IMPROVING SOUTH FORK PEACHTREE CREEK WATERSHED USING THE TRIPLE BOTTOM LINE – DEKALB COUNTY, GEORGIA

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Abstract. Restoring two streams, two lakes, and protecting a buffer are part of a plan to improve the health of South Fork Peachtree Creek based on environmental, social and financial criteria. DeKalb County is similar to many metro-Atlanta Georgia communities with a Storm Water Management Plan and a Watershed Protection Plan to fulfill state and federal regulations. In developing Watershed Management Plans to satisfy these requirements, DeKalb County chose to use the triple bottom line (TBL) approach to prioritize different Watershed Improvement Plans. The prioritization method allows flexibility and consistency while evaluating environmental, social and economic measures and identifying projects with the greatest value per dollar.

We wanted a TBL model that used science based methods and was easy to implement to determine if a project would benefit the health of the stream. A TBL model that can evaluate the best environmental project must be able to recognize that there are different types of assets and include projects such as detention pond retrofits and stream restoration projects. The Prioritization Matrix developed here uses a grid analysis to weigh different TBL measures in order to select the best overall environmental project.

INTRODUCTION

Based on environmental, social and financial criteria, the restoration of streams and lakes in two different parks is part of a plan to improve the health of South Fork Peachtree Creek. DeKalb County is similar to many metro- Atlanta Georgia communities with a Storm Water Management Plan and a Watershed Protection Plan to fulfill state and federal regulations. In developing Watershed Management Plans to satisfy these requirements, we chose to use the triple bottom line (TBL) approach to prioritize different Watershed Improvement Plans. The prioritization method allows flexibility and consistency while evaluating environmental, social and economic measures and identifying projects with the greatest value per dollar.

DeKalb County has a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Phase I Stormwater Discharge Permit. The MS4 permit has a Storm Water Management Plan (SWMP). We also have two waste water treatment plants with NPDES discharge permits and a Watershed Protection Plan (WPP). The two plans (SWMP and WPP) require us to protect and improve the health of our streams, including streams with Total Maximum Daily Loads (TMDLs) and TMDL Implementation Plans. DeKalb County contains 284 square miles with a population of almost 700,000 residents. The County is split between two major drainage basins with the northern third (approximately 30%) draining to the Chattahoochee River and the Gulf of Mexico and the remaining two thirds (approximately 70%) draining into the South River and Yellow River which are part of the Ocmulgee River Basin which drains to the Atlantic Ocean.

As part of the WPP, a watershed planning process was identified where subbasins in the County are studied over several years and Watershed Management Plans (WMPs) are developed for each subbasin where Watershed Improvement Projects are identified. The subbasins are prioritized in the WPP based on water quality and biological impairments and the South Fork Peachtree Creek, which is a subbasin of the Chattahoochee River is identified as one of our top priority basins to address the health of the stream. The South Fork Peachtree Creek subbasin is 27.8 square miles with 76.9 linear miles of streams.

The WMP development process has nine basic steps. The steps are:

1. Identify TMDLs and other plans and projects in the subbasin
2. Walk the streams to identify water quality and physical conditions
3. Inspect existing county owned structural Best Management Practices (BMPs)
4. Inspect potential conveyance and flooding issues
5. Develop potential structural BMPs and stream restoration projects
6. Develop estimate load reductions for the projects
7. Develop estimate costs for the projects
8. Evaluate and prioritize the potential projects
9. Develop project concept plans for the top projects

The focus of this discussion is on the eighth step, to evaluate and prioritize the projects. For projects to be successful, they must address social, environmental and financial concerns. This approach is often called the triple

bottom line. Not only must projects be good for the environment, they must also have the support of the public and be cost effective. Two recent articles that discuss the importance of a triple bottom line approach and the selection of different criteria and weighting these criteria are, "From short-term to long-term sustainable solutions" by Emily Callaway et al and, "Decentralized Strategies for the Sustainable Water" by Tom Birkland. The City of Sandy Springs, Georgia also used a prioritization methodology based on the Triple bottom line to prioritize projects as presented by Laurie Hawks et al in, "TMDL Implementation Plan: A Case Study". In this case, criteria were developed and weighted based on the grid method.

METHODOLOGY

Once the data has been collected in the field and potential projects identified, then the task of prioritizing the projects begins. We wanted a prioritization method that was flexible, easy to use, and would provide consistency. A method that could incorporate Triple Bottom Line criteria as discussed earlier was also desired. Flexibility was needed so that once the current study was completed, if a new potential project was identified, it could be evaluated and added to the priority list. We also wanted a method that County staff could use to evaluate projects without having to hire a consultant to update the priority list. We also did not want to be tied to a modeling program that ran on a certain GIS software application that would require the model to be updated by a consultant when the software was upgraded. A spreadsheet method was the desired level of sophistication. A spreadsheet Prioritization Model could certainly accept results from a GIS computer model if available, but it is not necessary to use the decision model. The method needed to accept subjective criteria as well as criteria that were calculated from data collected in the field. A method was also needed so the criteria selected were transparent and easy to explain. A spreadsheet model also provides consistent answers and the documentation needed to justify why different projects are and are not selected.

There are several methods available for making decisions. The website, MindTools, provides a discussion of some of the methods used to select among different options. The three methods discussed in MindTools and used in this methodology are Grid Analysis, Paired Comparison Analysis, and Analytic Hierarchy Process. Grid Analysis allows the comparison of several different factors. The different factors desired to evaluate the projects are selected, a scale is developed for each factor and then weights are assigned to each factor. This method allows great flexibility to determine how many factors to consider, what measures are going to be used to evaluate each factor and what the importance of each factor should be. In DeKalb County's case, we wanted to use factors that addressed social, environmental and financial issues. A criterion to evaluate the social factor could be whether there are public education opportunities associated with the project or not. The measure of that social criterion could be whether the project is located in a public park or next to a school. A criterion to evaluate the environmental factor could be whether the projects are located on a stream segment with a TMDL or not. The measure for that environmental criterion could be how far it is located from the stream segment. A criterion to evaluate the financial factor could be whether grant funding is available for the project. The measure for that financial criterion could be the percentage that the grant would pay for the project. Thus the Grid Analysis was determined as the best decision model to use.

The Paired Comparison Analysis helps the decision maker compare two totally different factors and determine their relative importance to each other. By examining a pair of factors together at one time and ranking their importance, multiple factors can be evaluated and their weights determined. This method was used in combination with the Grid Analysis to determine the weights of the different criteria. The Analytic Hierarchy Process uses the Grid Analysis and Paired Analysis to allow a group to be involved in determining the weights for the various criteria. The analysis can be computerized to simplify the analysis. In the future, the Analytic Hierarchy Process will be used to refine the weights used in our methodology.

Sandy Springs, Georgia Example. As presented by Hawks, a previous application of the Grid Analysis using Triple Bottom Line criteria was done in Sandy Springs, Georgia. A Prioritization Matrix was developed to prioritize stormwater projects that combined the risk based approach of asset management with Grid Analysis. Risk was defined as the probability of failure times the consequences of failure. The criteria used to evaluate the consequences of failure were based on social, environmental and financial factors of the Triple Bottom Line. For example, a stream reach was identified as an asset and a stream restoration project was developed for that stream reach. The risk was calculated for the asset in the existing condition and then the risk was calculated assuming the project was completed as designed. The difference in risk calculated for the two conditions was defined as the benefit. The benefit was then divided by the cost of the project to determine the benefit-cost ratio. The benefit cost ratio was used to rank the projects based on the best benefit per dollar. The criteria used in this Prioritization Matrix are presented in Table 1.

The criteria had to change based on the type of project being evaluated because different projects have different attributes; however, the factor being evaluated and the weight of that factor were kept the same. A good example of this fact is that the criteria used to evaluate the econom-

ic factor for a detention pond was the height and volume of the pond while the criteria for streams was the seriousness of the property damage for stream restorations.

One lesson learned with this application was the more specific the goal of the matrix, the easier it is to apply. The lesson seems obvious in hindsight, but was not realized at the beginning of the project. The goal of the project was to select the best capital project regardless whether it was a storm sewer system repair, culvert upgrade, detention pond retrofit, or stream restoration. The matrix either becomes over simplified or too complex for easy use.

Table 1: Sandy Springs Prioritization Criteria

Criterion	Detention Pond	Stream Restoration
Physical condition		
TSS Annual Yield (lb/acre/year)	X	
Bank Erosion (percent of bank eroded)		X
Fecal Coliform (cfu/ acre/ year)	X	X
Condition of Pond (Excellent to Bad)	X	X
Performance		
Storage Volume (provided vs. required)	X	
Habitat Score (Per field assessment)		X
Number of Past Work Orders	X	X
Environmental		
Ponds rated higher than restorations	X	X
Fecal TMDL for watershed	X	X
Biota TMDL for watershed	X	X
Social		
Number of parcels affected		X
City owns Property	X	X
Urban/ Rural Discharge ratio	X	
Economic		
Seriousness of Property Damage		X
Dam Height and Pond volume	X	

DeKalb County Prioritization Matrix. The asset management approach for determining risk before and after construction of the project was not used in building the DeKalb County prioritization matrix. Since the consequences of failure do not typically change after the project, the effort spent determining these factors would be better used by focusing on factors that did change and could be evaluated directly as a benefit. The goal of the matrix was also reduced in scope to select the project that improves the health of a stream while including the Triple Bottom Line approach. The factors identified for evaluation in DeKalb County were:

1. **Improving quality of life** by creating or association with public amenities. Being in an area easily accessible by the public such as a park is of higher value. Projects with educational opportunities or that can be combined with other departmental projects such as transportation projects or natural resources projects are of higher value. To help with the rating, the Mason Mill in DeKalb County was used as a reference project scored as a10. The project was in an existing park, associated with a project being built by the PATH Foundation, and provides excellent educational opportunities because of the different BMPs that were constructed with walking trails beside them.
2. **Improving public health and safety** by reducing the risk of flooding of either a road or a building. The Project can also reduce the risk of property damage with flood mitigation measures such as berms or channel diversions. The measure used was the value of the property being protected by the improvement (i.e. $1 million=10), or if public safety is involved at a road, then changes in potential storm flow that causes flooding is used as the measure; i.e. increasing flood protection from a 2 year storm to a 100 year storm =10.
3. **Located on or adjacent to 303(d) listed/TMDL water segment** and the pollutant of concern is being reduced. The measure used was 10 if the project was located on or adjacent to the stream segment, 9 if 0.1 miles away and decreasing to 0 if a mile of more away.
4. **Cost effectiveness** was based on pounds of sediment removed divided by cost to build and maintain the project over 20 years. Sediment was selected as the pollutant to use for cost effectiveness because most pollutants are attached to sediment and are removed when the sediment is removed. Potential factors such as accessibility, located in a County park, and grant availability were considered cost factors and so they were included in the determination of project cost which was used in the cost effectiveness factor.

South Fork Peachtree Creek Application. Based on an analysis performed while developing DeKalb's Watershed Protection Plan, one of the top priority watersheds needing improvements in the county is South Fork Peachtree Creek. The development of a Watershed Management Plan was started in June of 2012. The watershed is 27.8 square miles with 76.9 linear miles of streams. All of the field work is completed and we identified 15 potential

detention pond projects and 51 potential stream restoration projects. While the criteria for the matrix have not been finalized, the method was applied and two Watershed Improvement Projects were selected for implementation. Two projects were selected based on the funding available. We intend to have the projects designed in time to bid the projects in the spring of 2013. The two projects selected were Johns' Homestead Park and Little Creek Horse Farm Park. Both projects involved stream restoration work and the Johns' Homestead project includes the rehabilitation of two lakes while the Little Creek Horse Farm project includes fencing horses out of the stream buffer.

Johns' Homestead Watershed Improvement Project. The site is located on County-owned property off Lawrenceville Highway, approximately 0.5 miles east of I-285. Entry to the project is via Johns Road/Stapp Drive behind Reboboth Baptist Church. Future plans for the site include a walkway by the PATH Foundation through the site with a wetland boardwalk and improvements to park amenities centered around the old Johns' home and other remaining buildings.

Existing Conditions. Johns Homestead is a 48 acre tract of land and contains two lakes, one immediately below the other, totaling approximately 7 acres in size in the middle of the site. Approximately 100 acres flows into the upper lake. A 24" pipe originally drained from the upper lake to the lower lake. The pipe has failed and now the flow is diverted around the eastern edge of the lower lake. An additional drainage area of approximately 125 acres joins the flow that is diverted around the edge of the lower lake. Only high flows overtop the upper end of the diversion and flow into the lower lake (See Figure 1).

The diversion adjacent to the east bank of the lake is a large eroded stormwater gully. The United States Corps of Engineers has claimed the eroded gully as a stream under their jurisdiction. The stream is subjected to severe erosion, especially at the downstream end. Approximate dimensions of the eroded stream at the downstream end are 15 feet deep and 15 feet wide with side slopes greater than 1(H) to 1(V).

The outlet control structure (OCS), a vertical 24-inch corrugated metal pipe (CMP), is partially filled with debris. The outfall from the lake is a corroded 12-inch CMP that needs replacement. The lake also has a 12-inch reinforced concrete pipe (RCP) that serves as an emergency spillway. The downstream end of this pipe has a moderate erosion issue.

Proposed Conditions. The outlet pipe from the upper lake to the lower lake will be enlarged to a 36 pipe and the diversion will be filled and an emergency spillway discharging into the lower lake will be constructed. Structural control devices will be utilized at the upstream end of the lower lake to keep low flows from the 125-acre basin discharging in to the stream, but the majority of the water will flow into the lower lake with the discharge from the upper lake. The stream is tightly located between the lake and the property line. Only low level stream restoration is possible which will include channel grade control devices in the stream to prevent future erosion. Where sufficient layback area exists, the side slopes of the gulley along the lake will be laid back and bioengineered to stabilize the slopes. The banks and buffer will be stabilized and landscaped.

Improvements to the lower lake outfall are also planned. The improvements included a new wave wall, a larger OCS with a 72" outfall pipe. In addition, an emergency spillway will be graded to allow for relief of larger rainfalls.

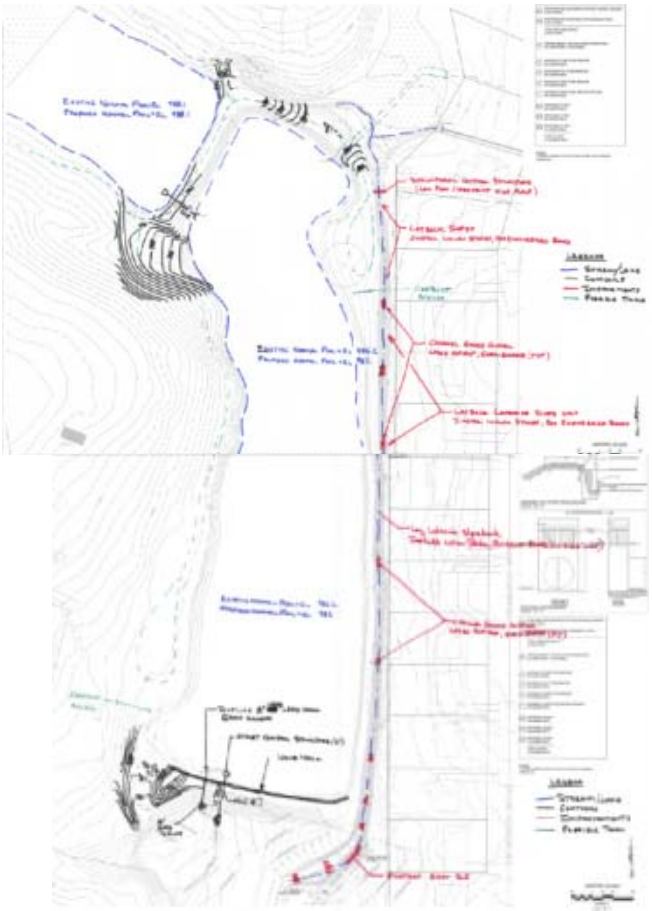

Figure 1: Johns' Homestead Site Plan

Little Creek Horse Farm Watershed Improvement Project. Little Creek Horse Farm is located at 2057 Lawrenceville Highway, north of Orion Drive and east of Lawrenceville Highway. South Fork Peachtree Creek (SFPC) flows through the property.

Little Creek Horse Farm is an approximate 38-acre facility owned and managed by DeKalb County Parks and Recreation. Amenities at the park include a horse barn,

indoor and outdoor riding arenas, and pastures. The pastures are loosely divided into two separate areas by a fencing system to separate the male and female horses. The "mares" pasture is typically well vegetated with grass, and the "geldings" pasture has a large barren land area on the north side of the creek. A perimeter fence runs along Orion Drive and an access road. This project focuses on the section of creek and its tributary that are easily accessible from the park facility (see Figure 2).

Existing Conditions. A wooden pedestrian bridge over SFPC is used by park personnel and horses to cross the creek. The bridge is in need of structural upgrades or replacement. SFPC runs for approximately 3,000 feet through the park property. However, 1,700 feet of the creek is northeast of the pastures and other amenities and the remaining 1,300 feet is easily accessible from the park facility. The stream width for SFPC varies from 40 to 50 feet and the height of the streambank ranges from 6 to 9 feet. Field inspection on August 2, 2012, was focused on a length of approximately 1,100 feet from the tributary Stream 5, to approximately 200 feet upstream of the access road bridge. The stream bed is approximately 75 percent gravel, cobble and boulder with fine sediment surrounding. The deposition of fine materials in the stream varied from moderate to heavy deposition. The streambanks were moderately stable with some vegetation on the banks. However, in areas where horse stream crossings were observed, the banks were severely eroded. Five streambank crossing areas used by horses were observed, measuring approximately 200 feet in length measured from the top of bank. The riparian buffer of SFPC varied from 10 to 200 feet. Most of the buffer was less than 50 feet wide along the north side of the creek. As previously stated, these areas are either active pasture land or disturbed land. A sanitary sewer line runs parallel to the south streambank and is located between 40 feet and 70 feet from the streambank.

Two tributaries flow into SFPC, Stream 2 and Stream 5. Stream 2 is identified as a possible improvement project; Stream 5 is located outside of horse reach. The stream bed of Stream 2 is 25-50 percent gravel, cobble and boulder with fine sediment surrounding. The stream has a heavy deposition of fine materials and the full bottom width of the channel is sediment laden. There is very little water in the channel, and some areas contained non-flowing pools. The right and left streambanks are moderately unstable with some vegetative cover. The streambanks at the culvert crossing are greatly deteriorated due to horses using the area as a crossing between pastures. Most of the riparian buffer of Stream 2 is greater than 50 foot wide.

Proposed Conditions. The existing bridge structure will be replaced with a prefabricated bridge and the existing abutments will be reinforced with helical piers. Bare soil areas on the north side of the creek will be vegetated to avoid sediment runoff into SFPC.

Streambank stabilization, stream buffer restoration, and a fencing system, are planned along SFPC. Approximately 200 feet of streambank stabilization is required at the areas where the horses are currently entering and leaving the pastures to get into the creek. Riparian buffer along about 700 feet of SFPC is needed to enhance the water quality flowing into the creek. A fencing system is needed to control the movement of horses, thereby limiting the number of stream crossings needed by the horses to cross the stream.

Select reaches of Stream 2 streambank (approximately 300 linear feet) may be re-graded and bioengineered to form stable slope with the aim of preventing additional channel erosion. A low water stream crossing is needed where the culvert underneath Orion Drive is draining into Stream 2. A low water crossing will be designed with materials suitable for horses to walk on and placed at a strategic location to avoid additional streambank disturbance. The riparian buffer for Stream 2 at the area close to the Orion Drive culvert requires restoration.

Figure 2. Little Creek Horse Farm Site Plan

CONCLUSIONS

To improve the health of the county streams, we developed a watershed planning process that uses social, environmental and financial criteria, the Triple Bottom Line, in the development of Watershed Management Plans. This method was utilized in the South Fork Peachtree Creek watershed. A grid analysis using 5 Triple Bottom Line criteria was used to select two projects from the 66 potential projects identified in the field. The two top projects selected for construction were a stream restoration and livestock management project at the Little Creek Horse Farm Park and a dam improvement project

which includes stream restoration at the Johns Homestead Park. These two projects were determined to be the best at improving stream health and satisfying the Triple Bottom Line.

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