

THE EFFECTIVENESS OF THE DEBRIS BARRIER AT THE INTERSECTION OF ESLAVA CREEK AND WOODCOCK BRANCH

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Urban watersheds, such as Dog River Watershed in Mobile, AL experience many problems with pollution. Trash and other debris wash up on riverbeds and banks, and disrupt the natural habitat and health of the stream. City officials are challenged with deciding how to manage this problem. The City of Mobile has opted to buy a debris barrier, which is a floating boom with a net that drops about a foot deep. This barrier prevents garbage and debris from continuing downstream. This study focuses on the effectiveness of this barrier through a couple methods. Visual observations of the barrier and the surrounding area were taken before, during, and after a rainfall event to examine how much debris is actually caught and where the debris comes from. A quantitative approach is also used. The barrier is upstream from Luscher Park, which is a site for the annual Coastal Cleanup. The quantitative method aims to predict how much less garbage should be collected at the next Coastal Cleanup event. By using data collected at past Coastal Cleanups, as well as data from collections near the debris barrier, an estimation can be derived that will predict the figures for the next Coastal Cleanup. If the prediction is close to the actual amount, then the debris barrier is working. This study can then be used to decide whether another debris barrier would be an appropriate investment, and identify possible modes of improvement for a future installation.

Keywords: trash, pollution-river, garbage barrier

Introduction

Most urban watershed cities worldwide experience difficulties trying to stop pollution in streams. Trash, dirt, oils, and other chemicals wash into storm drains that empty into the streams that comprise the urban watershed. The Environment Protection Authority in Australia notes that lower oxygen levels, increased algae levels, and over sedimentation are some issues facing their rivers (EPA 2003). American watersheds are no exception. The Monterey Bay region in California has interest groups like Save Our Shores that have begun to promote funding for water health. They note that the estuaries and streams that are being polluted also pollute the coastline, where many people enjoy recreational activities (Couch 2007).

These same problems can be applied to Mobile Bay and the surrounding beaches in Baldwin County, and on Dauphin Island. An example is Mobile's Dog River Watershed that covers a large portion of Mobile's urban and suburban reaches. In fact, 60% of the watershed is in the city limits (AWW 2004). In the past year, the City of Mobile installed a debris barrier at the confluence of the Eslava Creek and Woodcock Branch (Figure 1). City officials pinpointed this site as a major source of pollution into Dog River.

The City of Mobile opted to begin trash collection and pollution prevention by installing a debris barrier in 2007 (Blankenship 2007). As previously mentioned, the confluence of Eslava Creek and Woodcock Branch on Government Blvd. behind Food World utilizes the debris barrier. In a study for the University of New Mexico, a floating boom that collects water surface debris was identified as a cost efficient and effective method of pollution removal and prevention (Ho 2005). The debris barrier is essentially a long floating, cylindrical bar that stretches across a stream. Extending down from the floating boom is a net, up to four feet deep, that thwarts trash from continuing downstream, while allowing water to pass (PatentStorm 2005). Many cities choose this design because of its ease of installation, effectiveness, and cost.

Another valuable method of river pollution removal is a Continuous Deflection Separator (CDS). A CDS unit is a very sophisticated machine that uses a river's natural hydraulic energy from running water to stop and collect river pollutants. These large cylinders are constructed in a range of sizes depending on the needs and size of the location. The CDS allows water to pass through it and swirl in a circular motion, then pass through a screen. The screen stops any debris, and even some oils and grease, which

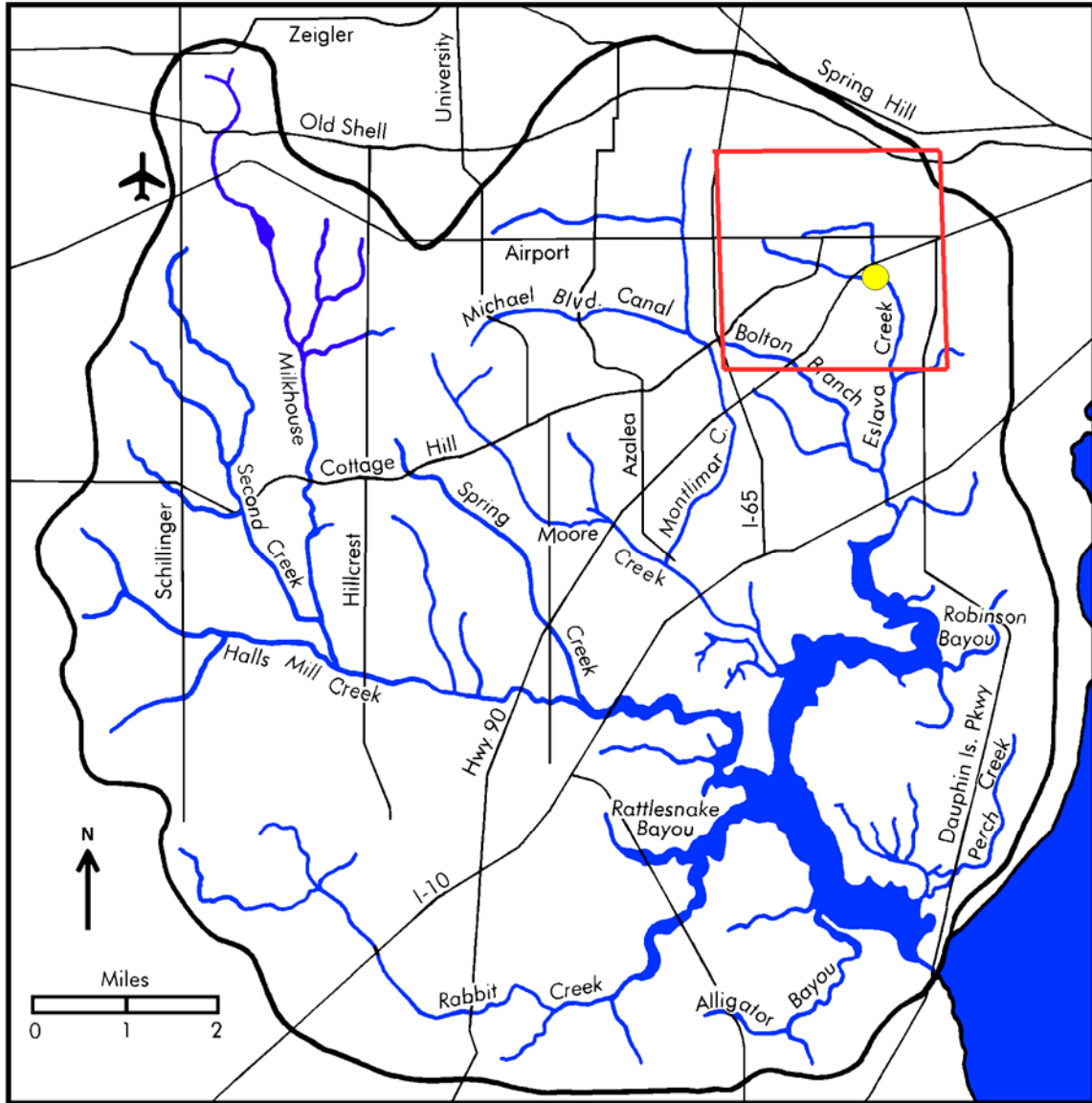


Figure 1

This is a map of the Dog River Watershed in Mobile, AL. The confluence of Eslava Creek and Woodcock Branch is highlighted in the red box, where the debris barrier is located.

Source: <http://www.usouthal.edu/geography/fearn/480page/MapColor.gif>

collects in the center, as the water continues to flow. Large debris settles to the bottom for removal later, and smaller debris is trapped to the water level, and still unable to leave the removal cylinder (Kaspersen 2000). Orlando, FL has installed two units as of 2000, with plans of installing more (Stephenson 2000). According to a case for a neighborhood being developed in San Jose, two units cost approximately \$38,000 with annual maintenance amounting to about \$1,200 (Kaspersen 2000). Both in Orlando and in San Jose, it is speculated that a CDS unit removes nearly 80% of oils and greases, and an even higher percentage of floating debris.

These are just some main ways that cities try to protect the quality of watersheds. The debris barrier is an effective method, but most likely less successful than a CDS unit. A floating barrier with a net will not have the ability to trap pollutants in the same manner that a CDS unit can. The debris barrier does not include a method for oil and grease removal. The CDS unit is much more expensive to buy, install, and maintain. Developers of CDS claim, however, that the cost pays for itself within several years.

Research Question

Does the debris barrier recently installed on Government Blvd. behind Food World where Woodcock Branch enters Eslava Creek prevent a significant amount of pollution from traveling farther downstream in the Dog River Watershed? This point of convergence was identified as the appropriate place because a large quantity of debris is believed to flow through there. With the possibility of new debris barriers being placed around the watershed, it is important to know whether the theories for placing the first one were accurate, so that they can either be used again, or modified for a more efficient procedure at other points on the river.

Methods

Visual observations of the debris barrier took place in order to evaluate the debris barrier's effectiveness. Observations before rainfall identified pollution in the stream that may be stagnant. Observations during a rainfall event were ineffective since most rainfall events during the research period occurred during the night when visual observations would have been impossible due to lack of lighting. A heavy rainfall event that occurred after an observation provided the opportunity to observe the types of trash caught in the barrier, as well as offering clues to how well the barrier worked.

Coastal Cleanup is an annual event that takes place worldwide. Dog River Clearwater Revival is a group that collects garbage out of the river at Luscher Park, which is downstream from the debris barrier, as a part of the Coastal Cleanup event. Data about how much garbage was collected from the river and its banks from past cleanup years was available from Amy King who is in charge of the Mobile Area cleanup. A record of trash collected from the barrier was available by contacting John Windley, the Superintendent of Public Works for the City of Mobile who is in charge of cleaning around the barrier. The values from each department were presented in different scales, and were incomparable.

Results

The first visit to the debris barrier behind Food World on US-90 (Government Street) at the confluence of Eslava Creek and Woodcock Branch was on March 31, 2008. In Figure 2, many key observations of the barrier are shown. The debris barrier's construction consists of a long yellow, floating boom that stretches like a horseshoe

across the channel. Both sides of the debris barrier have steel cables tied to an anchor. The Eslava Creek side of the channel has a long steel cable that is anchored above the concrete channel. Conversely, the Woodcock Branch side of the debris barrier has a short steel cable that is anchored into the concrete channel about midway between the streambed and shore. The yellow boom floats about six inches tall above the water. Extending below is a section about two feet deep with a net built in that is about one foot wide. These dimensions are visual estimates made from the riverbank.

Two days before the first visit, Mobile received a light rain that most likely did not affect the debris barrier's surroundings except to add debris to the area. The Woodcock Branch side is a concrete channel and has less sediment near the barrier than the Eslava side. In the Eslava Creek, the bank has more sediment and plenty of tall grasses, which provide stopping points for debris. In fact, the Eslava creek side of the confluence had plenty of Styrofoam cups, and bags caught along the lower banks. The Woodcock Branch side has larger items such as boxes caught on the sediments. The barrier itself had some trash caught along the floating boom of the barrier on the surface of the water (Figure 2). The majority of the trash appeared to be cups, chip bags, fast food wrappers, plastics of different types, and athletic balls.

Overnight on March 4, 2008 to the morning of March 5, 2008 Mobile received a very heavy rainfall event. By 7:00 am on the fifth, the 24 hour rainfall total recorded at the airport was 7.83 inches. In the next couple of hours about a half of an inch of rain fell on also, totaling over eight inches during the night. These numbers were extracted from



All of the following photos were taken on 3/31/08.

Image 1 to the left shows the Eslava Creek extension of the debris barrier. The steel cable anchor extending above the channel is seen to the right edge of the photo.



Image 2 to the left shows the short cable anchored at the middle of the concrete channel on the Woodcock Branch side of the debris barrier.



Image 3 is a wide range view of the debris barrier. Some debris is seen along the barrier, and north of the barrier resting on stream sediment.

Figure 2

observations taken by the National Weather Service of Mobile at the Mobile Airport.

On the fifth, a second trip was taken to the debris barrier to observe its status post-rainfall (Figure 3). Water levels had risen extremely high over the course of the evening. This was evident by watermarks on the concrete channel as well as the extent to which the grass in the channel was pushed over. In the previous visit, the Eslava side of the debris barrier rested along the second steel step from the bottom of the streambed, where as now it rested over a foot higher on the fourth step as seen in the first image of Figure 3. The boom was bowed across the confluence, as the water level was still higher than during the previous visit. Shown in the second image of Figure 3, the anchor on the Woodcock side had grasses covering it and the steel cable. Figure 3 also shows a large pile of debris accumulated in the center of the bow on top of the water and against the barrier. Two other short spans of the barrier collected debris. Along the bank walls and streambed banks there were several places washed clean of trash that was present at the earlier visit.

Conclusions

Through observations of the debris barrier's surrounding area and the barrier itself, some interesting conclusions can be made. The visits provided insight into the construction of the debris barrier, and why it was placed at the Eslava Creek and Woodcock Branch intersection.

It can be argued that the debris barrier is effective. Its purpose is to prevent trash from passing that point of the stream, and to amass along the barrier for easy removal. This is exactly what it has done. According to the City of Mobile, three removals have



All of the following photos were taken on 4/5/08.

Image 1 shows the raised level of the Eslava side of the boom and the apparent raise in water level.



Image 2 shows the Woodcock Branch anchor that is covered by the grasses and debris.



Image 3 shows the debris and garbage amassed in the center of the debris barrier along its bend.

Figure 3

collected three cubic yards total of debris since its installation. A fourth removal is scheduled for early April (Windley 2008).

The flaw in the study is that the debris barrier has not been observed during an actual rainfall event. One could argue that without this observation, it cannot be proven how the debris was piled against the barrier. However, the study can say that from looking at the stream surrounding the barrier before and after, it can be inferred that it worked. Before rainfall, debris was dispersed along the barrier and the riverbanks. After an abnormal rainfall event that allowed the water in the channel to rise several yards in depth, this debris was corralled to a central bend in the barrier. Since it is the barrier's job to prevent trash from continuing down the stream, then it has completed its job.

Through the study, a potential flaw has been identified in the floating boom's installation, as seen in the first image of Figure 3. As previously mentioned, the April 4th and 5th rainfall event saw over 8 inches of rain throughout Mobile. This allowed the stream channel to reach a depth well over the height of the Woodcock Branch anchor. Because of the piling of dead grasses and sediment along the steel cable, it is evident that at the highest point of the flash flood event, the water level was higher than the cable allowed the barrier to move. Therefore, a person can assume that at this edge the barrier was submersed. This could allow some debris to float around the bend along the channel wall, and pass the barrier.

This particular place does seem like an appropriate site for the barrier as well. There was much debris around the banks and in the parking lots around the streams. It is also a large drainage region that drains stream intersections with two major highways, Airport Blvd. and Government St. In addition, the confluence of Woodcock Branch and

Eslava Creek allows the barrier to span a long distance and develop into a horseshoe type formation that pushes debris into a central location of the boom.

If plans for more barriers in the Dog River Watershed are to be implemented, this study of the first one proves that it works effectively and validates the purchase of a second. A similar point of high pollution from trash and other debris should be chosen, as well as a point where major areas are drained. This study recommends that future debris barriers be installed similar to the Eslava Creek side on both sides of the channel to prevent any possible debris loss during rainfall anomalies. The debris barrier is effective as a small-scale, cost-efficient, stream-garbage removal tool.

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