Erosion & Sedimentation
Goals, Objective and Strategies

Introduction

Defining goals and objectives can often be confusing. To assist the mind in clarifying how to develop goals and objectives, this section briefly describes how they are commonly viewed.

Goals are general guidelines that explain what you want to achieve. They are usually long-term and represent global visions such as "protect the shore lines from eroding."

Objectives are the headings of the descriptions that define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific, measurable, and have a defined completion date. They are more specific and outline the "who, what, when, where, and how" of reaching the goals.

Strategies are the specific elements of work that are needed to accomplish an objective.

Effective goals:

- are broad statements of meaningful outcomes
- are clearly written
- are achievable
- provide a framework for writing statements of objectives
- are adaptable to changes in the program
- are consistent with the mission statement of the program and institution

Effective objectives:

- use action words that specify definite, observable behaviors
- indicate an appropriate level of attainment
- are assessable through one or more indicators
- comprehensively and meaningfully define a goal
- are realistic and achievable
- use simple language

Problem Statement

Users and lake residents have expressed concern about shoreline erosion. The perception is that sources of erosion include wave action from boat traffic and weather as well as fluctuation in lake levels resulting in unstable shorelines and

loss of trees in buffers. Residents are concerned about sediment movement and deposition in the lake and the coves. Sources of sediment include shoreline erosion, stream channel erosion and movement from new or existing impervious surfaces.

Background

To develop goals, objectives and strategies for erosion and sedimentation a background is needed as to what these are and how they are manifested at Deep Creek Lake. So this section provides a background to the issue.

At Deep Creek Lake the issues associated with erosion and sedimentation are manifested in the following ways:

- Shallower waters, making boating difficult if not impossible during times when it is desirable to do so.
- Increased subaquatic vegetation, including invasive species in the shallower areas of the lake impeding boating and swimming
- Receding shorelines and trees falling down and into the lake causing loss of buffer strip width
- Impaired fish habitats due to the disturbance of sediment by the movement of water, either by wind or man-made by boats.

Erosion and sedimentation are very complicate technical issues. Nature's way is always to erode and move eroded materials around. It's basically unstoppable. Temperature cycles, rain, snow, ice all cause materials to expand and contract and eventually to disintegrate into small particles and create soils. These small particles are then moved by wind and flowing waters to lower lands, eroding further, where they settle.

All we can do, as humans, is to slow down the process and perhaps redirect the outcome, meaning redirecting the sediment and waters, to other areas.

The distribution of sediments and their potential for resuspension have significant influence on internal nutrient recycling, sediment oxygen demand, macrophyte and benthic community distributions, loss of water depth and other processes in lakes. The distribution and resuspension of sediment within a lake area are generally recognized to be a function of wind speed, fetch, water depth, slopes of the surrounding shores, particle size, sediment cohesiveness and other factors."

Soil is made up of decomposing organic plant and animal material mixed with tiny rock fragments containing a whole variety of minerals. Soils are derived from weathering and erosion process of larger rocks or deposits. Soil particles are

constantly washed and blown away and often wind up in various types of waterbodies, where it's called sediment. Sediment is generally classified by particle or grain size. Sediment can exist in a suspended manner if the particles are small enough, or when large enough, can settle on the bottom of bodies of water.

The primary sources of sediment in the Deep Creek Lake watershed are:

- Runoff from cultivated farm land
- Runoff from developed land
- Runoff from forested land
- Stream bank erosion
- Lake shoreline erosion

DNR has performed two studies at Deep Creek Lake to attempt to quantify the degree of sedimentation occurring in the lake. The first study was conducted in 2010. The second one was conducted in 2012, with the report being released recently (Ref. 1).

The recent study performed by DNR confirmed earlier studies that sedimentation is definitely taking place in certain parts of the lake. Sediments were found mostly in the shallow coves of the Southern part of the lake. Certain coves have sedimentation accumulation of over 2 ft thick.

The report described various ways of removing the sediment and the possible costs associated with it. In the end, their recommendation is to do "nothing' with the existing sediment, but to put the effort into controlling the erosion that causes the sedimentation in the lake.

The primary focus of sediment is how it winds up in the lake, because it affects the navigability of the lake's waters, somethings that is very important to those living on or nearby the lake or those visiting the lake area. Sedimentation in streams, especially in the kind of streams that are in the DCL watershed, is of small importance, except as a source of additional sediment that can be transported during extreme weather events.

Runoff or surface water runoff are waters that flow downhill on top of the surface via natural drainage paths dictated by the laws of gravity. Hence runoff can wind up in streams or directly in the lake. Runoff is faster on steeper slopes.

Runoff of surface waters cause soil particles to be dislodged from larger soil clumps and carry them along as dictated by gravitational forces. The larger ones will be transported to down stream locations, the smaller ones to the ultimate destination, the lake.

The speed of the runoff has a great influence on what and how much is transported. The speed in turn is controlled by the nature of the surface and the intensity of the source of the water.

The source of the water is either direct rainfall or flow from ground sources coming further uphill, such as springs.

The nature of the surface is often characterized by some kind of roughness factor, and the rougher the surface, the slower the runoff speed. Hence agricultural land is often classified as somewhat smooth, while forest are classified as rough.

Runoff can be channeled by man-made structures. It's then classified as storm water management. If properly designed, operated, and maintained, storm water management systems should carry very little sediment. All sediment should have been trapped upstream from the final discharge point.

Once sediment is present on the bottom of the lake it can move around by water currents. While there very few natural currents in the lake, waves and water temperature differences can set up regions of recirculation which can then transport sediment from one location to another. The smaller particles will move first, leaving behind the larger ones. One can see the result of this phenomenon everywhere around the lake on the shoreline.

Sedimentation

The overall goal is to minimize erosion which then minimizes sedimentation. Before we can quantify the term 'minimize' we must have an understanding of how the forces of erosion and sedimentation work at Deep Creek Lake.

The work recently completed by DNR (Ref.1) provides some quantification of the amounts of sediment that have been deposited in the lake since its formation in 1923. The analysis characterizes the amounts of sediment deposited, where, and the amount of water depth reduction it caused

The DNR program follows the process outlined in the State's Soil Erosion and Sedimentation Control plan (Ref. 2). Four steps are identified to deal with the sedimentation issue (Ref.1):

1. Identify the accumulated sediment
2. Understand the environmental relations
3. Analyze the alternatives
4. Reduce sediment input

Item 1 is essentially accomplished as reported in Ref. 1. However, there is a need to make such assessments on a regular basis to determine how successful the mitigation measures were.

Somewhere on the shores of Deep Creek Lake

Devising means to minimize erosion and sedimentation needs to be integrated with storm water management practices. Stormwater management is treated as a separate set of goals, objectives and strategies. The following objectives to deal with the sedimentation issue are in part adapted from Ref.1

2. Develop an understanding of the erosion and sedimentation mechanisms that operate at Deep Creek Lake, including the movement of sediment in the lake itself
    1. Develop a map of the soil types covering the various sub-watersheds
3. Characterize the types of erosion taking place from the sedimentation work done to date
4. Identify existing drainage patterns, drainage area boundaries, and slopes
5. Identify areas of special concern
6. Characterize the areas of special concern
7. Identify erosion and sediment controls
    1. Vegetation
    2. Hardcover
8. Define measures to judge the performance of erosion control projects
9. Define desirable drainage patterns, drainage area boundaries and slopes
10. Identify erosion control projects
    1. Develop SOWs and budgets

2. Identify contractors
3. Award projects

11. Prioritize erosion control projects

Shoreline Stabilization

Receding shorelines and trees falling in the water are of major concern to boaters, the adjacent property owners and the State (DNR). The lake buy-down process established a hard buffer line of 25 ft from the lake's edge at the time of purchase. As weather and lake level practices erode the shoreline, the buffer width is eroding. There apparently are already several places where the 25 ft buffer monument is now found in the lake itself. This exposes the State, who is the owner of the lake and the buffer strip, to accusations of negligence. Shoreline erosion is taking place everywhere, in some areas more than others. An excellent attempt at quantifying erosion rates is documented in a masters theses (Ref. 4). Unfortunately, it only covers the northern part of the lake, but the results are compelling.

For the State to embark on a massive shoreline protection is not feasible. The State currently relies on adjacent property owners to install protective measures at the property owner's expense. This process is accompanied by a lengthy and expensive application process.

This, by all measures, does not make sense. The property owner is burdened with a costly and time consuming process with improving the State's real estate. As a result, many adjacent property owners do not have the inclination to protect the shoreline.

To encourage the protection of the lake's shores adjacent property owners should be given incentives to install protective measures. Specifically property owners who want to install protective measures should:

- be able to do so without fees to the State
- be able to select measures from a series of pre-approved designs developed by the State
- be allowed to install them during pre-approved times during the year.
- be given certain tax incentives when installing a protective measure

The Goal:

To protect the shoreline from further degradation (receding)

The Objectives:

1. Define a standard process for installing a shoreline protection measures
2. Identify the various types of shorelines to protect
3. Define a variety of shoreline protection measures applicable to the various types of shoreline
    1. Soft-scapes
    2. Hard-scapes Strategies

References for Erosion and Sedimentation

1. Richard Ortt, DNR, April 7, 2014, Deep Creek Lake Introduction, Sediment Calculations and Reduction Strategies (http://dnr.state.md.us/ccs/pdfs/dclwmp/040714_SC_DCLSedimentCradletoGrave.pdf)

2. 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control, MDE, December 2011, http://www.mde.maryland.gov/programs/Water/StormwaterManagementProgram/SoilErosionandSedimentControl/Documents/2011%20MD%20Standard%20and%20Specifications%20for%20Soil%20Erosion%20and%20Sediment%20Control.pdf

3. Catalin Demian, "Shoreline Erosion in Deep Creek Lake, Maryland: Patterns, Trends and Economic Implications," Thesis submitted to the Eberly College of Arts and Sciences at West Virginia University, 2007

4. Standard Erosion and Sediment Control Plan For Forest Harvest Operations in Maryland, http://www.dnr.state.md.us/forests/mbmp/mbmpfho8.html

Definitions

la·cus·trine [l*uh*-**kuhs**-trin]

adjective

1. of or pertaining to a lake.
2. living or growing in lakes, as various organisms.
3. formed at the bottom or along the shore of lakes, as geologicalstrata.