turbidity problems related to land use changes and storm water runoff, these instances can lead to operation problems at the water plant, and consequently cause Midland-Lonaconing to be in violation of finished turbidity standards (see discussions in Gilmore and Charlestown susceptibility analysis for more detail). Like Gilmore and Charlestown, these turbidity situations still occur periodically at Koontz reservoir.

With over 85% of the watershed semi-forested, runoff from storm events would not expected to be significant. Isolated areas may contribute to the cause and effect relationship of overland flow-erosion-sediment load. On a visit to the water plant, a town official expressed concern over an old mining drainage ditch that occasionally overflowed into Koontz Run. This ditch was not observed, but other potential sources of erosion from storm runoff were pointed out by subsequent field surveys and analysis of aerial photography and topographic maps. These could include portions of abandoned mine land along the eastern edge of the watershed, an extensive amount of old access roads, logging haul roads and skid trails, agricultural land (9% of watershed area), natural bank erosion, and transmission right of ways.

The above rainfall-turbidity graph corresponds to the clear-cut logging operation that took place in June-July 2000. While storm events are the most likely driving force behind high turbidity episodes, changes in the land use can exacerbate the effect of rainfall. While ground cover in the operation was minimally disturbed, turbidity during this period was higher on average than the past two years, but slightly lower than in 1997. The evidence of runoff from a main haul road (located in the major transmission right-of-way) was evident during a field visit, and may have contributed to the large increase in turbidity during the severe storm on August 7, 2000.

The heavily forested watershed likely attenuates most rainfall reducing runoff and erosion. However, like the other Midland-Lonaconing watersheds, there are a few factors that may contribute to erosion from potential sources and increased turbidity events at Koontz. With a relatively steep gradient from headwaters to reservoir, the travel time and velocity of storm water runoff is heightened. The small size of the watershed also contributes to this situation. During storm events, the ability of the reservoir to mitigate turbid water is limited due to its small (volume) capacity.

Future land use changes in the Koontz watershed could increase the potential of turbidity contamination in the reservoir. Alteration of forested land could increase the amount of exposed surfaces that can lead to erosion. Almost 65% of the watershed is privately owned. Historically, mining and logging have been common activities in the Koontz watershed. While there are permits and regulations in place to limit the amount of erosion and sediment runoff from these practices, the potential for contamination exists. Savage Mountain State Forest provides a great benefit to the water quality of the reservoir but future management of the land should limit or exclude regulated mining and/or logging. Recovery of the mineral and forest resources on any property in the watershed could potentially increase runoff, and raise the potential for turbidity contamination in the reservoir.

The intake at Koontz does not increase the susceptibility of the reservoir to turbidity, but suspended sediment eventually settles to the bottom where the intake is located. This could extend the period of time that the Koontz intake draws water with high turbidity.

Inorganic Compounds

Iron and Manganese levels in the Koontz reservoir are frequently above the NSDWR limits discussed in the Midland-Gilmore and Charlestown susceptibility analysis. Over the past two years iron and manganese levels have averaged 0.33 mg/L and 0.22 mg/L respectively, both above the NSDWR recommended drinking water limits. Like the other reservoirs, levels tend to be highest in the summer, most likely the result of decreased stream flow and an increase in the percentage of well water in the reservoir. The reason for these high levels has been the systems reliance on pumping well water into the reservoir to supplement flow from Koontz Run, usually in the summer when reservoir levels are low. The situation at Koontz differs from the other two reservoirs in that there is an artesian well that flows into the reservoir year-round. High concentrations of manganese and iron in a drinking water supply cause aesthetic effects such as taste and odor problems, but are not necessarily public health concerns.

Nitrates can enter the water supply as runoff from agricultural land, leaching from septic tanks, atmospheric deposition, and erosion of natural deposits. Nitrate has consistently been detected in the water supply, but detected concentrations have been well below 50% of the MCL trigger (see tableX). Nitrate concentration in the reservoir would not be expected to be much higher than supply concentration detects, because conventional plants, like Koontz, do not remove nitrogen in treatment processes. Besides deposition and natural sources, potential sources of nitrate in the Koontz watershed include the 125 acres used for cropland and pasture. Unless numbers of livestock or agricultural land use increases, nitrate concentrations should not increase in the future.

Volatile Organic Compounds

There have not been any VOC detects in the Koontz water supply since testing began in 1989. With an absence of potential sources, this reservoir is not susceptible to VOC contamination at this time. However, potential spills along Avilton-Lonaconing Rd. may pose a risk in the future. Reports of spills and regular monitoring, already conducted by Midland-Lonaconing, should alert officials to VOC contamination in the future.

Like Gilmore and Charlestown, trihalomethane detects are common at Koontz reservoir. The most common THMs detected in the water supply are chloroform and bromodichloromethane. While below 50% of the new MCL, the concentrations are the highest levels found in the Midland-Lonaconing system. The source of disinfection byproducts (THMS) is organic matter, which during water treatment combines with residual chlorine to form THMs. Organic matter is plentiful in the Koontz watershed, 85% of which is primarily deciduous forest. Comparing results with the future standard (Table?) shows that while THMs are regularly detected in the water supply, they do not currently exist in concentrations high enough to pose a health risk.

Synthetic Organic Compounds

SOC detects have been rather common at the Koontz water plant, but all results are below 50% of the MCL. All DEHP detections in the Koontz water supply are questionable because of its presence in all of the control sample blanks. Dalapon has been detected four times since 1995, but well below 50% of the MCL. Potential sources of this contaminant include Avilton-Lonaconing Rd and a major transmission line running through the watershed. See the SOC susceptibility analysis for Charlestown for more information on Dalapon. Koontz reservoir is not currently susceptible to SOC contamination.

Cyanide, Fluoride, and Asbestos

Cyanide was given a statewide waiver (testing is not required) because the water treatment process changes the compound. Cyanide undergoes a breakdown during chlorination and free cyanide is not stable under ambient reservoir conditions. Asbestos is given a waiver because aquifers near the water supply are not considered sources of the contaminant. Natural asbestos is associated with ultramafic rock, which is only found in portions of Cecil, Howard, and Baltimore

County, MD. Fluoride is tested annually at the Midland-Gilmore plant, but has not been detected in the finished water supply. In 1994, fluoride was detected in an unidentified well at one of the Midland-Lonaconing plants. The result, 0.14 mg/L, was significantly less than the 2.0 mg/L MCL. There are no obvious potential sources of fluoride in the Koontz watershed.

Heavy Metals

Regulated heavy metals are tested annually in the finished water produced at the Koontz plant, and since 1993 there has not been any contaminant detection. Abandoned mine land and exposed spoil waste located in the eastern portion of the watershed may be a potential source of contamination. However, contamination is either insignificant, non-existent, or the watershed naturally attenuates heavy metal runoff due to the absence of any detects over the past ten years. The potential for future heavy metal contamination does exist however, because of the watersheds past history of mining and the fact that the Georges Creek basin contains a majority of the state's coal reserves.

Radionuclides

Radionuclides have been detected once in the water supply, but were well below 50% of the MCL. Gross Alpha and Gross Beta are tested once every four years at Midland-Lonaconing. Without the presence of any natural sources radionuclides are not expected to be at high enough levels to contaminate the surface water supply. Koontz reservoir is not susceptible to radionuclide contamination.

Microbial Contaminants in Midland-Lonaconing Reservoirs

In the 1990 management plan for Georges Creek, total coliform counts for tributaries of Georges Creek ranged from 6,152 to 848,333 MPN/100mL.. The report attributes high levels to failing septic systems and inadequate sewage treatment plants (DNR/MDE, 1990). Midland-Lonaconing does not test for any microbial contaminants in its water supply reservoirs; it is required to take 6 total coliform samples per month of finished drinking water.. If one sample (out of six) is positive, then Midland-Lonaconing is in violation of the Surface Water Treatment Rule.

The system has been in violation of the MCL for total coliforms three times since 1990, the last occurring in June 1996. Every sample that has total coliforms present must be analyzed for fecal coliforms. Since 1990, no positive fecal coliforms have been found in the system's finished drinking water. These samples are not differentiated by water plant or reservoir source and are collected at points in the distribution system. It would be difficult to use this data for the assessment. In addition, bacteriological monitoring by Midland-Lonaconing does not adequately give an indication of contamination in the system's reservoirs (raw water). In order to better assess the susceptibility of each reservoir, Fecal coliform and E. coli sampling at the reservoirs is scheduled to begin in September 2000 and continue for at least two years as part of a special source water assessment project. Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human and animal wastes. When this data becomes available it will be added to the assessment for all Midland-Lonaconing reservoirs.

Midland-Lonaconing has never tested for species of *Giardia* or *Cryptosporidium* in its water supply. It is believed that these two pathogens are fairly common in surface waters of the United

States. High turbidity can be an indicator for the presence of these and bacteriological pathogens. Sources of contamination include human and animal waste, including birds. Water filtration does not always provide a 100% effective barrier; especially against *Cryptosporidium* oocysts. In 1992, an investigation was undertaken when a young boy whose water was supplied by the Midland-Gilmore reservoir contracted Giardiasis. After reviewing the case, the Allegany Health Department concluded that the water supply system was an unlikely source of the *Giardia*.

Potential sources of pathogenic protozoa, viruses, and bacteria in the Midland-Gilmore watershed include the cattle pasture in the headwaters of Elklick Run, and the residential area adjacent to Bushkirk Hollow Rd. Septic systems in the residences along Bushkirk Hollow Rd. can be a source of contamination. On a site visit to Midland-Gilmore there were obvious signs of deer around the periphery of the reservoir, which can be carriers of *Cryptosporidium* and *Giradia*.

Potential sources of pathogenic protozoa, viruses, and bacteria in the Charlestown watershed include the large open pastures (9% of watershed) in the headwaters of Jackson Run, residences along Jackson Mountain Rd. on septic, and natural wildlife populations. Potential sources in the Koontz watershed include the minimal amount of pasture in the watershed and natural wildlife populations. There are also scattered residences above the reservoir using septic systems that could contribute to contamination.

Without any data from the reservoirs at this time, it is unknown whether the watershed can attenuate the contamination of microbial contaminants. Based on the land use in the watershed, it is likely that the threat of a major contamination of these contaminants is minimal. Further residential development, an increase in cattle, or the failure of old septic systems could increase the potential of microbial contamination in the future.

A Susceptibility Analysis Summary Table is located in the Appendix.

J. RECOMMENDATIONS FOR SOURCE WATER PROTECTION PLAN

With the information contained in this report, the town Midland-Lonaconing is in a position to protect their reservoir(s) water supply by understanding the area delineated for source water protection (watershed), keeping track of potential contaminant sources, and evaluating future development and land planning. A source water protection plan for each of the Midland-Lonaconing reservoirs is the underlying goal of this assessment. Specific management recommendations for consideration are listed below:

Form a Local Watershed Planning Team

- Midland-Lonaconing officials can become active members in the George's Creek Watershed Association (GCWA), a newly formed organization interested in protecting aquatic ecosystems in the Georges Creek Valley.
- Midland-Lonaconing should form either a local planning team, or a committee within the GCWA to implement a source water protection plan for the three reservoirs based on this source water assessment.

Public Awareness and Outreach

- Future Consumer Confidence Reports should list that this report is available to the general public through their public library, contacting the town office of by contacting the Water Supply Program at MDE.
- A road sign along Bushkirk Hollow Rd. explaining to the public that they are entering a protected drinking water 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 spill notification and response.
- A similar spill response sign along Avilton-Lonaconing Rd. in the Koontz watershed.
- Include interested members of the public on either the local watershed planning team or the GCWA committee.

Monitoring

- Continue monitoring for fecal coliform and/or E. coli in the reservoir after the two-year MDE sponsored monitoring program is over.
- Meet with utility or Allegany DPW to discuss if and when Dalapon (or any other pesticide) is sprayed on rights of way or roads that pass through the three reservoir watersheds. If applicable, sample for pesticide after application at first flush in the reservoir.
- Continue to monitor for all Safe Drinking Water Act contaminants as required by MDE, including raw reservoir sampling when feasible.

Land Acquisition/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.

- Purchase or look into the availability of grants or loans to establish buffers along reservoir feeder streams or in sensitive areas.
- In the Midland-Gilmore watershed, purchase a parcel of Allegany Land and Coal Co.'s property immediately above the reservoir for permanent protection, or enter into an agreement with Allegany Land and Coal Co. to permanently establish an easement or buffer on property directly above the reservoir.

Planning/New Development

- In Midland-Lonaconing, discuss with DNR officials (Dans Mountain WMA) the possibility of erecting a sign, and if feasible, a fence on the Bushkirk Hollow Rd. turnout to prevent illegal dumping.
- In Midland-Lonaconing, contact the Allegany County DPW to discuss mitigating the overflow of stormwater from the Bushkirk Hollow Rd. culvert into the reservoir.
- In Koontz, identify the mining drainage ditch (that occasionally overflows) and discuss options with MDE and MD Bureau of Mines for reclamation potential.
- In Koontz, re-vegetate exposed bank adjacent to reservoir if it is contributing to erosion.

Contaminant Source Inventory Updates

- Midland-Lonaconing should continue to conduct its own detailed field surveys of the three watersheds to ensure that there are no new potential sources of contamination in the future.
- Update MDE on potential land use changes that may increase the susceptibility of each reservoir to contaminants.
- Identify local sources of erosion in reservoir watersheds by cooperating with MDE and/or DNR and landowners to do detailed stream surveys.

Permits

- MDE and Town of Lonaconing officials should meet with officials of the Allegany and Garrett County Soil Conservation Districts, and the DNR Forestry service to discuss conservative logging operations and future forestry permits in the reservoir watersheds.
- MD Bureau of Mines should include Town of Lonaconing officials and Water Supply personnel in review of future mining permits in the three watersheds.

REFERENCES

MD Dept. of Natural Resources / MD Dept. of the Environment, (DNR/MDE) 1990, Georges Creek Watershed Water Supply Resources and Facilities Development and Management Plan, 110p.

MD Dept. of Natural Resources, (DNR) 1985, Inventory of Maryland Dams and Assessment of Hydropower Resources, 198p.

MD Dept. of the Environment, Water Supply Program, (MDE) 1999, Maryland's Source Water Assessment Plan, 36p.

Rummel, Klepper, and Kahl, (RKK) 1990, Town of Lonaconing, MD Water Treatment Facilities Study, 33p.

Slaughter, Turbit H., and John M. Darling, 1962, The Water Resources of Allegany and Washington Counties, 408p.

OTHER SOURCES OF DATA

MDE Water Supply Inspection Reports
MDE Water Supply reader file for Midland-Lonaconing
MDE Water Supply Program Oracle® Database (PDWIS)
Midland-Lonaconing Monthly Operating Reports (MORs) and Self-Monitoring Reports
Department of Natural Resources Spot Satellite Image, Frostburg
USGS Topographic 7.5 Minute Quadrangle, Lonaconing
Maryland Office of Planning 1997 and 1994 Allegany County Land Use Map
Maryland Office of Planning 1999 Property View Tax Map, Allegany Co.

Figure A - Georges Creek Watershed

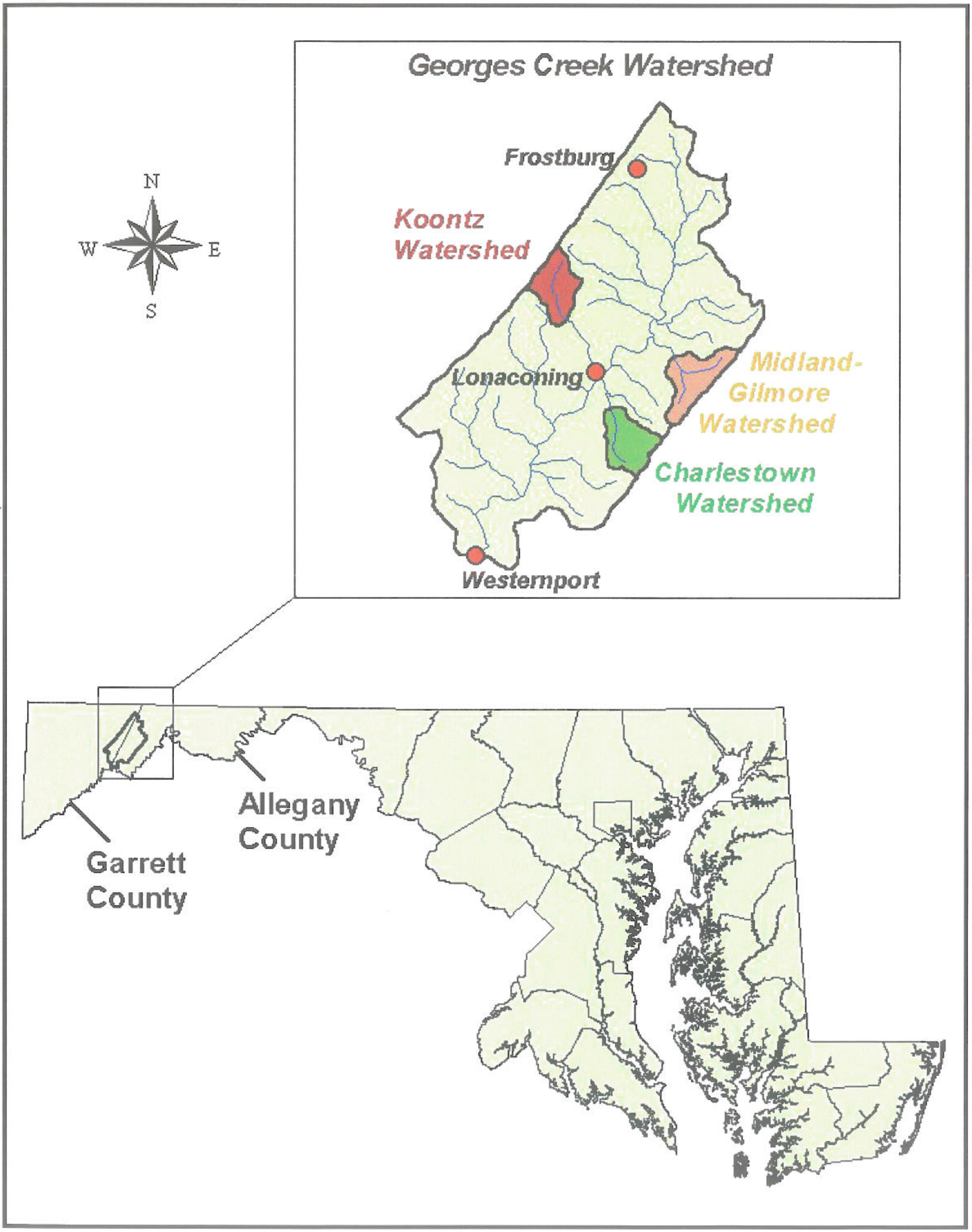


Figure 2. Midland-Gilmore
Land Use within the Watershed

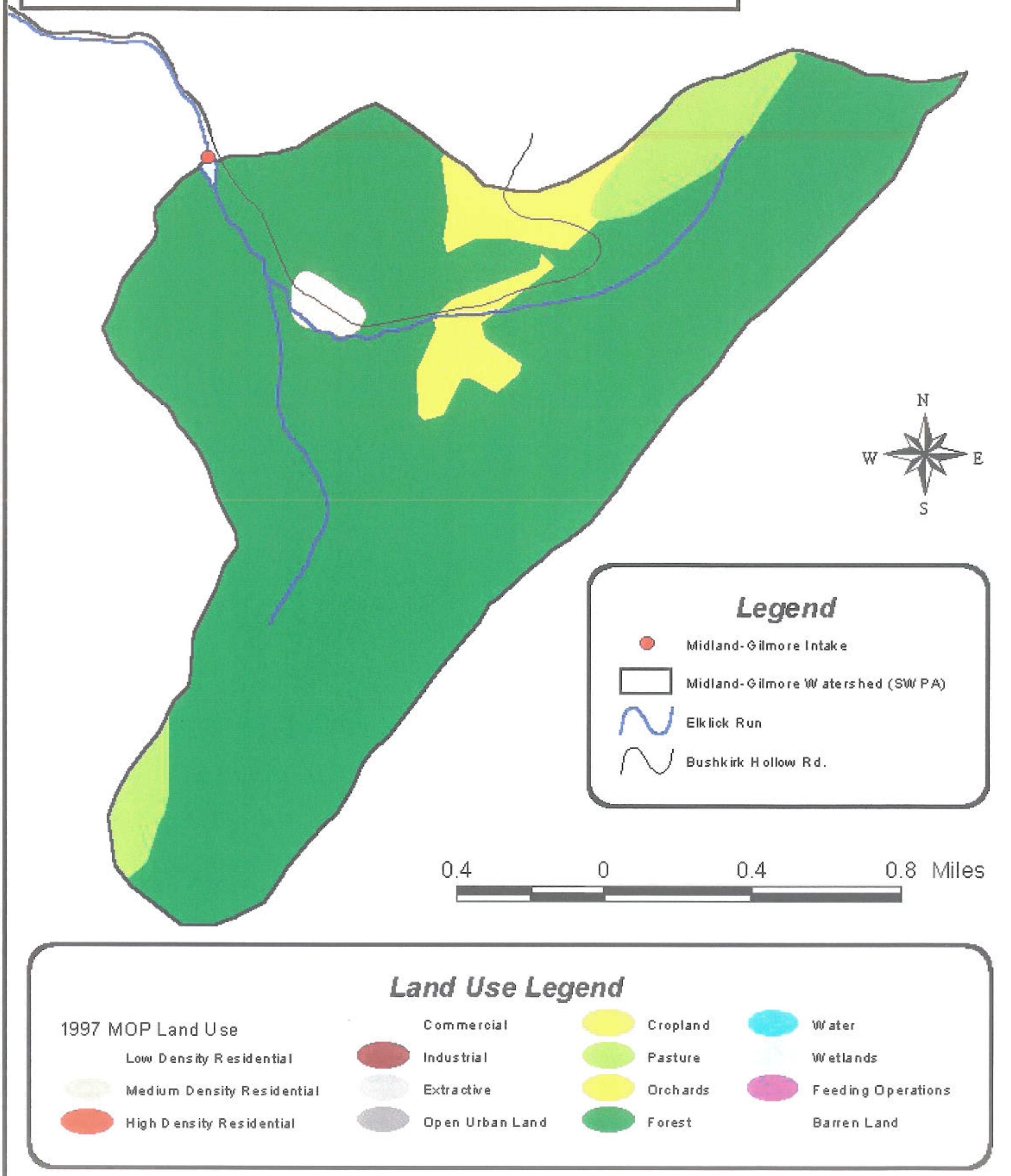


Figure 3. Midland-Lonaconing
Satellite Image of Watershed & Property Ownership

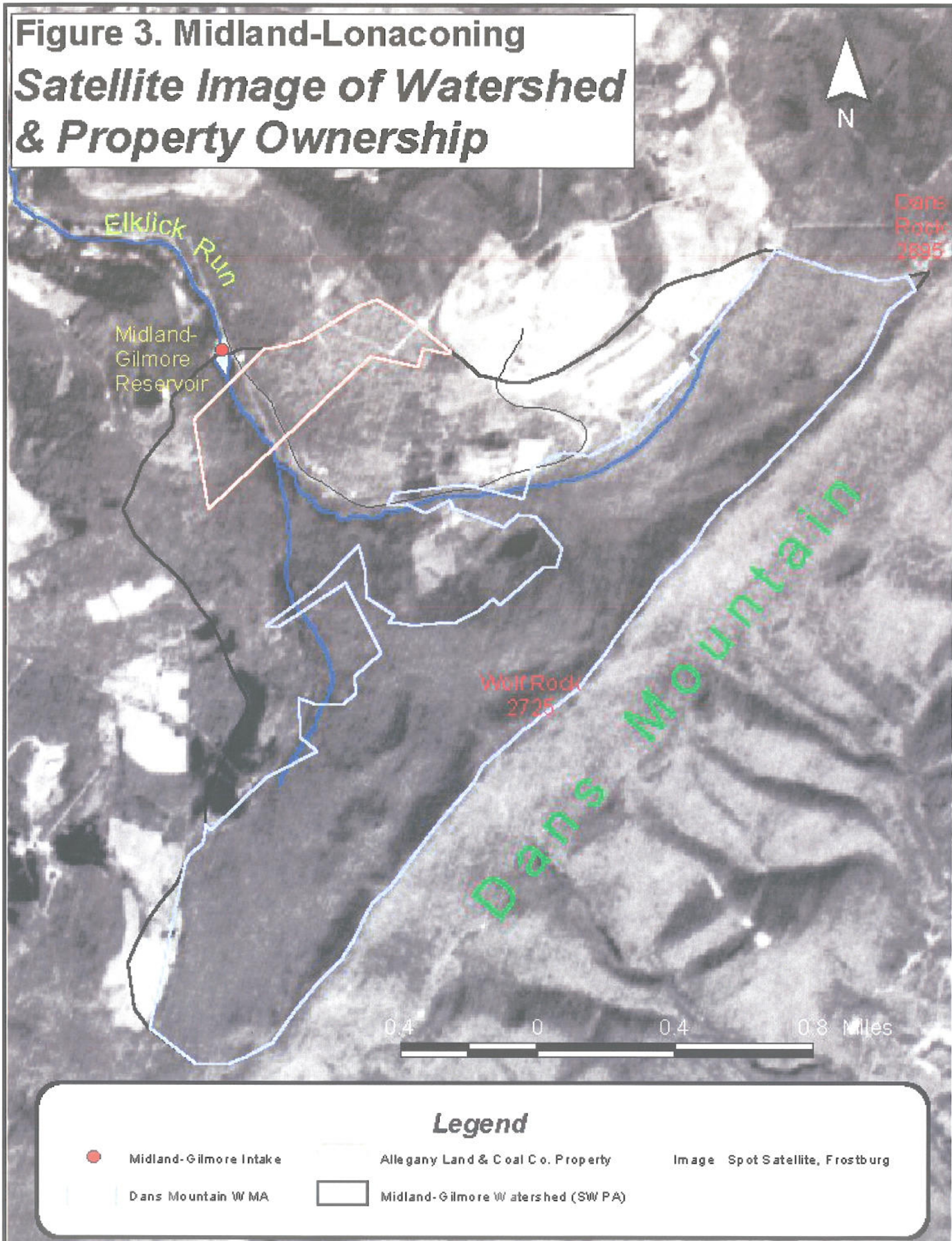


Figure 4. Charlestown *Source Water Protection Watershed & General Area*

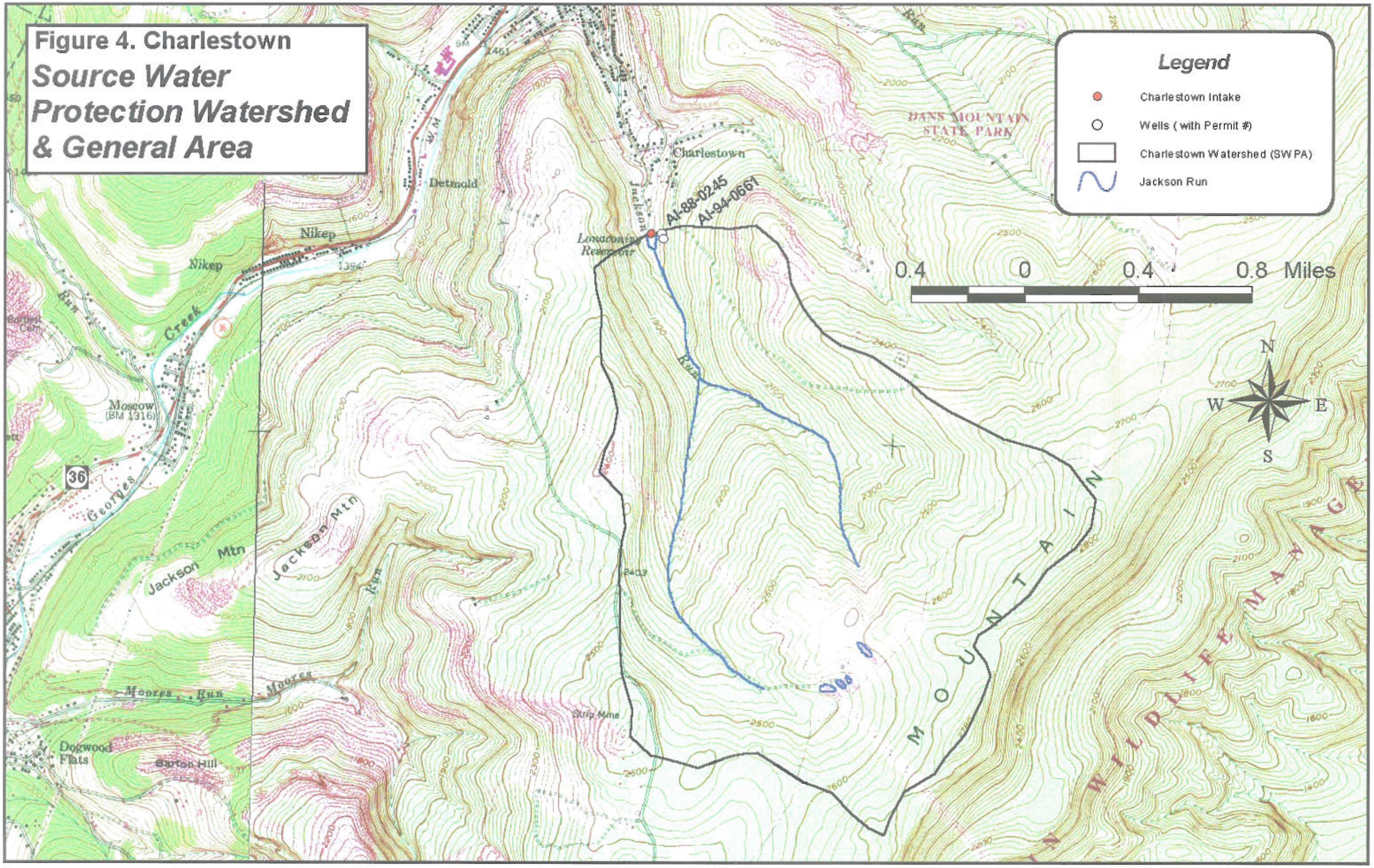


Figure 6. Charlestown Satellite Image of Watershed
Charlestown Reservoir
Jackson Run
Dans Mountain
Legend
Charlestown Intake
Dans Mt. Wildlife Mgmt. Area Boundary
Charlestown Watershed (SWPA)
Jackson Run
Approximate Locations of Old Deep Mines
Apprxomiate Extent of Old Surface Mine

Figure 8. Koontz Reservoir

Land Use within the Watershed

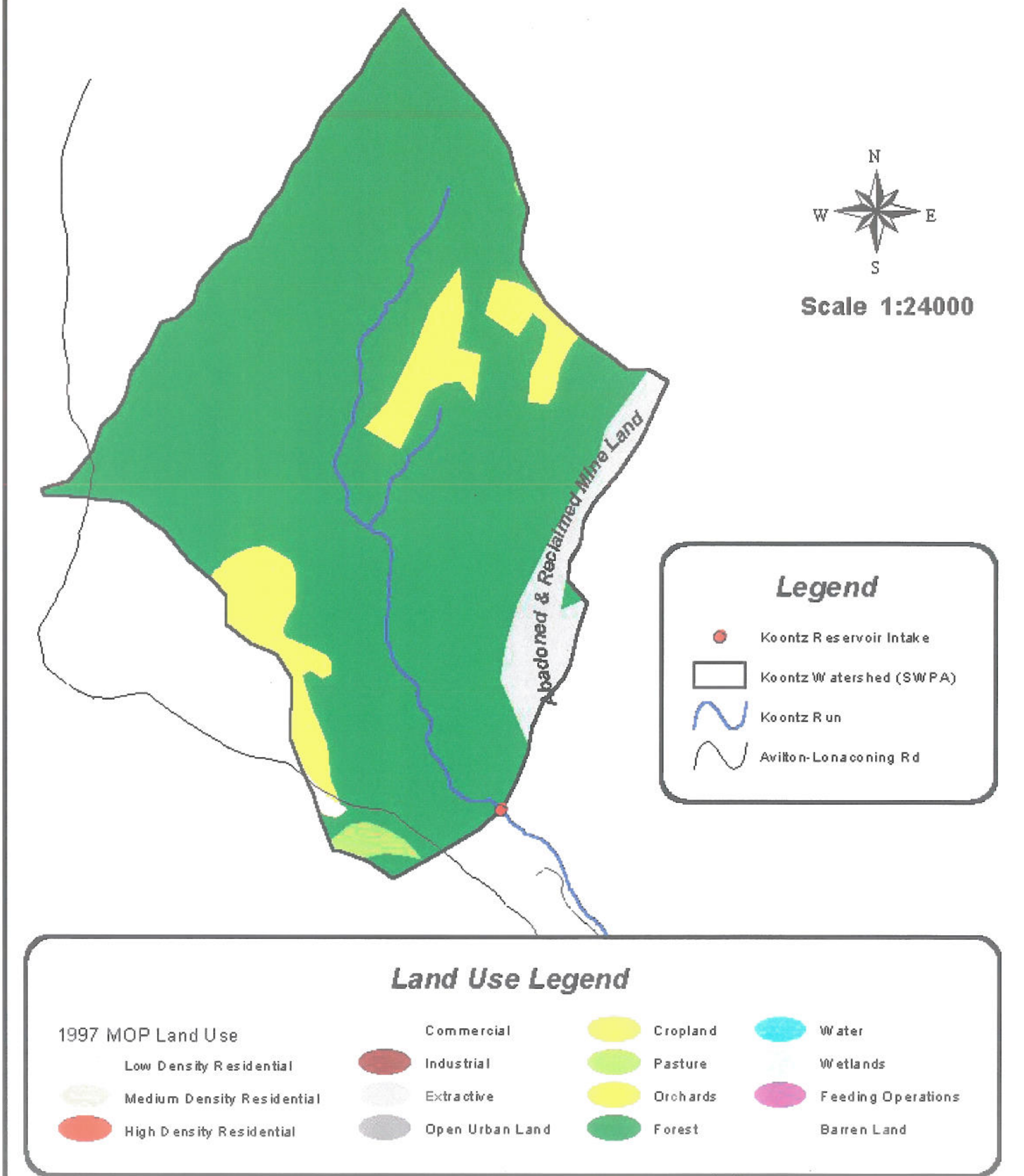


Figure 9. Koontz Reservoir
Satellite Image of Watershed