July 2017
Deep Creek Lake Dredging Evaluation Garrett County, Maryland

Cove Evaluation Report

ANCHOR
QEA

Prepared for Maryland Environmental Service

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1 Introduction

1.1 Deep Creek Lake Sedimentation

Deep Creek Lake (Lake), located in Garrett County (County), Maryland, is a man-made lake created in 1925 with a surface area of approximately 3,900 acres and a storage volume of 106,000 acre-feet (Whitney Bailey Cox & Magnani, LLC [WBCM] 2013). The Lake is a large recreational hub and is responsible for most of the tourism revenue in the County. Since the creation of the Lake, sedimentation has occurred, specifically within the coves in the southern portion of the Lake (WBCM 2013). Sediment accumulation has led to decreased water depths and has generated several concerns amongst residents. In southern coves, specifically, residents have complained about reduced boat access, poor water quality due to turbidity, submerged aquatic vegetation (SAV), reduced recreational use, and odor (Friends of Deep Creek Lake 2012).

The Maryland Department of General Services and Department of Natural Resources (DNR) commissioned a sediment study of the Lake to evaluate the residents' concerns and identify possible solutions. The study, developed by WBCM in 2013, identified ten coves that had experienced the most significant sedimentation and evaluated the possibility of dredging to address the concerns of the residents. The study recommendation was for no dredging because the sedimentation that has occurred is not causing any major problems within the Lake. The study instead recommended taking measures to reduce the sediment inflow to the Lake.

Through funding provided by the DNR from a Waterway Improvement Fund (WIF) Grant, the County has requested further investigation into the possibility of dredging one or more of the coves in the southern portion of the Lake. Through this investigation, the County intends to select a cove and reapply for the WIF Grant to support implementation of a dredging project. An alternatives analysis comparing the ten coves identified in *Deep Creek Lake: A Sediment Study* (WBCM 2013; WBCM study) was conducted to select the most likely cove to receive the WIF Grant and be the most beneficial in terms of cost and environmental benefits.

The ten coves being evaluated for dredging are shown in Figure 1 and include Arrowhead Cove, Harvey's Cove, Poland Run Cove, Green Glade Cove, Hazelhurst Cove, Turkey Neck Cove, Chadderton School Cove, Deep Creek Cove, Penn Cove, and Pawn Run Cove.

Figure 1
Coves Evaluated For Dredging
Deep Creek Lake Dredging Evaluation
Garrett County

Source: Google Earth 2017

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2 Cove Evaluation and Ranking

2.1 Evaluation Matrix Development

The ten coves were evaluated by ranking each of them based on the criteria identified by the WIF Grant manual and additional criteria determined by discussions with agencies and previous dredging experience. For each criterion, coves were ranked to determine the most desirable cove for dredging. In most cases, the criteria for evaluating the coves involved the consideration of multiple elements. To differentiate, the elements were typically assigned a percentage-based weight to determine significance compared to other elements, and that weight was applied to a total score. The final ranking for each criterion was based on the total score, with the lowest number being associated with the most desirable. To prioritize coves for both the WIF Grant and additional criteria, the rankings of each were weighted and combined to develop a final score.

The cove evaluation matrix ranked the coves on 18 total categories, including nine from the WIF Grant Manual and nine additional criteria. Each cove was given a ranking within each criterion on a scale from 1 to 10. The 18 categories were then weighted by importance (either by point values specified or estimated importance), and a final ranking was calculated for the ten coves. The analysis ranged from cost, environmental, and economic impacts, to increases in safety and boating access, to difficulty in obtaining required permits. This analysis included impacts the dredging would have on not only the respective cove but also the Lake and community. Criteria that would result in all coves having the same ranking or minimum scoring from the WIF Grant were given a weighted average of 1%. This meant that in the ranking system, the criteria that did not differ from cove to cove played a very minor role in the final ranking. The final ranking results are presented in Table 1.

2.2 Supporting Documents

The cove evaluation included a literature review of several reports, prior studies, and other documents detailing existing conditions and observations of the Lake that were prepared by others. No additional sampling or data collection was performed as part of this evaluation. The data available from these reports were used to populate the matrix and identify the most suitable cove for dredging. The following documents were reviewed to provide data during the evaluation matrix development:

- Deep Creek Lake: A Sediment Study (WBCM, 2013)
- Deep Creek Lake Sediment Study: Background, Summary, and Critique (Friends of Deep Creek Lake, June 2014)
- Deep Creek Lake Coliform Count (Garrett County, 2016)
- Deep Creek Dredging Impact Analysis (Garrett County Economic Development)
- Deep Creek Hydroelectric Station, 2016 Annual Report (Brookfield Power Piney & Deep Creek, LLC, 2016)

- Deep Creek Lake Recreation and Land Use Plan (Maryland DNR)
- Deep Creek Lake Dye Study, PowerPoint Presentation (Maryland DNR, 2009)
- Deep Creek Lake Sediment Study, Physical and Chemical Characteristics of Lake Sediments (Maryland Geological Survey, October 2011)
- Deep Creek Lake Water Quality, 2015, annual water quality update (Maryland DNR, 2015)
- Deep Creek Lake Submerged Aquatic Vegetation Survey (Maryland DNR, 2015)
- Deep Creek Lake Water Quality Sampling (Downstream Strategies, 2016)
- U.S. Geological Survey Hydrologic Data for Deep Creek (Banks et al., 2010)
- Water Quality Analysis of Eutrophication for Deep Creek Lake and the Deep Creek Watershed (Garrett County, Maryland, July 2011)
- Watershed Report for Biological Impairment of the Deep Creek Lake Watershed in Garrett County, Maryland Biological Stressor Identification Analysis (Maryland DNR, June 2009)
- Deep Creek Lake Baseline Assessment Report (EcoCheck, March 2011)
- Deep Creek Lake Sediment Study: Physical and Chemical Characteristics of Lake Sediments (Maryland Geological Survey, October 2011)
- Aerial Photos from Green Glade Cove (T. Custer, November 2016)
- Waterway Improvement Fund Grants Manual (Maryland DNR Boating Services, 2016)

3 Waterway Improvement Fund Grant Criteria

The WIF Grant criteria are outlined in the WIF Grant Manual (Maryland DNR Boating Services 2016). Each cove was ranked for the criteria listed subsequently using all available project documents, data, and maps. Each criterion includes a brief explanation of how the ranking process for the coves was carried out to replicate the scoring defined in the WIF Grant Manual. The following are the criteria being evaluated for the WIF Grant:

- Regulatory permits/environmental
- Continuation of a current project
- Cost/benefit Expand/improve public boating access
- Safety
- Projected expenditure rate
- Boating congestion
- Sustainable elements
- Other/state or local priority

As each cove was ranked, the criteria were weighted based off total number of points available from the WIF Grant scoring. The WIF Grant scoring was typically assumed to be the same for all coves and the projected scoring and weight were combined to develop a total score. Based on projected scoring points for all coves, state and local priority (52%) was weighted as the most important criterion, whereas safety, improving boating access, and the expenditure rate were all weighted at 10% of the scoring. Boating congestion, continuation of a current project, and sustainable elements were each weighted at 5% of the scoring. The results of the WIF Grant Ranking are presented in Table 2.

3.1 Regulatory Permits/Environmental

The WIF Grant criteria for regulatory permits give precedence to projects that have either been previously issued permits or will be imminently issued permits. Projects with no permits and projects with potential environmental issues are given the minimum score for this criterion. Due to the anticipated date for submittal of the WIF Grant application by the County, it is unlikely that permits will be issued or could be considered imminent. The December 2013 Sediment Study by WBCM suggests that acquiring permits would be a difficult process that will take several years to complete. Previous experience in permitting similarly sized dredging projects suggests a duration of 1.5 to 2 years for successful acquisition of permits.

Based on past project experience, the following permits and studies will likely be required for all coves for dredging operations:

- Joint Federal/State Permit (U.S. Army Corps of Engineers Section 404/Maryland Department of the Environment [MDE] Wetland and Waterway Permit)
- Environmental Review of Rare, Threatened, and Endangered Species
- Sediment Control Permit

Additionally, construction of a staging area would also require the following permits:

- Garrett County Forest Conservation
- Garrett County Sediment Control Permit
- Garrett County Stormwater Management Permit
- Garrett County Grading Permit

Given that each cove within Deep Creek requires all the above permits, all of them are assumed to receive the same score of 1 for this criterion. Thus, all of them were given the same ranking of ten, and this criterion was weighted at 1% in the final scoring system. The regulatory permit/environmental ranking summary is presented in Table 3.

3.2   Continuation of a Current Project

The WIF Grant criteria assigns additional scoring to projects that are a continuation of an existing project. As the development of this evaluation is funded by a previous WIF Grant, any future work, including engineering design or dredging, would be considered a continuation of an existing project. Thus, all coves are all projected to receive the maximum score of 10 points and are weighted at 5% in the final scoring system. The ranking summary for continuation of a current project is presented in Table 4.

3.3   Cost/Benefit

The cost/benefit ratio criterion is intended to prioritize projects that enhance boating access to the public. The criterion states that projects affecting only a limited segment of the boating public, such as spur-channel dredging, are given a minimum score when grading. The coves being evaluated in this study generally fall into this category, as cove dredging would primarily affect private property owners along the waterfront. Despite the same low WIF Grant score (1) for all coves under this criterion, the coves were compared with others to determine where a dredging event would affect the most boaters at the lowest projected cost.

The scope of this evaluation did not include development of detailed cost estimates; therefore, the costs developed by WBCM in the 2013 Sediment Study were assumed to be sufficient to do a cove-by-cove comparison. The WBCM study had developed costs for hydraulic dredging, mechanical

dredging in the wet, and mechanical dredging in the dry. The coves were evaluated for these options and combined into one final score.

To evaluate and rank the coves, Anchor QEA calculated the cost/benefit ratio by dividing the total cost of dredging by the number of properties impacted by dredging. A second consideration was done by dividing total cost of dredging by the total volume of sediment being removed to determine the total cost per cubic yard of removal. The above ranking was done for all three dredging methods. The coves were ranked by the sum of the three dredging types for both cost per resident and cost per cubic yard. The cove that has the lowest combined ranking of cost per property and cost per cubic yard for all three dredging types represents the best cost/benefit and is given priority. The summary results of the cost/benefit analysis are presented in Table 5, with backup analysis for each of the dredging types on Table 5-1 through Table 5-3.

3.4   Expand/Improve Public Boating Access

The WIF Grant prioritizes projects that expand or improve public boating access. To evaluate improvements to public boating for each cove, it was assumed that a dredging event would increase boating availability in each cove by expanding the area with a suitable draft for boat access; as such, all coves would receive the same WIF Grant score of 20. The number of properties per cove was originally used as a basis for analysis, but though useful, it did not represent the full impacts that dredging would have on each individual cove. Using cove aerial photographs, the number of actual docks and boat slips were counted, which provided a more thorough analysis because several properties showed multiple boat slips or docks. Figure 2 presents an example of the difference between the number of properties and number of boat slips. This evaluation assumes that prior to dredging, all boats were limited in use and dredging would increase lake boat use by the number of available docks and boat slips within the cove being dredged. For the ranking, the cove with the highest number of available boats (total number of docks and boat slips) was given the highest ranking. To make sure the analysis was accurately conducted across all coves, the dock and boat slip count was performed during a summer month when it would be likely that all properties would have their docks or boat slips in the water. The results of the public boating access evaluation are presented in Table 6.

Note: The parcel map for Turkey Neck Cove (left) identifies 21 properties that would be impacted by dredging. The Google Earth image (right) displays 70 docks/boat slips within Turkey Neck Cove.

Figure 2
Comparison of Properties in Turkey Neck Cove and Number of Docks/Boat Slips
Deep Creek Lake Dredging Evaluation
Garrett County

3.5 Safety

The WIF Grant prioritizes projects that directly improve boating safety. To evaluate the coves for safety, the matrix considered the number of docks or boat slips in each cove, the average depth of each cove, the total area of dredging proposed in the WBCM study, and the percentage of the dredging footprint that lies outside the 100-foot no-wake zone. Each of the considerations were given a percentage weight to combine into a single score.

The most significant consideration is the percentage of the area outside of the no-wake zone. The study assumed that shallow waters—where rocks, debris, or potential grounding hazards may be found—outside of the no-wake zone are more dangerous to boaters, as boats are more likely to be operating at greater speeds. Therefore, this was given the greatest weight at 45% of the total safety score. Average cove depth was also considered a higher priority at 35% of the weighted safety score with the assumption that coves with shallow water were more likely to create hazards for boat traffic through congestion and possible grounding situations. Coves with the shallowest water (and greatest need for dredging) were given the highest ranking.

The rankings also assumed that any dredging event would be an improvement in safety to the local boat traffic in each cove; therefore, coves with the most docks or boat slips were given a higher ranking. The area of dredging consideration prioritized coves with the largest dredging footprint with the assumption that the increased water depths would reduce boat congestion within the Lake if dredged. Dredging in any cove would result in an improvement in boating safety and all coves would receive the same WIF Grant score of 20. The results of the safety evaluation are presented in Table 7.

3.6 Projected Expenditure Rate

The projected expenditure rate for a project is based on the total duration of a dredging project. The WIF Grant prioritizes projects where 100% of the requested funding is expended within the first 2 years. Total project durations for each cove were evaluated to analyze the projected expenditure rate. For dredging operations, a production rate of 200 cubic yards per day was assumed based on recent dredging production rates for similarly sized lake dredging projects in Maryland. Using estimated volumes required for removal from the WBCM study, an estimated dredging duration was calculated for each cove. The WBCM study also defines allowable dredging windows for the Lake determined by impacts on recreational use of the Lake. The projected windows are March 1 to Memorial Day (76 days) and Labor Day to December 25 (98 days). The WBCM study assumes dredging equipment must be out of the water prior to Memorial Day, cannot re-enter the water until after Labor Day, and must be out of the water again prior to December 25. Due to these restrictions, the spring window must include a 10-day demobilization period, and the fall period must include 10-day mobilization and 10-day demobilization periods. Using the above windows and their additional restrictions, each cove dredging duration was used to determine how many dredging seasons were

required for completion. The coves were then ranked by their required dredging seasons, with the highest ranking going to the shortest dredging duration. The results of the evaluation for projected expenditure are presented in Table 8.

Though these dredging windows are recommended by the WBCM study, it should be noted that there are likely to be additional environmental restrictions that may further complicate the schedule. Additionally, due to the high costs of mobilization and demobilization, it would create unnecessary costs to disrupt ongoing dredging operations. The dredging windows are used in the analysis for cove comparison, however it should be noted that the cove chosen for dredging will likely have continuous dredging operations that extend through the summer season and will impact recreational activities for the selected cove. The benefits of a dredging event in any cove should outweigh the temporary impacts of lost recreational opportunities. This criterion is the only one where the coves would have differing WIF Grant scores due to the different volumes in each cove. For the purposes of this evaluation, the maximum score of 20 points was assumed as this criterion prioritizes the shortest duration and multiple coves would meet the 1 year requirement.

3.7   Boating Congestion

The WIF Grant prioritizes projects that do not have a negative impact to boating congestion. Any dredging event will have a temporary negative impact on boating congestion because it will reduce the amount of open water for boat access. However, it should be noted that following a successful dredging event, the open water available to boaters is expected to increase based on increased water depths in areas that may have previously been inaccessible to boaters. Based on this assumption, it was assumed all coves would receive the top WIF Grant score of 10 points. To evaluate boating congestion for each cove, three factors were considered to decide which cove's dredging operation would likely have the least impact on boating congestion: boats impacted, dredging duration, and impact of dredging outside of the 100-foot no-wake zone. Each factor was given its own ranking and weighted based on importance to boating congestion. Both the boats impacted and dredging duration criteria were weighted equally (40% each), with impact of dredging outside of the 100-foot no-wake zone weighted lower (20%).

The number of boats impacted was calculated using the total number of docks and boat slips per cove, with the highest ranking for coves that had the least docks and boat slips impacted. The dredging duration was ranked the same way as the boats impacted criterion, with the highest ranking for the shortest dredging duration. The impact of dredging outside of the 100-foot no-wake zone evaluated the percentage of a dredging project for each cove that will take place in an area outside of the 100-foot no-wake zone. This factor was evaluated to prioritize the least amount of area outside of the no-wake zone. The impact of dredging outside of the 100-foot no-wake zone is weighted slightly lower than the other two factors, though dredging outside of the 100-foot no-wake zone would theoretically impact boats that want to get near the cove being dredged, it is

believed that few boats travel to other coves on a regular basis and thus will have their boating activities impacted. The results of the boating congestion evaluation are presented in Table 9.

3.8   Sustainable Elements

The WIF Grant prioritizes projects that include a sustainable, environmentally sensitive component. To analyze sustainable elements, all coves were assumed to be dredged with hydraulic processes because that is considered lower impact, as such all coves were assumed to be awarded the WIF Grant score of 10 points. The rankings between the coves was decided by sedimentation rate with the assumption that a cove with lower sedimentation over time is more sustainable and thus more practical. The current sedimentation rate was calculated using the average depth of sedimentation for the last 42 years as determined from comparison of bathymetric surveys from 1970 and 2012 (WBCM, 2013). The cove with the slowest sedimentation rate was considered the most sustainable and ranked the highest. The results of the sustainable elements evaluation are presented in Table 10.

3.9   Other/State or Local Priority

The WIF Grant provides additional scoring to projects that are considered mandatory or have a high local or state priority. This criterion was the most significant and could provide up to 200 points on the WIF Grant application review. For this criterion, all coves were given equal rankings, as no matter which cove is selected, it will be considered a local priority for the WIF Grant. The results of the local priority evaluation are presented in Table 11.

4 Additional Criteria

The additional criteria considered as part of the evaluation are similar to the WIF Grant criteria but also include considerations for environmental, engineering, and constructability concerns specific to how each would impact the Lake. These criteria were developed through discussions with governing agencies and from previous dredging experience. The additional criteria did not include any proposed scoring; thus, as part of this evaluation, the criteria were assigned a weight of importance based on experience with similarly sized lake dredging projects within the state of Maryland. The following are the criteria considered:

- Environmental impacts
- Lake water level impact
- Proximity to placement area
- Economic impact
- Recreational activity impact
- Community support
- Current/historical cove depth
- Dredging engineering logistics
- Permitting/potential mitigation costs

Each cove was ranked for each criterion listed using all available project documents, data, and maps. After the coves were ranked, each criterion was weighted to calculate a final score. Lake water impact and proximity to placement area were both ranked low (2.5%) because they are not expected to play a major role in project safety, difficulty, cost, or other major factors. Economic impact, community support and historical cove depth were weighted at 10%. Though important, past project experience in dredging Maryland lakes suggests these categories are not a top priority when deciding on a project location. Recreational activity and environmental impacts were weighted at 12.5%, and permitting and mitigation costs were weighted at 15% of the total scoring. These criteria were found to have more of an effect in determining which cove to implement a dredging project on within the Lake. Dredging engineering logistics were found to be the most significant criterion, weighted at 25% of the total scoring. Dredging engineering logistics factor in several aspects of the project, including cost, impacts, and efficiency. Each criterion is broken out in the following sections with a brief explanation of how the ranking process for the coves were implemented taking into consideration previous project experience. A summary of these additional criteria rankings is presented as Table 12.

4.1 Environmental Impacts

This additional criterion was developed to minimize negative environmental impacts from a dredging project and favor positive environmental impacts. The environmental evaluation considered the

following impacts: SAV in density and richness, sediment thickness, and water quality by coliform count. Additional data, such as fish survey results were available but data was typically from the entire Lake and did not differentiate between the individual coves and could not be used during this evaluation. Accumulated sediment thickness presented in the WBCM study was determined to be the highest weighted environmental impact and was given a weighted score of 50% of the total environmental impact. Deeper coves are less likely to experience disturbance of bottom sediment and resuspension of material into the water column; additionally, deeper coves limit the effect of sunlight in the water, which would limit the growth of SAV. The evaluation assumed that dredging would remove the full thickness of accumulated sediment and that the greatest change in bathymetry represented the most significant environmental impact. The environmental impacts evaluation is presented in Table 13, with backup in Tables 13-1 through 13-4.

For the SAV evaluation, the data used were collected by a Maryland DNR SAV monitoring program that has been in progress since 2010. The SAV ranking was given a weighted score of 25% of the total environmental impact. This weight is lower because the presence of non-invasive SAV, although a nuisance for property owners, is generally considered to be representative of a healthy ecosystem. The SAV ranking prioritized coves with a greater density of SAV and macroalgae. The rank prioritized coves containing invasive species for dredging more than coves with only native species, and it prioritized coves with the least amount of richness, or number of species. Not all coves in the dredging evaluation were included in the SAV monitoring. Coves without SAV data were assigned the average density, and richness during the evaluation.

Coliform count is a method used to test for water contamination that counts the number of colonies of coliform bacteria (*E. coli*) in most probable number (MPN) per 100 milliliters of water. MDE's *Guidance for County Recreational Water Quality Monitoring and Notification Programs* describes a monthly average threshold for clean recreational water of 200 MPN/100 milliliters and a single sample threshold of 400 MPN/100 milliliters. Monthly coliform count data for the Lake was collected by the County every May through September from 1993 to 2016. There were single sample outliers for Arrowhead Cove, Chadderton School Cove, Green Glad Cove, Hazelhurst Cove, and Pawn Run Cove that were above MDE thresholds; however, most samples fell well below the MDE threshold. The total coliform rank was given a weighted score of 25% of the total environmental rank and was based off an average of the entire dataset for each cove. Data were not available for all coves in the dredging evaluation; coves without coliform count data were assigned the average of available data so as not to adversely impact their overall rank.

In addition to sediment thickness, SAV, and coliform count, Anchor QEA reviewed a 2016 water quality sampling report by Downstream Strategies, LLC. The data within this report were not included in the environmental ranking for several reasons. The data were collected on September 7, 2016, and represent a snapshot in time rather than a consistent trend on the order of months or years. The

samples were collected during a dry period and do not represent potential runoff conditions. Water quality could vary greatly during and after a rainfall event. A limited set of parameters were selected to manage costs and maximize the number of sample areas. Selected parameters provided information about general chemistry (pH and total organic carbon), potential health concerns (arsenic, lead, and nitrates), or indicators of contamination (conductivity, chlorides, aluminum, and sulfate). Based on the parameters selected, the report indicates that water quality was consistent between different coves and was not suitable for ranking the coves.

4.2   Lake Water Level Impact

Due to the size of the Lake and the water capacity, it is unlikely that any dredging event would have a significant impact on the Lake water level. Of the three dredging methods considered, only mechanical excavation would possibly influence water level in the Lake. This method would require the water level in the Lake to be drawn down to allow for equipment access to the targeted removal areas. To evaluate for this criterion, mechanical excavation was assumed. The least amount of lake water draw down to expose historical cove depth was used as the primary driver. The historical depth was calculated for each cove using average cove depth and sediment accumulation over the previous 90 plus years. Using the lake surface area and historical cove depth, the discharge volume to expose the historical cove depth was calculated for each cove. Due to the low probability of lowering the lake water levels for sediment removal in one cove, this criterion was assigned a reduced weight. The results for the lake water level evaluation are presented in Table 14.

4.3   Proximity to Placement Area

Determining the proximity of each cove to the final placement area is a method for evaluating the amount of trucking required to place the sediments removed from the Lake. For placement of the dredged material, the WBCM study previously identified the County Landfill on Oakland Sang Run Road in Oakland, Maryland, and a closed quarry site off Garrett Highway north of Quarry Road. The WBCM study presented haul distances to these sites for each cove. To evaluate the coves for this criterion, the haul distances presented by WBCM were used as the basis for the ranking.

Of all the coves, only Green Glade Cove was limited by the placement facility capacity. Due to the large quantities of dredged material anticipated from Green Glade Cove, material would need to be placed at both facilities. Using the total quantity of sediment being dredged, distances to each placement facility, and percent break up of placement, the weighted distance of Green Glade Cove was calculated. Using this weighted distance and the distances of the other nine coves to their respective placement facilities, a ranking was created, with shortest distance ranking highest and longest distance ranking lowest. The results of the proximity to placement area evaluation are presented in Table 15.

Previous experience with dredging Maryland lakes suggests that placement of dredged material at the closed quarry may not be viable for this project; however, due to the relatively short distances to the landfill placement location from all coves, it is unlikely that this criterion will play a significant role in the final selection of a dredging location. Thus, the weighted value for the proximity to placement area is much lower than other criteria studied for this evaluation.

4.4   Economic Impact

This criterion attempts to minimize the economic impact to the County created by lost income from reduced property values with the assumption that waterfront properties on coves where sediment accumulation is a problem will decrease by 10%. To evaluate economic impacts for each cove, rankings were based on the amount of yearly tax revenue lost by the County per year based on a dredging event in only one cove. Operating with the assumption that all properties in each cove would lose water access if no dredging event was implemented, the WBCM study determined that the total decrease in property values for all properties in the coves in this evaluation combined would be $2,400,000 per year. Without any knowledge of the individual properties, all were assumed to be equal in value, and the total property value lost in each cove was based on its total number of properties. To determine tax revenue lost in each cove by not implementing a dredging event, the total value lost for each cove was multiplied by the County tax rate of $2.475 per $100 of assessed value. This evaluation assumes that dredging of a cove would negate this property loss for all the properties within the dredged cove. After calculating total tax revenue lost per year from not dredging each cove, the tax revenue based on a dredging event in each cove and the resulting lost revenue of all other coves was determined. The final rankings for economic impacts, presented in Table 16, shows the coves where a dredging event would result in the least yearly tax revenue loss for the County.

4.5   Recreational Activity Impact

The additional criteria included an evaluation of how a dredging project would impact local recreational activity. This category is similar to the boating congestion criteria of the WIF Grant evaluation; however, the boating congestion criteria focused on minimizing the impact to recreational activities during dredging operations. The additional criteria focused on the benefits to recreational activity following completion of a dredging event. To analyze recreational activity impact to each cove, the potential for an increase in boating was used as the primary ranking factor. Three major factors were considered during this evaluation: long-term boating access, increased boat usage, and increased boating area.

Rankings were developed for each of these categories, weighted, and combined into a total rank. Long-term boat access was determined by projecting the average cove depth in 25 years based on the average sedimentation rate per year. The evaluation prioritized coves that would have the least

amount of water depth and, therefore, the most restricted boat access for dredging. Long-term boat access was considered the most important factor and was given the highest score (40%).

Increased boating access was directly tied to the number of docks and boat slips located in each cove. The assumption for this evaluation was that a dredging event would increase the use within the Lake by total number of docks and boat slips available in the respective cove; thus, coves with more docks and boat slips received higher rankings. The evaluation also prioritized coves with the largest area impacted by dredging. A larger area being dredged represents a larger area of available boat access within the Lake. The final two factors, increased boating access and area impacted by dredging, were weighted lower than long-term boat access because sedimentation and loss of boat access are likely to affect more of the Lake if only one cove is dredged. Sedimentation is not only an issue for boats being accessible within the water but is also a safety concern. Coves with a higher rate of sedimentation have a higher risk of boats running aground. Therefore, the boating access was weighted higher at 40%, and both increased boat usage and increased boating area were weighted at 30%. The results for the recreational activity impacts are presented in Table 17.

4.6   Community Support

Prioritizing coves for community support was based on the same analysis used in the WIF Grant criteria for state or local priority. Community support was evaluated based on the assumption that owners of all properties within each cove are in favor of a dredging event in their cove. The coves with more property owners were ranked higher due to the assumption that they would have more support to perform dredging projects. The results of the community support evaluation are presented in Table 18.

4.7   Current/Historical Cove Depth

Historical cove depth is important to this evaluation, as it can be used to determine the coves that have undergone the most significant changes because of sedimentation. The coves with the most sedimentation are likely coves with the poorest water quality and pose safety hazards to the boating public. Sedimentation has occurred in all ten of the coves being evaluated for a possible dredging event; thus, to evaluate which cove is most deserving when it comes to current and historical cove depth, it was necessary to look at current depth and historical recorded depths prior to sedimentation for each cove. The percent decrease in depth for all coves was compared, and the highest ranking was given to coves that had the largest percentage of depth lost due to sedimentation. The results of the historical cove depth evaluation are presented in Table 19.

4.8   Dredging Engineering Logistics

Dredging engineering logistics was considered the most important of the additional criteria because it represented the likelihood and practicality of implementing a dredging project in one of the coves.

This is a small part of a larger evaluation performed in detail prior to any dredging event and includes consideration of several factors affecting equipment access, efficiency of dredging, environmental considerations, sediment characteristics, water access from upland, and others. For this evaluation, factors considered for ranking the coves were limited to equipment access, probable cut thickness, upland staging area requirements, and distance to water access. These factors were weighted based on previous project experience.

Prioritizing coves based on available equipment access was based on the existing average water depth in each cove. To dredge hydraulically or mechanically in the wet, deeper water is beneficial, though not required, to allow equipment to access the sediment targeted for removal. If mechanical removal in the dry was the selected dredging method, it would be beneficial for less water depth; however, this method is unlikely, so only wet dredging was considered. This criterion prioritized coves having deeper water depth; however, because water access is not required, the weight of this factor was only 15%.

In a typical dredging operation, the thickness of the cut, defined as the vertical distance from the bottom of the dredging template to the top of the existing sediment surface, is a factor in dredging production, which is a factor of total cost. Typically, a larger cut thickness is desirable because it would result in a greater production rate. A smaller cut thickness means less material to be removed per square foot of surface area and requires the dredge to move more frequently, thereby lowering production and increasing costs. This criterion prioritized coves with the largest cut thicknesses with a weight of 25%.

The WBCM study developed acreage requirements for access, staging of dredging and dewatering equipment, and temporary stockpiling of dredged material for each cove. Due to the difficulty and potential costs in securing access to property for equipment and material staging, the evaluation prioritized coves that required the least amount of area.

In addition to upland acreage requirements, waterfront access is also important for launching equipment into the Lake and equipment and material transfer, if needed. Mechanical dredging in the wet would require a waterfront facility capable of transferring material from a barge to a truck; it is unlikely that a facility suitable for this purpose exists in any of the coves being evaluated. If mechanical dredging in the wet is the selected dredging method, the distance between the cove and the material transfer point could potentially create delays. Three boat ramps were identified within the Lake (Figure 3) that may be suitable for supporting dredging equipment. The evaluation prioritized coves closer to the boat ramps.

These four categories were weighted to obtain a final weighted ranking, which is presented in Table 20. Equipment access and distance to a suitable boat ramp were both weighted at 15% each, average cut thickness was weighted at 25%, and staging area land requirements were weighted at

40%. Though equipment access, cut thickness, and minimum distance to boat ramp are important, they are relatively small inconveniences, and steps can be taken to overcome them. As such they will likely make only a small difference in total dredging duration and cost. Land access for staging, on the other hand, is a more significant concern because most of the land surrounding the coves is private and finding a suitable staging area could take more time, effort, coordination, and cost.

Figure 3
Boat Ramp Locations
Deep Creek Lake Dredging Evaluation
Garrett County

Source: Google Earth 2017

Public Boat Ramp
Harvey's Cove
Bill's Marine Service Boat Ramp
Poland Run Cove
Green Glade Cove
Hazelhurst Cove
Yacht Club Boat Ramp
Turkey Neck Cove
Chadderton School Cove
Arrowhead Cove
Pawn Run Cove
Penn Cove
Deep Creek Cove

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4.9   Permitting/Mitigation Costs

Permitting and mitigation costs are likely to factor into the total cost of any dredging project. As such, it is assumed that permitting for a larger area would be more difficult to achieve than permitting for a smaller area. To evaluate permitting and mitigation costs for the coves, all permitting was assumed to be consistent with every cove, with the exception of the total area. Priority was given to coves with smaller dredging footprints. The results for permitting and mitigation costs are presented in Table 21.

5   Summary of Results and Conclusion

5.1   Summary of Results

Of the ten coves evaluated, the top three coves in the combined, final ranking are, in order, Arrowhead Cove, Turkey Neck Cove, and Poland Run Cove. These three coves were also the top ranked in the WIF Grant criteria. Tables 1, 2, and 12 present the summary of rankings for the combined, overall score, WIF Grant score, and additional criteria score, respectively.

One of the more significant factors in this evaluation is the amount of public boating that occurs in each cove. This is an element that is considered in several of the evaluation criteria in both the WIF Grant and additional criteria evaluations. The intent of the WIF Grant is to fund projects that benefit the general boating public; therefore, the scoring prioritizes projects that affect the largest populations. Due to the weighting of this factor, the cove with the most properties affected by dredging—Arrowhead Cove (70 properties and 94 docks or boat slips)— was also the top ranked cove. This rank was weighted at 52% of the total WIF Grant rank.

Other key drivers were dredging and engineering logistics, which evaluated coves on constructability and implementation concerns and were weighted at 25% of the total additional criteria rankings. Arrowhead Cove ranked first in logistics, which considered variables such as equipment access, cut thicknesses, land access required for dredging, and minimum distance to a boat ramp.

5.2   Conclusion

Based on the results of this evaluation, the County will begin the process for applying for the WIF Grant to design and implement a dredging project in the top-ranked cove. Design and permitting of such a project is generally expected to have a duration of 1 to 2 years and requires a preliminary investigation of the cove, including existing bathymetry, shoreline structures, and geotechnical and analytical testing of the sediments targeted for removal.

Implementation of a dredging project in any cove would likely disrupt regular boating operations within the cove for most of the duration of the project. Additionally, noise from dredging operations and frequent truck traffic may also cause some concerns for residents and tourists. These factors will be considered in future stages of design; however, it is believed that the long-term benefits of a dredging project would outweigh these temporary inconveniences. It should be noted that a dredging project is not a long-term solution to a sedimentation problem and that measures should also be taken to evaluate and limit sedimentation inflow to the Lake whether a dredging event is implemented or not. Benefits of a successful dredging project include increased areas for boating access, reduced risks of grounding, preserved or increased property values due to available draft at water access points, and improved aesthetics.

Based on the findings of this evaluation, Arrowhead Cove is the top-ranked cove and the best candidate for securing WIF Grant funding. The anticipated removal volume in Arrowhead Cove is below average for most coves; therefore, projected duration and costs are lower. Its lower-than-average costs and the highest number of impacted properties and boaters give it a very high cost to benefit ratio that is more desirable for securing WIF Grant funding.

6 References

Banks, W.S.L., W. Davies, A. Gellis, A. LaMotte, W. McPherson, D. Soeder, 2010. Hydrologic Data for
Deep Creek Lake. July 2010. Retrieved from
https://md.water.usgs.gov/deepcreek/bathy/Bathymetry_feet_spot.pdf

Downstream Strategies, 2016. Deep Creek Lake Water Quality Sampling, October, 2016.

Friends of Deep Creek Lake, 2012. DCL Sediment Impacted Coves, Why Dredging is Necessary and
What We Can Do.

Garrett County Health Department, Coliform, Turbidity and Nutrient Data from 1993 – 2016.

Maryland DNR (Maryland Department of Natural Resources) Boating Services, 2016. Waterway
Improvement Fund Grants Manual. July 2016.

Maryland DNR Resource Assessment Service, 2015. Deep Creek Lake Submerged Aquatic Vegetation
Survey, Report of Survey Activity and Results.

WBCM (Whitney Bailey Cox & Magnani, LLC), 2013. Deep Creek Lake: A Sediment Study. December
2013.

Tables

Table 1

Overall Cove Ranking

Cove Name[1]	WIF Grant Score[2]	Additional Criteria Score[3]	Combined Score	Final Rank[4]
Arrowhead Cove	2.4	4.7	7.0	1
Chadderton School Cove	3.1	5.3	8.4	6
Deep Creek Cove	3.5	5.0	8.5	7
Green Glade Cove	2.8	6.4	9.1	8
Harvey's Cove	2.8	5.5	8.2	5
Hazelhurst Cove	3.1	7.2	10.3	10
Pawn Run Cove	3.9	5.4	9.3	9
Penn Cove	3.5	4.2	7.7	4
Poland Run Cove	2.3	5.2	7.5	3
Turkey Neck Cove	2.0	5.4	7.4	2

Notes:

1. Coves were evaluated and ranked for priority based on a series of criteria from the Waterway Improvement Fund Grant Manual and additional criteria.

2. Anchor QEA developed projected scoring for implementing a dredging event on any one of the selected coves using the WIF Grant criteria; the ranking of each category multiplied by the percentage of points from the projected score was used to create a WIF Grant score for each cove.

3. The criteria were weighted by Anchor QEA based on the anticipated significance of each category related to successfully implementing the dredging project. For each criteria, the ranking multiplied by the percentage developed by Anchor QEA was used to create the additional criteria score for each cove.

4. The combined scores are the sum of the WIF Grant and additional criteria scores and are ranked in ascending order.

Indicates the top three ranked coves

WIF: Waterway Improvement Fund

Table 2

Waterway Improvement Ranking

				Improve Public Boating		Projected Expenditure	Boating	Sustainable	Safety/State or Local	WIF Grant
Cove Name	Regulatory Permits/ Environmental	Continuation of a Current Project	Cost/ Benefit	Access	Safety	Rate	Congestion	Elements	Priority	Scoring
Arrowhead Cove	10	1	3	1	10	2	6	1	1	**2.4**
Chadderton School Cove	10	1	8	9	4	5	4	7	1	**3.1**
Deep Creek Cove	10	1	2	10	3	8	7	6	1	**3.5**
Green Glade Cove	10	1	4	2	1	10	10	5	1	**2.8**
Harvey's Cove	10	1	5	4	8	4	5	4	1	**2.8**
Hazelhurst Cove	10	1	5	5	6	7	9	2	1	**3.1**
Pawn Run Cove	10	1	10	8	5	9	8	10	1	**3.9**
Penn Cove	10	1	9	7	9	6	1	9	1	**3.5**
Poland Run Cove	10	1	5	6	2	3	1	8	1	**2.3**
Turkey Neck Cove	10	1	1	3	7	1	1	3	1	**2.0**
Total Available Points[1]	30	10	30	40	40	20	10	10	200	
Projected Scoring	1	10	1	20	20	20	10	10	100	
								Total Projected Score		**192**	
Percentage of Total Points[2]	1%	5%	1%	10%	10%	10%	5%	5%	52%	

Notes:

The rankings presented here are presented on a scale of 1 to 10, with 1 being the best option and 10 being the worst option relative to each criterion.

1. Maximum points available based on the scoring criteria presented in the WIF Grants Manual (Maryland Department of Natural Resources).

2. Categories have been weighted based on the projected points of the WIF Grant criteria that dredging of any cove is likely to receive.

Indicates the top three ranked coves.

WIF: Waterway Improvement Fund

Table 3
Regulatory Permits/Environmental

Criteria:	Waterway Improvement Fund Grant
Title:	Regulatory Permits/Environmental
Description:	Prioritizes projects that have permits issued or imminent.
Scoring:	Projects with permits issued or imminent (30); projects with no permits or potential environmental issues (1).
Ranking Assumptions:	Evaluate each cove with each anticipated permit. Projects with less required permits or projects that would be easier to permit are ranked higher. All coves are expected to require the same permits and are ranked the same.

		Joint Federal/State			Rare, Threatened, and			
Cove Name	Rank	USACE Section 404	MDE Wetland and Waterway Permit	Garrett County Forest Conservation	Endangered Species	Cultural and Architectural Resources Plan	Sediment Control Permit	Permits Acquisition Difficulty
Arrowhead Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Chadderton School Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Deep Creek Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Green Glade Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Harvey's Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Hazelhurst Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Pawn Run Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Penn Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Poland Run Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult
Turkey Neck Cove	10	Yes	Yes	Yes	Yes	No	Yes	Difficult

Notes:
MDE: Maryland Department of the Environment
USACE: U.S. Army Corps of Engineers

Table 4
Continuation of Current Project

Criteria:	Waterway Improvement Fund Grant
Title:	Continuation of a Current Project
Description:	Prioritizes projects that are already ongoing.
Scoring:	If project is a continuation (10); if not, (1).
Ranking Assumptions:	None of the coves are part of an existing project. All are ranked the same (1).

Cove Name	Rank	Current Dredging Project?
Arrowhead Cove	1	Yes
Chadderton School Cove	1	Yes
Deep Creek Cove	1	Yes
Green Glade Cove	1	Yes
Harvey's Cove	1	Yes
Hazelhurst Cove	1	Yes
Pawn Run Cove	1	Yes
Penn Cove	1	Yes
Poland Run Cove	1	Yes
Turkey Neck Cove	1	Yes

Table 5
Cost/Benefit Summary

Criteria:	Waterway Improvement Fund Grant
Title:	Cost/Benefit
Description:	Priority goes to projects with high cost/benefit ratios that increase usage, cause major improvements, help navigation, and lead to Association of Drainage Authorities improvements.
Scoring:	Projects with a high cost/benefit ratio (30); low-ratio projects that benefit a limited segment of the boating public (1).
Ranking Assumptions:	Ranked coves based on total projected cost and number of properties that benefit from dredging; additional ranking based on cost per cubic yard of removal.

Cove Name	Rank	Hydraulic Dredging Rank	Mechanical Wet Dredging Rank	Mechanical Dry Dredging Rank	Hydraulic Dredging $/cy Rank	Mechanical Wet Dredging $/cy Rank	Mechanical Dry Dredging $/cy Rank	Sum of Rankings
Arrowhead Cove	3	1	1	1	7	7	8	25
Chadderton School Cove	8	7	7	7	6	6	5	38
Deep Creek Cove	2	5	5	5	2	2	2	21
Green Glade Cove	4	8	8	8	1	1	1	27
Harvey's Cove	5	4	4	4	8	8	6	34
Hazelhurst Cove	5	6	6	6	3	3	10	34
Pawn Run Cove	10	9	9	9	10	10	9	56
Penn Cove	9	10	10	10	4	4	3	41
Poland Run Cove	5	3	3	3	9	9	7	34
Turkey Neck Cove	1	2	2	2	5	5	4	20

Note:
cy: cubic yard

Table 5-1

Hydraulic Dredging Cost/Benefit Analysis

Criteria:	Waterway Improvement Fund Grant
Title:	Cost/Benefit
Description:	Priority goes to projects with high cost/benefit ratios that increase usage, cause major improvements, help navigation, and lead to Association of Drainage Authorities improvements.
Scoring:	Projects with a high cost/benefit ratio (30); low-ratio projects that benefit a limited segment of boating public (1).
Ranking Assumptions:	Ranked coves based on total projected cost and number of properties that benefit from dredging. Additional ranking based on cost per cubic yard of removal.

Cove Name	Rank	$/cy Rank	Disposal Site	Volume (cy)	WBCM Cost Estimate	Properties within Cove (Impacted by Dredge)	$/cy	$/Property
Arrowhead Cove	1	7	Quarry Site	15,625	$575,344	70	$36.82	$8,219
Chadderton School Cove	7	6	County Landfill	30,240	$1,110,600	24	$36.73	$46,275
Deep Creek Cove	5	2	County Landfill	36,800	$1,332,000	32	$36.20	$41,625
Green Glade Cove	8	1	Quarry Site	119,000	$4,148,250	80	$34.86	$51,853
Harvey's Cove	4	8	Quarry Site	18,600	$687,750	24	$36.98	$28,656
Hazelhurst Cove	6	3	County Landfill	32,600	$1,190,250	28	$36.51	$42,509
Pawn Run Cove	9	10	County Landfill	49,000	$1,973,750	24	$40.28	$82,240
Penn Cove	10	4	County Landfill	32,100	$1,173,375	12	$36.55	$97,781
Poland Run Cove	3	9	Quarry Site	17,500	$650,625	25	$37.18	$26,025
Turkey Neck Cove	2	5	County Landfill	10,600	$387,750	21	$36.58	$18,464
Average				36,207	$1,322,969	34	$36.87	$44,365

Notes:

cy: cubic yard

WBCM: Whitney Bailey Cox & Magnani, LLC

Table 5-2

Mechanical Wet Dredging Cost/Benefit Analysis

Criteria: Waterway Improvement Fund Grant

Title: Cost/Benefit

Description: Priority goes to projects with high cost/benefit ratios that increase usage, cause major improvements, help navigation, and lead to Association of Drainage Authorities improvements.

Scoring: Projects with a high cost/benefit ratio get (30) points. Low-ratio projects that benefit a limited segment of the boating public get (1) point.

Ranking Assumptions: Ranked coves based on total projected cost and number of properties that benefit from dredging. Additional ranking based on cost per cubic yard of removal.

Cove Name	Rank	$/cy Rank	Disposal Site	Volume (cy)	WBCM Cost Estimate	Properties within Cove (Impacted by Dredge)	$/cy	$/Property
Arrowhead Cove	1	7	Quarry Site	15,625	$833,156	70	$53.32	$11,902
Chadderton School Cove	7	6	County Landfill	30,240	$1,609,560	24	$53.23	$67,065
Deep Creek Cove	5	2	County Landfill	36,800	$1,939,200	32	$52.70	$60,600
Green Glade Cove	8	1	Quarry Site	119,000	$6,111,750	80	$51.36	$76,397
Harvey's Cove	4	8	Quarry Site	18,600	$994,650	24	$53.48	$41,444
Hazelhurst Cove	6	3	County Landfill	32,600	$1,728,150	28	$53.01	$61,720
Pawn Run Cove	9	10	County Landfill	49,000	$2,682,250	24	$54.74	$111,760
Penn Cove	10	4	County Landfill	32,100	$1,703,025	12	$53.05	$141,919
Poland Run Cove	3	9	Quarry Site	17,500	$939,375	25	$53.68	$37,575
Turkey Neck Cove	2	5	County Landfill	10,600	$562,650	21	$53.08	$26,793
Average				36,207	$1,910,377	34	$53.16	$63,717

Notes:

cy: cubic yard

WBCM: Whitney Bailey Cox & Magnani, LLC

Table 5-3

Mechanical Dry Dredging Cost/Benefit Analysis

Criteria:	Waterway Improvement Fund Grant
Title:	Cost/Benefit
Description:	Priority goes to projects with high cost/benefit ratios that increase usage, cause major improvements, help navigation, and lead to Association of Drainage Authorities improvements.
Scoring:	Projects with a high cost/benefit ratio (30); low-ratio projects that benefit a limited segment of the boating public (1).
Ranking Assumptions:	Coves are ranked based on total projected cost and number of properties that benefit from dredging. Additional ranking based on cost per cubic yard of removal.

Cove Name	Rank	$/cy Rank	Disposal Site	Volume (cy)	WBCM Cost Estimate	Properties within Cove (Impacted by Dredge)	$/cy	$/Property
Arrowhead Cove	1	8	Quarry Site	15,625	$763,125	70	$48.84	$10,902
Chadderton School Cove	7	5	County Landfill	30,240	$1,450,800	24	$47.98	$60,450
Deep Creek Cove	5	2	County Landfill	36,800	$1,746,000	32	$47.45	$54,563
Green Glade Cove	8	1	Quarry Site	119,000	$5,487,000	80	$46.11	$68,588
Harvey's Cove	4	6	Quarry Site	18,600	$897,000	24	$48.23	$37,375
Hazelhurst Cove	6	10	County Landfill	32,600	$1,607,000	28	$49.29	$57,393
Pawn Run Cove	9	9	County Landfill	49,000	$2,400,000	24	$48.98	$100,000
Penn Cove	10	3	County Landfill	32,100	$1,534,500	12	$47.80	$127,875
Poland Run Cove	3	7	Quarry Site	17,500	$847,500	25	$48.43	$33,900
Turkey Neck Cove	2	4	County Landfill	10,600	$507,000	21	$47.83	$24,143
Average				36,207	$1,723,993	34	$48.09	$57,519

Notes:

cy: cubic yard

WBCM: Whitney Bailey Cox & Magnani, LLC

Table 6

Public Boating Improvements Ranking

Criteria:	Waterway Improvement Fund Grant
Title:	Expand and Improve Public Boating Access
Description:	Prioritizes projects that increases boating access for the general boating public.
Scoring:	Increased boating access for general public (40); replacement or major improvements to existing boating access facilities (20).
Ranking Assumptions:	Ranking based on number of docks and slips that would have increased boating access following a dredging event in each cove; assumes dredging event would improve boating access for every slip in each cove.

Cove Name	Rank	Properties within Cove (Impacted by Dredge)[1]	Number of Docks or Boat Slips[2]
Arrowhead Cove	1	70	94
Chadderton School Cove	9	24	18
Deep Creek Cove	10	32	6
Green Glade Cove	2	80	85
Harvey's Cove	4	24	50
Hazelhurst Cove	5	28	39
Pawn Run Cove	8	24	23
Penn Cove	7	12	24
Poland Run Cove	6	25	34
Turkey Neck Cove	3	21	70

Notes:

1. Properties within each cove provided by Whitney Bailey Cox & Magnani, LLC (Table 8.1 – Properties Impacted located, WBCM 2013).

2. Number of docks/boat slips based on review of Google Earth imagery recorded in September 2013 (summer month); no visual "public" docks noticed, only private.

Table 7

Safety Ranking

Criteria:	Waterway Improvement Fund Grant
Title:	Improvement of Boating Safety
Description:	Prioritizes projects that directly improve boating safety, including firefighting improvements, lighting, guard rails, and accessibility improvements.
Scoring:	High improvements in safety (40); common dredging projects (20).
Ranking Assumptions:	Shallow water depths, especially those outside of no-wake zones, can be hazardous to boaters.

Cove Name	Final Rank	Number of Docks or Boat Slips[1]	Boat Slips Rank	Average Cove Depth[2] (feet)	Cove Depth Rank	Area[3] (acres)	Area of Dredging Rank	Percent Outside 100-foot No-Wake Zone[4] (%)	No-Wake Zone Rank	Weighted Ranking Score
Arrowhead Cove	10	94	1	6.2	10	9.9	7	6%	9	8.1
Chadderton School Cove	4	18	9	3.8	4	10.4	5	12%	3	4.4
Deep Creek Cove	3	6	10	3.8	5	14.3	2	13%	2	4.3
Green Glade Cove	1	85	2	4.8	8	52.9	1	81%	1	3.6
Harvey's Cove	8	50	4	4.7	7	8.9	8	8%	7	6.6
Hazelhurst Cove	6	39	5	5.4	9	10.3	6	10%	4	6.0
Pawn Run Cove	5	23	8	3.2	3	11.2	3	9%	5	4.7
Penn Cove	9	24	7	2.8	2	6.2	10	4%	10	6.8
Poland Run Cove	2	34	6	2.4	1	10.6	4	9%	5	3.7
Turkey Neck Cove	7	70	3	4.6	6	6.7	9	8%	7	6.2
Weight of Ranking			**15%**		**35%**		**5%**		**45%**	

Notes:

1. Number of docks/boat slips based on review of Google Earth imagery recorded in September 2013 (summer month); no visual "public" docks noticed, only private.

2. Average depths of each cove within proposed dredge area by U.S. Geological Survey (http://md.water.usgs.gov/deepcreek/bathy/Bathymetry_feet_spot.pdf).

3. Lake surface area impacted by dredging represents the proposed limits of dredging by Whitney Bailey Cox & Magnani, LLC (WBCM; Table 4.1 – DCL Sediment Study, WBCM 2013).

4. Percent of dredging proposed outside of the 100-foot no-wake zone provided by WBCM (Table 7.1 – Area of Water Closed for Construction, WBCM 2013).

Table 8
Projected Expenditure Rate Ranking

Criteria:	Waterway Improvement Fund Grant
Title:	Projected Expenditure Rate
Description:	Criteria prioritizes projects where funding will be completed in a shorter duration.
Scoring:	100% of funds expended within first year (20); 100% of funds expended within 1 to 2 years (10); funds not fully expended after 2 years (1).
Ranking Assumptions:	Projects ranked based on shortest duration, with an assumed production rate of 200 cy per day of dredging.

Cove Name	Rank	Volumes (cy)[1]	Dredging Rate[2] (cy/day)	Dredging Duration[3] (days)	Spring Dredging Season[4,5]	Fall Dredging Season[4,6]	Dredging Season Days[4]	Dredging Seasons	Within 2 Year Completion
Arrowhead Cove	2	15,625	200	79	76	98	174	0.6	TRUE
Chadderton School Cove	5	30,240	200	152	76	98	174	1.0	TRUE
Deep Creek Cove	8	36,800	200	184	76	98	174	1.2	TRUE
Green Glade Cove	10	119,000	200	595	76	98	174	3.6	FALSE
Harvey's Cove	4	18,600	200	93	76	98	174	0.7	TRUE
Hazelhurst Cove	7	32,600	200	163	76	98	174	1.1	TRUE
Pawn Run Cove	9	49,000	200	245	76	98	174	1.6	TRUE
Penn Cove	6	32,100	200	161	76	98	174	1.1	TRUE
Poland Run Cove	3	17,500	200	88	76	98	174	0.7	TRUE
Turkey Neck Cove	1	10,600	200	53	76	98	174	0.5	TRUE

Notes:

1. Volume calculations provided by Maryland Department of Natural Resources based on comparison of 1925 and 2012 bathymetry by Whitney Bailey Cox & Magnani, LLC (Appendix B, WBCM 2013).

2. Dredging production rate based on experience with previous similarly sized lake dredging projects in the state of Maryland.

3. Assuming constant dredging rate production.

4. Two potential seasons: March to Memorial Day (76 days) and Labor Day to December (98 days).

5. Spring dredging requires demobilization before Memorial Day (10 extra days).

6. Fall dredging requires mobilization after Labor Day and demobilization before Christmas (20 extra days).

cy: cubic yard

Table 9
Boating Congestion Ranking

Criteria:	Waterway Improvement Fund Grant
Title:	Boating Congestion
Description:	Prioritize projects that do not impact boating congestion in any manner.
Scoring:	No boating congestion impact (10) adding to boating congestion (1).
Ranking Assumptions:	Coves ranked based on impact of project on number of docks and boat slips, duration of dredging, and impact on percent outside of the no-wake zone.

Cove Name	Rank	Number of Docks/Slips (Google Earth Estimate)[1]	Rank Number Docks/Slips impacted	Dredging Duration[2] (days)	Rank Duration Impact	Percent Outside 100-Foot No-Wake Zone[3] (%)	Rank No Wake Impact	Weighted Ranking Score
Arrowhead Cove	6	94	10	79	2	6%	2	5.2
Chadderton School Cove	4	18	2	152	5	12%	8	4.4
Deep Creek Cove	7	6	1	184	8	13%	9	5.4
Green Glade Cove	10	85	9	595	10	81%	10	9.6
Harvey's Cove	5	50	7	93	4	8%	3	5.0
Hazelhurst Cove	9	39	6	163	7	10%	7	6.6
Pawn Run Cove	8	23	3	245	9	9%	5	5.8
Penn Cove	1	24	4	161	6	4%	1	4.2
Poland Run Cove	1	34	5	88	3	9%	5	4.2
Turkey Neck Cove	1	70	8	53	1	8%	3	4.2
Weight of Ranking		**40%**		**40%**		**20%**		

Notes:

1. Number of docks/boat slips based on review of Google Earth imagery recorded in September 2013 (summer month); no visual "public" docks noticed only private.

2. Dredging production rate based on experience with previous similarly sized lake dredging projects in the state of Maryland.

3. Percent of dredging proposed outside of the 100-foot no-wake zone provided by Whitney Bailey Cox & Magnani, LLC (Table 7.1 – Area of Water Closed for Construction, WBCM 2013).

Table 10

Sustainable Elements Ranking

Criteria:	Waterway Improvement Fund Grant
Title:	Sustainable Elements
Description:	Prioritizes projects that incorporate a sustainable, environmentally sensitive component (renewable resources, low-impact development techniques).
Scoring:	Projects that incorporate sustainable/environmental element (10); other projects (1).
Ranking Assumptions:	Assumes hydraulic dredging is lower-impact than mechanical removal and that lower sedimentation rate is more sustainable.

Cove Name	Rank	Average Cove Depth[1] (feet)	Average Depth of Sedimentation[2] (feet)	Current Depth with Sedimentation (feet)	Boating Access Now[3]	Sedimentation Rate[4] (feet/year)	Estimated Thickness of Sedimentation by 2037 (feet)	Cove Depth with Sedimentation 2037 (feet)
Arrowhead Cove	1	6.2	1	5.2	TRUE	0.024	1.6	4.6
Chadderton School Cove	7	3.8	1.8	2.0	FALSE	0.043	2.9	0.9
Deep Creek Cove	6	3.8	1.6	2.2	FALSE	0.038	2.6	1.2
Green Glade Cove	5	4.8	1.4	3.4	FALSE	0.033	2.2	2.6
Harvey's Cove	4	4.7	1.3	3.4	FALSE	0.031	2.1	2.6
Hazelhurst Cove	2	5.4	1	4.4	TRUE	0.024	1.6	3.8
Pawn Run Cove	10	3.2	2.7	0.5	FALSE	0.064	4.3	-1.1
Penn Cove	9	2.8	2.3	0.5	FALSE	0.055	3.7	-0.9
Poland Run Cove	8	2.4	1	1.4	FALSE	0.024	1.6	0.8
Turkey Neck Cove	3	4.6	1	3.6	FALSE	0.024	1.6	3.0

Notes:

1. Average depths of each cove within proposed dredge area by U.S. Geological Survey (http://md.water.usgs.gov/deepcreek/bathy/Bathymetry_feet_spot.pdf).

2. Volume calculations provided by Department of Natural Resources based on comparison of 1970 and 2012 bathymetry by Whitney Bailey Cox & Magnani, LLC (Appendix B, WBCM 2013).

3. Assume 4-foot depth of water needed for boating purposes.

4. Rate of sedimentation calculated by depth of sedimentation across 42 years (1970 and 2012).

Table 11
State, Safety, or Local Priority Ranking

Criteria:	Waterway Improvement Fund Grant
Title:	Safety, State, or Local Priority
Description:	Prioritizes projects that have mandatory circumstances, special circumstances, or high local/state priority.
Scoring:	Safety or state priority (200); local priority (100).
Ranking Assumptions:	Ranked assuming the cove with the most residents will have the largest local priority. All coves receive highest rank, which assumes any selected cove will be considered a local priority.

Cove Name	Rank
Arrowhead Cove	1
Chadderton School Cove	1
Deep Creek Cove	1
Green Glade Cove	1
Harvey's Cove	1
Hazelhurst Cove	1
Pawn Run Cove	1
Penn Cove	1
Poland Run Cove	1
Turkey Neck Cove	1

Table 12

Additional Criteria

Additional Criteria Rankings										
Cove Name	**Environment Impacts**	**Lake Water Level Impact[1]**	**Proximity to Placement Area**	**Economic Impact**	**Recreation Activity Impact**	**Community Support**	**Current and Historical Cove Depth**	**Dredging Engineer Logistics**	**Permitting and Potential Mitigation Costs**	**MD DNR Scoring**
Arrowhead Cove	10	10	1	2	7	2	10	1	4	**4.7**
Chadderton School Cove	4	4	6	6	5	6	3	6	6	**5.3**
Deep Creek Cove	7	3	6	3	4	3	4	4	9	**5.0**
Green Glade Cove	8	8	9	1	1	1	6	10	10	**6.4**
Harvey's Cove	6	7	2	6	7	6	7	5	3	**5.5**
Hazelhurst Cove	8	9	10	4	10	4	9	8	5	**7.2**
Pawn Run Cove	1	6	3	6	2	6	1	9	8	**5.4**
Penn Cove	2	2	3	10	6	10	2	3	1	**4.2**
Poland Run Cove	3	1	5	5	3	5	5	7	7	**5.2**
Turkey Neck Cove	5	5	6	9	9	9	8	2	2	**5.4**
Weight of Ranking[2]	12.5%	2.5%	2.5%	10%	12.5%	10%	10%	25%	15%	

Notes:

Rankings are presented in ascending order, with 1 being the best option and 10 being the worst option relative to each criterion.

1. Lake water level impact considers only mechanical dredging in the dry.

2. Categories have been weighted to reduce impact of rankings that are consistent with all coves.

Indicates top three ranked coves.

MD DNR: Maryland Department of Natural Resources

Table 13

Environmental Impacts Summary

Criteria:	Additional Criteria
Title:	Environmental Impacts to Shallow Water Habitat
Description:	Purpose is to prioritize projects that reduce environmental impacts to shallow water habitat, including release of organic material into the water column, lake stratification, submerged aquatic vegetation (SAV) and monitoring, invasive species, and benthic community.
Scoring:	No scoring description.
Ranking Assumptions:	Dredging is done to increase water depth in coves. Deeper coves are less likely to experience disturbance of bottom sediment and release of material into water column. Ranking prioritizes coves with poor water quality and higher concentrations of chemical analytes. Coves with no information were assumed to be average relative to existing data.

Cove Name	Final Rank	SAV Rank	Average Cove Depth	Cove Depth Rank	Average Coliform Count (MPN/100 mL)	Coliform Count Rank	Weighted Ranking Score
Arrowhead Cove	10	10	6.2	10	40.75	4	8.5
Chadderton School Cove	4	1	3.8	4	41.11	3	3.0
Deep Creek Cove	7	8	3.8	5	n/a	3.5	5.4
Green Glade Cove	8	9	4.8	8	60.2	1	6.5
Harvey's Cove	6	3	4.7	7	n/a	3.5	5.1
Hazelhurst Cove	8	3	5.4	9	10.7	5	6.5
Pawn Run Cove	1	1	3.2	3	55.09	2	2.3
Penn Cove	2	3	2.8	2	n/a	3.5	2.6
Poland Run Cove	3	3	2.4	1	8.52	6	2.8
Turkey Neck Cove	5	3	4.6	6	n/a	3.5	4.6
Weight of Ranking	**25%**		**50%**		**25%**		

Notes:

SAV monitoring results from Maryland Department of Natural Resources Deep Creek Lake Submerged Aquatic Vegetation Survey (MD DNR 2015).

Monthly coliform data collected by Garrett County every May to September from 1993 to 2016.

mL: milliliter
MPN: most probable number

Table 13-1

SAV Evaluation

Criteria:	Additional Criteria
Title:	Environmental Analysis – SAV Coverage
Description:	Coverage of invasive and native SAV and macroalgae.
Scoring:	No scoring description.
Ranking Assumptions:	Prioritizes coves with a greater density of SAV and macroalgae. Prioritizes coves containing invasive species over native species. Coves with no data were assumed to be equal to average density for comparison.

Cove Name					SAV Monitoring Results					
	Rank	**Invasive?**	**Invasive Rank**	**Richness**	**Richness Rank**	**SAV Density**	**SAV Rank**	**MA Density**	**MA Rank**	**Weighted Ranking Score**
Arrowhead Cove	10	0	5	6.3	10	34.8	9	14.3	9	8.4
Chadderton School Cove	1	5	1	5.7	3	36.8	2	13.9	2	2.0
Deep Creek Cove	8	5	1	5.7	2	42.1	1	28.1	10	3.0
Green Glade Cove	9	5	1	5.6	1	32.1	10	9.1	1	4.6
Harvey's Cove	3	0	5	5.7	3	36.81	2	13.9	2	2.8
Hazelhurst Cove	3	0	5	5.7	3	36.81	2	13.9	2	2.8
Pawn Run Cove	1	5	1	5.7	3	36.81	2	13.9	2	2.0
Penn Cove	3	0	5	5.7	3	36.81	2	13.9	2	2.8
Poland Run Cove	3	0	5	5.7	3	36.81	2	13.9	2	2.8
Turkey Neck Cove[1]	3	0	5	5.7	3	36.81	2	13.9	2	2.8
Weight of Ranking			20%		20%		40%		20%	

Notes:

Monthly coliform data collected by Garrett County every May to September from 1993 to 2016.

Data represents number of colonies of coliform bacteria *Escherichia coli* (*E. coli*) per 100 milliliters of water.

Rankings for coves missing data were entered as the median of all coves to reduce negative impacts of not having data.

Average value of all recorded data for each cove.

Maximum value of all recorded data for each cove.

1. Chadderton School Cove appears to be labeled as Turkey Neck Cove in this sampling plan.

Indicates no data available, so average data was used.

MA: macroalgae

SAV: submerged aquatic vegetation

Table 13-2

Water Quality Testing – Field Parameters

Criteria:		Additional Criteria			
Title:		Water Sampling Field Parameters			
Description:		Field collected water quality data from September 2016.			
Scoring:		Not applicable.			
Ranking Assumptions:		Not applicable.			

	Field Parameters[1,2]				
Cove Name	**pH**	**Temperature (°C)**	**Conductivity (µs)**	**Total Dissolved Solids (ppm)**	**Turbidity[3] (NTU)**
Arrowhead Cove	6.3	23.9	109.9	55.00	6
Chadderton School Cove	6.89	24.7	102.6	51.3	7
Deep Creek Cove	6.78	23.4	101	50.6	7
Green Glade Cove (stream)	7.89	25.1	101.6	50.8	6
Green Glade Cove (north shore)	7.34	25.5	99.9	49.9	<5
Harvey's Cove	n/a	n/a	n/a	n/a	n/a
Hazelhurst Cove	7.17	25.5	100.4	50.0	<5
Pawn Run Cove	7.07	23.8	105.3	52.6	11
Penn Cove	6.97	24.2	101.4	50.8	7
Poland Run Cove	7.69	26.2	100.8	50.4	<5
Turkey Neck Cove (Back Bay)	7.17	24.9	100.9	50.4	<5

Notes:

Samples were collected during a dry period and do not represent stormwater runoff conditions.

Samples were taken during a time of minimal boat traffic. Higher turbidity is often observed in the summer when there is significant traffic on the lake.

pH was observed to be more acidic on the samples collected from the west side of the lake and more basic in samples from the east side.

1. Field parameters tested during water quality sampling event by Downstream Strategies, LLC, on September 7, 2016.

2. Field parameters for pH, temperature, conductivity, and total dissolved solids were measured using an Oakton 300.

3. Turbidity was measured using a 120-millimeter Secchi tube. Results are comparable with lab analysis by ALS Environmental Laboratories.

µs: microSiemens

°C: degrees Celsius

n/a: not applicable

NTU: nephelometric turbidity unit

ppm: parts per million

Table 13-3
Water Quality Testing – Laboratory Analysis

Criteria:	Additional Criteria
Title:	Water Sampling Field Parameters
Description:	Field collected water quality data from September 2016.
Scoring:	Not applicable.
Ranking Assumptions:	Not applicable.

	General Chemistry			Metals								Nutrients	
Cove Name	Turbidity (NTU)	TDS (mg/L)	TOC (mg/L)	Aluminum (mg/L)	Arsenic (mg/L)	Iron (mg/L)	Lead (mg/L)	Manganese (mg/L)	Potassium (mg/L)	Chloride (mg/L)	Sulfate (mg/L)	Nitrogen, Nitrate (mg/L)	Phosphorus (mg/L)
Arrowhead Cove	5	58	3.4	0.12	ND	0.32	ND	0.055	1.2	11	12	.012J	0.078
Chadderton School Cove	5.4	60	3.5	0.16	ND	0.36	ND	0.049	1.2	10	12	ND	0.093
Deep Creek Cove	6.7	70	3.9	0.29	ND	0.76	ND	0.08	1.3	10	12	ND	ND
Green Glade Cove (stream)	5.3	62	4	0.12	ND	0.41	ND	0.061	1.4	10	12	ND	.025J
Green Glade Cove (north shore)	3.2	64	3.7	0.086	ND	0.17	ND	0.046	1.3	9.8	12	ND	0.075
Harvey's Cove	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hazelhurst Cove	2.2	63	3.3	0.04	ND	0.11	ND	0.032	1.2	9.8	12	ND	ND
Pawn Run Cove	7	64	3.9	0.15	0.0015J	0.73	ND	0.096	1.6	9.7	12	ND	0.068
Penn Cove	5.4	59	3.5	0.17	ND	0.34	ND	0.045	1.3	9.7	12	ND	ND
Poland Run Cove	2.1	65	3.4	0.27	ND	0.45	ND	0.065	1.3	9.6	13	ND	0.078
Turkey Neck Cove (Back Bay)	2	59	3.3	0.046	ND	0.12	ND	0.037	1.2	9.7	12	ND	ND

Notes:

Water samples were collected by Downstream Strategies, LLC, on September 7, 2016.

Lab analysis was performed by ALS Environmental Laboratories.

Water quality samples from sediment-impaired coves do not indicate water quality concerns based on the parameters tested by Downstream Strategies, LLC.

Two samples were taken at deeper main channel locations during this event, and results were consistent with the sediment-impaired coves.

Samples were collected during a dry period and do not represent stormwater runoff conditions.

Samples were taken after the Labor Day holiday when there was minimal boat traffic. High turbidity is often observed in the summer when there is significant traffic on the lake.

Iron values in Deep Creek Cove and Pawn Run Cove were about twice the next highest values observed, although the values are not of concern.

Report states that results do not explain the observed conditions that have deterred property owners from entering the water in their coves.

J: Indicates that analyte is present at an estimated concentration between the method detection limit and report limit.

mg/L: milligram per liter

n/a: not applicable

ND: non-detect

NTU: nephelometric turbidity unit

TDS: total dissolved solid

TOC: total organic carbon

Table 13-4

Coliform Count

Criteria:	Additional Criteria
Title:	Environmental Analysis – Coliform Count
Description:	Not applicable.
Scoring:	Not applicable.
Ranking Assumptions:	Prioritizes coves with a higher average coliform count.

Cove Name	Coliform Count[1,2]		
	Rank[3]	Average[4]	Max[5]
Arrowhead Cove	4	40.8	900
Chadderton School Cove[6]	3	41.1	1,601
Deep Creek Cove	3.5	n/a	n/a
Green Glade Cove	1	60.2	1,986.3
Harvey's Cove	3.5	n/a	n/a
Hazelhurst Cove	5	10.7	410.6
Pawn Run Cove	2	55.1	1,600
Penn Cove	3.5	n/a	n/a
Poland Run Cove	6	8.5	93.3

Notes:

1. Monthly coliform data collected by Garrett County every May to September from 1993 to 2016.

2. The data represents the number of colonies of coliform bacteria *Escherichia coli* (*E. coli*) per 100 milliliters of water.

3. Rankings for coves missing data were entered as the median of all coves to reduce negative impacts of not having data.

4. Average value of all recorded data for each cove.

5. Maximum value of all recorded data for each cove.

6. Chadderton School Cove appears to be labeled as Turkey Neck Cove in this sampling plan.

n/a: not applicable

Table 14
Lake Water Level Impacts Ranking

Criteria:	Additional Criteria
Title:	Lake Water Level Impacts
Description:	Prioritizing coves that would require the least change to normal water levels to facilitate dredging in the dry.
Scoring:	No scoring description.
Ranking Assumptions:	Lake water level is not anticipated to change unless dredging method is mechanical, in-the-dry removal. Coves are ranked by the least amount of lake water draw-down required to expose the historical cove depth.

Cove Name	Rank	Average Cove Depth[1] (feet)	Sediment Thickness[2] (feet)	Historical Cove Depth (feet)	DCL Drawdown Target Pool Elevation[3] (feet NGVD29)	Discharge Water Volume (1,000 gallons)[4]	Beyond Limits of Seasonal Drawdown?[5]
Arrowhead Cove	10	6.2	1	7.2	2,454.8	9,151,085	Yes
Chadderton School Cove	4	3.8	1.8	5.6	2,456.5	7,053,961	No
Deep Creek Cove	3	3.8	1.6	5.4	2,456.6	6,835,070	No
Green Glade Cove	8	4.8	1.4	6.2	2,455.8	7,880,101	No
Harvey's Cove	7	4.7	1.3	6.0	2,456.0	7,583,538	No
Hazelhurst Cove	9	5.4	1	6.4	2,455.6	8,190,786	No
Pawn Run Cove	6	3.2	2.7	5.9	2,456.1	7,498,806	No
Penn Cove	2	2.8	2.3	5.1	2,456.9	6,482,018	No
Poland Run Cove	1	2.4	1	3.4	2,458.6	4,357,659	No
Turkey Neck Cove	5	4.6	1	5.6	2,456.4	7,117,510	No

Notes:

1. Average depths of each cove within proposed dredge area by Whitney Bailey Cox & Magnani, LLC (WBCM; http://md.water.usgs.gov/deepcreek/bathy/Bathymetry_feet_spot.pdf).

2. Average depth of sediment accumulated in coves since 1925 by WBCM (Table 1.1 – DCL Sediment Study, WBCM 2013).

3. Normal pool elevation 2,462 feet according to National Geodetic Vertical Datum of 1929, Hydrologic Data for Deep Creek Lake and Selected Tributaries (USGS 2008, revised 2010).

4. Lake surface area approximately 3,900 acres (Introduction – DCL Sediment Study, WBCM 2013).

5. Seasonal drawdown occurring in the winter months lowers pool elevation to 2,455 feet NGVD29 (Introduction – DCL Sediment Study, WBCM 2013).

DCL: Deep Creek Lake

NGVD29: North Geodetic Vertical Datum of 1929

Table 15

Proximity to Placement Area Ranking

Criteria:	Additional Criteria
Title:	Proximity to Placement Area
Description:	Prioritizes coves based on proximity to disposal area.
Scoring:	No scoring description.
Ranking Assumptions:	Ranks based on shortest distance, disposal locations based on WBCM Report.

Cove Name	Rank	Disposal Site[1]	Distance[1] (miles)
Arrowhead Cove	1	Quarry Site	0.4
Chadderton School Cove	6	Garrett County Landfill	11.6
Deep Creek Cove	6	Garrett County Landfill	11.6
Green Glade Cove[2]	9	Quarry Site/Garrett County Landfill	12.7
Harvey's Cove	2	Quarry Site	3.5
Hazelhurst Cove	10	Garrett County Landfill	14.9
Pawn Run Cove	3	Garrett County Landfill	8
Penn Cove	3	Garrett County Landfill	8
Poland Run Cove	5	Quarry Site	10.9
Turkey Neck Cove	6	Garrett County Landfill	11.6

Notes:

1. Disposal site and haul lengths for each cove provided by Whitney Bailey Cox & Magnani, LLC (WBCM; Table 9.1 – Haul Lengths in miles, WBCM 2013).

2. Quarry site can only accept 65,000 cubic yards; remaining yardage will need to go to Garret County Landfill (Page 40, WBCM 2013).

Landfill	Miles	Quantity	% Total	Avg. Distance
Quarry	10.2	65,000	55%	12.74
Garrett County Landfill	15.8	54,000	45%	
Total		**119,000**		

Table 16

Economic Impacts Ranking

Criteria:	Additional Criteria
Title:	Economic Impact
Description:	Prioritizing coves that result in the least economic impact to Garrett County by way of lost income from reduced property values.
Scoring:	No scoring description.
Ranking Assumptions:	Dredging one cove with property values of all other coves decreasing by 10% due to loss of waterfront property and prioritizing coves where sum of all lost tax revenue is lowest; assumes no lost tax revenue due to tourism.

Cove Name	Rank	Properties within Cove (Impacted by Dredging)[1]	Cove Property Value Lost per Year[2]	Tax Revenue Lost per Year[3]	Yearly Tax Revenue Lost by Other Coves
Arrowhead Cove	2	70	$ 494,117.65	$ 12,229.41	$ 47,170.59
Chadderton School Cove	6	24	$ 169,411.76	$ 4,192.94	$ 55,207.06
Deep Creek Cove	3	32	$ 225,882.35	$ 5,590.59	$ 53,809.41
Green Glade Cove	1	80	$ 564,705.88	$ 13,976.47	$ 45,423.53
Harvey's Cove	6	24	$ 169,411.76	$ 4,192.94	$ 55,207.06
Hazelhurst Cove	4	28	$ 197,647.06	$ 4,891.76	$ 54,508.24
Pawn Run Cove	6	24	$ 169,411.76	$ 4,192.94	$ 55,207.06
Penn Cove	10	12	$ 84,705.88	$ 2,096.47	$ 57,303.53
Poland Run Cove	5	25	$ 176,470.59	$ 4,367.65	$ 55,032.35
Turkey Neck Cove	9	21	$ 148,235.29	$ 3,668.82	$ 55,731.18

Notes:

1. Properties within each cove provided by Whitney Bailey Cox & Magnani, LLC (WBCM; Table 8.1 – Properties Impacted, Deep Creek Lake Sediment Study; WBCM 2013).

2. Weighted property value decrease per year based on number of properties impacted by dredging and projected property value decrease by Garrett County ($36,000,000 over 15 years and $2,400,000 per year; Appendix H, Deep Creek Lake Sediment Study; WBCM 2013).

3. Tax revenue lost per year based on weighted property value decrease and Garrett County property tax rate of $2.475 per $100 (https://www.garrettcounty.org/resources/finance/pdf/Real-Property-Tax.pdf).

Table 17
Recreational Activity Impact Ranking

Criteria:	Additional Criteria
Title:	Recreational Activity Impacts
Description:	Prioritizes dredging of coves that increase recreational activities.
Scoring:	No scoring description.
Ranking Assumptions:	Focuses on recreational activity increase post-dredging by creating more boating access.

Cove Name	Rank	Average Cove Depth[1] (feet)	Average depth Sedimentation[2] (feet)	Sedimentation Rate[3] (feet/year)	Projected 2037 Sediment Thickness (feet)	Projected 2037 Average Cove Depth (feet)	Rank Increased Access Long Term
Arrowhead Cove	7	6.2	1	0.02	1.6	4.6	10
Chadderton School Cove	5	3.8	1.8	0.04	2.9	0.9	4
Deep Creek Cove	4	3.8	1.6	0.04	2.6	1.2	5
Green Glade Cove	1	4.8	1.4	0.03	2.2	2.6	6
Harvey's Cove	7	4.7	1.3	0.03	2.1	2.6	7
Hazelhurst Cove	10	5.4	1	0.02	1.6	3.8	9
Pawn Run Cove	2	3.2	2.7	0.06	4.3	-1.1	1
Penn Cove	6	2.8	2.3	0.05	3.7	-0.9	2
Poland Run Cove	3	2.4	1	0.02	1.6	0.8	3
Turkey Neck Cove	9	4.6	1	0.02	1.6	3.0	8
						Weight of Ranking	**40%**

Table 17 (cont.)
Recreational Activity Impact Ranking

Cove Name	Rank	Number of Docks/Slips (Google Earth Estimate)[4]	Rank of Increased Boating Usage	Area Impacted by Dredging[5] (acre)	Rank Area Impacted by Dredging	Weighted Ranking Score
Arrowhead Cove	7	94	1	9.9	7	6.4
Chadderton School Cove	5	18	9	10.4	5	5.8
Deep Creek Cove	4	6	10	14.3	2	5.6
Green Glade Cove	1	85	2	52.9	1	3.3
Harvey's Cove	7	50	4	8.9	8	6.4
Hazelhurst Cove	10	39	5	10.3	6	6.9
Pawn Run Cove	2	23	8	11.2	3	3.7
Penn Cove	6	24	7	6.2	10	5.9
Poland Run Cove	3	34	6	10.6	4	4.2
Turkey Neck Cove	9	70	3	6.7	9	6.8
		Weight of Ranking	**30%**		**30%**	

Notes:

Assume 4-foot depth of water needed for boating purposes.

1. Average depths of each cove within proposed dredge area by U.S. Geological Survey (USGS, http://md.water.usgs.gov/deepcreek/bathy/Bathymetry_feet_spot.pdf).

2. Volume calculations provided by DNR based on a comparison of 1925 and 2012 bathymetry by Whitney Bailey Cox & Magnani, LLC (WBCM; Appendix B, WBCM 2013).

3. Rate of sedimentation calculated by depth of sedimentation across 42 years (1970 and 2012).

4. Number of docks/boat slips based on review of Google Earth imagery recorded in September 2013 (summer month); no visual "public" docks noticed, only private.

5. Lake surface area impacted by dredging represents the proposed limits of dredging by WBCM (Table 4.1 – DCL Sediment Study, WBCM 2013).

Table 18
Community Support Ranking

Criteria:	Additional Criteria
Title:	Community Support
Description:	Prioritizes projects that have the largest community support.
Scoring:	No scoring description.
Ranking Assumptions:	Ranks assuming the cove with the most residents will have the largest community support.

Cove Name	Rank	Properties within Cove (Impacted by Dredging)[1]	Percentage of Total Prospective Dredging Candidates
Arrowhead Cove	2	70	21%
Chadderton School Cove	6	24	7%
Deep Creek Cove	3	32	9%
Green Glade Cove	1	80	24%
Harvey's Cove	6	24	7%
Hazelhurst Cove	4	28	8%
Pawn Run Cove	6	24	7%
Penn Cove	10	12	4%
Poland Run Cove	5	25	7%
Turkey Neck Cove	9	21	6%
Total		**340**	

Note:

1. Properties within each cove provided by Whitney Bailey Cox & Magnani, LLC (Table 8.1 – Properties Impacted located, WBCM 2013).

Table 19
Historical Cove Depth Ranking

Criteria:	Additional Criteria
Title:	Current and Historical Cove Depth
Description:	Comparing coves by historical depths and current depths to evaluate sedimentation.
Scoring:	No scoring description.
Ranking Assumptions:	Prioritizing coves that have experienced the most sedimentation.

Cove Name	Rank	Average Cove Depth[1] (feet)	Average Depth of Sedimentation[2] (feet)	Historical Cove Depth	Percent of Historical Depth Lost to Sedimentation
Arrowhead Cove	10	6.2	1	7.2	14%
Chadderton School Cove	3	3.8	1.8	5.6	32%
Deep Creek Cove	4	3.8	1.6	5.4	30%
Green Glade Cove	6	4.8	1.4	6.2	23%
Harvey's Cove	7	4.7	1.3	6.0	22%
Hazelhurst Cove	9	5.4	1	6.4	16%
Pawn Run Cove	1	3.2	2.7	5.9	46%
Penn Cove	2	2.8	2.3	5.1	45%
Poland Run Cove	5	2.4	1	3.4	29%
Turkey Neck Cove	8	4.6	1	5.6	18%

Notes:

1. Average depths of each cove within proposed dredge area by U.S. Geological Survey (http://md.water.usgs.gov/deepcreek/bathy/Bathymetry_feet_spot.pdf).

2. Sediment thickness for each cove provided by Whitney Bailey Cox & Magnani, LLC (Appendix B, WBCM 2013).

Table 20

Dredging Engineering Logistics Ranking

Criteria:	Additional Criteria
Title:	Dredging Engineering Logistics
Description:	Evaluating coves based on constructability and implementation concerns.
Scoring:	No scoring description.
Ranking Assumptions:	Prioritized limiting equipment access issues, increased cut thickness increases production rate, minimizing land acquisition requirements and minimizing distance to boat ramps.

Cove Name	Rank	Average Water Depth[1] (feet)	Equipment Access Rank	Average Cut Thickness[2] (feet)	Cut Thickness Rank	Land Required Staging/Access[3] (acre)	Land Required Rank	Minimum Distance to Boat Ramp[4] (miles)	Distance Rank	Weighted Ranking Score
Arrowhead Cove	1	6.2	1	1.0	7	8	2	1.07	1	2.9
Chadderton School Cove	6	3.8	7	1.8	3	15	5	1.67	6	4.7
Deep Creek Cove	4	3.8	6	1.6	4	15	5	1.56	4	4.5
Green Glade Cove	10	4.8	3	1.4	5	22	10	2.68	10	7.2
Harvey's Cove	5	4.7	4	1.3	6	10	3	1.9	9	4.7
Hazelhurst Cove	8	5.4	2	1.0	7	15	5	1.84	8	5.3
Pawn Run Cove	9	3.2	8	2.7	1	20	9	1.63	5	5.8
Penn Cove	3	2.8	9	2.3	2	15	5	1.42	2	4.2
Poland Run Cove	7	2.4	10	1.0	7	10	3	1.55	3	4.9
Turkey Neck Cove	2	4.6	5	1.0	7	5	1	1.67	6	3.8
Weight of Ranking			**15%**		**25%**		**40%**		**15%**	

Notes:

1. Average depths of each cove within proposed dredging area by U.S. Geological Survey (http://md.water.usgs.gov/deepcreek/bathy/Bathymetry_feet_spot.pdf).

2. Sediment thickness for each cove provided by Whitney Bailey Cox & Magnani, LLC (Appendix B, WBCM 2013).

3. Land required for dredging of cove (Appendix C, WBCM 2013).

4. Boat ramps identified and distance from coves measured using Google Earth; includes Public Boat Ramp, Bill's Marine Service, and Yacht Club.

Table 21
Permitting and Mitigation Costs Ranking

Criteria:	Additional Criteria
Title:	Permitting and Mitigation Costs
Description:	Prioritizing based on anticipated permitting cost and mitigation requirements.
Scoring:	No scoring description.
Ranking Assumptions:	Assumes permitting to be consistent with all coves, mitigation requirements to vary based on area impacted by dredging.

Cove Name	Rank	Surface Area Impacted by Dredging[1] (acres)
Arrowhead Cove	4	9.9
Chadderton School Cove	6	10.4
Deep Creek Cove	9	14.3
Green Glade Cove	10	52.9
Harvey's Cove	3	8.9
Hazelhurst Cove	5	10.3
Pawn Run Cove	8	11.2
Penn Cove	1	6.2
Poland Run Cove	7	10.6
Turkey Neck Cove	2	6.7

Note:

1. Lake surface area impacted by dredging represents the proposed limits of dredging by Whitney Bailey Cox & Magnani, LLC (Table 4.1 – DCL Sediment Study, WBCM 2013).