

The background image shows a scenic view of a lake with a sandy beach in the foreground. A red canoe with 'MAD RIVER' written on its side is parked on the beach. Several yellow and red kayaks are also visible. The lake is surrounded by a dense forest of trees, and the sky is blue with scattered white clouds. A large tree trunk is visible on the right side of the frame.

# Deep Creek Watershed Management Plan

**October 1, 2014**

Prepared by the Deep Creek Watershed Plan Steering Committee

For the Garrett County Board of County Commissioners and Maryland Department of Natural Resources

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## Acknowledgements

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## Deep Creek Watershed Management Plan

# Executive Summary

Deep Creek Lake, the largest freshwater lake in Maryland, is nestled in the state's western mountains of Garrett County. Deep Creek Lake has evolved as a primary recreational destination and economic engine for the county. Among the popular water-based activities are boating, fishing, swimming, water skiing, and sailing. The 3,900-acre lake offers year-round recreational opportunities but is most popular during the summer months. In 2000, the state of Maryland purchased the lake and its buffer through legislation passed by the Maryland General Assembly. The Department of Natural Resources (DNR) was assigned the responsibility for managing the lake and the buffer zone. The new law included stewardship requirements and authorizations, but it did not address the potential impacts from the watershed to water quality in the lake.

Over the years, the Deep Creek community, the county, and DNR have shown a growing interest in ensuring that the quality and recreational value of the lake is maintained. Concerns have arisen related to sediment in coves, submerged aquatic vegetation (SAV), water quality, lake level fluctuations, and other issues. Many concerns extend beyond the authority of the state-owned property. Consequently, a more extensive assessment of the entire watershed is needed. DNR and the Garrett County Commissioners agreed to work together to develop a watershed management plan and signed a memorandum of understanding (MOU). The MOU outlined the process for creating the plan and established a steering committee composed of volunteers who represent the various interest groups and residents in the watershed. The committee

agreed on the following vision statement as the foundation for future actions:

**Through partnerships with private land owners and government agencies, the Deep Creek watershed will improve its environmental stability and economic viability while retaining its rural landscapes and natural beauty so that, for generations to come, local citizens and visitors have a special place to live, work, and play.**

A public meeting was held on October 5, 2013, to gather input from the community to identify issues and concerns. These issues were compiled into "problem statements." The steering committee established four subcommittees, composed of community volunteers and supported by state and county staff, to develop goals, objectives, and strategies to address the problem statements:

- Accountability, Agency Coordination, and Public Understanding
- Water Quality (including sedimentation, SAV, and other factors affecting water quality)
- Impacts from Growth (including industrial growth as well as recreational uses of the watershed)
- Lake Levels

Each subcommittee prepared a report that was reviewed and modified by the steering committee, resulting in the final content of the Deep Creek Watershed Management Plan. The plan presents a menu of recommended goals along with the needed actions and timeframe for addressing them. The recommended goals

and actions also address the need to continue analyzing ongoing issues and management of resources. The plan proposes actions to be considered by state and local authorities as well as local educators and organizations.

The recommended goals, fully explained and detailed within the complete watershed management plan, are as follows:

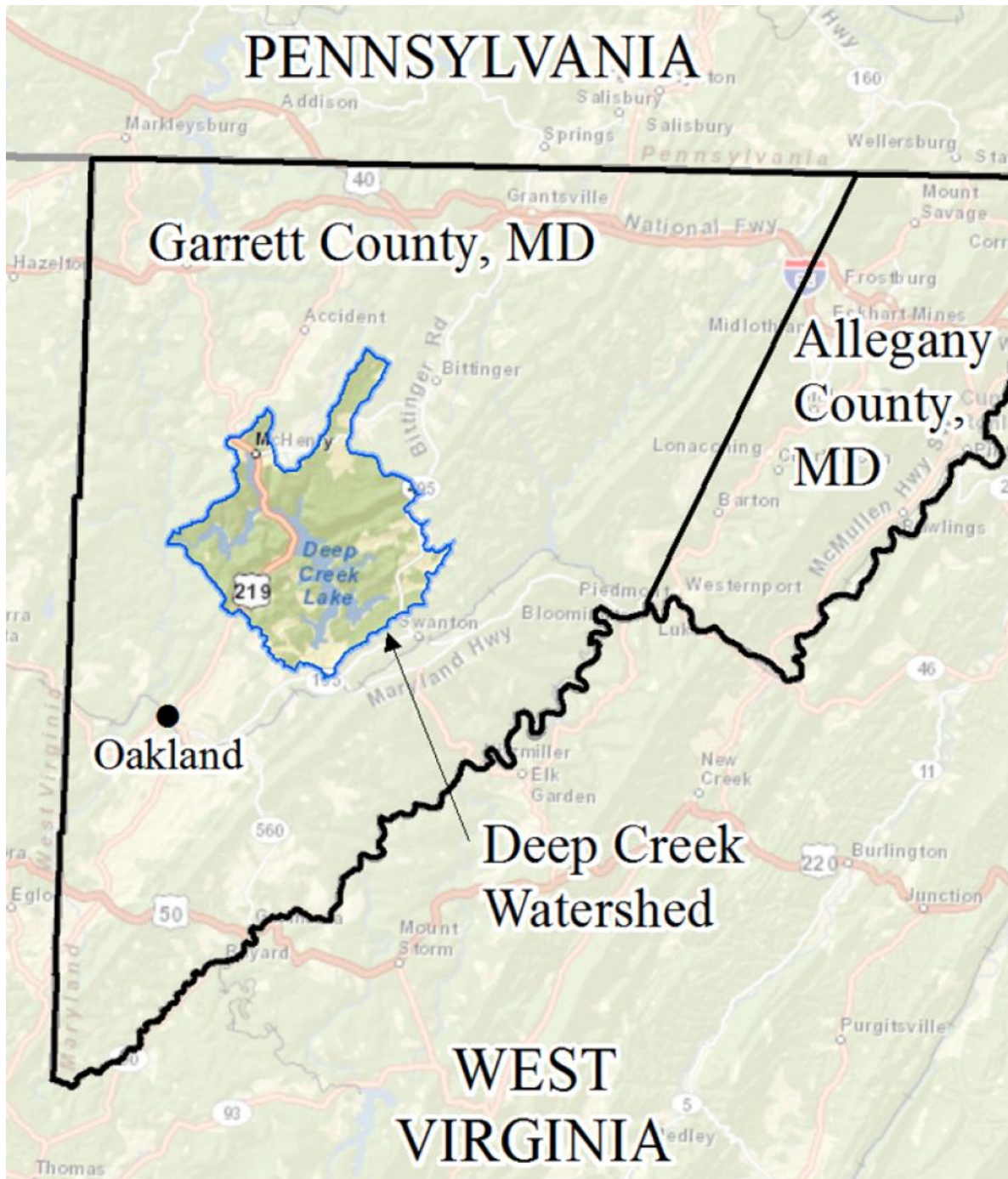
- Goal 1: Improve management, funding, coordination, and accountability for the Deep Creek watershed.
- Goal 2: Nurture an informed and engaged citizenry regarding the Deep Creek watershed.
- Goal 3: Collect the information needed to make informed management decisions that achieve the desired condition of the Deep Creek Lake and watershed.
- Goal 4: Manage existing land uses to achieve the desired condition of the Deep Creek Lake and watershed.
- Goal 5: Manage SAV in Deep Creek Lake to maintain and improve the ecological stability of the lake, while working with waterfront landowners to minimize the interference of SAV with recreational uses of the lake around docks.
- Goal 6: Prevent erosion and sedimentation to the greatest extent possible to protect water resources from increased sediment loading and associated water quality problems.
- Goal 7: Promote policies that balance environmental sustainability and economic viability.

- Goal 8: Manage stormwater infrastructure to decrease pollution from both existing and proposed development to ensure healthy watershed conditions.
- Goal 9: Protect the watershed from the adverse effects of impaired septic systems and ensure adequate capacity and management of public sewerage systems.
- Goal 10: Preserve and enhance the quality of recreational opportunities while ensuring that those opportunities are in harmony with environmental stewardship.
- Goal 11: Maximize the retention of forest cover to protect high-value aquatic and terrestrial natural resources.
- Goal 12: Assure that the water appropriation analysis and allocation methodology for Deep Creek Lake provides a fair distribution of water for all users, especially during the months of May through September.
- Goal 13: Improve access to navigable waters for property owners who typically have shallow water during the summer months.

The steering committee agreed that the issue needing the most immediate attention is the development of a formal structure for interagency and inter-jurisdictional management. The second most critical need is the development of a financing strategy to support the plan and recommended staffing. The plan recommends beginning work on these two tasks immediately and offers the support of the steering committee to continue their role in assisting the county and state in moving the watershed plan forward.



**Figure 1. Deep Creek Lake and Watershed**





# Introduction

The Deep Creek Watershed Management Plan provides a course for protecting, enhancing, and restoring the resources of the Deep Creek watershed. The plan was developed as a cooperative effort between the Maryland Department of Natural Resources, Garrett County, and members of the local community. The plan provides an array of actions needed to address the concerns expressed by local citizens and evaluated by the steering committee and its subcommittees. The actions also address the need to continue analyzing ongoing issues, address new issues, and manage the resources. The plan is not intended to replace or supplement any existing plan, regulation, or policy. Instead, it identifies problems and proposes actions to be considered by state and local authorities as well as local educators and organizations.

There is a pressing need to continue the momentum and partnerships begun through the development of this plan. The plan does not address everything, and new issues or concerns will surface. Consequently, it proposes an approach for establishing a long-term partnership that would address new issues while continuing the cooperation, education, and actions that evolved through the development of this plan.

## How to Use this Document

The Deep Creek Watershed Management Plan has been prepared using a number of resource materials and with input from local citizens and state and local natural resource experts. The plan is the culmination of the work of the steering committee and its subcommittees.



It presents this work in the form of goals, objectives, and strategies with introductory material to provide context.

Additional information and background data can be found in a separate Characterization Report. This report provides detailed assessments to support the goals, objectives and strategies presented in this plan. The Appendices document (pending) will contain all of the meeting minutes and materials from the steering committee and subcommittees. These materials provide a more detailed understanding of the issues and discussions that resulted in the goals, objectives and strategies presented in the plan itself.

The material for the Appendices is posted at [www.dnr.maryland.gov/deepcreekwatershedplan/](http://www.dnr.maryland.gov/deepcreekwatershedplan/) and can be reviewed under each steering committee and subcommittee meeting date. The Deep Creek Watershed Characterization Report is also posted on the same web page.

# Background

## Deep Creek Lake

Deep Creek Lake, the largest fresh water lake in Maryland, is nestled in the state's western mountains of Garrett County. In 1922, Garrett County rivers were surveyed to identify opportunities for constructing dams and generating electricity. Deep Creek was the only one of four identified sites to be built.<sup>i</sup> Construction began in 1923 and was completed in 1925. The dam was owned and operated for many years by the Pennsylvania Electric Company (Penelec). Then, in 1980, the state of Maryland, through the Department of Natural Resources (DNR), agreed to manage recreation and public access at Deep Creek Lake. Lake management regulations were promulgated through a public process beginning in 1981 and were updated in 1986, 1988, 1989, and 2000. These regulations are still in effect and provide the basis for the DNR lake management operations. Boating and other permit fees were established to fund maintenance and management of the lake.<sup>ii</sup>

In 1999, Maryland entered into negotiations with General Public Utility, Inc., Penelec's holding corporation, to purchase the lake bottom, buffer zone properties, and other parcels owned by the power company. The purchase was completed in 2000 for \$17 million. The purchase did not include the dam, intake, tunnel, or power plant. General Public Utility later sold the dam, intake tunnel, and hydro-electric plant to the parent company of Brookfield Renewable Energy Partners.

Deep Creek Lake has evolved as the centerpiece of tourism in Western Maryland. Releases from

the dam through the power plant enter Maryland's only designated "wild river," the Youghiogheny, which supports a renowned trout fishery and one of the most challenging kayaking and rafting runs in the country. The lake itself has also become a primary recreational destination and is the economic engine for Garrett County. Among the popular water-based activities are boating, fishing, swimming, water skiing, and sailing. The 3,900-acre lake offers year round recreational opportunities, but is most popular during the summer months.

The Deep Creek watershed is entirely within Garrett County, the westernmost county in Maryland. The county seat is Oakland, located 8 miles to the south. The watershed covers 41,435 acres and is located within the Mississippi River drainage basin. Based on the United States Geological Survey's (USGS) National Hydrography Dataset (NHD: 1:24,000 scale), it contains 49.4 miles of streams. Forests cover 50 percent of the land; agriculture and development each cover another 20 percent; and wetlands and water cover the remaining 10 percent.

Management of the lake and watershed uses falls under the jurisdiction of several county and state agencies, requiring partnership and communication to effectively balance the potential impacts to and use of the lake and the watershed. The Maryland DNR manages the lake and the buffer and all activities within those areas on behalf of the state. Water uses and releases are managed through an appropriation permit issued by the Maryland Department of the Environment (MDE). Land use within the watershed and outside the lake buffer is

controlled through zoning and other development permits issued through Garrett County.

## What Keeps a Watershed Healthy?

Healthy watersheds are described by what they provide, such as 1) good water quality, 2) plentiful water supply, 3) clean air, 4) diverse and native plant and animal communities in aquatic and terrestrial habitats, 5) resiliency to natural and human-induced disturbances such as extreme storm events and flood flows, and 6) high quality, nature-based recreational opportunities.

These services are the result of many different watershed characteristics, working in concert. The following characteristics have profound effects on the benefits that watersheds provide:

- **Forests:** There is a direct relationship between the amount of forest cover in a watershed and the health of streams and lakes. More forest is better. Goetz et al. 2003<sup>iii</sup> recommends maintaining at least 50 percent of the watershed in forest and at least 75 percent of the riparian zone in forest for the best chance of keeping healthy streams. The riparian zone is the transition area between land and a river, lake, or stream.
- **Impervious surfaces:** As impervious surfaces (roads, buildings, parking lots, etc.) increase, so does the amount of stormwater that runs off into water bodies. Increased surface runoff introduces pollutants, warms the water, and disrupts hydrology, which may in turn increase damage from floods and erosion. DNR has developed general thresholds for impervious surfaces based on its Maryland Biological Stream Survey

program. Watersheds with 2 to 5 percent impervious cover generally have high aquatic biodiversity and healthy fisheries. Between 5 and 10 percent, biodiversity and fisheries production begins to decline. Beyond 10 percent, these attributes are generally impaired and are unlikely to reach former levels, even with stormwater retrofits, impervious surface removal, or tree planting/re-vegetation. (The amount of impervious cover for the Deep Creek watershed has not yet been determined.)

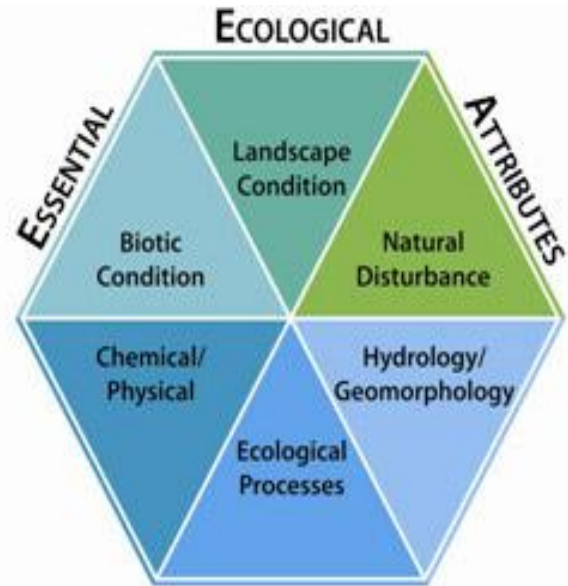
- **Submerged aquatic vegetation (SAV):** In lakes, SAV provides habitat for fish and promotes water clarity. The science is still emerging on how much SAV cover is needed to maintain healthy fish populations in lakes. Researchers in Minnesota, known as the “land of 10,000 lakes,” have found that conditions for game fish deteriorate when the percent of SAV falls below 10 percent or exceeds 60 percent.<sup>iv</sup> This range does not consider the wide variation in depths and shapes found in different zones of lakes.

These are just a few examples of the attributes of watersheds that need to be understood and managed. The U.S. Environmental Protection Agency (EPA) has developed the Healthy Watersheds Assessment Framework<sup>v</sup> as a tool for evaluating the health of a watershed through the assessment of essential ecological attributes. The framework includes six distinct groups of attributes that should be understood and managed to maintain and improve healthy watershed functions:

- 1) **Landscape condition:** Natural vegetative habitat patches and corridors provide the green infrastructure, or interconnected

natural areas, necessary to maintain good landscape condition in healthy watersheds.

- 2) **Biotic condition:** Healthy aquatic ecosystems reflect healthy watershed conditions. The biotic condition is measured by examining habitat along with the presence, numbers, and condition of aquatic organisms and communities in a water body.
- 3) **Chemical/physical parameters:** Parameters such as nutrients, temperature, dissolved oxygen, organic matter, and acidity are important components of ecosystem health.
- 4) **Natural disturbance regimes:** Understanding the natural disturbance regime (fire and flood frequency) of a watershed allows managers to develop management and protection measures that will maintain the watershed in as natural a condition as possible.
- 5) **Hydrology/geomorphology:** Healthy streams have a natural flow regime with a magnitude, frequency, duration, timing, and rate of change that creates habitat for multiple species. Further, in a healthy stream, erosion and sediment deposition rates achieve a balance, or dynamic equilibrium, based on water flow, soil type, and other factors. The dynamic equilibrium of the physical system establishes the dynamic equilibrium of the biological system, thus maintaining the ecological integrity of the system as a whole.
- 6) **Ecological processes:** Energy flow, elemental cycling, and the production, consumption, and decomposition of organic matter are barometers for assessing the health of a watershed.



US EPA Assessment Framework 1

**Figure 2. The Healthy Watersheds Assessment Framework (U.S. EPA)**

A watershed management plan evaluates and manages these essential ecological attributes. The plan lays out a framework for understanding and managing the land and waters in a way that will ensure that these healthy watershed benefits are maintained and improved over time.

## How Does a Watershed Affect the Condition of a Lake?

All lakes have a natural “aging process” — a long-term transition from lake to pond, pond to marsh, marsh to meadow, and meadow to dry land. This transformation means that lakes receive sediment even in watersheds that have not been highly disturbed by development. Some sediment is carried into the lake by streams, but sedimentation also occurs through the decomposition and deposition of plant material and the movement of sediment within the lake and from its shores.

This natural evolution takes place over geologic time, but the process can either be quickened or slowed by human activity or intervention.<sup>vi</sup> In human-made lakes, like those in Maryland, the aging process may affect the primary purpose for which the lake was made, such as flood storage, recreation, or water supply, and potentially need some form of intervention to preserve it. Lake conditions and watershed activities should be continually monitored in order to make informed management decisions that ensure the long-term health of a lake and its watershed.

Deep Creek Lake was created when a dam was constructed in the 1920s. Its watershed is relatively small compared to the volume of water in the lake. However, the water quality, fisheries, and other aquatic indicators

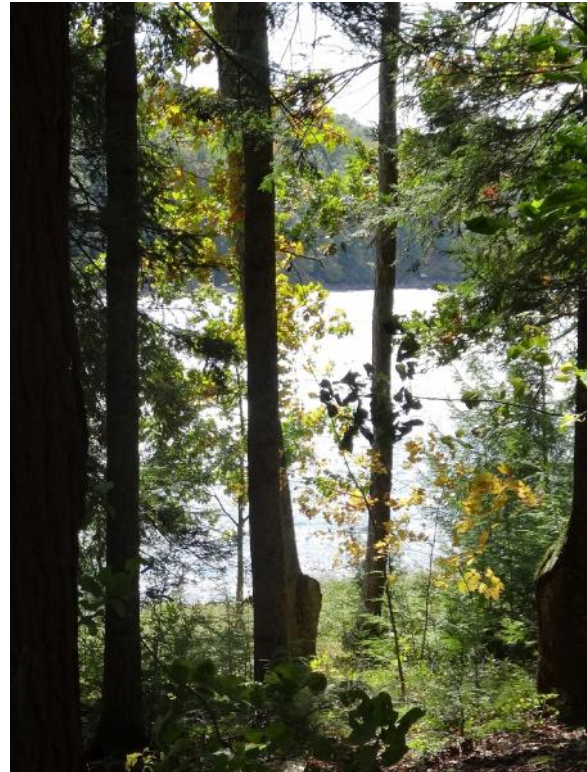
demonstrate that the lake has responded well, to this point, from changes to and impacts from the watershed. In simple terms, the lake is aging slowly and gracefully.

This plan addresses measures for both in-lake management as well as watershed management as an integrated approach. Specifically, Goal 3, discussed later in this plan, establishes the expectation that future management actions will maintain the lake in a mesotrophic condition, preserving the slow aging process. By setting this level of trophic state as a goal, activities within the watershed and within the lake itself can be evaluated and management decisions made to sustain the current high-quality conditions.

# A Watershed Plan for Deep Creek

When the Maryland General Assembly passed legislation in 2000 authorizing the purchase of Deep Creek Lake and its buffer, the new law included stewardship requirements and authorizations — but it did not address the watershed as a whole or its potential impact on water quality in the lake. The law required the development of a Deep Creek Lake Recreation and Land Use Plan that focuses on the lake’s shoreline and buffer area as well as the state’s responsibility for the lake and lands it now owned. (To read the full plan, visit <http://www.dnr.state.md.us/publiclands/dcreport.asp>.) The law also authorizes DNR to implement the Recreation and Land Use Plan by adopting regulations necessary to protect public health, safety, and natural resources. It established a Policy and Review Board (PRB), charged with reviewing and advising DNR on any matters related to the Deep Creek Lake Management and Maintenance Fund and the maintenance of the lake and buffer area. The law also requires PRB approval of any new regulations related to fees or changes to the Land Use and Recreation Plan. (More information on the PRB can be found at <http://dnr2.maryland.gov/publiclands/Pages/western/deepcreeknrma.aspx>.)

Over the years, the community, the county, and DNR have shown a growing interest in ensuring that the quality and recreational value of the lake is maintained. Concerns have arisen related to sediment in the coves, submerged aquatic vegetation, water quality, lake level fluctuations, and other issues. Many extend beyond the authority of the state-owned property and warranted assessing the watershed as a whole. Consequently, DNR and



the Garrett County Commissioners agreed to work together to develop a watershed management plan and signed a memorandum of understanding (MOU) that outlines the process for creating the watershed plan.

The MOU established a steering committee composed of volunteers representing the various interest groups and residents in the watershed, jointly appointed by the secretary of DNR and the County Commissioners. The committee began by establishing its role, outlining the process for developing a watershed plan, and defining rules of operation. The committee agreed on the following vision statement as the foundation for future actions:

**Through partnerships with private land owners and government**



**agencies, the Deep Creek watershed will improve its environmental stability and economic viability while retaining its rural landscapes and natural beauty so that, for generations to come, local citizens and visitors have a special place to live, work, and play.**

A list of steering committee members can be found in the Acknowledgements section of this plan; the meeting minutes and additional materials can be found at [www.dnr.maryland.gov/deepcreekwatershedplan/](http://www.dnr.maryland.gov/deepcreekwatershedplan/).

## Understanding the Issues

The watershed planning work began with identifying the issues and concerns being expressed by the community. A public meeting was held to gather input and a web site survey gathered input from those who were not able to attend the public meeting or steering committee meetings. The community expressed concerns about water quality, agency accountability and coordination, lake levels, quality of recreation, erosion and sedimentation, industrial impacts, infrastructure, forestry and agriculture, geese, growth pressures, communication, public information, and education. These issues were compiled into eight “problem statements” and agreed upon by the steering committee. The problem statements then became the foundation for defining the goals, objectives, and strategies. The problem statements, by category, are described below.

**1) Lake Levels.** Lake residents are concerned that variations in lake levels are affecting shoreline stability and recreational

access. Downstream users are concerned that change in the current structure of lake releases will impact their economy, including both whitewater recreation and power generation. Cold water fisheries are also dependent on continuous cold water releases.

**2) Water Quality.** Citizens are concerned that water quality in the lake will worsen. Specific sources of concerns include septic systems, sewage spills, stormwater runoff, geese, gasoline engines, disturbances from Marcellus shale gas extraction, lawn management, and agriculture.

**3) Residential, Commercial and Industrial Growth.** Citizens are concerned that uncontrolled industrial, commercial, and residential development will adversely impact water quality, increase traffic, degrade roads, threaten drinking water, and impair the aesthetic beauty of the lake and watershed. Specific concerns involve increased impervious cover, increase in pollution from stormwater runoff, impacts from septic systems, wastewater treatment capacity, and gas extraction development. DNR has also expressed concerns about reduction in tree canopy from clearing for development.

**4) Submerged Aquatic Vegetation (SAV).** Lake users are concerned that the growth of SAV is affecting boating and swimming. Other concerns involve the spread of invasive SAV. Some citizens recognize that SAV is an indicator of healthy water and fish habitat. Most boaters view SAV as a nuisance and are concerned about swimming safety in areas with SAV.

- 5) Erosion and Sedimentation.** Lake users and residents expressed concern about shoreline erosion. Sources of erosion include wave action from weather and boat traffic, as well as fluctuation in lake levels resulting in unstable shorelines and loss of trees in buffers. Residents are also concerned about sediment movement and deposition in the lake and the coves. Sources of sediment include shoreline erosion, stream channel erosion, and erosion caused by stormwater flow from new or existing impervious surfaces.
- 6) Accountability, Agency Coordination, and Lake Management Responsibility.** Citizens observed a lack of clarity and accountability regarding the agencies and people responsible for different management actions on and around the lake and in the watershed. Citizens also felt that agencies are not coordinating their work and a localized management authority is needed.
- 7) Recreation Needs and Conflicts.** Lake users expressed concern about the over-use of the lake by boaters. Concerns were expressed over noise levels from boats and inadequate public access to the lake.
- 8) Public Understanding and Participation.** Citizens expressed concern about the lack of participation from watershed residents as opposed to lake residents. They also reported a lack of access to information on lake management and on the watershed and lake in general.

## Getting Results

The steering committee established four subcommittees assigned with developing goals,

objectives, and strategies to address the problem statements:

- Accountability, Agency Coordination, and Public Understanding
- Water Quality (including sedimentation, SAV, and other factors affecting water quality)
- Impacts from Growth (including industrial growth as well as recreational uses of the watershed)
- Lake Levels

These subcommittees were staffed by DNR, the University of Maryland Harry Hughes Agro-Ecology Center, and county staff, with resources experts providing information as needed. Steering committee members served as chair of the subcommittees as well as participants. Subcommittee membership was open to the public and advertised through the media, the web, and word of mouth. Everyone who applied to participate in a subcommittee was appointed to one or more subcommittees. Lists of the subcommittee members and resource experts are on the Acknowledgements page of this plan.

The subcommittee chairs reported at each monthly steering committee meeting on the progress being made to develop goals, objectives, and strategies to address the problem statements. Most materials and meeting notes have been posted to [www.dnr.maryland.gov/deepcreekwatershedplan/](http://www.dnr.maryland.gov/deepcreekwatershedplan/).

In addition to the reports from the subcommittees, the steering committee's monthly meetings also consisted of educational presentations from resource experts on agriculture, county land use policies, stormwater management and sediment control, SAV, stream water quality, forestry, and lake sedimentation.

These presentations provided an overview of the existing conditions, issues, and policies for consideration in the development of the watershed plan. More detailed reports are available for review and presented by chapter at [www.dnr.maryland.gov/deepcreekwatershedplan/](http://www.dnr.maryland.gov/deepcreekwatershedplan/). These reports became the body of the Characterization Report that accompanies this plan.

Each subcommittee prepared a report explaining the goals, objectives, and strategies for addressing the problem statements, and presented their final drafts to the steering committee. The steering committee reviewed the work at a two-day retreat that resulted in the final content of the watershed management plan. Timing and sequencing were discussed for each recommendation to provide a context for the order of work needed to accomplish the goals. The steering committee agreed, however, that the issue needing the most immediate attention is the development of a more formal structure for interagency and inter-jurisdictional management. Throughout the development of

this plan, the steering committee and subcommittee members have questioned what will happen after the plan is finalized. They were concerned that the plan would not be effectively implemented without a managing or coordinating entity. The second most critical need is the development of a financing strategy to support the plan and recommended staffing. The subcommittee recommended that work on these two tasks should begin immediately after the plan is finalized and approved.

The plan is designed to employ an adaptive management approach for determining the actions that need to be implemented, when, and by whom. Adaptive management is an iterative process of decision-making that relies on monitoring the results of past actions to improve the results of future actions. It is inherently a learning process that provides the opportunities to revisit decisions and adjust the course of action to improve long-range outcomes. Effective use of adaptive management depends on regular reviews of progress and results, which then inform the next cycle of work.



*The Deep Creek Lake Discovery Center welcomes visitors at Deep Creek Lake State Park. PHOTO/ MD DNR*

# Goals, Objectives, and Strategies

The goals, objectives, and strategies of the watershed plan are organized as developed by the subcommittees; however, some strategies have been moved under other topic areas or combined with those from other subcommittees for continuity with other strategies or to eliminate duplication.

Recommendations for the timing of implementation are based on several factors:

- 1) Does the strategy depend on other actions or strategies to be initiated or completed first?
- 2) Is the strategy currently being implemented and recommended to continue?
- 3) Is there currently a mechanism or entity in place to address the strategy or does something need to be developed?

## *Accountability, Agency Coordination, and Public Understanding*

### **Goal 1: Improve management, funding, coordination, and accountability for the Deep Creek watershed.**

As with many combined public and private spaces, economic and political realities create conflicts for precious economic resources. Deep Creek Lake receives state funding and indirect services through various state and regional offices and programs. DNR manages the lake using funds provided through recreational user fees and has paid for programs related to water quality and sedimentation. However, there is no dedicated source of revenue for the lake or its watershed beyond the annual recreational user fees, 25 percent of which are provided to Garrett County as required by state law. The county receives property taxes from residents throughout the watershed. Although taxes for property near Deep Creek Lake can be extremely high, the money collected goes into the county's general fund and is not earmarked for watershed stewardship or lake investment. Clearly, there is a need for increased dedicated funding at both the state and county levels for watershed management. This funding problem

must be resolved if the watershed management plan is going to be successfully implemented.

The plan recommends the development of a management structure based on a formal agreement that establishes coordination and accountability linked to commitments, responsibilities, funding, and attendant authority. This approach to establishing a management structure does not usurp the current authority of any of the agencies. Instead, it uses the existing areas of authority to assign responsibility and accountability for certain components of the watershed management plan.

#### **Management Options**

The final decision regarding the structure and components of a new cooperative management approach will be up to the existing governing authorities (the Garrett County Commissioners, the state of Maryland, and potentially the

Maryland General Assembly). The subcommittee considered five categories of management structures and produced a discussion paper detailing similar structures that are in place across the country (see [http://www.dnr.state.md.us/ccs/pdfs/dclwmp/020314\\_SC\\_GovernanceOptions.pdf](http://www.dnr.state.md.us/ccs/pdfs/dclwmp/020314_SC_GovernanceOptions.pdf)). As a result, the following options are offered as a foundation for the development of that structure.

**1. Do nothing.** Maintain current structure, funding, and staffing.

**2. Augment the current management.**

- Add staff to the state and county agencies who are focused on Deep Creek Lake and its watershed management.
- Augment and expand responsibilities of the Deep Creek Lake Policy and Review Board (PRB), including providing advice to the County Commissioners.

**3. Sign a cooperative agreement.** The agreement would identify and establish a long-term approach for cooperative management of the lake and its watershed among the signatory entities. All signatories would retain current authorities but a commitment for action would be defined through annual work plans or long-term action plans. (The agreement could be combined with other options as well.)

**4. Establish a 501(c)3 non-profit organization or augment an existing one.** A non-profit organization could be responsible for conducting education programs, monitoring,

restoration projects, and providing coordination among responsible parties. A non-profit organization could also raise funds and receive grants for certain types of work. Two formats should be considered:

- A non-profit organization independent of a homeowners association
- A non-profit organization managed as a homeowners association

**5. Create a watershed district authority.** This would establish an independent governmental entity but would require legislative action.

Both the subcommittee and the steering committee agreed that “do nothing” is not an acceptable option. The steering committee agreed that a cooperative agreement is critical for establishing the partnership, roles, and accountability structure. The structure should include a hierarchy for reporting, with responsibility assigned to several subcommittees to cover key areas of interest (such as technical issues, citizen input, and financing). The partnership should be staffed with an executive director and other positions as needed. Work should begin immediately on the development of a new Memorandum of Understanding between DNR and Garrett County to create the management structure, hire an executive director, and establish a committee to guide the process.

Based on subcommittee recommendations and the steering committee review, the following objectives and strategies were devised.

<b>Objective 1</b>	
Develop and implement a management structure for the formal coordination of activities within the Deep Creek watershed consistent with the vision set forth in the Annotated Code of Maryland, Natural Resources Article, Section 5-215. This new partnership should oversee the implementation of the Watershed Management Plan, provide coordination between government and non-government partners, manage financial resources, and communicate with the public. Retention of current authority of the PRB for fees, laws, and regulations that affect the lake should be considered within the new management structure.	
<b>Strategies</b>	<b>Timing</b>
1. DNR and the county commissioners will execute a new Memorandum of Understanding focused on the development of a new management structure, scope of work for hiring an executive director, and the development and implementation of a financing plan.	first year
2. DNR and the county commissioners will form an implementation committee to guide the development of the management structure and implementation of the watershed management plan.	first year
3. The county and the state agencies will develop a management structure consistent with the recommendations of the watershed management plan.	first year
4. Consider whether state legislation with county endorsement is necessary to carry out the recommendations for the management structure.	0 to 3 years
5. All parties will sign an agreement to formalize accountability and commitment to the lake and its watershed.	0 to 3 years

<b>Objective 2</b>	
Develop sufficient, sustainable sources of funding to implement the watershed plan, including but not limited to addressing future needs for educational goals, objectives, programs, and adequate staffing.	
<b>Strategies</b>	<b>Timing</b>
1. Develop a financing strategy for the lake and its watershed to implement the watershed management plan and carry watershed management into the future. The financing strategy should include a thorough analysis of future and current local and state funding sources and needs for the lake and its watershed, including options for fundraising and endowments, as well as staffing needs.	first year
2. Establish a process for implementing and continually evaluating the financing needs.	0 to 3 years

<b>Objective 3</b>	
Ensure necessary and sufficient staffing of all state, county, and related agencies and partners to address management issues for the Deep Creek watershed.	
<b>Strategies</b>	<b>Timing</b>
1. Evaluate the needs and develop a plan to expand permanent and seasonal state and county staffing and operating resources to provide adequate service to the public, management of the lake and its watershed, coordination among entities, and support general outreach and education.	0 to 3 years
2. Provide financial resources to allow hiring/contracting of outside resource experts on lakes and watersheds as needed. This strategy will be a component of Strategy 1 under Objective 2.	0 to 3 years

<b>Objective 4</b>	
Develop a process for transparency and accountability for implementation of the watershed plan and associated costs.	
<b>Strategies</b>	<b>Timing</b>
1. Create and maintain a user-friendly dashboard/set of indicators to document and track implementation progress as well as water quality conditions, trends, and issues. The dashboard will include access to the county’s Health Department data and annual reports.	0 to 3 years
2. Develop a mechanism for public feedback on progress or issues.	0 to 3 years



## Goal 2: Nurture an informed and engaged citizenry regarding the Deep Creek watershed.

Having an informed public is key to achieving the vision and the goals of the plan. The seasonal variations in the size and interests of the community provide a challenge for keeping the public informed and involved in maintaining and improving the watershed’s natural resources while balancing the economic and recreational interests of the area. This complexity and needed balance is not unique to the Deep Creek

watershed and is experienced in most resort or seasonally dominated communities. However, the process of providing public education and consistent information needs to be constructed and coordinated. There are many recommendations for educational activities within this watershed management plan that should be coordinated and implemented by various partners throughout the watershed.

Objective	
Increase direct and indirect outreach to residents, businesses, and visitors regarding their responsibilities for maintaining and improving the quality of and impacts to the Deep Creek watershed.	
Strategy	Timing
<p>1. Develop an outreach plan, including the identification of outreach tools and programs (such as a speakers’ bureau, train-the-trainer program, etc.) that could increase outreach to citizens, businesses, and visitors. This could be coordinated with and/or managed by local non-profits selected by the new coordinating organization. The development of the plan should be coordinated with the Deep Creek Lake State Park Discovery Center and include activities supported by the state park both at the Discovery Center and off-site. The plan should be related to topics in the watershed management plan, include an implementation schedule, and include strategies to:</p> <ul style="list-style-type: none"> <li>a. Inform and educate the public regarding state ownership of the lake and the buffer and what that means to property owners and lake users.</li> <li>b. Develop a lawn care and buffer maintenance manual similar to the Critical Areas Buffer Manual to assist with understanding and implementation of appropriate planting and maintenance of the buffer and land adjacent to the buffer, including maintaining and re-planting trees.</li> <li>c. Inform and educate the public regarding the need and benefits of infiltrating stormwater to support higher water levels throughout the season.</li> </ul>	0 to 3 years



## *Lake and Stream Water Quality*

**Overarching Goal:** Protect, maintain, and/or improve the water quality parameters in Deep Creek Lake and its watershed needed to maintain and improve the lake at the mesotrophic level and to maximize the capacity of the watershed to support recreational uses and healthy aquatic and terrestrial living resources and habitats.

### **Goal 3: Collect the information needed to make informed management decisions that achieve the desired condition of the Deep Creek Lake and watershed.**

The condition of a lake is usually described by its “trophic state.” The determination of the trophic state, according to the Carlson Trophic State Index, is based on the interaction of three factors: chlorophyll from algal biomass, phosphorous concentrations, and clarity measured through secchi depth.

Deep Creek Lake is classified as a mesotrophic lake. Mesotrophic lakes are generally clear water lakes with beds of SAV and moderate levels of nutrients and plant productivity. In contrast, oligotrophic lakes are very low in nutrients and, as a result, have very low levels of aquatic plants and animals. At the other end of the spectrum, eutrophic lakes are very high in nutrients and support an abundance of aquatic plants, both algal and SAV. In some cases, nutrient enrichment in eutrophic lakes can impair water quality. While today (2014) the water quality of the lake is generally good, many citizens are concerned about the water quality in shallow coves and near-shore areas. Current monitoring does not assess these areas.

While lakes are evaluated by nutrient inputs, plant productivity, and clarity, stream health is determined by different criteria. Streams are less impacted by nutrients and more impacted by sediment deposition, temperature, acidity, and other factors. The current condition (2000-2012) of streams in the Deep Creek watershed was

evaluated using criteria consistent with methods being used to evaluate stream health throughout Garrett County and across Maryland.

Stream health information within the Deep Creek watershed was gathered from the Maryland Biological Stream Survey, which provides data on fish and benthic macro-invertebrates, and from Stream Waders, which provides data on benthic macro-invertebrates. These programs use a statewide standard that has been adjusted for the western Maryland region. Most of the streams within the watershed that have been monitored by these programs are rated as poor or fair, with a few rated as good. Stream Waders sites were scattered around the watershed fairly evenly and likely represent a good picture of the current health of streams (12 percent rated good, 31 percent fair, and 57 percent poor).

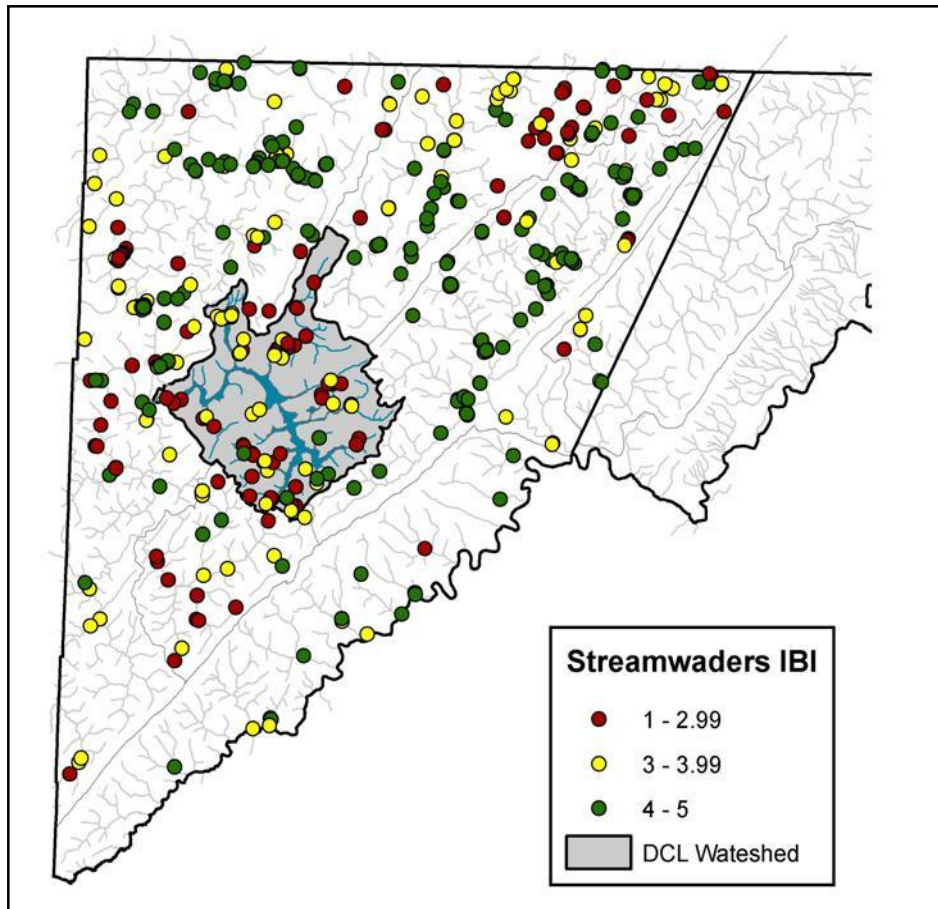
In general, stream health conditions are consistent conditions observed in the Little Youghiogheny River watershed, located in the southwest portion of Garrett County. In contrast, the most pristine streams in Garrett County are concentrated in heavily forested locations like the Savage River watershed in the northeast portion of the county (Figure 3). The ratings are based on a statewide standard that has been adjusted for the western Maryland region. (More detailed information on streams in the Deep

Creek watershed can be found in the Deep Creek Watershed Characterization report.) Although the majority of streams draining into Deep Creek Lake have been evaluated, DNR recommends additional stream monitoring throughout the watershed. Furthermore, there are questions remaining regarding the probable causes of the poor or fair ratings. A number of factors, such as land use changes, acid mine drainage, and low stream gradient may be contributing to the low biological community scores. Additional monitoring and assessment are needed to better understand stream health in the watershed.

In addition to identifying and managing sources of pollution to the lake and opportunities to

improve stream health, conservation of rural lands is a crucial element of the watershed management plan. The retention of economically viable forestry and agricultural industries is key to maintaining the rural landscape and natural beauty of the watershed. The existence and stewardship of these working lands maintains the vegetated cover and stream buffers that absorb and filter stormwater, recharge groundwater, and support local economy — all of which are integral to the vision of this plan. Engaging landowners in forest stewardship management plans, agricultural land conservation efforts, and tax incentive programs will support these conservation efforts.

**Figure 3. Garrett County Stream Waders sample locations and benthic IBI scores (2000-2012).**



<b>Objective 1</b>	
Improve our understanding of the sources of nitrogen, phosphorus, and sediment inputs to Deep Creek Lake and the streams that feed it, in order to prioritize places where conservation, restoration, and management activities will be most effective.	
<b>Strategies</b>	<b>Timing</b>
1. Conduct a nutrient synoptic survey in the spring when nutrient concentrations are typically at their highest to quantify nutrient concentration and yield from sub-watersheds.	0 to 3 years
2. Develop an inventory of stream restoration opportunities by conducting a stream corridor assessment of 30 miles of streams within the watershed. Prioritize stream restoration projects.	first year
3. Work with stakeholders, landowners, and partners to identify and implement watershed restoration projects.	0 to 3 years

<b>Objective 2</b>	
Continue regular monitoring of the Deep Creek watershed (lake and stream water quality) to inform decisions and management actions on lake and watershed conservation and restoration.	
<b>Strategies</b>	<b>Timing</b>
1. Continue the Deep Creek water quality monitoring workgroup, engaging all entities that conduct and/or use the data developed by water quality monitoring programs.	ongoing
2. Identify specific monitoring objectives and develop a water quality monitoring program for the next 5 years, reevaluate every 5 years, and include long-term monitoring objectives and criteria.	0 to 3 years
3. Convene yearly water quality monitoring meetings to discuss results, progress, and integration of multiple monitoring programs.	ongoing
4. Prepare publicly available annual reports on Deep Creek watershed water quality monitoring results, implementation actions, and management recommendations.	0 to 3 years, then ongoing
5. Coordinate research needs to complement monitoring and management objectives in partnership with academic institutions and funding programs.	3 to 5 years
6. Continue monitoring of Cherry Creek for acid mine drainage remediation.	ongoing

**Goal 4: Manage existing land uses to achieve the desired condition of the Deep Creek Lake and watershed.**

<b>Objective 1</b>	
Maximize the water quality, air quality, habitat and economic services provided by forests through conservation, restoration and management efforts.	
<b>Strategies</b>	<b>Timing</b>
1. Manage the forested public lands as a model of sound forestry practices and stewardship.	ongoing
2. Encourage the retention of forests by engaging landowners in forest stewardship management plans through the Garrett County Forestry Board.	ongoing
3. Identify landowner incentive programs, conduct outreach and education, and enforce and implement buffer management to increase tree canopy, promote lakeshore and stream buffer reforestation, and discourage mowing grass in the buffer.	0 to 3 years
4. Develop conservation priorities for forests and for other lands that provide exceptional water quality protection and support high-quality aquatic and terrestrial habitats.	ongoing
5. Develop a plan to protect priority conservation areas based on existing zoning; future growth impacts; and private, local, and state conservation assistance programs.	3 to 5 years
6. Develop a strategy, including cost-share programs, to aggressively treat hemlocks being attacked by the wooly adelgid, especially on private lands.	0 to 3 years/ asap

<b>Objective 2</b>	
Maintain agricultural land use within the watershed and ensure that best practices are deployed to minimize, mitigate, and reduce the impacts of nutrient and sediment inputs to the lake.	
<b>Strategies</b>	<b>Timing</b>
1. Educate and encourage landowners to keep land in agriculture through state and county conservation and agricultural land retention programs.	ongoing
2. Identify and prioritize opportunities to implement agricultural best management practices, such as cover crops, stream protection, stream buffers, wetland restoration, etc.	0 to 3 years
3. Encourage compliance with nutrient management, and target outreach and monitoring efforts to maximize compliance.	ongoing
4. Promote farm and forest sustainability through alternative incomes sources	ongoing

that maintain the rural character of the watershed and through the use of locally produced farm and forest products.	
5. Coordinate efforts of the Forestry Board, Soil Conservation District, and Farm Bureau to achieve mutual objectives.	0 to 3 years

<b>Objective 3</b>	
Minimize fertilizers and pesticide inputs to the lake and its streams from lawn care practices.	
<b>Strategies</b>	<b>Timing</b>
1. Conduct a survey of residential lawn owners and lawn care companies to determine the degree of homeowner and commercial fertilizer application practices.	0 to 3 years
2. Educate lawn owners about lawn care practices that reduce fertilizer inputs, including soil testing before application and information on the state fertilizer laws.	ongoing

<b>Objective 4</b>	
Manage additional nonpoint and point sources of pollution to Deep Creek Lake and its streams, including those associated with geese populations.	
<b>Strategies</b>	<b>Timing</b>
1. Educate landowners on habitat modification practices and permits for nest production control for the reduction of geese populations.	ongoing
2. Discourage feeding of geese on public and private lake shoreline property.	0 to 3 years
3. Encourage goose hunting where and when permitted and safe, and encourage agricultural land owners to allow hunting on their lands.	0 to 3 years
4. Monitor occurrence of violations with point source discharges to evaluate potential impact to water quality.	0 to 3 years
5. Encourage marina operators to participate in the Clean Marina Program.	0 to 3 years
6. Monitor the amount and location of road salt applied by the state and county.	0 to 3 years
7. Continue mitigation for acid mine drainage on Cherry Creek.	ongoing

*Submerged Aquatic Vegetation (SAV)*

**Goal 5: Manage SAV in Deep Creek Lake to maintain and improve the ecological stability of the lake, while working with waterfront landowners to minimize the interference of SAV with recreational uses of the lake around docks.**

Communities of native SAV are normal and important components of healthy freshwater mesotrophic ecosystems. They provide oxygen, nutrients, and food for all aquatic organisms and many species of waterfowl. They also function as habitat and nursery areas for many aquatic animals, including invertebrates and fish. The small aquatic animals, in turn, serve as food for larger game species of fish. Healthy SAV communities play an important role in the maintenance of healthy aquatic and terrestrial living resources.

In recent years, excessive growth of SAV has become a problem for boaters and swimmers in some portions of Deep Creek Lake. This is particularly an issue in shallow coves and areas affected by the deposition of sediments that have reduced water depths. Low lake levels may also increase growth of SAV in shallow cove areas. In addition, two non-native invasive plant species, Eurasian watermilfoil (*Myriophyllum spicatum*) and Hydrilla (*Hydrilla verticillata*) have been identified in the lake. The invasive species compete aggressively with native species, impacting recreational use of portions of the lake, and do not provide the same ecological benefits as native SAV.

Over the past several years, DNR has conducted annual surveys and monitoring of SAV in Deep Creek Lake. These studies have identified the



*Hydrilla is an invasive species of submerged aquatic vegetation (SAV) found in Deep Creek Lake. PHOTO/ BARBARA BEELAR*

location, size, and extent of the SAV communities, as well as the specific plant species. Continuation and expansion of SAV monitoring activities are essential to conservation, restoration, and management actions that are consistent with responsible watershed management. This plan recommends instituting an ongoing Water Quality Workgroup to address water quality and SAV monitoring activities implemented through partnerships with research organizations; the plan also recommends developing educational materials for homeowners, visitors, realtors, business owners, and other lake users.

<b>Objective 1</b>	
Develop a long-term monitoring plan, managed through the Water Quality Workgroup, to track changes in SAV species composition, abundance, and distribution to inform native and non-native SAV management plans.	
<b>Strategies</b>	<b>Timing</b>
1. Identify and recommend additional SAV monitoring objectives to be incorporated into the long-term monitoring plan.	ongoing
2. Include SAV monitoring results in annual reports and water quality dashboard.	3 to 5 years

<b>Objective 2</b>	
Manage the SAV communities around the docks and navigational channels to minimize interference with recreational uses such as boating and swimming.	
<b>Strategies</b>	<b>Timing</b>
1. Identify areas where SAV is considered to be a public use concern through a user-based evaluation, such as participatory GIS recreational use workshop or other venue.	0 to 3 years
2. Identify all possible management options for SAV around docks and navigational channels, including control strategies, lake levels, and dock permitting policies, and the appropriate means of implementing them.	ongoing
3. Develop an education program to provide all lake users with appropriate management options to support and maintain native SAV communities and healthy fish populations.	0 to 3 years

<b>Objective 3</b>	
Control existing populations of established invasive SAV species using best management practices, and prevent future introductions of harmful non-native species of SAV.	
<b>Strategies</b>	<b>Timing</b>
1. Determine if existing non-native SAV species are detrimental to the lake’s ecosystem and active recreational usage.	ongoing
2. Identify and implement control strategies to reduce the negative impacts of targeted non-native harmful species, such as hydrilla.	ongoing
3. Identify management plans and implement control strategies to prevent future introductions and spread of hydrilla, Eurasian watermilfoil, and other harmful non-native species of SAV.	ongoing

**Goal 6: Prevent erosion and sedimentation to the greatest extent possible to protect water resources from increased sediment loading and associated water quality problems.**

Erosion wears away the surface of the land and deposits sediments in waterways. Erosion results from wind, water, ice, and gravity, but the ways in which people use and manage the land can greatly increase the process.

Erosion and sedimentation have impacted Deep Creek Lake. The primary sources of sediment in the watershed, in no particular order, are:

- Stormwater runoff from cultivated farm land
- Stormwater runoff from developed land
- Stormwater runoff from forested land
- Stream bank erosion
- Lake shoreline erosion from wind and boat wakes

Shoreline erosion is everywhere, especially in shallow areas. In some places, erosion has made the shoreline unstable and deposited sediment on the lake bottom. Effects of this process include:

- Increasingly shallow waters, making boating difficult, if not impossible, in some locations
- Increased SAV, including invasive species in the shallower areas of the lake, which impedes boating and swimming
- Receding shorelines that reduce the buffer zone and cause trees to topple into the lake
- Impaired fish habitats due to the disturbance of sediment by the movement of water, either by wind or by boats

Receding shorelines create many problems. Trees falling in the water are a major safety concern to boaters and swimmers, the adjacent property owners, and DNR. The buffer zone, established at the lake's edge at the time of purchase, is eroding away. There are already several places where the full width of the buffer has eroded into the water. This exposes the state, as the owner of both the lake and buffer strip, to accusations of negligence.

Property owners who want to protect and improve the shoreline are burdened with a costly and time-consuming process. There is a long-standing need for DNR, in consultation with the Maryland Department of the Environment (MDE), to develop and make publicly available uniform procedures for shoreline stabilization that are appropriate for specific conditions found throughout the lake and to minimize the costs of permitting and installation that the property owner currently must bear. Public acceptance of such guidelines would be enhanced if the county and Policy Review Board help to develop them.

Citizens believe that property owners who want to install protective measures should be able to:

- Do so without fees for permits
- Select shoreline protective measures from a series of pre-approved designs developed in consultation with the state.
- Install them during pre-approved times
- Receive incentives to install such protective measures.



The state has determined that it will not engage in processes to remove sediments from the lake. In their evaluation of assessing the various options available to remove sediment, private initiatives were not considered;

however, some lakeside property owners would like to pursue the restoration of navigable coves on their own. A process needs to be defined for this to happen.

<b>Objective 1</b>	
Identify the causes and mechanisms of erosion and sources of sediment within the Deep Creek watershed, including the movement of sediment in the lake.	
<b>Strategies</b>	<b>Timing</b>
1. Consider existing and ongoing sedimentation studies to identify probable sources of sedimentation through an analysis of watershed condition based on soil type, slope, drainage patterns, land use, and other factors, and considering sedimentation studies done to date.	0 to 3 years
2. Identify and quantify the causes and mechanisms of lake and stream shoreline erosion to include heightened wave energy from wind and boat wakes.	0 to 3 years
3. Categorize erosion by shoreline type and severity potential.	3 to 5 years
4. Identify existing shoreline control measures around the lake and categorize with respect to efficacy and visual impact and correlate with the results from Strategies 1 and 2.	0 to 3 years
5. Prioritize areas of special concern and develop remedial approaches in consultation with MDE.	0 to 3 years

<b>Objective 2</b>	
Develop an erosion and sediment control implementation plan.	
<b>Strategies</b>	<b>Timing</b>
1. In consultation with MDE, identify the means to control various erosion processes identified under Objective 1.	3 to 5 years
2. In consultation with MDE, define measures to judge the performance and adequacy of erosion control projects.	3 to 5 years
3. Identify and prioritize erosion and sediment control projects. Coordinate with results from stream walks, storm water management, and agricultural erosion initiatives.	3 to 5 years
4. Identify funding and partnerships to complete at least one or two projects a year. Projects should be coordinated with the stream walks, stormwater management, and agricultural erosion initiatives.	3 to 5 years

<b>Objective 3</b>	
Revise, streamline, and incentivize lake shoreline protection measures and permitting.	
<b>Strategies</b>	<b>Timing</b>
1. The appropriate agents of the Deep Creek Lake Management Office, DNR, MDE, the county, and other partners as appropriate should meet to discuss the goals and objectives of the shoreline erosion program.	first year
2. Define and articulate the responsibilities of the state and lakeside property owners regarding the maintenance of the buffer strip and the shoreline.	0 to 3 years
3. Define and develop standard approaches for selecting and installing shoreline protection measures based on the various types of shoreline conditions that need to be protected.	0 to 3 years
4. Review permitting requirements and procedures, identify improvements and develop a process that streamlines shoreline erosion control practices in a cost-effective manner for the responsible party.	0 to 3 years
5. Evaluate options to eliminate the fees and develop incentive programs for shoreline erosion projects.	0 to 3 years
6. Promote the merits of shoreline stabilization and encourage homeowners through incentive programs, as they are developed, to install appropriate measures to prevent further shoreline erosion.	ongoing

*Addressing Impacts from Growth*

**Goal 7: Promote policies that balance environmental sustainability and economic viability.**

The main areas of concern about development, both existing and new, fall into four broad categories: land use, stormwater, septic and sewerage, and recreation. Specific topic areas are gas drilling, wind farms, other industrial concerns, aesthetics in regard to architectural design of commercial buildings, loss of tree canopy, legacy stormwater problems, failing septic, adequacy of public sewerage, shoreline erosion, and public access to lake resources. The public expressed concerns that development damages the aesthetic beauty of the watershed. Although it is difficult to quantify aesthetic beauty, current zoning

regulations have provided some architectural guidelines for commercial buildings throughout the watershed. It was agreed that, although these architectural standards provide some protection, additional guidelines for commercial buildings should be explored in order to address this concern. The watershed has also seen a loss of waterfront businesses due to the increased demand for private residences and transient vacation rental units. Because waterfront businesses serve as a point of access for the general public, the loss of such businesses exacerbates the concern that there is not

enough public access to the lake. The consensus of the group was that steps should be taken to ensure the viability of such waterfront properties in order to protect public access to the lake as well as preserve the unique experience of accessing such businesses by boat.

Development of industrial opportunities within the watershed related to natural gas drilling is an issue of much debate locally as well as statewide. The potential impacts to the

environment are the subject of the state’s Marcellus Shale Advisory Commission. (More information on the work of this commission and best practices proposed for the industry should well drilling be allowed to proceed in the state can be found at

<http://www.mde.state.md.us/programs/Land/mining/marcellus/Pages/Commission.aspx>.)

The purpose of the objectives described below is to assure that, if gas drilling is approved in Maryland, Garrett County takes the necessary measures to prohibit gas wellheads within the Deep Creek watershed.

<b>Objective 1</b>	
The county’s planning commission should strengthen the current site design and architectural review standards applied to commercial development within the watershed.	
<b>Strategies</b>	<b>Timing</b>
1. The county should include this topic as part of its comprehensive plan cycle, scheduled to begin in fiscal year 2016.	0 to 3 years
2. If, after public review, this objective is included in the comprehensive plan, the county should formulate regulatory language to be included in the <i>Deep Creek Zoning Ordinance</i> as part of the update for that ordinance.	3 to 5 years
3. Should the regulation be included in the Deep Creek zoning ordinance, the staff of the Office of Planning & Land Management is the responsible entity for enforcement at the time of permit application.	ongoing

<b>Objective 2</b>	
Promote new and retain viable waterfront businesses.	
<b>Strategies</b>	<b>Timing</b>
1. The county’s Office of Economic Development and the Garrett County Chamber of Commerce should form a “think tank” to determine ways in which waterfront businesses can be supported and encouraged.	0 to 3 years

2. The think tank should revisit the two recommendations from the 2008 comprehensive plan to 1) work one-on-one with individual waterfront businesses at risk of being lost and 2) explore with the local tax assessor the potential for changes in the way that property assessment values are prepared for waterfront businesses.	0 to 3 years
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<b>Objective 3</b>	
No shale gas drilling wellheads should be allowed within the Deep Creek watershed.	
<b>Strategies</b>	<b>Timing</b>
1. If shale gas drilling is permitted in Maryland, Garrett County should prohibit gas wellheads in the watershed in order to protect the unique quality of the Deep Creek watershed.	0 to 3 years
2. As part of the Comprehensive Plan process, the Planning Commission should include this recommendation for inclusion within the document.	0 to 3 years
3. Should this recommendation be included in the Comprehensive Plan, a regulatory mechanism should be included in the Deep Creek Watershed Ordinance at the time of its review.	0 to 3 years

*Addressing Impacts from Growth*

**Goal 8: Manage stormwater infrastructure to decrease pollution from both existing and proposed development to ensure healthy watershed conditions.**

Both the lake and the streams are affected by changes in land cover that increases stormwater runoff and the pollutants it carries. Legacy stormwater is the biggest contributor to stormwater issues in the watershed. Older developments often have problems that the county has difficulty fixing due to private property concerns and lack of right of way. Runoff from highways and roads is another concern that will require coordination and cooperation between state and local highway agencies.

This plan recommends taking these initial steps to address stormwater issues: identify the areas

of highest concern, assess options for addressing those concerns, and conduct a pilot project to improve management of stormwater. The long-term approach is to systematically assess and address stormwater issues on a sub-watershed scale. Education of homeowners, local businesses, and visitors is a critical component needed to achieve long-term success in reducing impacts from stormwater. Installing best management practices on private property can be expensive, and maintenance of stormwater features is also a concern; for that reason, an incentive program is needed to encourage action by private landowners.

<b>Objective 1</b>	
Develop an incremental plan to identify existing stormwater problems at a sub-watershed level and create an action plan for addressing issues and educating residents on best management practices.	
<b>Strategies</b>	<b>Timing</b>
1. The county's Office of Permits and Inspection Services and Department of Engineering will provide a list of known areas of concern. This list will be used to rank sub-watersheds with regard to highest need, severity, accessibility, and other factors.	first year
2. Conduct an on-site survey of the highest ranking sub-watersheds to determine the stormwater issues and their source.	0 to 3 years
3. Convene a meeting of appropriate agencies and interested parties within the Deep Creek watershed to devise an action plan for addressing concerns in the highest ranking sub-watershed.	0 to 3 years
4. Create an implementation plan and timeline to implement the technical aspects of the action plan. This becomes the pilot project.	0 to 3 years
5. Work with citizens in the sub-watershed to educate land owners on stormwater best management practices that can be established on their land. Promote a stormwater best management practice incentive program as per Goal 8, Objective 2.	Ongoing
6. Assess the effectiveness of the sub-watershed pilot area plan implementation. If it is found to be successful, select the next sub-watershed that will be designated for action.	3 to 5 years or more

<b>Objective 2</b>	
Design and implement a stormwater best management practices incentive program.	
<b>Strategies</b>	<b>Timing</b>
1. Review the Bay-Wise Yardstick Program and propose a similar program to be used in the Deep Creek watershed. A list of possible incentives for participation will be included as well as an implementation schedule and approach. The University of Maryland Extension Service will serve as the support agency for the program.	first year

Objective 3	
The use of stormwater best management practices for both state and county roads operations will be made a priority for maintenance and legacy infrastructure whenever practicable.	
Strategy	Timing
1. Work through the proposed governing entity to engage the appropriate agencies to devise and/or compile educational materials pertinent to best stormwater management practices. Include educational opportunities or trainings for roads workers and create a plan to incorporate best management practices into their workflow.	ongoing
2. Work with the State Highway Administration to determine the best approach for reducing impacts from state roads. Identify potential opportunities for stormwater retrofits.	ongoing

*Septic and Sewerage*

**Goal 9: Protect the watershed from the adverse effects of impaired septic systems and ensure adequate capacity and management of public sewerage systems.**

As septic tanks process organic matter, they also discharge effluent that contains significant concentrations of pathogens and nutrients. The effluent has traditionally been discharged to soil, sand, or other media absorption fields for further treatment through biological processes, adsorption, filtration, and infiltration into underlying soils. These conventional systems work well if they are:

- Installed in areas with appropriate soils and hydraulic capacities
- Designed to treat the incoming waste load to meet public health, ground water, and surface water performance standards
- Installed properly
- Maintained to ensure long-term performance

While septic permits are not issued in Garrett County unless suitable conditions exist, system failures sometimes occur. In addition to concerns about occasional failures, Maryland has raised statewide concerns about nitrates and phosphorus. Nitrates that leach into ground water used as a drinking water source can cause methemoglobinemia, or blue baby syndrome, and other health problems for pregnant women. Nitrates and phosphorus discharged into surface waters directly or through subsurface flows can spur algal growth and lead to eutrophication and low dissolved oxygen in lakes, rivers, and coastal areas. In addition, pathogens reaching ground water or surface waters can cause human disease through direct consumption, or recreational contact (U.S. EPA Onsite Wastewater Treatment Systems, 2002 Manual EPA/625/R-00/008 February 2002).

Conventional septic systems might not be adequate for addressing these concerns. As a result, systems using the Best Available Technology (BAT) are now required for all new home construction or septic replacements in the Chesapeake Bay watershed. Deep Creek watershed is not within the Chesapeake Bay watershed; however, BAT systems are required for all new systems or replacements that occur within the lake buy-down area<sup>vii</sup>. These systems are better at removing nutrients, specifically nitrogen, and last longer than a regular system, but they are more expensive to install and require continuing maintenance and electricity. This plan recommends encouraging — but not requiring — the use of BAT systems within the Deep Creek watershed. Consideration was given to developing incentives but, given the cost of installation and maintenance, county resources would be best directed elsewhere. The best way to protect ground

water in the watershed is to encourage the expansion of public sewer systems. Homeowner costs, however, are a great concern. To address this issue, the plan recommends conducting an educational campaign to promote the benefits and considering alternatives to the current system of debt repayment. (For more information see the)Impacts of Growth subcommittee meeting notes at [http://www.dnr.state.md.us/ccs/pdfs/dclwmp/031314\\_IQG\\_Minutes.pdf](http://www.dnr.state.md.us/ccs/pdfs/dclwmp/031314_IQG_Minutes.pdf)

Expanding the public sewer system also creates the potential for more dense growth — an often unintended negative consequence. Land use controls and the use of proper stormwater practices should work together to control any negative impact of such growth. In addition, public sewer systems work most efficiently and safely when operated under best management practices. The county should employ such practices routinely.

<b>Objective 1</b>	
Encourage the use of Best Available Technology (BAT) septic systems within Deep Creek watershed.	
<b>Strategies</b>	<b>Timing</b>
1. Devise and/or compile educational materials for distribution to homeowners regarding the benefits of BAT systems.	first year
2. Distribute the materials to homeowners in prioritized phases, starting with structures older than 50 years, structures aged 40 to 50 years, and structures aged 30 to 40 years.	0 to 3 years
3. The Environmental Health Department will distribute information regarding BAT systems to every new home applicant.	ongoing

<b>Objective 2</b>	
Expand public sewer consistent with the 2014 Garrett County Water & Sewer Master Plan, as well as upgrades to the existing sewer system so that it complies with BAT or best management practices as appropriate, to include relevant training.	
<b>Strategies</b>	<b>Timing</b>
1. Devise a marketing campaign to be targeted at residents of areas planned for public sewer to increase awareness of the need for services in order to decrease the impacts of failing septic.	ongoing
2. Develop creative alternatives to debt re-payment on public systems to address current deterrents to the cost of the system.	3 to 5 years
3. Work with county agencies to identify training and best management practices for sewer system management.	ongoing

*Recreation*

**Goal 10: Preserve and enhance the quality of recreational opportunities while ensuring that those opportunities are in harmony with environmental stewardship.**

The DNR Park Service manages both the Deep Creek Lake State Park and the Deep Creek Lake Natural Resource Management Area (NRMA). Deep Creek Lake State Park consists of 1,818 acres and is visited by more than 194,800 visitors annually. It is the primary public access point to Deep Creek Lake, providing a public boat ramp and dock; one mile of shoreline for swimming, paddling, and fishing; a 112-site family campground; four picnic shelters; and nature programs at the Discovery Center. The park maintains approximately 12 miles of natural surface trails and a designated public hunting area.

The Deep Creek Lake NRMA is comprised of the land and water of Deep Creek Lake and approximately 65 miles of the lake's publically owned shoreline, otherwise known as the "buffer strip." The NRMA is managed by the DNR Park Service, which staffs and supports a Lake Management Office at the state park.

The Lake Management Office is responsible for implementing regulations that govern the protection and use of the lake and buffer strip, as well as state conservation easements on approximately 1,500 properties surrounding the lake.

Recreation is the primary reason for making Deep Creek Lake and the surrounding watershed a vacation destination. The close proximity to several major metropolitan areas in four states also makes the lake area a prime location for a vacation or retirement home. This plan recommends actions for preserving and enhancing the quality of recreation while ensuring environmental stewardship.

Public access to the lake is perceived as limited, but there are many public access points that the public does not know about and not all public access points are properly signed. Increasing public access to recreational resources is a priority throughout Maryland and certainly in



the Deep Creek watershed. Access, especially to the lake, is needed for fishing, boating and other water sports. An inventory of those sites needs to be made, which includes the type of public access granted. Those sites need to be promoted and properly signed.

Permits for docks and boating are issued through the DNR Lake Management Office. The Lake Management Office must field inquiries and process permits for all lake users, both

resident and transient. In order to make the enjoyment of recreation at the lake as seamless as possible, the Lake Management Office must have the proper equipment and technology. Updates to the office software are needed to streamline the staff's ability to do queries and searches on permitting information. Adequate technology is vital to the accomplishments of that office as well as to the dissemination of information to the public.

<b>Objective 1</b>	
The DNR Lake Management Office should upgrade their buffer strip and conservation easement land use monitoring, lake and land use permitting and boating count databases.	
<b>Strategies</b>	<b>Timing</b>
1. DNR will assess the hardware and software needs of the Lake Management Office, looking for opportunities to upgrade and improve efficiency.	first year
2. The Lake Management Office will investigate the development of a GIS-based green infrastructure analysis of current land use of the buffer strip and lands under conservation easements.	0 to 3 years
3. DNR will establish a timeline for upgrades.	0 to 3 years



<b>Objective 2</b>	
The DNR Lake Management Office should identify and promote current and future public access locations with a focus on supporting non-motorized recreational activities.	
<b>Strategies</b>	<b>Timing</b>
1. The Lake Management Office will map the locations and types of all existing public access points and produce a brochure for visitors.	0 to 3 years
2. The Lake Management Office will visit access sites and determine whether appropriate signage exists at each location. If not, signage will be obtained and erected. Signage should include educational information when appropriate.	0 to 3 years
3. Assure the public access brochures created by the Lake Management Office are reproduced and distributed through local businesses, the visitor's center, and on the Internet.	0 to 3 years
4. The Lake Management Office, working with appropriate partners, will review past records where potential future sites of public access have been highlighted. These sites will be reviewed for potential use as public access in relation to cost, type of access, public facilities and/or infrastructure needed, and other factors deemed appropriate by the group.	3 to 5 years

<b>Objective 3</b>	
The Maryland Park Service will enhance recreational opportunities and green infrastructure at Deep Creek Lake State Park and be a model for stewardship.	
<b>Strategies</b>	<b>Timing</b>
1. The state park will expand the current hiking and biking trail system to include 5 to 10 additional miles of natural surface trails.	ongoing
2. New trail guides and a downloadable trail map will be available for visitors.	0 to 3 years
3. Two new playgrounds featuring nature-themed elements will be installed in the day use area of the state park.	0 to 3 years
4. Energy efficiency and alternative energy solutions will be installed at the state park Discovery Center.	3 to 5 years
5. The state park will evaluate opportunities for implementing management practices on park lands to reduce erosion and improve management of stormwater.	0 to 3 years

**Goal 11: Maximize the retention of forest cover to protect high-value aquatic and terrestrial natural resources.**

Retention of forests is critical to maintaining and improving water quality and wildlife habitat. Garrett County is blessed with abundant forests that support a segment of the local economy. At the same time, development continues replacing some forests with homes, roads, and businesses. The Maryland Forest

Service has analyzed forest resources throughout the state and identified high-value forests that need to be retained to protect sensitive habitats and species. Local planning policies need to be evaluated in relation to this data to identify the best approaches for protecting sensitive habitats.

Objective	
The county and state will work together on planning for conservation of high value and sensitive resource acres in development areas.	
Strategies	Timing
1. Assess how current development regulations and policies at the state and county level impact high-value and sensitive resources areas.	0 to 3 years
2. Garrett County and DNR work together to identify opportunities for forest retention in development areas.	0 to 3 years

## Lake Levels

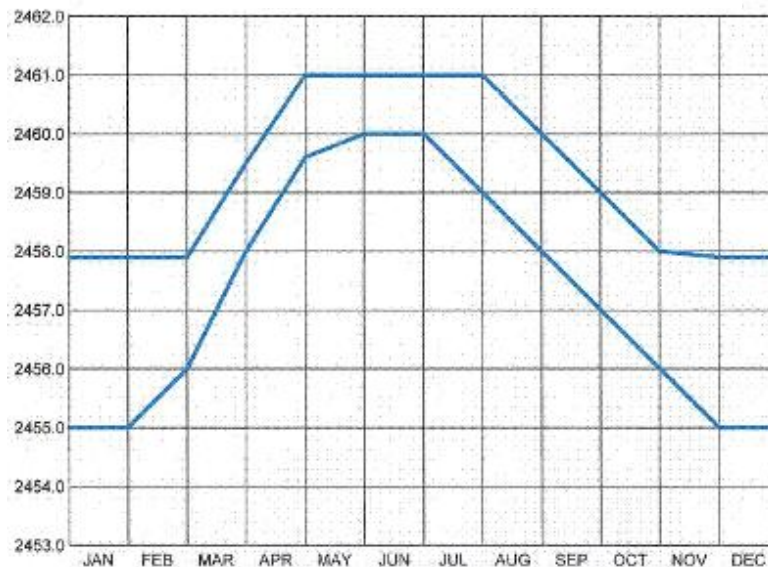
**Over-arching Goal:** To maintain higher lake levels that allow lake users adequate water levels for recreation, to strictly limit excursions below the lower rule band, and to provide for the needs of other users of the water resource.

### **Goal 12: Assure that the water appropriation analysis and allocation methodology for Deep Creek Lake provides a fair distribution of water for all users, especially during the months of May through September.**

The levels in Deep Creek Lake fluctuate from year to year and throughout the season. The changes in lake levels are related to varying inflow from yearly and seasonal precipitation and groundwater, as well as periodic outflows from water releases. Water releases are designed to balance the uses of the lake. They support power generation, maintain cool waters for the trout fishery, protect the base flow of the river, and help sustain white water recreation in the Youghiogheny River. Depending on precipitation, evaporation, etc., water is generally at its highest level in mid-April through mid-July, and then lowers until October or November. Levels begin to climb again as the winter ice begins to melt in early spring.

The Maryland Department of the Environment (MDE) issues a water appropriation permit setting the rules and limits for these releases. The permit operates under a “rule band,” which establishes maximum and minimum water elevations at different times of the year. The permit requires that whitewater releases be reduced when the water level falls below the minimum level or “lower band,” and all whitewater releases must cease if water levels fall more than one foot below the lower band. Releases to maintain water temperatures are not subject to the minimum band. Details on the rules and conditions for releases can be found at [http://www.mde.maryland.gov/programs/Water/Water\\_Supply/Documents/Deep%20Creek%20Lake/dcl-p-08r.pdf](http://www.mde.maryland.gov/programs/Water/Water_Supply/Documents/Deep%20Creek%20Lake/dcl-p-08r.pdf).

**Figure 4. 2011 Revised Operating Rule Band**



Conflicts arise primarily in drought years when water levels are low. Lakefront homeowners in more shallow coves cannot access the lake with their boats and releases for whitewater recreation are reduced, while the trout fishery must be maintained through cold water releases and power must be generated as much as the resource and the permit will allow. Wet years can also be problematic because higher water levels for extended periods of time can promote shoreline erosion where control measures are not in place. Extended periods of high lake levels increase the concerns of lakefront property owners regarding the loss of shoreline and buffer area, as well as the increase in sediment deposition in the lake.

The subcommittee researched the current methodology and data used in developing the permit, and then proposed potential alternatives. The major questions were related to understanding the requirements for the different purposes for releases and any permitted exceptions to the lower rule band. The current permit is written to provide multiple benefits from the releases for multiple users. Although this approach is efficient and provides for simultaneous uses of the water resource, a more detailed examination of any single user's needs and allocation was difficult to assess.

In considering the issues and needs of the users, four main concerns arose:

- In August of 2010, the Deep Creek Policy and Review Board sent a letter to MDE asking the department to reconsider the Brookfield Water Appropriation and Use permit. Approximately 1,700 persons had signed a petition to have action taken to address low lake levels that were impairing boating for lakefront property owners. MDE worked with a stakeholder

workgroup to revise the permit, which was re-issued in August of 2011. MDE analyzed many years of data concerning lake levels, precipitation, stream flow, and water releases from the lake. Several changes were made to the permit, including extending the maximum water level or "upper rule band," allowing for excursions above the upper rule band from May through October, eliminating the need for temperature enhancement releases on days of whitewater releases, and requiring the permittee (Brookfield Power) to monitor the loss of water through the wicket gates and submit a plan to MDE for reducing wicket gate losses. The adjustments made to the permit did not cover all of the changes requested by the Policy and Review Board. The board requested that MDE consider raising the Lower Rule Band. MDE evaluated the impacts of raising the Lower Rule Band and determined that it would have serious negative impacts on the whitewater community, would not significantly raise lake levels, and that levels during a hot dry summer would still fall below the Lower Rule Band. As a result, this change was not made to the permit.

- A variety of economic benefits are derived from Deep Creek Lake, both upstream and downstream. The economic interests of the town of Friendsville and the businesses that derive their income from the whitewater kayaking, rafting, and related services are as important as the economic interests of those in the Deep Creek watershed. Whitewater interests benefit from scheduled weekend and weekday releases throughout the summer as well as from the temperature enhancement

releases and discretionary releases for power generation. The county benefits from substantial property tax revenues. Lake users benefit from a longer season on the water when lake levels are higher.

- Temperature enhancement releases are needed to maintain water temperature at or below 25 degrees Celsius to allow coldwater fish, such as trout, to survive. Coldwater fish experience stress or death when the water temperatures rise above 25 degrees Celsius for extended periods of time. Releases from the lake cool the streams to benefit the fish, while also generating power and current for whitewater recreation.
- Brookfield Power, which owns and maintains the dam and the infrastructure of the plant, must be able to generate the power through discretionary releases according to permits and the rule band.

The steering committee questioned whether water in the lake can be conserved by altering the methodology of the temperature enhancement releases and explored the development of a water budget and predictive model. Subcommittee members gathered information on data availability and compared this approach with the current practice for development of the appropriation permit.

The subcommittee agreed that an improved protocol for temperature enhancement releases, paired with a water budget that has a predictive capability, could possibly save water in the lake. Exploring these conditions would require a study conducted by an independent water resource engineering firm with a proven related track record. This firm would be

approved by all parties, independently funded, and would work with state staff.

At the latest, the results of the proposed independent study should be provided to MDE one year in advance of the permit renewal currently scheduled for 2019.

There is significant value in continuing this discussion with appropriate experts from DNR and MDE, and an independent consulting engineering firm. The discussion should continue for several reasons:

- To increase the level of understanding regarding the available data and the decision process for the development of the permit
- To better understand and appreciate all parties' needs and concerns
- To gain a better understanding of the ability to collect the data to refine the appropriation process and temperature enhancement release protocols
- To build trust among the users, regulators, and interested parties

DNR and MDE have the responsibility and authority to implement strategies in support of the objectives of Goal 12 and the related overarching goal. Should the independent studies of a water budget and altered protocol for temperature enhancement releases prove scientifically feasible and reasonable in cost, the steering committee recommends that the departments incorporate these findings in a new permit for water releases. The proposed predictive model would help predict water levels based on measured and estimated inflows, which would in turn improve the decision process for the timing and volume of

releases. The hope is that this approach would accommodate the needs of all users while maintaining higher water levels throughout the summer. However, the data required to predict the water inputs will need to be identified,

potentially collected, then evaluated by the proposed independent water resources engineering firm to determine if this approach is better than the current management method.

Objective 1	
Develop a water budget that affords equitable allocation of the resource for consideration by MDE.	
Strategies	Timing
1. Hire an independent water resources engineering consulting firm, approved by all parties and externally funded. The consultant will evaluate and recommend adjustments to protocols for temperature enhancement releases as described in Objective 2 and will define and develop a water budget that can be used for Deep Creek Lake, including conditions for strictly limiting excursions below the lower band from May through September.	0 to 3 years
2. Request that MDE consider allowing the upper rule band to be Full Pool of 2461.3 feet. (This does not mean the water must be at 2461.3; it just allows Brookfield a larger margin.) Consider incentives for Brookfield to achieve full pool by May 1st of each year.	3 to 5 years
3. Request that MDE consider the results of the study conducted by the independent water resources engineering consultant described in Strategy 2 prior to the development of the appropriation permit. Any proposed changes to the temperature enhancement release protocol must be approved by the DNR Power Plant Research Program. This study must be completed and data provided to MDE one year in advance of the permit renewal.	3 to 5 years
4. DNR Power Plant Research Program continues to refine the protocol for temperature enhancement releases based on results of the study.	

*Lake Levels*

**Goal 13: Improve access to navigable waters for property owners who typically have shallow water during the summer months.**

Remedies to address lake level issues in the shallow coves are recommended to offer relief to affected boat slip owners. On an administrative level, communications with new property owners should be improved so that they are

more aware of any potential limitations experienced as the lake level lowers throughout the season. DNR has studied the possibility of dredging the lake coves but, as the lake owner, determined that this is not a cost-effective

option for the state to undertake. (See the Decision Matrix in the DNR document, *Deep Creek Lake: A Sediment Study*, October 2013, <http://www.dnr.state.md.us/ccs/pdfs/dclwmp/DCLAlternativesFinal.pdf>.) However, should individual property owners or a group of property owners desire to initiate dredging on

their own, a process needs to be developed and guidelines need to be put in place to assure the practices are implemented as reviewed and recommended by the Deep Creek Lake Policy and Review Board<sup>viii</sup> and in accordance with DNR and MDE requirements.

<b>Objective 1</b>	
Assist property owners in areas that typically have low water levels during the summer months.	
<b>Strategies</b>	<b>Timing</b>
1. In order to help shallow cove slip owners without impacting other stakeholders, request DNR to evaluate regulations and consider adjustments that provide more options for increasing access for a variety of recreation opportunities. Consider methods to extend docking facilities to deeper waters.	0 to 3 years
2. Work with the Board of Realtors and other appropriate agencies, investigate mechanisms to assure that an “eligibility report,” prepared by the DNR Lake Management Office, is provided to property buyers at the closing of a property transfer. The eligibility report describes current permits, property conditions, restrictions, and other factors. Comprehensive information on water conditions along the specific property, any current violations that require correction, and confirmation that the buy-down <sup>ix</sup> transfers with the property should be added to this report.	0 to 3 years

<b>Objective 2</b>	
Consider dredging to the original lake bottom contours.	
<b>Strategies</b>	<b>Timing</b>
1. Evaluate whether dredging will be allowed and where it may take place.	first year
2. If dredging is allowed, develop evaluation criteria and identify areas where private and/or county-led initiatives to remove sediments are possible.	3 to 5 years
3. Identify means and disposal options to remove sediments by private and/or county organizations.	3 to 5 years
4. Assess the legal, permitting, and disposal requirements related to dredging.	3 to 5 years
5. Develop organizational structures that can deal with the needs.	3 to 5 years
6. Identify potential sources of funding.	3 to 5 years



## Conclusion and Next Steps

The strategies identified in this plan present a menu of needed actions and a timeframe for addressing them. Some actions are already underway through state or county management; they are part of the process of government. Other actions, such as educational programs and activities, could be assumed by local non-profit organizations. Most of the actions are identified as needing to be initiated or completed in the near term.

Recognizing that not everything can be done at once, a new management or coordinating organization, as proposed, will evaluate the actions based on available funding, willing partners, and pressing needs, and develop a work plan to address the recommendations. In

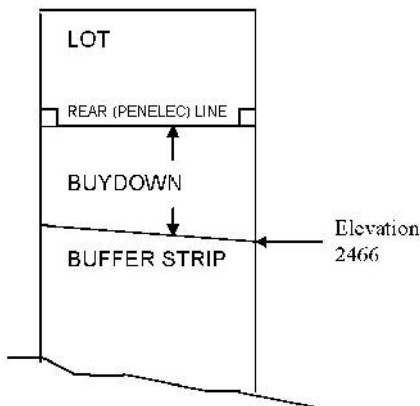
addition, new issues may arise that could take precedence over planned activities. The community will need to recognize and allow the flexibility necessary to manage a program focused on ever-changing environmental issues and needs.

There is a strong need for coordinating all of the activities to assure the message is consistent and the actions taken are addressing the most immediate issues. Recognizing that the strategy for developing a new management structure will take some time to get underway, the steering committee recommends and stands ready to continue their role in assisting the county and state in moving the watershed plan forward.



## Endnotes

- <sup>i</sup> [http://www.thefullwiki.org/History\\_of\\_Garrett\\_County%2C\\_Maryland#wikipedia\\_Hydro\\_electric\\_power](http://www.thefullwiki.org/History_of_Garrett_County%2C_Maryland#wikipedia_Hydro_electric_power)
- <sup>ii</sup> Maryland Department of Natural Resources. "Deep Creek Lake Recreation and Land Use Plan." Annapolis, MD: Maryland :Department of Natural Resources, October 2001: page 1.
- <sup>iii</sup> Goetz, S. J., R. Wright, A. J. Smith, E. Zinecker, and E. Schaub. 2003. IKONOS imagery for resource management: tree cover, impervious surfaces, and riparian buffer analysis in the Mid-Atlantic region. *Remote Sensing of Environment* 88(1-2): 195-208.
- <sup>iv</sup> Valley, R.D., T.K. Cross and P. Radomski. 2004. The role of submerged aquatic vegetation as habitat for fish in Minnesota lakes, including the implications of non-native plant invasions and their management. Minnesota Department of Natural Resources. Special Publication 160.
- <sup>v</sup> <http://water.epa.gov/polwaste/nps/watershed/framework.cfm>
- <sup>vi</sup> <http://des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-3.pdf>
- <sup>vii</sup> The "buy-down area" was defined as the land between the lake buffer strip, which was set at an elevation of 2466 feet, and the rear boundary of the former Penelec property. The state of Maryland acquired this land as part of the purchase of Deep Creek Lake. For a limited period of time, adjacent lot owners were offered the opportunity to purchase the portion of this area next to their property. The provision of sale included a conservation easement attached to the land to prevent future permanent development. Not all property owners participated in the buy-down offer. Consequently, the widths of both the buy-down parcels and the buffer strip vary around the lake. The DNR Lake Management Office oversees both the protection of the public buffer strip and compliance with the state-held conservation easements on the buy-down properties.



- <sup>viii</sup> <http://dnr2.maryland.gov/publiclands/Pages/western/deepcreeknrma.aspx>

- <sup>ix</sup> See Endnote vi.