

CHAPTER 2. DEEP CREEK

Originating near Eglon, West Virginia the Youghiogheny (Yok-i-gay-nee) River or Yough (Yok) for short flows in a northerly direction for approximately 132 miles to where it joins the Monongahela River in McKeesport, Pennsylvania. The name is from a native American word meaning “a stream flowing in a contrary direction”. In Maryland it is the only river basin that does not flow to the Chesapeake Bay.



View of Deep Creek Lake,
Maryland

For the Deep Creek Management Unit, we will focus on the area of land that encompasses all the streams which flow into Deep Creek from the headwater tributaries to its confluence with the Youghiogheny River. Figure 2-1. depicts the location of the Deep Creek Management Unit.

PROJECT AREA CHARACTERISTICS

Stream Classification

In order to compare waterways, geographers, geologists, and hydrologists classify each waterbody into stream orders. The higher the stream order the larger the waterbody. Waterways with stream orders between one to three are headwater streams—meaning they are the start of a watershed. Often, these streams are intermittent; they may not flow all the time and are typically unnamed. Moving up the scale, streams in orders three to five are slightly larger because they are a merger of order one and two streams. Lastly, larger streams such as the Youghiogheny, Monongahela, and the Ohio Rivers are considered to be between streams orders six to eight depending on the number of smaller tributaries that

Table 2-1. Tributaries to Deep Creek

Tributaries	Drainage Area (Acres)	Stream Designation
Red Run	2,278	IIIP
Smith Run	623	IIIP
Hoop Pole Run	414	IIIP
Pawn Run	2,626	IIIP
Green Glade Run	880	IIIP
North Glade Run	4601	IIIP
Meadow Mountain Run	2,443	IIIP
Cherry Creek	7871	IIIP
Gravelly Run	540	IIIP

have merged into it (Briney, 2019). Regarding this scale, Deep Creek would be a fifth order stream. Therefore, all the named tributaries within this watershed fall between stream orders one to five.

There are nine named tributaries that flow into Deep Creek. Table 2-1 identifies these streams with their corresponding acreages of drainage area.

In addition to these, there are several small tributaries that are formally unnamed.

In Maryland, streams are designated into one of eight waterbody use classes. The Deep Creek Watershed is classified for use as a nontidal cold water stream, and it has protections for public drinking water known as Class IIP.

Topography

The topography of this region is characterized by steep slopes, small drainage basins, and a thin soil profile (The Maryland Department 2014). The elevation of the lake is 2462 feet above sea level. The Deep Creek area is divided by the Hammel Glade – Meadow Mountain Run lowlands southeast of Thayerville. The northwest half of the region is steep and has sandstone ridges. The southeastern half is the opposite, it has a flatter and gentler topography. When the Appalachian Mountains were forming, the tectonic plates folded creating mountains.

Climate & Climate Change

Climate change is a “hot” topic these days but what actually is climate change? Contrary to general belief, climate is not the same as weather. Weather is a short-term measurement of the state of the atmosphere in a single location. It involves air temperature, how much humidity is in the air, both rain and snowfall precipitation, and wind speed. Climate tracks averages and patterns of weather over long periods of time over an entire region. Basically, climate change is the study of changes in the averages and patterns of weather.

The Earth’s climate has been changing for many centuries. However, these changes are not equivalent to the changes currently referred to as climate change. Although data supports that the Earth’s rotation and orbit change the amount of solar energy received, and thus alters climate over long time intervals, recent studies support that climate has been drastically fluctuating at an unnatural rate (Carbon Brief, 2011).

Carbon dioxide (CO₂) is a small portion of the makeup of Earth’s atmosphere but the fluctuations in CO₂ play a huge role in climate change. CO₂ is a common, naturally occurring gas. We inhale oxygen and exhale carbon dioxide. Part of the most natural cycle on earth, plants take in carbon dioxide and release oxygen.

However, human activities have exacerbated this natural cycle and have offset the amount of carbon dioxide our atmosphere can handle. It is widely accepted that the warming of global temperatures is a direct result of man-made emissions of greenhouse gasses (Carbon Brief, 2011). Burning fossil fuels and stripping the land of trees and plants has increased the amount of CO₂ while decreasing the natural world’s ability to offset the emissions. Humans have increased atmospheric CO₂ concentration by 48% since the Industrial Revolution began, a greater leap than what had happened naturally over a 20,000-year period up to 1850. Since 1950, our fossil fuel consumption has increased by 550% while carbon dioxide emissions have increased by 500% Earth (National Aeronautics and Space Administration (NASA)).

Scientists agree the level of CO₂ in the atmosphere needs to stay below 350 parts per million (ppm) to address the catastrophic impacts of climate change. In 2019, CO₂ concentrations surpassed 415ppm in the atmosphere, the first time this has occurred in at least 2.5 million years. (NASA). The last measurement recorded on NASA's website during the writing of this conservation plan was 421ppm in April 2023.

The current range of uncertainty lies between 350 ppm and 450 ppm, a threshold we are rapidly approaching. Exceeding 450 ppm will land us in the high-risk zone, a point where we'll see irreversible tipping points. We are already seeing irreversible impacts at current CO₂ levels from intense heat waves, heavy rainfall events, increased drought durations, melting ice caps, and warming sea levels. There are many ways in which climate change will impact, and is already impacting the Youghiogheny River watershed (NASA and Staeffen, et. al, 2015).

Maryland has recorded an average temperature nearly 4° F higher than the average between 1895-1915. Compared with temperatures in 1910, Maryland has 30 fewer days with temperatures below freezing. Winter temperatures have become warmer, at a rate of 1.3° F per decade from 1970 to 2000 in the northeast U.S. Even more alarming, projections show it could be as much as 5.4 °F warmer by 2050 than it was in the 1990s. Since the late 1800s, global temperatures have increased by about 2 degrees Fahrenheit. According to the NASA website on Global Climate Change, nineteen of the warmest years have occurred since 2000, with the exception of 1998. The years 2016 and 2020 are tied for the warmest year on record since we started keeping track back in 1880.

In addition to the higher temperatures, Maryland has also seen an increase in annual precipitation. More rain events are considered downpours, which increase flooding hazards. About 30% of Maryland rainstorms between 2007-2016 would have fallen into the top 1% of storm intensity had they occurred in the 1950s. Increased precipitation goes hand in hand with a higher frequency of large storm events, causing changes in peak stream flows, more erosion, and pollution runoff.

The temperature of water in our streams is an important factor in maintaining a healthy aquatic ecosystem. However, increased temperatures can lead to warmer streams. This doesn't sit well with our cold-water fish species like brook trout. Projections show Maryland could be unsuitable for cold water fish species by the year 2100 if we don't curb our greenhouse gas emissions.

As precipitation changes and increased temperatures carve the path for a longer growing season, we expect to see changes in stream flows. The peak stream flows are expected to occur 10-14 days earlier and summer low-flows are expected to last about a month longer. This could also impact our forest ecosystems that rely on the early spring flows of ephemeral streams.

As the climate changes and plant hardiness zones shift northward at an estimated 13.6 miles per decade, species are inhibited by habitat fragmentation when they would

instinctively move north with suitable climate for their habitat needs. Maintaining and restoring habitat connectivity is crucial in a holistic approach to conservation efforts.

Socioeconomic Profile

Demographics & Population Patterns

The Deep Creek watershed occupies approximately 40,971 acres or 64 square miles. Within that area there are seven municipal units, all within the state of Maryland. It is estimated that 14,952 people live in the Deep Creek management unit. Table 2-2 identifies the population by the municipal unit.

TABLE 2-2. MUNICIPAL UNITS IN THE DEEP CREEK MANAGEMENT UNIT

State	Municipal Unit	% in Unit	2020 Population	% of Unit Population
MD	District 6, Sang Run	37.0	2090	14.0%
MD	District 1, Swanton	33.1	1683	11.3%
MD	District 10, Deer Park	27.3	1671	11.2%
MD	District 7, East Oakland	16.3	2433	16.3%
MD	District 14, West Oakland	14.8	4355	29.1%
MD	District 12, Bittering	6.8	899	6.0%
MD	District 5, Accident	0.2	1821	12.2%

Land Use Planning & Zoning

Zoning is an important tool available to communities. Although it can be viewed in a negative light as an infringement of landowner rights, when used properly, zoning can help safeguard a community's character.

Garrett County is the only county in Maryland that does not have county-wide zoning. However, Deep Creek has a Watershed Zoning ordinance that was amended May 25, 2010. The ordinance applies to all the lands, properties, buildings, structures and their uses situated within the territory drained by Deep Creek and its tributary systems. There are nine zoning districts within the watershed: RR – Rural Resource; AR – Agriculture Resource; LR1 – Lake Residential District 1; LR2- Lake Residential District 2; TR – Town Residential District; TC – Town Center District; C – General Commercial District; CR1 – Commercial Resort 1; CR2 – Commercial Resort 2.

The zoning ordinances give reasonable consideration to the character of districts and their suitability for particular uses; encourages orderly development and the most appropriate use of lands; conserve the value of land and buildings; promote the conservation of natural resources; prevent environmental pollution; promote health and general welfare; avoid undue concentration of population; provide for adequate light and air; secure safety from fire, panic and other dangers; lessen congestion on roads; facilitate the adequate provision of transportation, parking,

water, sewage, parks and other public facilities; give effect to the goals, objectives and policies of the Development Plan for Garrett County, Maryland; carry out the Vision in the Smart and Sustainable Growth Act of 2008; serve other purposes for zoning as authorized under state law.

Income

Table 2-3 below displays the average and median household incomes for each of the municipal units in the region. The median household income is the point where half the people make more and the other half make less, fundamentally it's the middle point. It is used over the mean or average income for statistical analysis because individuals with extremely high salaries may skew the results and bring the average up. Per capita income is another common figure utilized when comparing incomes. Essentially the per capita income is the average income earned per person (age 15 and older) in a given area and within a specific year.

TABLE 2-3. HOUSEHOLD INCOME IN THE DEEP CREEK WATERSHED

State	Municipal Unit	Median Household Income	Average Household Income
MD	District 6, Sang Run	\$48,323	\$61,907
MD	District 1, Swanton	\$55,833	\$96,081
MD	District 10, Deer Park	\$48,911	\$73,543
MD	District 7, East Oakland	\$67,250	\$98,983
MD	District 14, West Oakland	\$66,652	\$89,784
MD	District 12, Bittinger	\$69,125	\$118,110
MD	District 5, Accident	\$58,625	\$76,973

Within the Deep Creek Management Unit there are approximately 4,263 households. Of those households' 65% receive some sort of social security income and 42.8% receive retirement income. Out of those same households only 2.4% receive public assistance while 20.6% receive food stamps or Supplemental Nutritional Assistance Program benefits.

Poverty

The federal poverty level is a measure used to determine the level of income at which an individual or family qualifies for federal benefits and programs. This level is a set minimum amount that a family needs to provide clothing, shelter, transportation, and other necessities.

Currently 13.5% of the people in the United States are living below the poverty level. Within the Deep Creek watershed, the state data is the lowest data available. In Maryland 10.3% of the population live below poverty level. A slightly less percentage than the United States.

Environmental Justice

Environmental justice is defined as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. This goal will be achieved when everyone enjoys: the same degree of protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work” (U.S. EPA).

In Maryland, each census tract is given an Environmental Justice Socioeconomic score that takes into account the communities minority population, poverty level, and communities English speaking proficiency. Communities with 50% or more minorities, poverty rates exceeding 25%, or having 15% limited English proficiency are given higher scores. A score over 75 makes the community eligible for Environmental Justice status. Within the Youghiogheny Headwaters Management Unit none of the census tract areas qualify as Environmental Justice Communities.

Housing

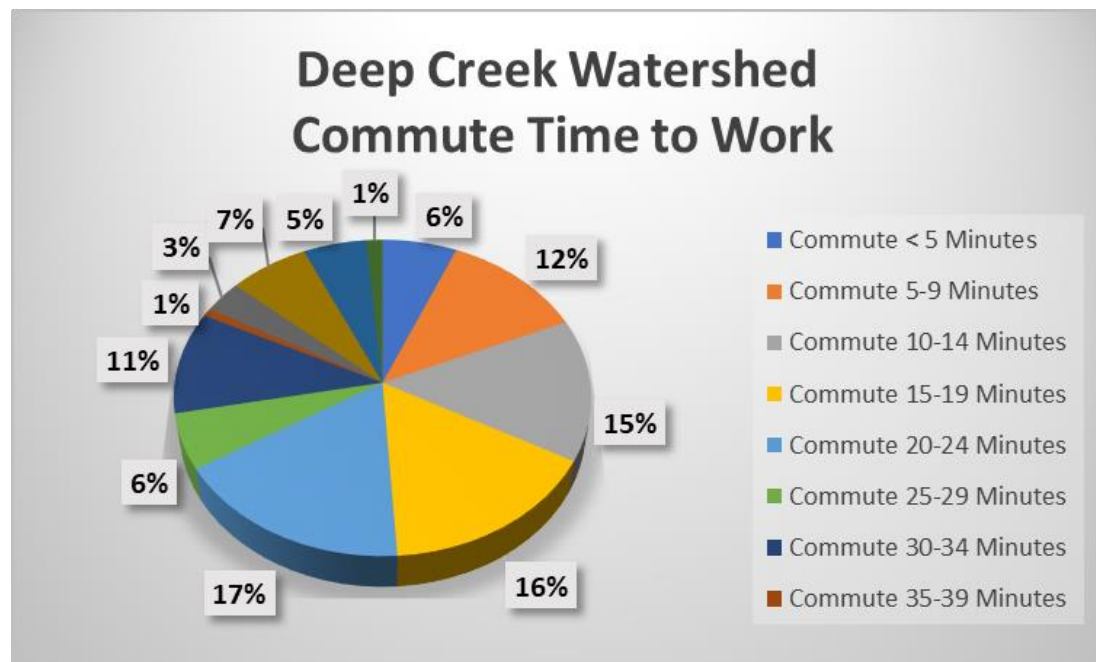
The Deep Creek Lake area grew slowly and steadily in both population and housing between the 1940s and 1970s. Rapid change began in the 1980’s with the completion of Interstate 68. It ended the area’s isolation from a largely Pittsburgh area-oriented resort destination to visitors and investors from Washington, DC, and Baltimore, Maryland. The Code of Maryland mandates that the “highest” use of the lake is for recreational purposes, with protection of natural resources and ecological balance also a primary concern. To that end, the lake is primarily managed to maintain the lake level for an array of recreational opportunities while continuing to provide water for power generation. Garrett County also adopted a Deep Creek Lake watershed zoning ordinance in June, 2010 to provide for land use regulations. (EcoCheck Baseline Assessment April, 2011)

McHenry and Thayerville are the two largest towns within the lake area. McHenry is located northeast from the dam at the top of Marsh Cove and includes the Wisp Ski Resort and county fairgrounds. Thayerville is defined as the development that lines Route 219 between the bridge over the lake and Mayhew Inn Road.

A large proportion of land area is used for agriculture in southern areas of the watershed. The Basin contains 62% forest, 13% urban, 16% agriculture land and 9% is water. (Biological Stressor ID Analysis, 2012)

Employment

Within the Deep Creek region, of the total population approximately 6,971 individuals are in the workforce. Of those individuals, 80.8% work in the state and county in which they reside. Of the remaining individuals, 5.8% work within the state of their residence but outside the county and 13.4% work outside the state of their residence.



The majority of the workforce, 72%, has a commute under 30 minutes with 33% percent spending 15 minutes or less. Approximately 9.5% work from home. Please note this data was based on data submitted in 2020 and the start of the Coronavirus pandemic. This was a changing time in our workforce, with many companies modifying schedules and employees' abilities enhancing working from home opportunities.

The top five employment industries within the Deep Creek Management Unit include:

1. Construction – 15.1%
2. Healthcare/Social Assistance – 14.8%
3. Educational Services – 9.4%
4. Accommodations/Food Service – 8.5%
5. Retail Trade – 7.2%

Utilities and Infrastructure

Public utilities vary in their availability, coverage, and reliability within the entire Youghiogheny Watershed. Broadband internet, cell phone service, sewage and drinking water systems that serve the public and their residential and commercial needs, electricity, and natural gas are all examples of utilities that exist in some portion of the Youghiogheny Watershed. Areas with elevated population density and areas that have increased tourism use are often better equipped than nearby rural areas.

Public Sewage

Public Sewer Systems are situated throughout the watershed and some systems may transfer water that originates in one watershed to another. Developed areas on the northern portion of the lake have sewer collection systems, whereas most developed areas on the southern side of the lake use septic systems.

Drinking Water

There are many drinking water systems throughout the watershed. Similar to sewage system infrastructure, the service areas often extend outside of the Youghiogheny River Watershed. There are 13 drinking water systems operated by the Garrett County, MD Public Works Department.

Internet Services

Internet service is available through DSL or Fiber optic in many parts of the watershed. There are still areas that do not have reliable access. Many internet utilities in the area were expanding their systems during the pandemic due to the increase in demand from business and homeowners.

Natural Gas

Natural gas is available through direct service lines and storage tanks at individual points of use. Service through direct service lines is non-existent in the rural areas. There are many different companies who offer delivery to businesses or homes. Additionally, many offer tank rentals and service contracts.

Education

Maryland operates on a county-wide school district. There is one school district in the Deep Creek Management Unit—Garrett County School District.

LAND RESOURCES

Geology

Deep Creek is located within the Appalachian Plateaus Physiographic Province of Maryland. The three major geologic structures are the Casselman Basin syncline, the Deer Park anticline, and the Accident anticline. The Casselman Basin syncline is oriented to create the northern part of the region. While the Deer Park anticline is located at the southern border of the region and extends to the southern end of the Accident anticline.

The bedrock of the ridges varies from Mauch Chunk, Pottsville, and Pocono which is an aquifer with many springs and wells. Sections of the Allegheny and Pottsville Formations are mapped as a single unit in Garrett County (Amsden). These bedrock strata formed between the Devonian, Mississippian, and Pennsylvanian periods, ranging from 280 to 400 million years ago (Smith, 1998; Wagner and Coxe, 2000).

Soil Characteristics

Soil is a record of the geological climatic history of the region (Blumberg, et. al, 1982). The physical landscape depicts how the land is used; the soil type and conditions influence the determination of these land uses. For example, mining only occurs in areas where coal and limestone deposits exist. In Maryland, the soil is influenced by weathering, vegetation, climate, and time. Sedimentary rocks, such as shale, sandstone, and limestone, are prevalent in the Youghiogheny Watershed and subsequently along Deep Creek in Maryland.

The development of soil relies on several factors: climate, plant and animal organisms, parent material, time, and differences in elevation. Soils with similar characteristics, such as horizons, thickness, and arrangement, are identified as soil series. The influence of each factor of the soil varies, creating the diversity of soil series, both locally and regionally. These series are commonly named after towns or geological features where they were first discovered and mapped. They can differ in texture of the surface soil, slope, and stoniness, among other characteristics. These differences divide the soil series into phases, and the phases are a feature that can be used to determine management practices. It is important to note that there can be several phases within a soil series that can exist.

Individual soils have different characteristics that affect their behavior and may limit some uses. For example, soils with seasonally high-water tables are not ideal for farming as they frequently experience flooding. Therefore, the type of soil determines the use of the land.

Soil Associations

Soil associations are two or three major soil types, and a few minor soil types, grouped together. They are landscapes with distinct, proportional patterns of soils. Individual soils can occur in more than one soil association, just in different proportions or patterns. Garrett County in Maryland has six soil associations. Of these, four are along Deep Creek. These associations are important, especially to the public, to provide basic information about soil and to provide a general guide for watershed management.

- **Calvin-Gilpin**

Description- Gently sloping to steep, moderately deep, well-drained soils; formed over acid, red to gray shale, and sandstone.

Location- Extends from near McHenry north-northeastward on both sides of U. S. Highway 219 to the Pennsylvania line. It also extends from near New Germany northeastward to the Pennsylvania line. The last one extends from near North Glade southwestward through Oakland to the West Virginia line.

Land Use- Generally supports the most intensive farming in the county. Mainly row crops are alternated with strips of hay or close-growing crops. Many of the farms specialize in producing milk, beef, or other animal products.

Limitations- The depth of bedrock is only a moderate limitation for basement excavations. The slope and the depth to bedrock is a severe

limitation for sewage disposal by septic tanks, and other means of disposal may be required in many places.

- **Lickdale-Armagh-Peat**

Description- Nearly level to gently sloping, deep, poorly drained, and very poorly drained soils; formed over acid clay shale to hard sandstone.

Location- Occupies one area in the central part of the county. Mostly level but there are gentle slopes in places. The area is a shallow headwaters basin that is primarily drained by Cherry Creek but is drained in part by the North Branch of Casselman River.

Land Use- Small acreage of the area is cultivated because of the natural drainage problems.

Limitations- Severe limitations for building sites and for sewage disposal by septic tanks, primarily because of long periods of wetness. Peat is not satisfactory for building foundations because it is poor at bearing strength and shrinks and subsides when drained.

- **Dekalb-Calvin-Gilpin**

Description- Gently sloping to steep, moderately deep, well-drained, very stony soils; formed over acid, red to gray sandstone, and shale.

Location- Located in the greater part of the Savage River Watershed in the east-central and northeastern part of the county, on the western slopes of Backbone Mountain, and the area between Red Run Cove and Gap Run in the west-central part of the county.

Land Use- Forage crops, and pastures, but most of it is used for woodland, wildlife habitat, watershed protection, and some kinds of outdoor recreation.

Limitations- Large boulders and some outcroppings of hard rock. The area is not used for cultivated crops.

- **Dekalb-Gilpin-Cookport**

Description- Gently sloping to steep, moderately deep, well-drained and moderately well-drained, very stony soils; formed over acid, gray to yellowish sandstone, and shale.

Location- The area consists primarily of the eastern slopes of Backbone Mountain and Big Savage Mountain along the entire eastern part of the county. The other area is irregular and extends over many parts of the county west of Hoop Pole Ridge and Meadow Mountain.

Land Use- Small areas have been used for forage crops and pasture, but generally the association is used for woodland, wildlife habitat, watershed protection, and outdoor recreation.

Limitation- This area is not used for cultivated crops.

Prime Agricultural Soils

Prime farmland is defined by the U.S. Department of Agriculture as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It can be cultivated land, pastureland, or forestland, but cannot be urban or built-up land or water areas. Prime farmland has a dependable supply of moisture, a favorable growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, few or no rocks, and is not excessively erodible or saturated with water for long periods. The slope is mainly between 0 and 6 percent. Prime farmland is of major importance in meeting the Nation's short and long-range needs for food and fiber, and should be used wisely.

There are 5 different prime agricultural soils within Garrett County (Natural Resources Conservation Service).

Land Protection

Agricultural Preservation

The Protected Agricultural Lands Database lists multiple properties located in Deep Creek Watershed. There are six properties completely in Deep Creek Watershed, totaling 1,069.6 acres. There is one other property which is partially located in Deep Creek and partially outside of the Youghiogheny River Watershed, totaling 284.8 acres. The properties are all listed as easements by Maryland Agricultural Land Preservation Foundation (MALPF) Easements. The mission of MALPF is to preserve production farmland and woodland for the continued production of food and fiber for all of Maryland's citizens, curb the expansion of random urban development, help curb the spread of urban blight and deterioration, protect agricultural land and woodland as open space and to protect wildlife habitat and enhance the environmental quality of the Chesapeake Bay and its tributaries (Maryland Department of Agriculture)

Conservation Lands

Deep Creek Watershed has one recorded conservation easement according to the PAD-US Geodatabase. The property is partially located in Deep Creek and partially located in the Upper Casselman River Watershed, totaling 593 acres. (PAD_StateLands).

Land Use

Deep Creek Watershed, due to the reservoir, is nearly 10% open water. The highest percentage out of the Yough subwatersheds. Deep Creek also had the highest percentage of developed open space and highest percentage of woody wetlands. Nearly half of Deep Creek is covered in deciduous forests. See Table 2-4 for a breakdown of land uses in the watershed.

Ownership

For this plan, properties are categorized as private property, public lands or state lands.

Private property refers to the ownership of property by private parties - essentially anyone or anything other than the government. Public lands are any lands and interests in lands owned by the United States (U.S.) (Cornell Law School). State lands are properties owned by a U.S. state which provide opportunities for enjoying healthful outdoor recreation and serve as outdoor classrooms for environmental education (DCNR).

The majority of Deep Creek watershed is privately owned. There are not any properties listed as public according to *Public Lands*. There are two properties listed as State Lands. The first property is the Deep Creek Lake Natural Resource Management Area, totaling 4,955.05 acres. The second State Lands property is the Deep Creek Lake State Park, totaling 1,377.1 acres (PAD_StateLands).

TABLE 2-4. LAND USE IN DEEP CREEK

Total Acres	Percent	Land Cover Class
3,790	9.7%	Open Water
2,948	7.5%	Developed, Open Space
420	1.1%	Developed, Low Intensity
264	0.7%	Developed, Medium Intensity
59	0.2%	Developed, High Intensity
95	0.2%	Barren Land
18,377	47.0%	Deciduous Forest
611	1.6%	Evergreen Forest
3,730	9.5%	Mixed Forest
240	0.6%	Shrub/Scrub
538	1.4%	Herbaceous
5,257	13.4%	Hay/Pasture
390	1.0%	Cultivated Crops
1,518	3.9%	Woody Wetlands
898	2.3%	Emergent Herbaceous Wetlands

Source: U.S. Census Bureau, 2023

Critical Areas

Erosion & Sedimentation

Erosion is a natural process where rocks and soil are removed from one location and deposited in another. This process is often aided by human influences, such as vegetation removal along streambanks. With a lack of vegetation along streambanks and steep slopes, loose soil particles become dislodged and can be washed into streams during periods of precipitation. They are carried by the water and will eventually deposit somewhere downstream. The process of sedimentation will potentially change the stream channel's path. This is apparent throughout the Indian Creek Watershed where soil particles have formed islands or point bars. Over time these particles play havoc to the stream habitat needed for many biological species, such as macroinvertebrates. Sediment not only changes the suitable habitat; it impacts the food source for these species along with the physical and chemical properties of the stream. Sediment in the water can even change the water temperature, heating up a cold-water stream. More information about erosion and sedimentation is located in the section on Water Resources.

Fish & Wildlife Habitat

- **Riparian Corridors**, the vegetative areas adjacent to streams, are important to the health of the watershed, providing important habitat that impacts both aquatic life and terrestrial wildlife. By providing shade to the streams, riparian corridors allow streams to maintain cool temperatures that support trout populations and more importantly the macroinvertebrates that serve as the food source for the trout. The plants and shrubs that naturally grow along streambanks also provide adequate shelter for some terrestrial wildlife. More information about the benefits of riparian corridors is located in the Water Resources section.
- **Floodplains** are natural areas of low-lying ground next to some stream segments that increase the stream's capacity to move water during periods of high flows. These areas tend to have vegetation that is water tolerant and good for absorbing and filtering the stream's excess flow. Floodplains exist for a purpose and that is to provide the excess water a place to go, to decelerate the speed at which it flows, and alleviate potential flooding downstream. More information about Floodplains is located in the section on Water Resources.
- **Wetlands** are areas of land that for at least part of the year are covered with water, maintain a dominance of water loving plants, and have soils that are hydric or wet in nature. Wetlands are essential as they are sites of groundwater recharge; they are also excellent filtering agents and are essential in flood prevention. More information about Wetlands is located in the Water Resources section.

Hazardous Areas

Active Coal Mine Sites

Currently, no active coal mines are in operation in the Deep Creek Watershed, underground or surface mines included.

Coal mining has occurred for many years throughout Western Maryland and Northern West Virginia. Deep Creek was avoided due to interests in recreation at the lake. Cherry Creek is an eight-mile tributary of Deep Creek and was the location for the first abandoned mine drainage treatment (AMD) system in Maryland using the Abandoned Mine Lands (AML) fund.

Non-Coal Mining

Mineral mines or quarries are industrial mines where operators are removing rocks like limestone and shale that are later crushed down into various sizes for construction activities.

Often the impacts of quarries are similar to those of coal mining: Water quality degradation, increased truck traffic and air pollution. Damage to homes during blasting can occur. Because rocks, and soil are removed, the topography of the site changes which could lead to a change in natural drainage patterns. The aesthetics of the remaining product scars the landscape and takes years before new trees begin to grow and heal the landscape.

Within the Deep Creek Watershed, one Non-Coal Mining site exists, the Thayerlerville Quarry off of 210 in Deep Creek.

Oil and Gas

Natural gas has been extracted from the Youghiogheny Watershed for nearly 150 years. Overtime, extracting these resources has been done one of two ways—either by conventional or unconventional drilling. Conventional drilling is the most common method. Small conventional well sites are common throughout the entirety of Appalachia.

Unconventional or hydraulic fracturing is currently banned in Maryland. West Virginia and Pennsylvania have an extensive fracking history and it is currently allowed in both states.

There are four conventional oil and gas operations in the Deep Creek Watershed and zero unconventional projects.

Landfills and Illegal Dumpsites

Although no permitted landfills exist within the Deep Creek Watershed the area is not immune to trash disposal. Some people, in lieu of trash pickup, opt for burning or burying their trash, and others just dispose of it along back roads in illegal dump sites.

Trash pickup within the watershed is not mandatory, and there are costs associated with having weekly trash pickup. Garrett County, MD does operate a landfill and several transfer stations available to all Garrett County residents.

Illegal dumpsites along the roadside are not only unsightly but can have environmental, health and safety, and economic impacts that are hazardous to the area. Environmentally, these dumpsites can pollute the soil, air, and water. Chemicals may leach out into soil, into the water table, and into the streams. If burned, the chemicals in plastics and other items can be released into the air and are toxic to breathe for any one downwind. Illegal dumpsites also pose health and safety issues, especially to children who may play near the dumpsites. Economically, property values can decrease, property owners can be held liable, and the cost of cleanup can be expensive. Items disposed of at these orphan dumps vary from site to site but typically can contain furniture, household trash, tires,

electronics, vehicle parts, paint and other chemicals. There are no documented illegal dumpsites within the Deep Creek Watershed, although this does not mean they are not present.

Waste Sites

Waste sites are categorized by two programs: The Resource Conservation Recovery Act (RCRA) and Comprehensive Environmental Response Compensation and Liability Act (CERCLA). The major difference between these two programs is that RCRA regulations are for waste facilities that are currently active in operation where CERCLA manages the remediation of abandoned and inactive facilities.

- RCRA is federal legislation that was passed in 1976 that oversees solid waste from “cradle to grave” or origination to disposal (U.S. Environmental Protection Agency). Regulations are in place to manage generation, transportation, treatment, storage, and disposal. The waste can be in either solid, liquid or a gaseous state. Under the legislation the waste is divided into two categories: Subtitle C – Hazardous waste and Subtitle D - Non-Hazardous waste. Although underground storage tanks are managed as a non-hazardous waste, we have pulled them aside to give it the attention they need.
 - Hazardous Waste is managed by the United States Environmental Protection Agency (U.S. EPA) although they may authorize state agencies to implement key provisions of the hazardous waste requirements. A hazardous waste is any waste that is ignitable, corrosive, reactive, or toxic. No RCRA sites exist within the Deep Creek Watershed; however, data is not readily available. More information about the specific sites is located in Appendix E.
 - Non-Hazardous Waste is managed by states, however, the Environmental Protection Agency set minimum standards for how facilities should be designated and operated. This includes the issuance of permits that ensure compliance and federal criteria for municipal and industrial waste landfills. The practice of open dumping is banned. Individual states may implement more stringent requirements.
 - Underground storage tanks are also regulated as a Non-Hazardous Waste. In order to be classified as an underground storage tank, the tank, combination of tanks and piping must have at least 10 percent of its combined volume underground. Underground means below the surface surrounded by soil. A fuel tank in a person’s basement is not considered an underground storage tank. In Pennsylvania, storage tanks must be registered

annually and a valid operating permit is required before operations can start. Within the Deep Creek Watershed there are currently seven active underground storage tanks at seven locations. The tanks in the watershed hold gasoline or diesel. There are 13 closed sites.

- The Comprehensive Environmental Response Compensation Liability Act (CERCLA), more familiarly known as Superfund, investigates and cleans up sites contaminated with hazardous substances. The United States Environmental Protection (US EPA) agency was granted responsibility for overseeing cleanup activities at uncontrolled or abandoned waste sites as well as accidents, spills, or other emergency releases of pollutants and contaminants. When responsible parties can be identified, their participation can be assured through orders, consent decrees or small party settlements. Costs are also recovered from financially viable individuals or companies upon completion of the cleanup action. When a responsible party cannot be identified the US EPA ultimately cleans up the site.

Across the country more than 40,000 Superfund sites exist. The worst of these sites requiring long-term remediation are put onto a list known as the National Priorities List. No National Priority List or active Superfund sites exist in Deep Creek Watershed.

Brownfields

Brownfields are defined as any previously developed property that has been contaminated by hazardous waste and identified by the United States Environmental Protection Agency as a candidate for cleanup. These sites possess a risk to human health and or the environment. Expansion, redevelopment or reuse of the land may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. No land restoration projects exist within the Deep Creek Watershed.

Landslides

“Landslides are a natural geological process involving the movement of earth materials down a slope” (Delano & Wilshusen, 2001). Because of the damage that can occur to buildings, roadways, etc., they are deemed a significant geological hazard. The extent of damage from landslides does vary depending on location, the amount of earth that is moved, the speed at which it moves, and any influences by humans.

A landslide occurs naturally when land, including rocks, soils, earth, and soil slip or move. This typically occurs due to certain geological features and gravity. It is also aided by heavy periods of precipitation that saturates the soil and by human influences. Human influences, such as construction activities, modify the slope leaving some areas susceptible to landslides.

The Youghiogheny Watershed is highly susceptible to landslides. Over the past few years, the Pittsburgh area has had hillsides come down, taking out houses and roads. The hillsides above Yough Lake along Route 40 had a massive movement and closed the main transportation route for several weeks.

Sinkholes/Mine Subsidence

“Sinkholes are a subsidence feature that can form rapidly and is characterized by a distinct break in the land surface and downward movement of surface materials into the resulting hole or cavity” (Kochanov 2015). Although sinkholes can occur naturally it is more prevalent in central and eastern portions of Pennsylvania where carbonate bedrock exists

That does not mean the Youghiogheny Watershed is immune. Human influences such as underground mining, installation of utilities underground, or excessive pumping of groundwater can also cause subsidence leading to the development of sinkholes. Technically, when subsidence is caused by mine drainage, it is termed mine subsidence rather than a sinkhole.

WATER RESOURCES

The Youghiogheny River Watershed is the only watershed in Maryland that flows into the Gulf of Mexico. Its northerly flow also makes it quite unique. The watershed has a gauntlet of conditions including pristine trout waters to acid laden streams. Farming and agriculture continue to affect its waters as well as failing sewage and septic systems. However, the overall pristine nature of this watershed along with its high elevations have become a mecca for outdoor recreation. With miles of trout streams, lakes for boating, hike/bike trails, waterfalls, white water rafting, the Youghiogheny River and its tributaries are a very special place.

According to the stream assessment completed in 2000, the water quality varies from poor to excellent with most stream and river segments rated as good. Some of the problems include, lack of riparian buffers, high bacteria levels associated with raw sewage discharges, nutrients, suspended sediments and low pH due to acid mine drainage from abandoned mines. Atmospheric deposition (acid rain) is also a problem in some parts of the basin due to naturally low buffering capacity. The Maryland Department of the Environment has listed Deep Creek Watersheds and its tributaries as impaired.

Water Quality

Water Quality Standards are the foundation for water-quality-based control programs mandated by the Clean Water Act. These standards form the legal basis for controls on the amount of pollution entering waters from sources such as industrial facilities, wastewater treatment plants and storm sewers. Standards are also the technical basis for reducing runoff from rural and urban areas. A standard can consist of either numeric or narrative limits for a specific physical or chemical parameter. When a stream or lake is not meeting adopted water quality standards, the assessment may lead to a determination of impairment, initiating further action such as a Total Maximum Daily Load limit (TMDL) or

other regulatory procedures. These rules spelled out the “designated uses” for the waterways. The designated uses are Aquatic Life and Human Health with various subcategories such as contact recreation. If these designated uses were not being attained in a particular waterway, then the stream was deemed to be impaired.

Pennsylvania and Maryland are required to develop a Management Plan and track their pollution and reduction efforts. Point source pollution (out of a pipe) and non-point source pollution (NPS) are monitored in order to comply with the Federal Clean Water Act. Point Source pollution is mostly readily available to sample and determine whether there is a problem. Non-point source pollution is a little tougher to assess. It originates from many sources, such as: abandoned mine drainage, agriculture, silviculture, urban/rural and industrial run-off, lack of sewage systems or failing septic systems, and atmospheric deposition.

Both states are required to send an Integrated Water Quality Monitoring and Assessment Report to the US Environmental Protection that lists the level of attainment of designated uses of the streams. Also known as the Integrated List, it lists those waters that are impaired and describes both the source and cause of the impairment. The Integrated List also reports on restoration efforts and numbers of streams delisted from impairment.

Current Conditions

According to the 2009 Maryland Deep Creek Lake Water Monitoring Program Report, the status of the lake is healthy overall. It is typical of moderately-sized deep reservoirs in temperate areas, exhibiting seasonal patterns in many parameters including dissolved oxygen, pH, temperature and water clarity. Seasonal temperature stratification is strong in summer and relatively weak in winter. Water quality parameters generally do not exceed state standards.

However, dissolved oxygen levels fall below standards in deeper waters during the summer, but that is not unusual for a thermally stratified lake system. Similarly, water temperature sometimes exceeds the standard usually in shallow waters. The lake is considered mesotrophic (moderately affected by nutrient inputs in excess of natural rates for freshwater lakes) but this is considered expected for this type of lake (EcoCheck Baseline Assessment 2011).

In general, the lake appeared to be safe for swimming from a bacterial indicator perspective. Bacteria scores were good in the southern lake region and very good in the mid-lake and McHenry regions. Based on all available water quality during the 2009 assessment, some issues remained that should be investigated, such as: erosion along shoreline, sedimentation in lake headwater areas, potentially harmful algae blooms.

In a Maryland Department of Natural Resources 2010 lake monitoring program, the results showed that nitrogen and phosphorous are average for lake sediments; most of the carbon measured in lake sediments is from algae production; sulfur is high in

some sediments and may contribute to the release of phosphorus from sediments which then increase biologic productivity and concentration and enrichment of most metals are within normal range for Garrett County.

Point Source

For discharges from a point source (basically a pipe), a National Pollutant Discharge Elimination System (NPDES) permit is required. Maryland issues the majority of NPDES permits for sewage, industrial waste, stormwater, concentrated animal feeding operations and biosolids.

Four permits have been issued. The final one, Garrett County Sanitary District, is a combination of nine towns. The discharged water is split into several watersheds: North Branch of the Potomac, Little Youghiogheny River, Deep Creek Lake and main stem of the Youghiogheny River.

TABLE 2-5. NPDES PERMITS IN DEEP CREEK WATERSHED

Permit Number	Facility Name	Date Issued	Date Expires	Type
MDR001425	Bills Marine Service	6/1/2022	12/31/2026	Non-POTW
MDG679540	Deep Creek Lake State Park	10/30/2020	7/31/2025	Water Supply
MDO054348	Deep Creek Lake WWTP	2/1/2021	1/31/2026	Sewage
MDG679674	Garrett Co Sanitary District	2/3/2022	7/31/2025	General Permit

Source: US EPA How's My Waterway

Nonpoint Source (NPS)

Non-point source pollution originates from many sources: abandoned mine drainage, agriculture, silviculture, urban/rural/industrial run-off, failing septic systems, and atmospheric deposition. Several tools are available in order to help assess and restore impaired streams.

Watershed Implementation Plans (WIP) are developed and funding from the Federal Clean Water Act Section 319 Program is used to implement restoration projects. Another tool used to reduce nonpoint pollution is to develop a TMDL (Total Maximum Daily Loads) for a particular watershed. A TMDL is the amount of pollutant loading that a waterbody can assimilate and meet our water quality standards. If a TMDL or a WIP is not needed, then a Water Quality Assessment is a final tool that a state could use to address the impaired stream and restore it. All of the planning tools/assessments must be approved by the US Environmental Protection Agency.

According to Maryland's 2021 Integrated Report all of the streams entering Deep Creek Lake are not meeting their Designated Use for Aquatic Life. They are impaired from TSS (total suspended solids), specifically nitrogen and phosphorus from post development erosion or sulfates (present in sediment) from urban runoff and storm

sewers. The sub-watershed of Cherry Creek is impaired by low pH and low acid neutralizing capacity. It is possible that sampling locations near wetlands, bogs and seeps associated with flat terrain in the watershed could explain some of the low pH and high sulfate concentrations. A TMDL for pH was developed and approved by the US EPA in 2003. The state built an abandoned mine treatment system and a lime doser in the Cherry Creek Watershed that has been working and water quality has improved. (Source: Maryland Biological Stressor ID Analysis, 2012)

The lake is not attaining its Designated Use for Aquatic Life, specifically fish and shellfish, due to mercury contamination from atmospheric deposition. There are currently fish consumption orders issued to limit the number of fish consumed in a month. A TMDL for mercury in Deep Creek Lake was developed and approved by the US EPA. Instead of TMDLs, water quality assessments were conducted and approved by the US EPA; one for nutrients (phosphorus) and one for biological stressors, targeting sediment, specifically TSS, nitrogen and phosphorus. It was decided to add phosphorus to the biological assessment with nitrogen for a basin-wide study and delist the specific Deep Creek Lake TMDL for phosphorus in 2011.

TABLE 2-6 IMPAIRED STREAMS IN THE DEEP CREEK WATERSHED

Stream	Source of Impairment	Type of Impairment	TMDL or Water Quality Assessment (WQA)
Youghiogheny River Basin-wide	Unknown	Nitrogen, Phosphorus	WQA Biological Stressor Identification, 2014
Deep Creek Lake	Atmospheric Deposition	Mercury	TMDL, 2004 revised 2012
Deep Creek Lake	Runoff/Storm Sewers	Phosphorus	WQA, 2011
Tributary, Cherry Creek	Unknown	Fecal Bacteria	TMDL, 2009
Youghiogheny River Basin-wide	Runoff/Animal Grazing	Sediment	TMDL, 2007
Tributary, Cherry Creek	Abandoned Mine Drainage	low pH	TMDL, 2003

Source: Maryland DOE List of TMDL and WQAs

Source Water Assessment and Protection Plans (SWPs)

As a result of the 1996 Amendments to the Safe Drinking Water Act, Maryland Department of the Environment initiated a program to assess the vulnerability to contamination of all public drinking water sources. The effort encompasses both large and small water systems. Water can be pulled from many different groundwater aquifers, springs or even surface flow from a river or stream. Within the Deep Creek Watershed there are two Source Water Assessment and Protection plans. However, there was some ambiguity as to how many wells are actually being used. An update in 2013 for the McHenry Water System included the Wisp Resort wells and the Deep Creek Lake Village wells. There is no plan listed for the Village Wells. In addition, there is no information as to whether there are other residential developments on their own system or whether the McHenry Water System supplies water to all residents and businesses within the Deep Creek Lake area.

TABLE 2-7. SOURCE WATER ASSESSMENT AND PROTECTION PLANS IN DEEP CREEK

Number	Name	Type
1111096	McHenry Water System	7 wells
1110016	Wisp Resort	3 wells

Source: Maryland DOE Source Water Program

Lakes

Deep Creek Lake is the largest freshwater reservoir completely within the Maryland borders. It was man made in 1925 by impounding Deep Creek to provide a water source for a nearby hydroelectric generation station. Part of the water allocation permit allows whitewater releases from the dam but is dependent on existing lake levels and energy needs. The state of Maryland purchased the lake property in 2000 and is managed by the Maryland Department of Natural Resources as Deep Creek Lake State Park.

The lake is located just west of the Allegheny Front on a large plateau known as the Tablelands or Allegany Highlands. It lies west of the Eastern Continental Divide and within the Mississippi River watershed. At full pool, the lake has 65 miles of shoreline, a surface area of 3,900 acres with a storage volume of approximately 106,000 acre-ft at the 2,462-elevation level. The lake's drainage is 64.7 square miles. Currently the water withdrawal from the lake is permitted for the Deep Creek power station and other limited purposes. (Deep Creek Lake State Park website).

The lake has a maximum depth of 75 feet and an average depth of 25 feet. The lake's watershed covers approximately 180,000 acres and is fed by four major tributaries and over 50 smaller streams. According to the current Maryland Integrated Report, all of the streams are classified as III-P (High Quality – Non-Tidal Coldwater and Public Water Supply).

Water Quantity and Temperature Change

Temperatures in Maryland have risen about 2.5°F since the beginning of the 20th century. Historically unprecedented warming is projected during this century. Heat waves are projected to be more intense, while cold waves are projected to be less intense. Precipitation is projected to increase, particularly in the winter and spring. The frequency and intensity of extreme precipitation events are also projected to increase, which could increase the risk of flooding. Maryland has a west-to-east contract in temperature. Larger seasonal variations occur in the highlands west in the Appalachian Mountains. (*NOAA State Climate Summaries 2022 for Maryland and the District of Columbia*)

Water Quantity issues could become a factor in the Deep Creek Lake area due to continued growth and pressure on the water resources. Lack of strict source water protection areas that include wellhead protection areas and protection of groundwater recharge areas could allow harmful pollutants to enter the groundwater wells or aquifers to diminish in size that are currently being used for water supply. In addition, out of basin transfers of waste water should also be evaluated because this is water that should go back into the watershed where it was withdrawn.

Important Components of Watershed Health

Wetlands

Wetlands are areas of land that, for at least part of the year, are covered with water. They also maintain / water loving plants and have soils that are hydric or wet in nature. Wetlands are essential because they are sites of groundwater recharge; they are excellent filtering agents and are essential in flood prevention.

Wetlands are broken down and classified into systems. Within the Youghiogheny Headwaters, wetlands are Palustrine, Riverine, or Lacustrine. Palustrine wetlands are in non-tidal areas that are dominated by trees, shrubs, persistent emergent, and emergent mosses or lichens (National Wetlands Inventory, 2019). According to the National Wetland Inventory, the Youghiogheny Headwaters have 3,767 acres of Palustrine wetlands. Most of these wetlands are scrub-shrub (1,455 acres), forested (1,240 acres), and emergent (844 acres). Scrub-shrub wetlands include areas that are dominated by woody vegetation less than 20 ft tall. Forested wetlands are characterized by woody vegetation that is 20 ft tall or taller. Finally, emergent wetlands consist of perennial plants, excluding mosses and lichens, that are the tallest lifeform with at least 30% areal coverage.

The Youghiogheny Headwaters also contain 613 acres of Riverine wetlands. Riverine wetlands contain deep water habitats that are contained within a channel (National Wetlands Inventory, 2019). These channels are open conduits that are created naturally or artificially, and they periodically or continuously contain flowing water. Additionally, these conduits provide a link between two bodies of water (National Wetlands Inventory, 2019).

Other than Palustrine and Riverine wetlands, Lacustrine wetlands make up for 348 acres of the Youghiogheny Headwaters. Lacustrine systems include wetlands and deepwater habitats within a topographic depression or a dammed river channel, lacking trees, shrubs, persistent emergents, and emergent mosses or lichens with 30 percent or greater coverage, and total an area of at least 20 acres (National Wetlands Inventory, 2019).

Floodplains

Floodplains are another important component to watershed health. These are natural areas of low-lying ground next to stream segments that increase the stream's capacity to move water during periods of high flow. These areas tend to have vegetation that is water tolerant and that are good for absorbing and filtering the stream's excess flow. Floodplains exist for a purpose, and that is to provide the excess water a place to go, to decelerate the speed at which it flows, and to alleviate potential flooding downstream.

Flood areas were Calculated from the National Flood Hazard Layer provided by FEMA (FEMA, 2021) and land cover data (MRLC, 2019) was used to determine if the area was developed, natural, or farmland. The Youghiogheny Headwaters has a total of 3,094 acres of floodplains. Of that 3,094 acres, 222 acres are developed, and 343 acres are farmland. The remaining 2,529 acres are natural. It is critical that these areas remain undeveloped. Development in floodplains and riparian corridors decreases the safety net they provide and can result in flooding downstream. Cutting down trees, mowing riparian buffers, and development in floodplains is done at our peril. Communities that have participated in these activities often wonder why they are now experiencing flooding and bank erosion.

Riparian Corridors

The 2,529 acres of natural floodplain areas are considered riparian corridors. Riparian Corridors are vegetated areas of land adjacent to streams. They too play an important role in stream health. They are the interface between terrestrial and aquatic ecosystems (Oates, 2000). The wider the buffer, the more effective it functions. Riparian vegetation typically includes trees, shrubs, and grasses that depend on wet environments to survive. Buffers provide many benefits to area streams including: reduction of water temperature; pollution, sediment, and nutrient trapping; channel stability; flood control; providing habitat; economic value; and recreational and aesthetic values. It is critical that these areas remain undeveloped.

Water Quality Monitoring

Socio-economic activities, urbanization, industrial operations, and agricultural production influence the environment and have increased dramatically during the past few decades, affecting freshwater environments (UNEP and WHO, 1996). These human-induced impacts have created a pressing need for comprehensive and accurate assessments of trends in water quality, to raise awareness of the need to address the consequences of present and

future threats of contamination and to provide a basis for action at all levels. Reliable monitoring data is the essential basis for such assessments. Monitoring is important as it provides information that permits rational decisions to be made on: describing water resources and identifying actual and emerging problems of water pollution; formulating plans and setting priorities for water quality management; developing and implementing water quality management programs; and evaluating the effectiveness of management actions.

Chemical Water Monitoring

Chemical water monitoring is the sampling and analysis of water constituents and conditions (EPA, 2009). These may include introduced pollutants, such as pesticides, metals, and oil; constituents found naturally in water that can nevertheless be affected by human sources, such as dissolved oxygen, and nutrients. Maryland Department of Natural Resources has been monitoring water quality at Deep Creek Lake through the program Eyes on Deep Creek (<https://eyesonthebay.dnr.maryland.gov/dcl/DeepCreekLake.cfm>). Sampling Began in 2009 for Cove Sampling and Mainstem Lake Monitoring. Cove sampling occurs monthly while mainstem lake monitoring occurs March through December. Figure 2-1 shows the Cove and Lake (Mainstem) sites throughout Deep Creek Lake (Maryland Department of Natural Resources, 2016). All sampling information can be found at <https://eyesonthebay.dnr.maryland.gov/dcl/DeepCreekLakeInfo.cfm>.



Figure 2-1. Deep Creek Lake Water Quality Monitoring Locations.

Biological Sampling

Biological sampling is an evaluation of the condition of a waterbody by sampling species that spend all or part of their lives in that waterbody. Sampling is conducted to gather a representative sample of the biological community located in the waterbody (USEPA, 2011). For each site sampled specific attributes, known as biological indicators, are compared to the conditions expected for that indicator based on reference sites. Biological indicators may include fish, benthic macroinvertebrates, algae, amphibians, aquatic plants, and birds. Data collected at reference sites provide a benchmark for assessing the biological condition of surveyed sites. Metrics are quantitative measures of biological indicators and can provide information on both the present and past effects of anthropogenic stress on aquatic systems. Physical and chemical changes in freshwaters can produce diverse biological effects ranging from severe, such as a total fish kill, to subtle, such as changes in enzyme levels or sub-cellular components of organisms. These sorts of changes can indicate that the ecosystem is under stress and that it has become unbalanced. As a result, there could be possible implications for the intended uses of the water and even risks to human health. Biological sampling is important as it provides a baseline to help ensure that the quality of waters and their associated aquatic life uses are protected and maintained. From 2000 to 2012, multiple programs conducted biological monitoring programs for the Deep Creek Watershed (MD Department of the Environment, 2012).

Bacteria Sampling

Bacteria present in water is one of the most important water quality issues worldwide, specifically to sources of drinking-water and water used for swimming recreation. What exactly is being tested for through swimmable waters? Testing can also be conducted to monitor compliance of NPDES permit discharges for fecal coliform. This is necessary as there are known facilities that consistently exceed their permitted discharges in the watershed. Any summer swimmable waters that are popular in the watershed need to be tested for *E. coli* for the protection of the community. As Deep Creek is popular for water activities, it would be in the area's best interest to test for bacteria.

BIOLOGICAL RESOURCES

Natural Setting

The Deep Creek Watershed is located within the Appalachian Plateau, just one of six physiographic provinces in Maryland. It is known for having the highest elevations that parallel mountain ridges separated by deep gorges creating whitewater conditions.

Of the eight classes of forest growth in Maryland, the western portion of the state is located within the Northern Hardwood, White/Red/Jack Pine, Elm/Ash/Cottonwood, and Exotic Softwoods according to the United States Department of Agriculture Forest Service.

The Northern hardwood forest contains a variety of beech, birch and maple trees that are common within the Appalachian Plateau where the elevation is higher and the climate is cooler providing favorable growing conditions for the northern tree species.

Biodiversity

Clean air, clean water, and fertile soils are required for a healthy ecosystem that benefits everyone and everything. Having a diversified population of plants and wildlife is essential and the more diversified community of organisms increases that ecosystem's resilience. A resilient ecosystem is important especially with all the stresses and challenges organisms face to survive between predators and invasive species.

Species of Concern/Species of Greatest Conservation Need

Several species classified as rare, endangered, or threatened reside in the Deep Creek Watershed. These include several species of plants, fish, amphibians, reptiles, birds, and mammals.

Species of Special Concern

Species of special concern (rare, threatened, or endangered species) are tracked by the state and federal natural resource agencies. It is a matter of policy for the resource agencies not to provide specific site location information in order to provide a level of protection to these organisms and their critical habitats. The state natural resource agencies are to be contacted if any land disturbance activities are planned to determine if those activities could potentially impact any species of special concern or their habitat. Species of concern in Garrett County, Maryland consist of 16 species of mammals, 23 bird species, 4 reptiles, 5 amphibians, 4 fish, 26 insects, 12 butterflies/moths, and 2 flatworms.

Species of Greatest Conservation Need

Species of Greatest Conservation Need (SGCN) include plants and animal species in which the species themselves or their habitat are declining to a level of concern. This listing is a broader group than the species of concern, but the species of concern are also identified as SGCN. The purpose of identifying these species is so that conservation activities and protections can be made in an effort to keep them from being identified as a rare, threatened or endangered species. Currently, this data was only available to us by state. Many of the species in this listing may not reside in the Deep Creek Watershed, for example the bottlenose dolphin. Within Maryland there are 41 mammals, 143 birds, 26 reptiles, 19 amphibians, 31 fish, 272 insects—36 bees/wasps, 101 butterflies/moths, 93 dragonflies/damselflies, 14 mayflies/stoneflies/caddisflies—and 78 other invertebrates that include 14 snails, 14 freshwater mussels, and 10 flatworms.

Invasive Species

A number of invasive species are found in the watershed. An invasive species is defined by the United States Department of Agriculture (USDA) Forest Service as “a species that is non-native to the ecosystem under consideration; and, whose introduction causes or is

likely to cause economic or environmental harm, or harm to human health (Executive Order 13112).” There are both plant and animal invasive species within the watershed boundary.

Invasive species can be damaging to native species, infrastructure, agriculture, and ecological processes vital for native and foundation species. The ecological impacts of invasive species vary depending on the species and its means of taking over an area.

Many invasive species are nearly impossible to control once they have taken over an area. In all cases, prevention and early treatment is of utmost importance. The USDA Forest Service recommends the following management practices to prevent the introduction of invasive species:

1. Inspect any plants or trees for egg masts or plant seeds before bringing them into the watershed or transporting them between watersheds.
2. Inspect and clean any forest machinery for egg masts or plant seeds before transporting the equipment between watersheds.
3. Inspect and clean all fishing, kayaking, or boating equipment using hot water and letting dry completely before entering a different body of water.
4. Limit transport of firewood from far away areas into the watershed; find locally sourced firewood.

Plants

Invasive plants have a tendency to displace natives and dominate landscapes, especially areas that have recently been disturbed. Some invasive plants, such as the ground vine mile-a-minute, smother natives. The invasive tree-of-heaven produces a chemical in its roots that prevents the establishment of other plants (Jackson and Grover). Others outcompete native plants for sunlight and nutrients. Once an invasive plant is introduced to an area, especially after a land disturbance has occurred, it often takes over the area and spreads rapidly. This causes issues for wildlife, including lack of necessary food resources from native plants and inability to traverse through thick stands of some invasive plants.

In addition, Deep Creek Lake is at high risk for aquatic invasive species to establish or reestablish due to its close proximity to the Potomac River and Lake Habeeb, which contain both hydrilla and Eurasian watermilfoil. While outside of the Youghiogheny Watershed area, controlling these invasives to prevent them from spreading is in the best interest for the Deep Creek watershed.

- **Hydrilla** is a fast-growing invasive weed that was discovered in Deep Creek Lake in 2013. Maryland Department of Natural Resources quickly acted to establish a control program and as of 2016 no hydrilla was detected within the control program site.
- **Eurasian watermilfoil** is another aquatic invasive plant within Deep Creek Lake. It occupies less than two percent of the available benthic habitat,

according to an aquatic invasive species survey conducted in 2016 (Lewandowski, et. al, 2018).

- **English ivy** originally brought to the United States as an ornamental plant quickly escaped when not maintained. It is able to climb vertical structures and produces berries that are carried from one place to another by birds. Once established in natural areas the ivy quickly covers the ground surface eliminating habitat for native plants. The ivy can smother tree canopies adding weight increasing the trees susceptibility to windthrow. In addition, tree trunks covered in the ivy hold in moisture providing protection of borers and other insects. (Maryland Department of Natural Resources, 2016).
- **Japanese stiltgrass** occurs in uplands and wetland habitats. It is believed to have been introduced in the United States in the early 1900s from eastern Asia coming in packing materials of packages. It establishes a lush green carpet where the grass crowds out native plants, especially in shady conditions. It can remain dormant in soil for many years making management and eradication efforts challenging. (Maryland Department of Natural Resources, 2016).
- **Garlic mustard** was introduced in the United States in the 1880s brought in by early settlers to New York for medicinal purposes. This flowering herb spreads rapidly through upland forest habitats where it outcompetes native plants. It is especially concerning because certain rare butterflies lay their eggs on it instead of native species. When the eggs are laid on garlic mustard, they fail to develop. Like stiltgrass garlic mustard is hard to eradicate because it can remain dormant for five years. (Maryland Department of Natural Resources, 2016).
- **Purple loosestrife** was introduced to Maryland in the 19th century. It arrived in ship's ballast water and attached to other materials and it was imported as a medicinal and decorative plant. While the plant is attractive it reproduces quickly and outcompetes native plants disrupting food chains and habitats in wet areas and marshes. (Maryland Department of Natural Resources, 2016).
- **Wavyleaf basketgrass** is a recent invader to the Maryland ecosystems being first detected in 1996 before expanding to various parks and natural areas in the 2000's. Like most invasives it spreads quickly by creating dense mats of shade-tolerant grass that covers the forest floor. They easily adhere to passing animals, people and equipment only to fall off later traversing large distances from the initial plant. It is a worthy target for eradication because its presence is limited to Maryland and Virginia. (Maryland Department of Natural Resources, 2016).

- **Phragmites** dominate native wetlands plants including native varieties of Phragmites. It first arrived in Maryland in the 18th century.

Animals

Invasive invertebrates and vertebrates commonly disrupt food chains, outcompete native species, and interrupt other ecological processes. Invasive insects, with no effective natural predators, can decimate native vegetation. Many invasive insects have no effective defense against them. It is paramount to prevent the spread of these invasive insects.

- **Emerald ash borers** have already destroyed a significant population of ash trees and is expected to cause close to 100% mortality of ash trees in the United States. Because of its rapid spread and thriving population, the emerald ash borer has almost no effective controls.
- The **hemlock woolly adelgid** is slowly killing the eastern hemlock, an important species for headwater health. The Hemlock-Northern hardwood forests are a key wildlife habitat. Maryland has over 42,000 acres of vulnerable hemlock forest at risk of infection by the hemlock woolly adelgid. The Maryland Department of Agriculture is working on a treatment and suppression plan.
- **Gypsy moths** devour the leaves of oaks and other hardwood species impacting several key wildlife habitats.
- **Spotted lanternfly** has wreaked havoc in Pennsylvania and the majority of Maryland; however, it has not been identified in Garrett County as of March 2023.
- **Virile crayfish** are the greatest threat to native crayfish diversity in the Deep Creek watershed. These crayfish have the capacity to displace native crayfish and alter aquatic food webs and habitats. First reported in the 1950s the virile crayfish has become widely established in western Maryland primarily through its use as bait by anglers.

Conservation

Conservation Threats

- **Land Conversion/Habitat Loss and Fragmentation**
Habitats can change, and have over the years. One of the greatest historical changes occurred following the glaciers. While they never quite advanced to Maryland, they did impact lower portions of the Youghiogheny River watershed in Pennsylvania. Habitats can change via natural circumstances such as storms, floods, and fires, or they can be a result of human activities, such as clearing lands for development or agriculture.

In the United States, the number one greatest threat to biodiversity is habitat loss (Stein et al., 2000). Residential development expanding from cities to rural areas encroaches on the potential habitat for many species of plants and animals. Between 1973 and 2010, Maryland's forests lost almost a quarter of a million acres according to the Maryland Department of Planning. Just between 2002 and 2010 alone, Maryland forests decreased by 3% leaving only 38% of the Maryland landscape to be forested. Agricultural land also decreased by 3.2% from 2002 to 2010, which isn't as drastic as the 19% loss experienced between 1973 to 2010. While the acreage of wetlands decreased by more than 1,000 acres since 1973 the acreage of lands covered by water grew by nearly 4,000. Low-density residential development increased nearly three times and industrial land uses increased by four times. Barren lands, including quarries and mines, doubled between 1973 and 2010 (Maryland Department of Natural Resources, 2016).

In order for optimal survival of all plant and animal species, terrestrial or aquatic efforts are needed to preserve continuous habitats when applicable. When continuous habitats can't be preserved, establishing a corridor is essential so that plants and animals don't become isolated to small parcels. More research including assessments and surveys are needed so it can be documented and then properly incorporated and used in future planning efforts.

- **Agriculture and Aquaculture**

Large spans of open, cleared lands for agricultural production have an impact on the habitat and connectivity of some SGCN species that require large contiguous forest and grasslands. Aquaculture, including the rearing of trout and other fish species for stocking, may have an impact on native species and their habitats.

- **Energy Production and Mining**

Maryland produces over half of the energy it uses, in-state from coal deposits and gas reserves in western Maryland, as well as hydroelectric potential in some rivers, solar energy and wind in the western mountain ridges, like those in the Deep Creek management unit. In addition to the threats that these activities pose, their supporting infrastructure such as pipelines, access roads, etc., are also of concern. Some of these greatest concerns are the increases in fragmentation of forest lands and other habitats. Other concerns are the placement of large facilities for wind and solar being located in movement corridors for birds and bats or the displacement of feeding areas and degradation of the overall health of the habitat.

- **Transportation and Service Corridors**

Transportation corridors provide a multitude of threats from fragmentation—increased predator access, physical barriers isolating populations—increased wildlife mortality via roadkill, easy pathways for the spread of invasive species, and noise disturbances leading to an overall decrease for quality of life.

Many invasive species have been introduced accidentally via packaging materials on shipments from other countries. Once these species are introduced, they are often hard to eradicate. See the section on invasive species for more information.

One impact of transportation, even at the local level that is often overlooked is fish passage. Depending on the type and placement of road culverts, if improperly placed, they can block upstream movement for aquatic organisms that rely on that for reproduction.

- **Harvesting Impacts**

Wildlife faces more challenges beyond overexploitation, which has been addressed through state and federal regulations. Bycatch and accidental mortality are plants and animals that were not the original target, but were accidentally collected and are often injured or killed during the collection process. Many nuisance or pest species are also being eradicated from certain areas because they are unwanted by people whether they are captured and released in a different habitat or they are killed on site. In some instances, species are misidentified for something else, for example many people think that water snakes are copperhead snakes and because they are undesired by people, they are killed.

Just like wildlife, plant species are also in jeopardy for being falsely persecuted via misidentification, or overharvested for desirable flowers, herbs, or medicinal plants. Plants can also be accidentally trampled.

- **Human Influences via Outdoor Recreation**

The outdoor recreation industry is a huge component to tourism in society today and probably even more post the Coronavirus pandemic. However certain activities can have drastic impacts to the plants and wildlife surrounding them. Below is a listing of some activities and their potential impacts.

- Hunting and Fishing

Hunting and fishing draw in millions of people annually and are beneficial in helping maintain biological systems so that species do not become overpopulated for their available habitat. However, managing the harvest is essential so that species do not become

overharvested. Sportsmen need to be careful that they don't transport invasive species from one location to another; this is particularly important for fishermen. Hunters and fishermen need to follow designated paths when available to reduce the accidental trampling of potentially sensitive plant species and small animals such as salamanders and frogs.

- Motorized Recreation/Bicycling
Motorized recreational vehicle riding can upset or destroy natural lands and habitat for significant plant and animal species. They can increase erosion, provide easy transportation for invasive species disturbance, and can even cause mortality via accidental trampling. Riders need to stay on designated paths for motorized and non-motorized riding.
 - Boating Activities
Boating in sensitive areas can impact bird nesting habitats or cause direct mortality of aquatic species. Boats that have not been thoroughly cleaned and/or dried between waterways have the potential to transport invasive species from one waterway to another.
 - Hiking/Wildlife Observation
Wildlife observation and hiking should be done in designated areas by staying on designated trails and paths. This will help reduce erosion in sensitive habitats, eliminate accidental trampling, and reduce the spread of invasive species.
- **Invasive Species** – See section on invasive species
 - **Climate change** – See previous section on climate change

Important Areas for Conservation: Natural Heritage Areas

In Maryland, natural areas are a voluntary recognition of special properties that contain vital natural resources. The Maryland Natural Heritage Program is a coordinated system that recognizes and seeks to conserve the best remaining examples of Maryland's diverse native landscape. While participation in the program is voluntary the selected and cooperating sites are sustainably managed to conserve the natural features for which the area was initially recognized. The goal of the program is to identify and conserve natural areas for future generations while increasing public awareness of these special places.

Within the Deep Creek Management Unit, no natural heritage areas have been designated.

Important Bird Areas

The Important Bird Area (IBA) Program was established in the 1980s in Europe by Birdlife International. In the United States, the National Audubon Society became a partner organization and manages the program in 46 states including Maryland, Pennsylvania and West Virginia.

The goal of the program is threefold: identify, monitor, and conserve areas that are the most essential for sustaining native bird populations. Once identified sites are monitored for changes to habitat or species that reside or visit the area. Lastly conservation efforts for long-term protection are prioritized to these sites. IBA sites are identified as essential habitats for one or more species of vulnerable bird populations including nesting areas, migration stops, and wintering grounds. Sites can be established on public and private lands, and just because a site is identified as an IBA doesn't mean the public has access to it. Sites are designated with bird and habitat protection in mind, not public access for bird watching.

Portions of two IBAs have been identified in the Deep Creek management unit. Both have been identified as a priority for the state of Maryland. The Youghiogheny Valley IBA, which is also located within the Youghiogheny Headwaters and the Middle Youghiogheny management units. The Glades IBA is also included in the Upper Youghiogheny management unit.

TABLE 2-8. IMPORTANT BIRD AREAS IN DEEP CREEK MANAGEMENT UNIT

IBA	Acres	Status	Priority	Species
Youghiogheny Valley	49,139	Identified	State	Alder Flycatcher, Canada Warbler, Golden-winged Warbler, Blackburnian Warbler, Wood Thrush, Willow Flycatcher, Cerulean Warbler, Northern Waterthrush, Kentucky Warbler, Red-shouldered Hawk, Broad-winged Hawk, Barred Owl, Hairy Woodpecker, Pileated Woodpecker, Acadian Flycatcher, Common Raven, Brown Creeper
The Glades	8,964	Identified	State	Not available

Important Mammal Areas

Mammals are an important component to our natural environment. In Maryland there are over 20 mammal species that are considered to be rare, threatened, or endangered. In addition, six species are believed to be extirpated and no longer found living wild. They include Gray wolf, American elk, Eastern Mountain lion, Snowshoe hare, American marten and Eastern harvest mouse. In Pennsylvania, following the strategies and logic behind the Important Birds Area Program, the Important Mammals Area project has been initiated to help protect and preserve precious habitats that sensitive mammal species need to survive. Maryland officials should reach out to Pennsylvania to discuss this program and determine if establishing an Important Mammal Program could be beneficial to protecting sensitive mammals in the Deep Creek watershed and Maryland in general.

CULTURAL RESOURCES

The Deep Creek watershed is full of cultural resources, especially since it is a tourist destination for many coming from the Washington D.C. metropolitan area. Deep Creek is known for its vast array of recreational opportunities brought by the Lake and surrounding natural areas.

Outdoor recreation continues to grow in western Maryland because of the vast resources including Deep Creek and the nearby resorts. According to the Tourism Economics study, in 2013, Garrett County tourism generated \$319 million. Tourism revenue makes up over 21% of Garrett County's annual labor income, and tourism provides 22% of the jobs in Maryland's westernmost county (Tourism Economics 2013).

Wildlife watching in Maryland is an important part of the state's economy. In 2011 alone, \$483 million dollars of revenue was generated from wildlife watching activities (Maryland Department of Natural Resources, 2016). This doesn't even include revenue gained by the 400,000 fishermen and 88,000 hunters in the state (Maryland Department of Natural Resources, 2016).

Recreational Resources

Trails

Trails are an asset to a community whether designed for recreational purposes or as a connector to a neighboring community. Within the Deep Creek Management Unit, the majority of trails have been established for recreational purposes to allow visitors the opportunity to enjoy the natural surroundings of the region. Trail uses in the area vary among walking/hiking, mountain biking, cross-country skiing, equestrian use, and all-terrain vehicles or off-road vehicles. There are 14 trails or trail systems in the Deep Creek subwatershed.

TABLE 2-9. TRAILS IN DEEP CREEK MANAGEMENT UNIT

Trail	Distance (miles)	Level	Description
Discovery/Sensory Trail	0.2	Easy	Starting at the Discovery Center at Deep Creek State Park this trail explores nature via smell, sound, and touch through woods and lakeside terrain.
Snakeroot Trail	0.25	Easy	Easy short route off of the Meadow Mountain Trail at Deep Creek State Park. Self-guided brochures are available at Ranger Station.
Crosscut Trail	1	Moderate	This trail features some of the rockiest contours of the mountain. It can be combined with the upper/eastern leg of the Cherry Creek Loop.
Lookout Trail	1.5-1.75	Moderate	A rugged, yet short, route that includes rocky and steep terrain for hiking and mountain biking.
Beckman Trail	2	Easy	This trail ventures along the ridgeline with slight elevation gain. Users can learn local history about the Brant Coal Mine by following the posted signs.

TABLE 2-9. TRAILS IN DEEP CREEK MANAGEMENT UNIT (CON'T)

Trail	Distance (miles)	Level	Description
Cherry Creek Loop	3	Moderate	Trail passes through multiple ecosystems from lake-level to near the top of Mountain Meadow.
Thayer Trace	3	Difficult	This is a connector trail between Deep Creek Lake State Park and Savage River State Forest.
Indian Turnip Trail	4.5	Moderate	Rocky trail ascending nearly 600 feet that need to be combined with sections of Meadow Mountain or Beckman's Trail to return to the starting point.
Meadow Mountain Trail	5.5	Moderate	Trail features wildflowers and birds in the summer while winter provides snowshoeing, cross-country skiing, and snowmobiling opportunities. Users must follow the Indian Turnip Trail to return to the starting point.
Fork Run Recreation Area	7.3	Easy - Difficult	Hiking and Biking Trails that are managed by Garrett Trails
Visitors Center/ Deep Creek Trail	0.5	Easy	Paved trail that connects the Garrett County Visitor Center to Wisp Resort. Trail traverses along the original Buffalo Swamp before Deep Creek Lake was constructed.
Mosser Road Heritage Trail	0.7	Easy	Non-motorized, paved, trail that connects Garrett College to Route 219 and the McHenry area near Deep Creek Lake.
Cunningham Swamp WMA Trail System		Easy	Two trail systems the main, and handicap accessible boardwalk
Meshach Browning Trail System	6	Easy-Medium	A six-trail system and historical exhibit around the life and times of Meshach Browning, one of the earliest settlers of Garrett County.

Parks

Parks are areas of land set aside for public use maintained for enjoyment and the recreational use of people (Landes, 2004). Parks can vary from small neighborhood parks to large state or federal parks. They can be publicly or privately owned and may vary between being free to having an access or user's fee.

Deep Creek State Park is the primary park facility in the management unit. It features the Deep Creek Lake and the adjoining Deep Creek Natural Resources Management Area, encompassing 5,700 acres for recreation. Constructed in the 1920s as a hydroelectric project, the park features a beach shower house and changing station, 2 swimming beaches with lifeguards that are typically open from 11 am to 6 pm between Memorial Day to Labor Day, over 20 miles of hiking and bicycling trails, 112 campsites, 3 playgrounds, 4 picnic shelters and various picnic tables with grills. In addition to the Discovery Center, an environmental education center, boat launches and ramps are available. Maryland State Parks require daily

user fees, which vary depending on season and residency. During peak season between Memorial Day to Labor Day the current fee is \$3 per day per person for Maryland Residents and \$5 per day per person for other visitors. During the offseason the rate is \$3 per vehicle for Maryland residents and \$5 per vehicle for all other visitors.

Other parks and recreational facilities in the area include Garrett County Agriculture Fair, Funland, Wisp Resort, Deep Creek Fun Zone, and Monkey Business Adventure Park.



Discovery Center at Deep Creek State Park

Camping

Camping is a popular recreational activity that increased in popularity due to the Covid pandemic in 2000 to 2001. However, throughout the Deep Creek region, camping via large campgrounds with numerous sites is not as popular with only two campgrounds and an RV park being located in the watershed. Visitors to the region tend to want more privacy and more home comforts. This is evident by the numerous amounts of private cabins, Airbnb and other rentals, along with Wisp Resort.

TABLE 2-10. CAMPGROUNDS IN DEEP CREEK MANAGEMENT UNIT

Campground	RV	Tent	Cabins	Yurts	Other	Website/Link
Mountain Meadow at Deep Creek State Park	x		x	x	Adirondack Shelter	Camping (maryland.gov)
Bumble Bee RV Park and Campground	x	x			Seasonal sites	Bumble Bee RV Park & Campground (bumblebeervparkandcampground.com)
Double G RV Park	x					Home - Double G RV Park

Boating

There are two main locations for boating within the Deep Creek Watershed. Adventure Sports Center International is a man-made whitewater course offering commercial rafting trips and private kayak access. Deep Creek Lake has many access points including public and private launches and marinas.

- Adventure Sport Center International (ASCI) A fee is required to access the course for all private and commercial guests.
- There are regulations for motorized boating on Deep Creek Lake. Maryland Department of Natural Resource's website will have the most up to date information.

Fishing

In Maryland there are nearly 100 species of freshwater fish within four ecological stream types: Highlands Warmwater, Highlands Coldwater, East Piedmont, and Coastal Plain. The Youghiogheny River headwaters are most likely to fall within the Highlands Coldwater habitat. Most common fishes likely to occur in the management unit include the cold water preferring common species such as the blacknose dace, creek chub, tessellated darter, and bluegill. In addition, some non-native fishes have been introduced to establish or maintain recreational fishing while others were introduced illegally as unused bait, aquarium pets, or purchased from live seafood markets. Maryland now has approximately 20-25 introduced fish some of which are popular like the largemouth bass and rainbow trout while some have become invasive in some parts of the state.

Deep Creek Lake is known for its large panfish and abundant walleye and smallmouth bass populations. While not as abundant the population of largemouth bass provides anglers with a quality sized fish. Northern pike are also common and can be over 40 inches in length. In the winter when the lake freezes over, it becomes Maryland's premier ice fishing destination.

There is one special regulation area in the Deep Creek Watershed. Four miles from the tailrace of Deep Creek Lake to the Sang Run Bridge is designated as catch and return and requires the limited use of artificial lures.

Hunting

In Maryland, licensed permit holders are permitted to hunt all legal, in season birds and mammals. Licenses are valid from August 1 through July 31 of the next year. Some species, such as deer, migratory game birds, furbearers, and bear require additional permits or stamps in order to hunt. Licenses are made available to both residents and nonresidents of Maryland and costs vary. In order to obtain a hunting license, hunters must take and pass an educational safety course unless they can document proof of hunting prior to 1977.

There are 551-acres designated within Deep Creek State Park that are open to hunting. Hunters must abide by all hunting regulations and seasons. Weapons should not be loaded until in designated hunting areas. Hunting is not permitted on Sundays. Firearm hunting is prohibited prior to October 15th and spring turkey and waterfowl hunting opportunities are available during listed seasons. Specifically for waterfowl, hunting must occur in designated areas with the required reservation.

Additional information is available at the Maryland Department of Natural Resources Deep Creek Lake State Park website.

Golfing

The sport of golf is popular for many, and golfing experienced the same dramatic increase in interest as did outdoor recreation during the Covid pandemic. Some of the benefits of golf were an excellent fit for recreation during the pandemic. First, it can be played solo or in small social groups. It is also played outside on large spacious courses.

Within the Deep Creek Watershed there are two facilities that have golf courses. WISP resort offers 2, 18-hole courses and Thousand Acre Golf Club also has an 18-hole course.

Environmental Education

The Youghiogheny River has unique opportunities for environmental education that should be utilized to their fullest extent. The Youghiogheny holds educational opportunities for people of all ages. It could be utilized as an outdoor environmental classroom or become a topic for an essay contest for school children. It could be a learning experience and phishing techniques for adolescents through adults, or a history lesson detailing the past events that helped shape our nation. There are many other opportunities for children, adults and seniors to continue their education, including subjects about history, science, math, English, biology, hobbies, and environmental stewardship. The Youghiogheny Valley was filled with a vast quantity of historic, cultural and environmental resources that have just begun to be rediscovered. The combination of these resources provides an outstanding opportunity to develop educational programs for both children and adults.

The Hickory Environmental Education Center in Accident, Maryland currently fulfills the environmental learning requirement for Garrett County public school students. All students in grades K through eight visit Hickory twice each year. High school students in Environmental Science, Biology, Chemistry, Earth Science, and Physical Science complete lessons at Hickory once each semester.

The Maryland 4-H Environmental Education and Camping Center in Swanton, Maryland is a camp and environmental education center accredited by the American Camp Association for homeschool, faith-based groups, charter school, retreats for university students, private schools, or anyone looking for adventures in the outdoors.

The Discovery Center at Deep Creek State Park offers a variety of educational programs as well as self-guided activities. It features hands-on exhibits showcasing the natural resources of Western Maryland.

Expanding and supporting existing environmental education in this area would be beneficial to individuals as well as the community at large in fostering a better understanding of the importance of conservation and stewardship. Environmental

education also exposes individuals to possible careers in these fields as well as empowers them to be better advocates for environmental justice.

Historical Resources

Watershed History

Little is known about the people of the Youghiogheny Watershed before the arrival of Europeans. It is believed that a clan known as the Monongahela lived in the area approximately from A.D 900 to 1600. They were nomadic gatherer-hunters residing in temporary or semi-permanent camps. Their lives were very much tied to the seasons. Most of their efforts in the spring through the early autumn would have been growing crops. Everyone participated in the planting and harvesting, but women, children, and older adults were responsible for tending the crops during the growing season. Men were responsible for most of the hunting. However, the cooperation of everyone was needed for processing. Men and women butchered the animals; women were responsible for preserving them.

The Monongahela lived in round, dome-shaped houses 9 ft to 30ft in diameter. These dome houses were made by cutting down small trees and pushing the cut end into the ground in a circle formation. The tops of the trees are then bent together and tied to make a frame. Poles were then bent around the outside of the frame to make the house more stable. Finally, large pieces of bark were cut and placed over the frame. A hole was left at the top of the roof to allow smoke from the campfire to escape out of the house. During the summer, cattails covered the houses and kept the rain from dripping inside, allowing air to circulate. The inside of the house was simplistic. The walls were lined with sleeping benches constructed from sticks and lined with animal skins or plant mats.

The houses were arranged in large circles to form a village. The center of the village was left open for group or ceremonial activities. A large fence, a stockade, surrounded some villages to help protect against raids from unfriendly groups. They had storage rooms attached to their houses, like a kitchen pantry, where they stored dried and preserved foods. Sometimes they were used for cooking.

They did not have a complex government. Instead, they had what is referred to as an egalitarian society, where everyone had a say in how the village was run. They believe this because most houses within the village were similar in size, most homes had their own food storage, and there were no apparent differences in how people were buried. Each house controlled its resources, though cooperation between families was necessary for the good of the village (Boyd & Furgerson, 1999).

Historically, known Native trails in the Meyersdale, Pennsylvania area may have been used by the Monongahela for trading with outside groups, such as the Turkeyfoot Path (Figure 2-2). These trails were probably the same ones used for

hundreds of years by prehistoric Native groups. Trade evidence is apparent from stone flakes and tools made from rocks from faraway parts of the country.



Figure 2-2: Monongahela Villages' locations and trading paths in Somerset County of the Youghiogheny Watershed. Image taken from <http://www.phmc.state.pa.us/portal/communities/archaeology/files/mysteryofmonindians.pdf>

The Monongahela mysteriously disappeared from the area 400 to 1,000 years ago. Following the Monongahela People, the Shawnee, Seneca, and Delaware tribes utilized the area as a hunting ground but not a permanent home. The name Ohiopyle comes from the Lenape, members of the Delaware nation. Their name for the area was "ahi opihøle," which means "white frothy water," referring to the falls and the whitewater in the area.

The earliest reference to the Youghiogheny River is a caption on a map drawn in 1737 by William Mayo: Spring heads of Yok-yo-gane river a south branch of the Monongahela. The name originated from one of the dialects from the Lenape and means "a stream flowing in a contrary direction" because it flows north for sixty miles, then north and west. Other variations of the name include Joxhio Geni, Yoxhio Geni, Yayughagany, Youghiogheni, Yehiogany, Yoxhiogany, Yohogania, Yochi Geni, Youghanne, and Yuh-wiac-hanne.

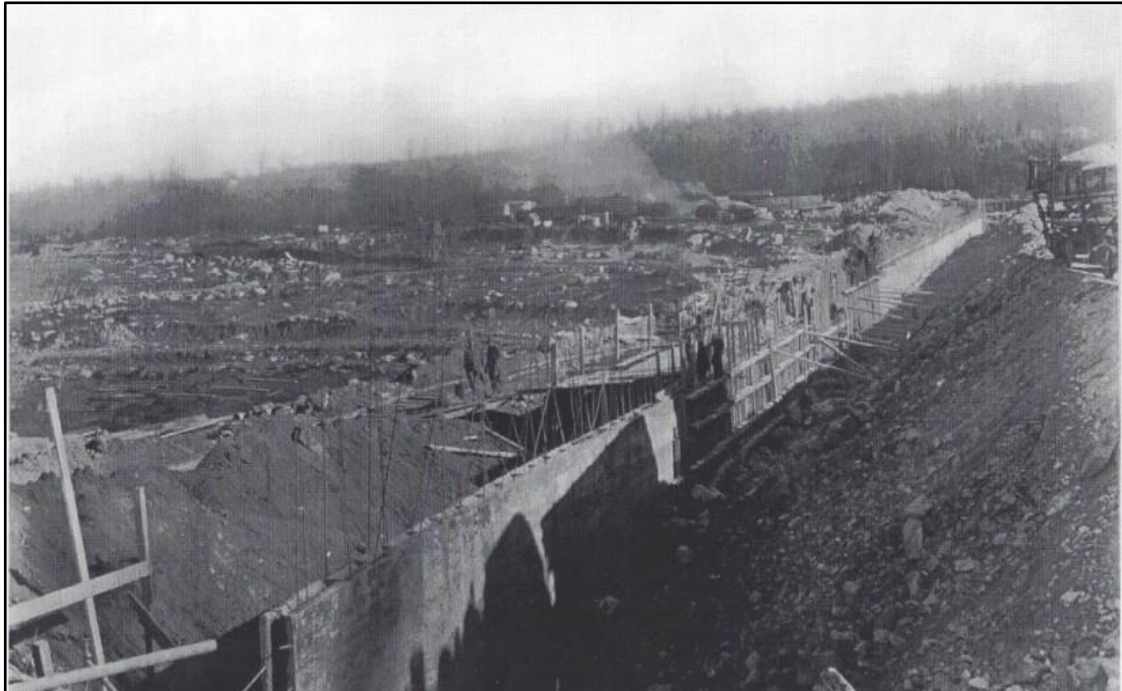
Since the Youghiogheny connected to the broad and boatable Ohio River, these rivers opened access to the entire western frontier. For this reason, the Ohio became the target of colonial explorers, traders, armies, and settlers in the 1700s. The basin was strategic, the height of land between the Potomac Valley and the Ohio Valley. Trails from Virginia were among the first routes leading to the interior, and they crossed the Youghiogheny.

Ownership of the Youghiogheny lands was under debate in the 1700s. The Iroquois claimed the land after they spent twenty years fighting other Native Nations for it. The French thought the land was theirs; they dated their claim from 1682 when La Salle canoed the Mississippi and declared that France owned the entire basin. The British believed it should belong to them because they intended to settle the land. They also claimed the land through a 1744 treaty with the Iroquois. In 1753, George Washington made his first appearance in the area at 21 years old to carry a message from the Governor of Virginia to the French at Fort LeBoeuf to tell them to stop the occupation of lands claimed by the English.

One mile below Swallow Falls is the mouth of Deep Creek. Two and a half miles above the confluence of Deep Creek and the Youghiogheny is a hydroelectric dam built in 1924. The twelve-mile-long lake with sixty-two miles of shoreline is the largest reservoir or lake in Maryland.

In 1908, planning began, but early attempts fell through. In 1921, the Youghiogheny Hydro-Electric Corporation, a subsidiary of the Pennsylvania Electric Corporation, was granted the right to construct dams across Deep Creek and the Youghiogheny River. In 1922, preliminary surveys were conducted to determine the power possibilities. The concept that resulted from these surveys proposed the construction of four dams and three powerhouses: one near the confluence of Deep Creek and the Yough, another in the Yough north of Deep Creek, and two dams south of Deep Creek. It was decided that the Deep Creek dam and powerhouse should be completed first. Ultimately, it was the only dam from the original concept to be constructed.

In 1923, land acquisition and construction began. The state licensed the Eastern Land Corporation to handle the real estate transactions. The price per acre ranged from \$5.00 to \$2,500, with an average cost of about \$55.00. Entire farms were purchased even when just a portion of the land would be flooded. Many farms were purchased not because they would be flooded but because the rising water would cut off the roads leading to them. About 140 farms were purchased to make up the 8,000 acres acquired for the project, with only 4,500 acres being inundated. Buildings were moved to higher ground, including private homes and two schoolhouses.



Construction of Deep Creek Dam. Time and photographer unknown. Taken from the website <https://www.deepcreekvacations.com/blog/2015/06/deep-creek-lakes-90th-birthday-bash/>

Mr. Charles Hawley & Company Inc., of Washington DC, built the dam and powerhouse. The 1,000 men employed for construction were housed in two large buildings. Various other projects resulted from the construction process, including connecting the B&O Railroad at Oakland and extending it to the dam and power sites, relocation of nearly 15 miles of highway, relocation of two steel bridges, the opening of a quarry to prepare stone for the dam, and roadways.

It took almost two years to complete, opening for operation at 4 p.m. May 26th, 1925. Today, the earth and rock fill dam remain much as it was then. It is about 1,340 feet long and crosses Deep Creek about 1.75 miles upstream from its confluence with the Yough. Water from the lake is transported to the powerhouse through a 7,000-foot power tunnel. The brick powerhouse can produce about 18 megawatts of electricity with its two Francis-type turbines and two generators (Taylor Made, 2023). In late 1991, the Federal Energy Regulatory Commission (FERC) released the Deep Creek Project from federal jurisdiction. It now operates with the State of Maryland surface water appropriations permit administered by the Department of the Environment. Power Plant Research Program has continued its involvement, providing technical expertise to produce an equitable water and resource management plan owned by Brookfield Renewable Energy Partners, L.P. The permit includes conditions to balance the following suite of resource and recreational concerns: 1) reservoir operations to make lake-based recreational opportunities more dependable and extend into the autumn and to protect lake

fisheries, 2) operation of the project to increase the number and dependability of whitewater boating opportunities, 3) mitigation of a long-standing dissolved oxygen problem in project discharges, 4) maintenance of a continuous minimum flow in the river to increase trout habitat, and 5) timing of generation during summer to maintain cold-water habitat on a year-round basis (Maryland DNR, 2023).

The lake has evolved as the centerpiece of tourism in western Maryland. As the years passed, the area's fishing and boating prowess became well-known to visitors from Pennsylvania. Baltimore/Washington DC population center residents also found the area a convenient getaway, especially after interstate highways were built, such as I-68 – the National Freeway – a major transportation route that arrived in 1991 and further opened western Maryland to tourism, commerce, and more.

Historical Sites

The National Register of Historic Places was established by the National Historical Preservation Act of 1966. The National Parks Service maintains the list nationally, in Maryland it is administered by the Maryland Historic Trust.

For consideration, or placement on the National Register a landowner applies to the State Historic Preservation Office. The first step is the completion of a Historic Resource Survey. This provides a historical description of the buildings, sites, structure, object, or district that the landowner would like placed on the National Register. The state office reviews the forms and, if needed, reaches out to the landowner for additional information to determine if it meets eligibility guidelines. If not, the landowner is provided appeal information. If a property does meet the initial eligibility, it is then nominated to the State Historic Preservation Board. If the Board approves the nomination, it recommends placement to the National Parks Service. Again, if it is denied by the Historic Preservation Board the landowner is given information about how to appeal.

Within the Deep Creek management unit, no sites have been identified on the National Registry.