



**NC STATE UNIVERSITY**

# **Disconnecting Stormwater Conveyances to Restore the Black Creek Watershed**

Final Report for CWMTF Grant 2008-1016

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## Executive Summary

The Black Creek Watershed Association (BCWA) is a partnership of citizens, neighborhoods, local government organizations and agencies working together since 2006 and is coordinated by NC State University. The BCWA initially assessed the causes of Black Creek's impairment, and developed a watershed restoration and action plan (2009) to improve the stream system's health that was accepted by EPA as an alternative to a TMDL if critical milestones are met by 2014. The Black Creek watershed, about 3.3 mi<sup>2</sup> in area, is in the northern section of the Town of Cary. The creek discharges to Lake Crabtree, in the Crabtree Creek subwatershed of the Neuse River Basin. The watershed is typical of a nearly built out Piedmont watershed, with hilly terrain, low-high density residential subdivisions, three schools, two town parks, and supporting commercial and office uses. The Town's popular Black Creek Greenway runs adjacent to most of Black Creek, hence many people are familiar with the creek system. Black Creek has been on the NC 303d list since 1998 with impairment for aquatic life. The watershed assessment identified excessive stormwater runoff volumes and velocity as the main impairing factors. Most of the watershed was built out before stormwater regulations such as the Neuse Rules and EPA Phase 2 were in effect.

NC State University staff, with support from BCWA, applied for this CWMTF grant to advance two main objectives: 1) Develop and implement a stormwater disconnect campaign- with the purpose of raising awareness of the importance of disconnecting stormwater conveyances from Black Creek and providing residents with tools needed to act; and 2) Conduct a watershed resident study to determine willingness to pay for improvements and use the results of this study for recommendations on funding restoration . The ultimate goal was to better understand how to move watershed residents to action in installing backyard stormwater retrofit best management practices (BMPs), and beginning the work of reducing runoff to Black Creek and its tributaries.

A watershed education campaign involved developing outreach materials and demonstration BMP sites to increase awareness of opportunities to engage in activities to improve the health of Black Creek. Presentations were made to HOA Boards, and residents were invited to a series of workshops where they had multiple opportunities to learn the issues and opportunities and view the demonstrations in person. The Center for Environmental and Natural Resource Economic Policy conducted a choice experiment survey of watershed residents to improve understanding of how residents view the watershed and how much they would be willing to pay for improvements.

The project successfully met its objectives. The process of educating and engaging residents resulted in high interest for installing residential best management practices among those residents who were targeted. The watershed survey revealed that once educated about the issues and potential solutions, most watershed residents surveyed were willing to pay something to see an improvement in the health of Black Creek, including a monthly stormwater fee. A demand for rain garden design and installation has increased and hopefully will continue to grow. To meet this demand, capacity needs to be built for local landscaping companies to conduct rain garden design and installation, and local stores will need to stock more plants that are suitable for rain gardens. Future programming efforts could tap into the

desire of residents to improve the creek by setting up a voluntary or regulatory funding structure, and implementing retrofits with the proceeds. Possible programs for funding could include a Town stormwater utility fee, a watershed improvement district, and/or a voluntary membership program. A program to install residential best management practice retrofits would likely need to provide significant subsidies to homeowners, though our research indicates that if such a program were undertaken and included an outreach component, there would likely be many willing participants.

## Proposed Scope and detailed objectives and Accomplishments

This stormwater planning grant had two main proposed objectives.

1. Develop and implement a stormwater disconnect campaign- with the purpose of raising awareness of the importance of disconnecting stormwater conveyances from Black Creek, and providing residents with tools needed to act.
2. Conduct a watershed resident study to determine willingness to pay for improvements and use results to help inform continued restoration funding.

This report is divided into those two objectives.

This was translated by CWMTF into the following activities as a **scope of work in the contract**:

- 1) Coordinate and facilitate Black Creek Watershed Association to use geodatabase to identify project sites, engage community members, oversee all project activities, and develop a financial plan
- 2) Conduct community and neighborhood workshops
- 3) Develop and disseminate outreach materials
- 4) Conduct watershed resident survey

### **1) Develop and implement a stormwater disconnect campaign (included 1, 2, and 3 from Contract Scope of Work)**

The purpose of this campaign was to raise awareness of the importance of disconnecting stormwater conveyances from Black Creek and its tributaries, including the range of actions homeowners and homeowner associations can take to do so, and to provide tools that are needed so that homeowners will take those actions. Throughout the campaign, we sought to build capacity of local residents (including members of the Black Creek Watershed Association) to inform others about watershed improvement, and actively participate in activities to reduce stormwater and improve the health of Black Creek.



*Methods:*

Methods tested for the campaign included the following.

- a) Working with the existing Black Creek Watershed Association to identify target audiences, assist with reaching out to those audiences, and provide ideas and feedback about educational outreach materials and methods.
- b) Targeting a subwatershed and its neighborhoods for outreach, education and involvement.
- c) Creating a campaign based around installing “rainscapes”, which was chosen as a user-friendly term. A range of “rainscapes” were offered, to allow homeowners to choose actions ranging from easy and inexpensive stormwater gutter disconnections, to the more work intensive and expensive, and more effective, rain gardens. An investigation of methods used by other organizations around the country helped inform the activities and materials developed. Some communities whose methods and materials informed this project included Montgomery County, Maryland’s “Rainscapes” program; Portland, Oregon; Seattle, WA; Chicago, Ill; and Washington, D.C.
  - (1) We partnered with NCSU Dept. of Horticulture professor Anne Spafford to design a fact sheet series. We hired her student, Brantley Snipes, to conduct the early designs and content.
  - (2) The Fact sheet series consisted of the following topics. All were posted online and printed for workshop participants.
    - (a) Rainscape: an overview of rainscaping: the purpose, techniques, and benefits of adding landscape enhancements to reduce stormwater runoff.
    - (b) Disconnect: how to disconnect a downspout for rain water dispersal
    - (c) Collect: how to use and maintain a rainbarrel, where to turn for information about cisterns.
    - (d) Naturalize: how to replace turf and soil with a mix of plants that improves infiltration
    - (e) Garden: an overview of rain gardens, followed by several subtopics (Size your rain garden, Design your rain garden, Construct your rain garden, and Plant your rain garden)
- d) Designing and installing 2 highly visible demonstration rainscapes in the target communities as part of the educational outreach effort
  - (1) Raingardens were constructed along the Beechtree HOA greenway that leads to the Town of Cary Black Creek Greenway.

- (2) A rainbarrel and rain garden was installed at the Wessex HOA Clubhouse. They are located in the courtyard, visible at all times from the Clubhouse meeting space.
- e) Inviting target audiences to workshops
  - (1) Direct presentations to HOA boards ahead of time “primed” the audience, led to buy-in from Boards to help advertise
  - (2) Emails to HOA lists, BCWA list, mailing to initial target subwatershed, flyers on doors of second targeted subwatershed
- f) Workshops provided introductions to issues and solutions, interactive exercises, and invited participants to join the project.
  - (1) The Rainscape Fact sheets and Rainscape applications were provided for those who were interested in possibly installing rainscapes on their property
- g) Following up with stormwater “audits”, where NCSU staff and a BCWA volunteer visited the residential property with the homeowner, looked for areas where stormwater was being conveyed directly to a ditch, creek, or stormdrain, and worked with the homeowner to identify appropriate landscaping techniques to reduce runoff (using a separate EPA319 grant).
- h) When high value projects were identified and the landowner requested assistance, we assisted with designing and/or installing rain gardens and rain barrels (using a separate EPA319 grant).

### *Results (framed as activities required in Scope of Work)*

- a. *Coordinate and facilitate Black Creek Watershed Association to use geodatabase to identify project sites, engage community members, oversee all project activities, and develop a financial plan*

The BCWA met in person five times over the course of the grant, to help identify areas to focus upon, to help plan activities, and to review all project products. In between meetings they also were prompted to communicate via online methods, including a listserve, Blog, and Facebook page. Of these, the listserve was most popular and most often used for BCWA members to share resources and discuss local policy issues such as rezoning. BCWA members helped implement and participated in the community workshops, and also helped with stream clean-ups. One member volunteered their time to help conduct stormwater audits, and another volunteered their time to update the geodatabase.

- b. *Conduct community and neighborhood workshops*

Six community workshops were held throughout the grant period, with attendance of 12-20 people at each. The first was to kick-off the residential stormwater retrofit campaign. Three workshops educated targeted neighborhoods regarding the issues concerning Black Creek and

the potential solutions that we called Rainscapes, and invited them to apply for a stormwater “audit” to determine potential rainscapes that could be installed. The other two workshops taught how to install and maintain rain gardens and rain barrels via hands-on activities.

*c. Develop and disseminate outreach materials*

The fact sheet series was developed and posted on a website devoted to rainscapes. A limited number of hard copies were printed out to distribute at workshops. The current version of the fact sheets still has “draft” posted on it, as we have submitted the drafts to professionals at NCSU for peer review in an attempt to publish them as official NC Cooperative Extension publications. While this is not necessary to meet the objectives of improving the Black Creek watershed, the fact sheets are broad enough to benefit watershed communities across the state.

Two demonstration rainscape sites on HOA property served as live visual examples of the projects that we were hoping to recruit homeowners to install- a rain garden and rain barrel at Wessex Clubhouse, and rain gardens on the Beechtree greenway. Community workshops were held at the Wessex Clubhouse and participants were brought out to the courtyard to view the rainscapes and ask questions. The Beechtree greenway rain gardens raised much discussion in the community, and have been highly regarded. Turn-out at community workshops from this neighborhood has been high, partly due to curiosity about the rain gardens.

Powerpoint presentations were developed for presentation at community group meetings and workshops. Presentations were delivered at HOA annual meetings.

Finally, a rainscape application form for homeowners to fill out and submit when they want an audit, and an audit form to guide auditors were created.

## **2) Conduct a watershed resident study to determine willingness to pay for improvements, use results for recommendations on funding restoration (#4 in the scope of work)**

So far, efforts to restore the Black Creek watershed have been largely funded by USEPA319 grants. As competition increases for decreasing amounts of government funded grants, the BCWA sought to expand their possibilities for funding long-term restoration efforts in their watershed. To better inform the BCWA about options for engaging residents and financing watershed restoration, NCSU conducted a willingness to pay for watershed improvements survey of single family homeowners in the watershed. Specifically, the survey sought to understand knowledge and attitudes about:

- Black Creek and its environmental condition
- Willingness to install private BMPs

- Willingness to pay a stormwater utility fee to improve Black Creek environmental condition

The BCWA and project team aimed to use the information to more sustainably plan for long-term restoration of the watershed.

### *Methods:*

The environmental condition of a watershed is a good which is not sold in the market and as such, no market and no market price exist for this good. Accordingly, the 'good' at hand in this study is referred to as a non-market good. If the underlying demand for a non-market good cannot in some way be linked to the demand of one or more market goods, the economic impact of a change in supply of the good can only be elicited by directly asking the relevant population about their preferences regarding such changes. Such preference elicitation is generally carried out using a stated preference survey (Ladenburg, Dahlgard, & Bonnichsen, 2010). The stated preference method used in this study is choice experiments (CE). This section will briefly explain the underlying theory of choice experiments and will then continue to give an overview of survey development, administration and analysis used to arrive at the results discussed next section.

The method of CE is based mainly on two fundamental theories: Lancaster's theory of consumer demand and random utility theory (Bergmann, Hanley, & Wright, 2006). Lancaster's consumer theory posits that the consumer receives utility from the characteristics of the good rather than the good itself (Lancaster, 1966). Changing one of the attribute levels in essence changes the 'good' at hand. Loosely speaking, the 'good' at hand in this study is the management of the Black Creek watershed. As such, the 'good' consists of both the environmental condition of watershed as well as the private and public actions taken to reach this environmental condition.

Choice modeling is based on the recognition that any good can be described in terms of its characteristics/attributes and the levels which these attributes take and aims to identify the utility that individuals receive from the different attributes which make up the good in question. This is accomplished by asking respondents to choose between a finite set of scenarios, also called alternatives, which in the study at hand would be different management scenarios of the watershed. These alternatives are defined in terms of their key attributes, which are in turn described by varying levels of that attribute. The attributes and attribute levels used in the survey are described later.

Two types of alternatives are generally used in choice experiments. The first, are those that are created by the researcher by combining different attribute level, and are hence referred to as "designed alternatives." To reflect real world choice making behavior, respondents are also usually given one alternative or option that allows them to keep things the way that they are. This alternative, which is described by attributes at their current levels, is referred to as the status quo, or baseline alternative. By making choices across alternatives, individuals implicitly make trade-offs between attributes and attribute levels.

Random utility theory in turn recognizes that there are both observable and unobservable components to the utility that individuals derive from the consumption of a good. While the former can be observed by the researcher through the data obtained from a survey, assumptions must be made about the

distribution of the latter so as to be able to make probabilistic inference about which alternatives are most preferred over the sample population (Hensher, Greene, & Rose, 2005). Assuming that individuals will choose the scenario that provides them with the highest utility, this allows researchers to estimate the relative utility associated with different attributes. Moreover, if one of the attributes is measured in monetary terms, this allows for the estimation of respondent's willingness to pay for the attributes in question by examining the marginal rate of substitution between the monetary attribute and the non-monetary attribute examined (Louviere, Hensher, & Swait, 2000).

The survey administered followed the experimental design process of focus groups, survey pretesting and the development of an efficient design as outlined by Hensher et al. (2005). As is required in the procedure for developing a good experimental design, a significant amount of effort was spent identifying and refining the attributes and levels to be used in the experimental design of the survey (Hensher et al. 2005). Moreover, a key challenge faced in designing the surveys was to identify relevant information about the watershed needed to give participants an appropriate context from which to answer the choice questions, while simultaneously keeping the survey precise and simple.

Both of the above challenges were overcome through the use of structured focus groups. Focus group discussions aided the narrowing of information, the ordering of the survey sections, the validation of attributes and levels used in the experimental design (discussed below) as well as the addition of facts respondents deemed necessary to answer the survey. Three focus groups were held to finalize the survey. Focus group participants were recruited through contacts within the Black Creek Watershed Association so as to approximate the population to be surveyed. A few BCWA members were invited directly to participate, and three BCWA members sent recruitment invitations to their homeowners association listserves. The invitation did not indicate what the survey was about. The resulting focus groups were comprised of watershed homeowners, Town of Cary stormwater staff, and NC Division of Water Quality staff. Feedback from focus groups was used to iteratively edit the survey. Lunch and soft drinks were offered as an incentive to attend the focus groups. Focus group participants were asked not to answer the survey in case they received a survey once administered.

Four attributes were varied across choice questions: the type of private BMP installed, the cost of the private BMP, the stormwater fee added to the monthly water bill and the resulting environmental condition. Discussions from the focus groups led to the final choices of attribute levels. Levels for the attribute 'type of private BMP installed' were chosen to be 'no BMP installed' as well as 'three 65 gallon rain barrels,' 'One 10x10 foot rain garden' and 'One 10x10 foot conservation planting.' These private BMPs were chosen because they are commonly installed in practice. Three rainbarrels were chosen so as to ensure that levels for the 'cost of private BMP' attribute were relevant for all private BMPs shown.

To get an accurate understanding of individuals WTP to restore the watershed, the range of private BMP prices and stormwater fees had to be wide enough to capture both the lower and the upper tails of the WTP distribution in the population. During the focus groups it became apparent that the majority of respondents would need subsidies of the private BMPs in order to consider scenarios specifying the installation of a private BMP. Accordingly, the levels chosen for the cost of the private BMP were {\$0, \$120, \$230, \$340, \$450, \$560}. The experimental design was restricted to ensure that the cost of \$0 only occurred with the level 'no private BMP installed' and vice versa. Levels for the stormwater fee attribute

were chosen to be in line with stormwater fees implemented in different counties across North Carolina: {\$0, \$3, \$5, \$8, \$10, \$12}. Finally, levels for the 'resulting environmental condition attribute' were chosen to be: 'current condition,' 'partial restoration' and 'full restoration.' Understanding of the attributes and credibility of the attribute levels was tested during the focus groups.

The final survey consisted of five main sections and was printed as a 32 page color booklet. In the first section, respondents are asked about their experience with and knowledge of Black Creek and its greenways. In the second section, the respondents are given an overview of the current condition of Black Creek, an explanation of the stormwater runoff problem as well as an overview of ways that can be used to address the problem of stormwater. This section also introduces a hypothetical program to improve the environmental condition of Black Creek and explains in detail all the attributes and levels that individuals will be confronted with in the choice section. To familiarize respondents with the subsequent choice questions, this section also given an example question. The third section contains the choice experiment in which respondents are faced with eight questions in which they have to rank three scenarios in order of their preference. Two of the three scenarios varied in every question and entailed a move away from the current, or "status-quo," condition of the Black Creek watershed. These scenarios entailed either the installation of a BMP on respondents' property, a stormwater fee added to the water bill, a change in the environmental condition, or any combination of these changes. These two scenarios are referred to as "designed scenarios" in the discussion below. The third scenario reflected the current condition of the Black Creek watershed, stayed the same across all choice questions, and is referred to as the "status quo scenario" in the discussions below. In the fourth section, respondents are asked follow up questions to identify potential protest behavior as well as identify possible non-attendance to specific attributes. This section also poses a number of questions about the perceived importance of watershed restoration and actions currently taken to improve environmental conditions. The final section asks for respondent demographics.

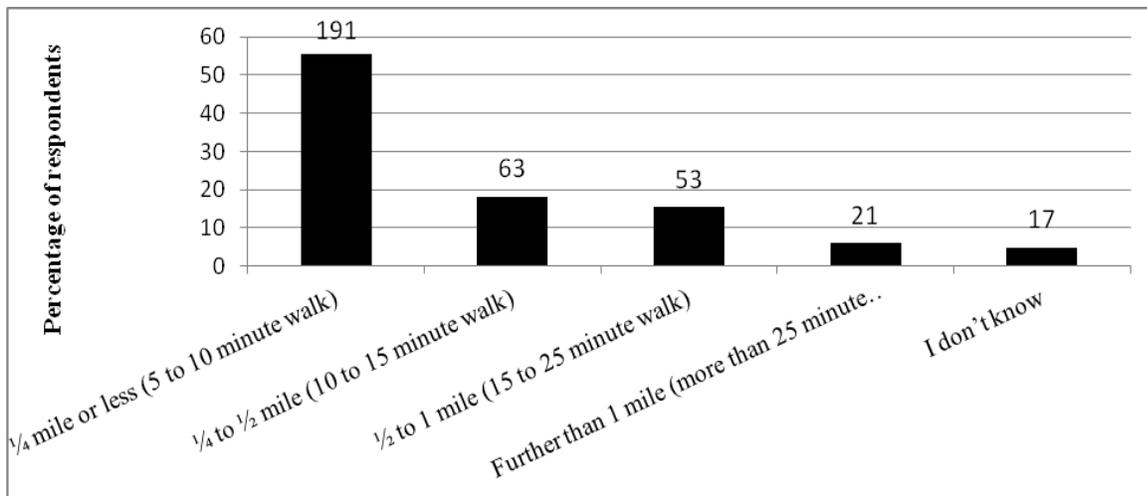
The survey was sent out to 750 randomly selected single family homeowners in the watershed. Researchers provided an incentive of entry into drawings to award two \$100 home improvement store gift cards. One drawing would include respondents who returned surveys within two weeks, and those early respondents would also be included in the second drawing of returned entries. Surveying procedures were based on Dillman's Tailored Design Method (Dillman 2000). First, all respondents were sent survey packets consisting of (1) a cover letter stating the nature of the survey, the importance of the topic at hand, the importance of survey participation, how confidentiality of responses was ensured, as well as incentives provided for completed and returned surveys; (2) the survey; (3) a business reply envelope. Each version of the survey was identified by a tracking number. Approximately two weeks later, postcards were sent out to all respondents, thanking them for their participation and reminding those who had not yet completed the survey to please do so. Finally, two weeks after the reminder postcards were sent out, a second survey packet was sent out to those respondents who had still not completed and returned the original surveys. This second packet contained the same survey, but a modified cover letter, reaffirming the importance of the study as well as reassuring respondents of survey confidentiality.

Of the surveys mailed, 30 were undeliverable and 358 were returned, resulting in a response rate of 50%. Given the nature of the data, a rank ordered logit model was used to analyze the survey data and determine aggregate WTP for watershed restoration.

*Results*

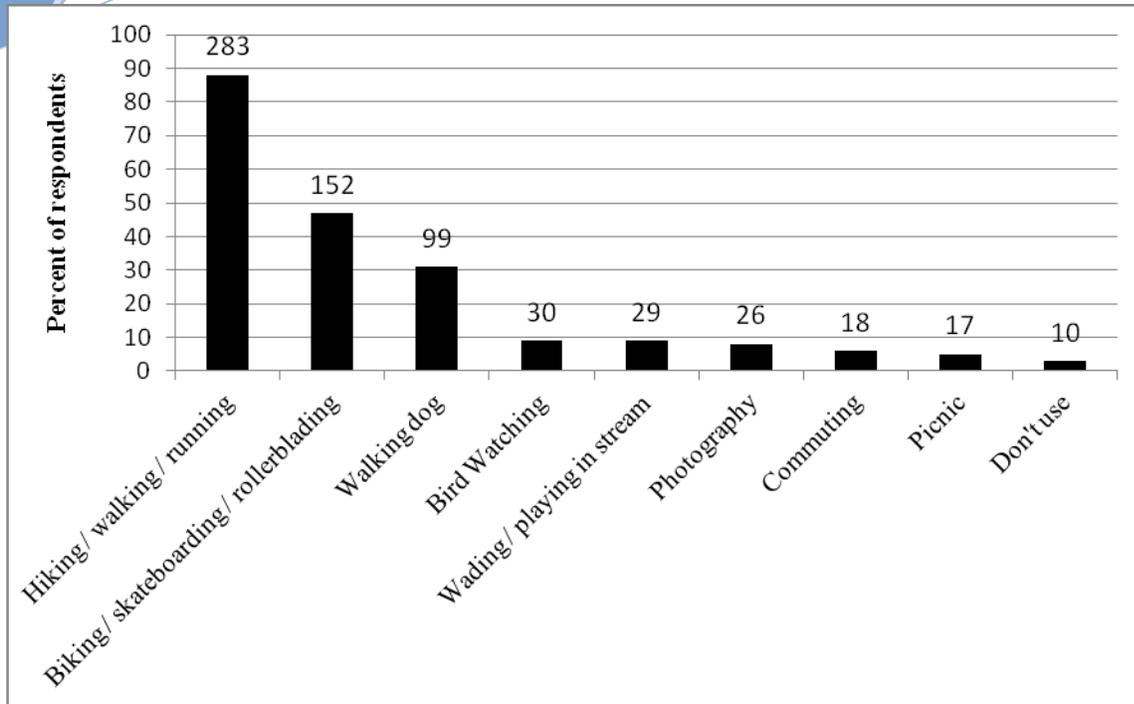
Current use and understanding of Black Creek

Respondents' use of the greenway was high. Nearly 65% of the respondents stated they used the Black Creek Greenway one or more times per month, while only 12% responded that they never used the Greenway. Regarding their proximity to the greenway, Figure 1 shows that 73% of respondents lived within a ½ mile of an access point. While the percentage of respondents indicating a specific response is shown on the vertical axes of the figures which follow, the number of respondents indicating a specific response is shown above each bar of the bar charts.



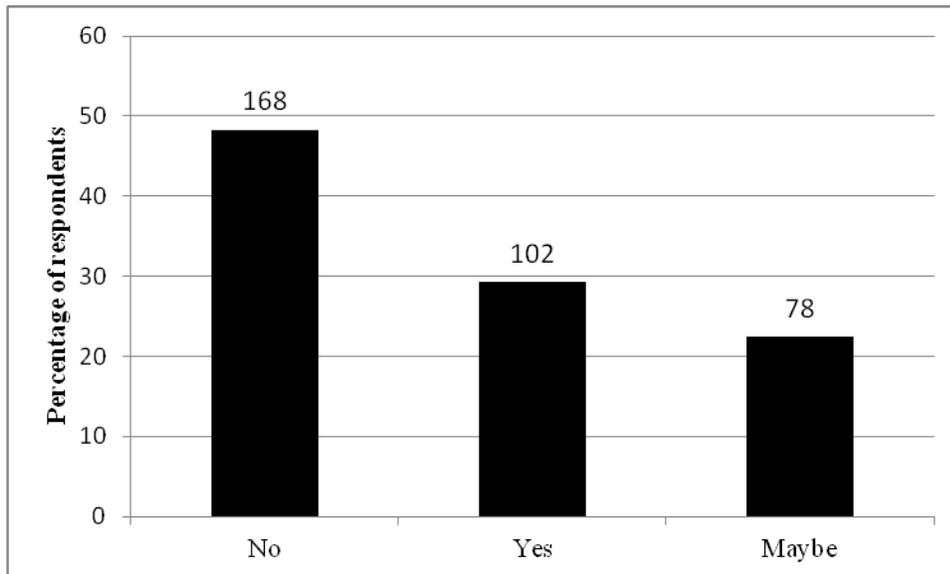
**Figure 1 How close respondents live to most frequent access point**

Respondents used the Black Creek Greenway for a number of uses, as seen in Figure 2.

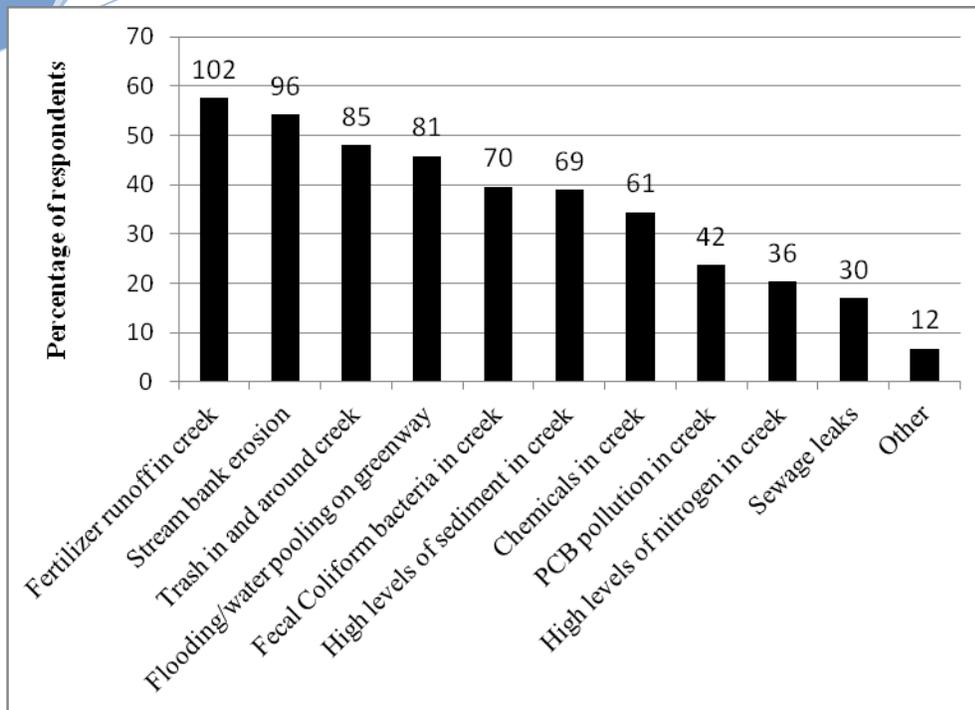


**Figure 2 Activities for which respondents use the greenway**

When asked if there were any environmental problems with Black Creek, nearly 50% said “no” (Figure 3). Respondents that answered “yes” or “maybe”, were asked to select the main environmental problems with Black Creek. The top three answers (shown in Figure 4) were (1) Fertilizer runoff in creek, (2) Stream bank erosion, and (3) Trash in and around the creek.

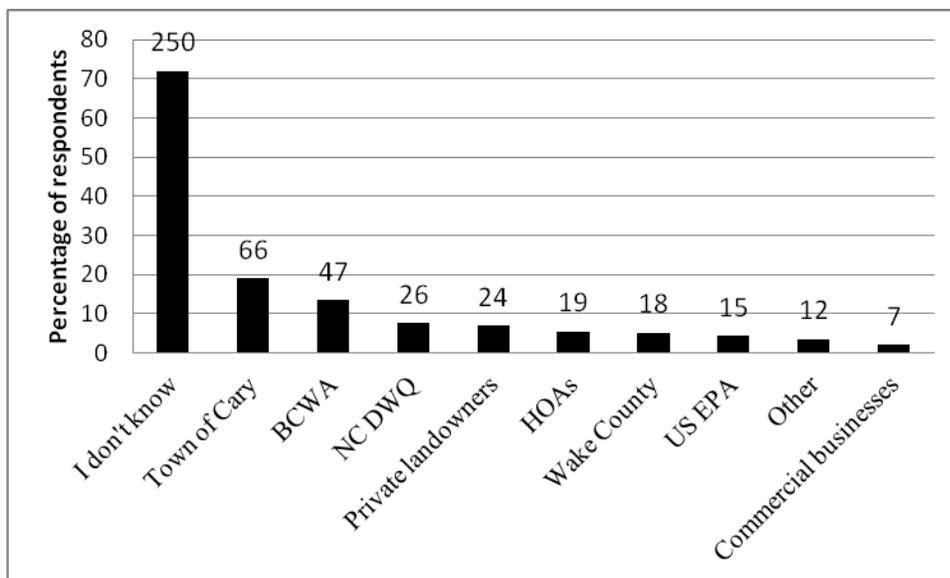


**Figure 3 Based on your current knowledge, are you aware of any environmental problems associated with the creek?**

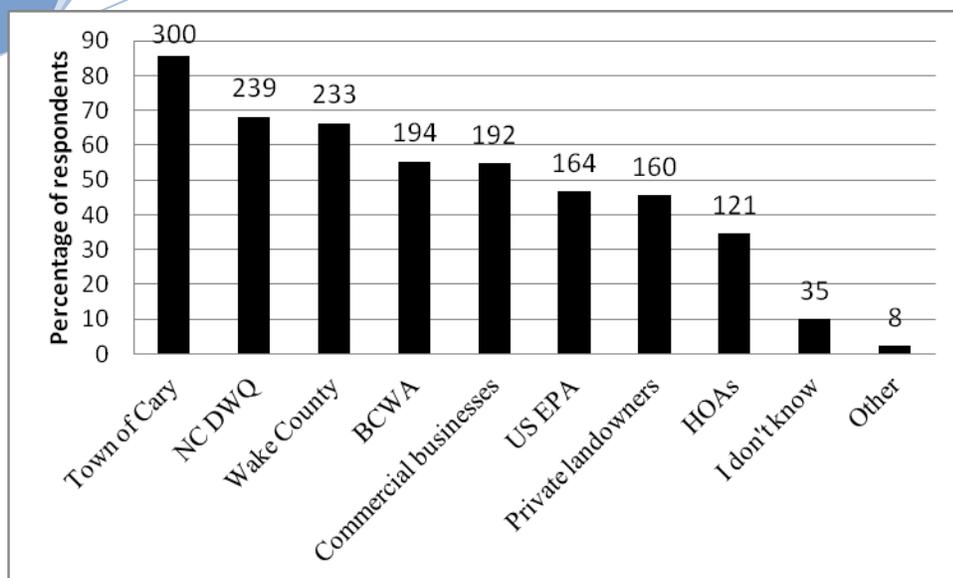


**Figure 4** What respondents thought were main environmental problem(s) with creek and greenway

At the end of the survey, respondents were also asked which entities they thought were taking actions to manage and improve Black Creek. Most did not know (72%), though 17% said Town of Cary. The breakdown of respondent answers to this question are shown in Figure 5. When asked who *should* contribute to managing watershed health and storm water, most responded with Town of Cary (85%), followed by North Carolina Division of Water Quality (68%), and then Wake County (66%), as shown in Figure 6.



**Figure 5** Which entities are believed to be taking concrete actions to improve Black Creek

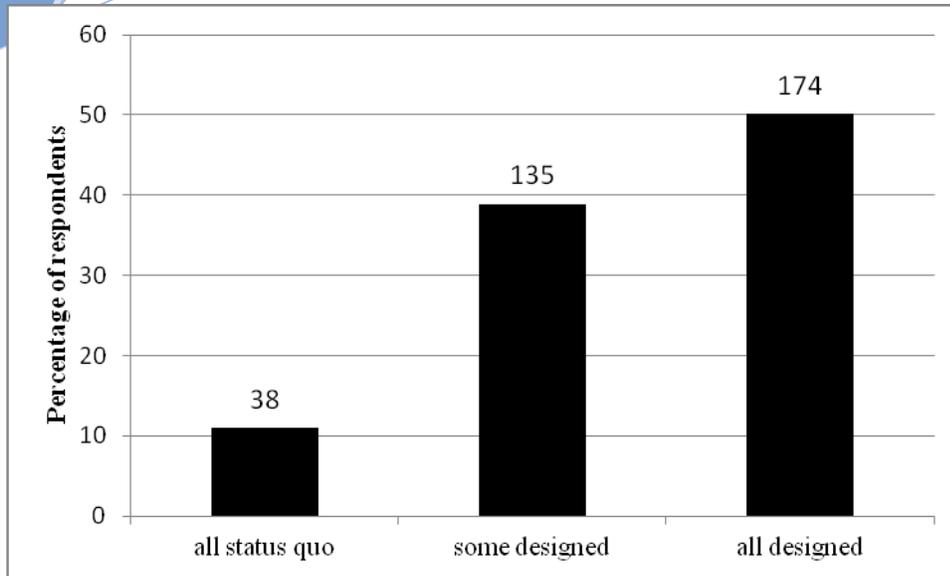


**Figure 6 Which entities should contribute to managing watershed health and stormwater?**

After reading the section educating respondents regarding the actual current impaired condition of Black Creek and ways to solve this problem, respondents were presented with the hypothetical program to improve Black Creek. After outlining the details of the hypothetical program, respondents were presented with the eight choice questions discussed in the methods section above. To recap, each of the eight choice questions consisted of three scenarios that respondents were asked to rank with from their most preferred to least preferred scenario. While the first two, designed scenarios, always entailed a move away from the current condition of the watershed, the third scenario, or “status-quo,” gave respondents the option to keep the current condition. Of the 358 respondents, 11 are not included in the analysis because they left more than two choice questions blank or answered the choice questions incorrectly (e.g., ranked two scenarios within the same choice question with the same rank).

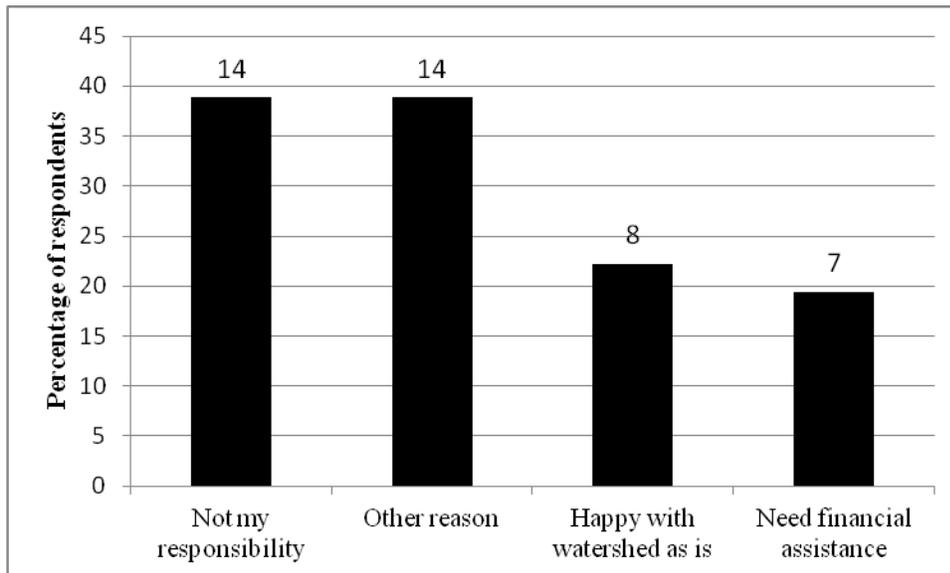
#### *Results of choice survey questions*

Half of the respondents always chose a designed scenario as the preferred scenario, while only 11% of respondents always chose the status quo as their most preferred option, showing a strong willingness of respondents to take action to improve the watershed (Figure 7). When examining only those respondents who always ranked a designed scenario as their number one choice, 53% of these respondents (93 out of 175) always ranked the status quo as their least preferred scenario, suggesting that they were willing to face all combinations of private BMP installations and stormwater fees offered in the design scenarios in order to see a movement away from the status quo.



**Figure 7 Number of times respondents picked a designed scenario as their most preferred option**

Respondents who always picked the status quo as their preferred scenario ( $N=38$ ) were asked why. Of the 36 who answered this follow-up question, 14 said “not my responsibility”, 14 chose “other reason”, and the rest said they were happy with the watershed as is, or needed financial assistance. The three most prevalent reasons stated in “Other reason” were 1.) Respondents feeling that the Town of Cary takes too many actions which impair the watershed making it unreasonable for citizens to be asked to do something ( $N=4$ ), 2.) Respondents not wanting to pay taxes ( $N=3$ ) and 3.) Respondents already having taken actions ( $N=2$ ).



**Figure 8 Reasons why some respondents chose status quo as most preferred option**

When further examining choices, some correlations were noted and can be found in **Error! Reference source not found.**1. First, respondent affinity impacts the choices made by respondents, with

respondents that use the Black Creek Greenway more than once a month being significantly more likely to always choose a designed scenario as their most preferred option, than those respondents using the Black Creek Greenway less than once a month or never. Interestingly, differences were not significant between respondents living at different distances from a greenway access point, but this is not very surprising given that almost all respondents lived very close to the greenway access point they used most frequently (these details are not shown in **Error! Reference source not found.**).

Respondents who were aware of environmental problems associated with the creek were also significantly more likely to always choose a designed scenario as their most preferred alternative than those respondents who were not aware of environmental problems associated with Black Creek. In a similar vein, respondents not aware of environmental problems were significantly more likely than those that were to always choose the status quo as their most preferred scenario.

Finally, environmental interest seems to be highly correlated with overall choices. Respondents that claimed to be very interested in the environment and environmental issues were significantly more likely to always choose a designed scenario than those that were “somewhat interested.” This trend carries through to those people who claimed not to be interested in environmental issues as respondents who are “somewhat interested” are significantly more likely to always choose designed alternative as their most preferred option than those respondents who claimed to be “not interested.”

**Table 1 Summary of respondent choices**

Category		Always chose status quo	Sometimes chose designed alternative	Always chose designed alternative	Total
Greenway use	More than once a month	15	81	129	225
	Less than once a month	22	53	43	118
Awareness of environmental problems	Yes	7	36	58	101
	No	24	66	76	166
Environmental interest	Very interested	9	39	104	152
	Somewhat interested	16	87	68	171
	Not interested	12	9	2	23

Willingness to pay estimates were developed for installing private BMPs and paying stormwater fees, and are shown in Table 2. Responses showed that significant subsidies are needed to entice respondents to install private BMPs. These included subsidies of 65-85% of rain gardens and conservation plantings, and 80-90% of the cost of rain barrels. The average willingness to pay for a rain

garden was \$219, while the average willingness to pay for three rain barrels was \$49. Rain gardens and conservation plantings appear to be preferred over rain barrels as private solutions.

**Table 2 Willingness to Pay for Private BMPs**

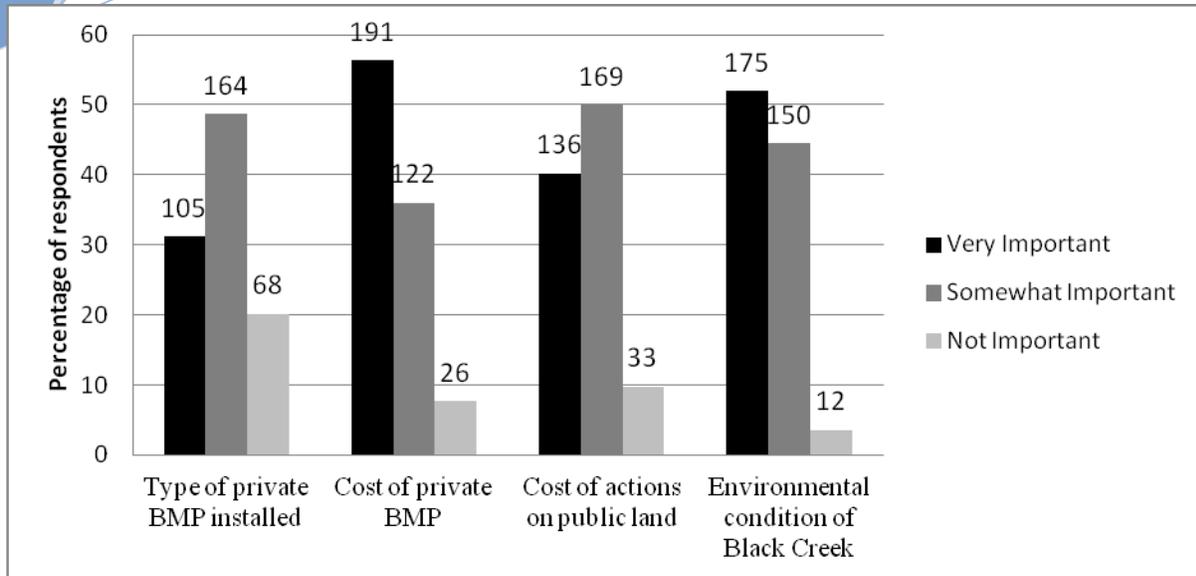
Private Best Management Practices			
	Willingness to pay	Market Prices	Subsidy Needed
Three Rain Barrels	\$49 (\$16 each)	\$90-\$165 each	~80-90% of cost
Rain Garden	\$194	\$6- \$12/ft <sup>2</sup> \$600- \$1,200	~ 65-85% of cost
Conservation Planting	\$219		

Table 3 illustrates that respondents were willing to pay an average \$3.56 per month stormwater fee, or 4.5% of the average Town of Cary water bill, to see the environmental condition of Black Creek improve from the current condition to partial restoration. To see an improvement from the current condition to full restoration, respondents were willing to pay an average of \$4.64 per month (5.9% of the average water bill). This shows respondents were on average willing to pay an extra \$1.09 per month to move from partial to full restoration of the watershed.

**Table 3 Total Willingness to pay**

Environmental Improvements			
Restoration level	Total willingness to pay	Monthly WTP (10 yrs)	% of Average water bill
Current → Partial	\$427	\$3.56	4.5%
Current → Full	\$557	\$4.64	5.9%
Partial → Full	\$130	\$1.09	1.4%

When asked which characteristics influenced their choices between scenarios, the top two most important characteristics were the cost of a private BMP and environmental condition of Black Creek (seeFigure 9).



**Figure 9 Importance of different characteristics in influencing respondent choices**

The demographics of the survey respondents are shown in Table 4 below. The reader should take note of the demographics of watershed survey respondents. Survey respondents skewed with slightly higher education levels than Town of Cary residents who responded to the Town’s Biennial Citizen Survey. In general, Town of Cary residents have higher education levels than North Carolina residents.

**Table 4 Education level, age, and race/ethnicity of Black Creek Survey respondents compared to Town of Cary Biennial Citizen Survey respondents.**

<i>Education Level</i>	<i>BCS</i>	<i>TOC</i>	<i>Age</i>	<i>BCS</i>	<i>TOC</i>	<i>Race / Ethnicity</i>	<i>BCS</i>	<i>TOC</i>
<b>High School or Less</b>	2.3%	10.6%	<b>18-25</b>	0.9%	7.3%	<b>White</b>	85.3%	83.2%
<b>Some College</b>	6.4%	22.1%	<b>26-35</b>	10.6%	20.5%	<b>African American</b>	2.9%	4.1%
<b>College</b>	41.4%	36.9%	<b>36-45</b>	22.4%	30.6%	<b>Hispanic or Latino</b>	2.1%	3.1%
<b>MA</b>	32.4%	23.6%	<b>46-55</b>	39.4%	20.5%	<b>Asian</b>	8.2%	5.6%
<b>Ph.D.</b>	17.5%	6.8%	<b>56-65</b>	16.5%	10.6%	<b>Other</b>	1.5%	4.1%
			<b>66-75</b>	6.8%	6.3%			
			<b>76+</b>	3.5%	4.3%			
<b>Total Responses:</b>	<b>343</b>			<b>340</b>			<b>340</b>	

*Note: BCS refers to the Black Creek survey results and TOC refers to the town of Cary’s 2010 Biennial Citizen Survey. The number of responses varies across questions because of item non-response.*

In summary, 50% of survey respondents in this suburban NC watershed were always willing to take on some kind of payments, whether for private BMPs and/or through stormwater fees, to see their local creek partially or fully restored. Most respondents were willing to pay *something* to see Black Creek watershed partially or fully restored. On average survey respondents were not willing to pay full or even half market rates for rain gardens, conservation plantings, or rain barrels, instead indicating a desire for significant subsidies to install these on their property. At this point in time in this watershed, it is very unlikely that many participants will be installing BMPs on their own without subsidies. Rain gardens and conservation plantings were more popular than rain barrels, as evidenced by the higher willingness to pay for these practices. This information is encouraging since these practices allow infiltration and thus are more important tools for restoring the watershed. Another key finding is the high value of education in prompting respondents' willingness to take action. While almost 50% (168) of respondents were not aware Black Creek had any environmental problems at the outset of the survey, once educated about the problems facing Black Creek and the available solutions, most of these respondents expressed willingness to take action to improve Black Creek's condition in at least some of their choices (remember, only 38 respondents always chose the status quo of an impaired stream condition as their preferred choice).

The results of the survey are helpful for informing future restoration efforts in the Black Creek watershed, and potentially other watersheds with similar demographics. The high survey response rate, and the resulting high percentage of participants who were willing to pay for watershed improvements indicate a potential source of funding and customers of future program efforts. While it is unlikely the Town of Cary is going to set up a special stormwater fee to specifically benefit Black Creek restoration efforts, other program mechanisms could possibly tap into this desire to improve the watershed. Possibilities include local government programs to provide assistance and subsidies to install private BMPs (potentially funded by a Town-wide stormwater fee if further research indicates the larger Town population to be amenable to such a fee), or a voluntary organization that collects membership payments to a fund that pays for Black Creek watershed restoration activities.

The authors wish to express their appreciation to the NC Clean Water Management Trust Fund for providing the grant that funded this study, and to the members of the Black Creek Watershed Association and staff from the Town of Cary for providing their support and assistance for the study.

## Changes to Scope of Work and Budget

Low-cost demonstration projects were intended to be a part of the education project but by some oversight were not specifically included in deliverables. These demonstration projects were a key outreach tool for educating residents about rainscapes. Two small projects were included, involved training volunteers on rain garden installation and engaging volunteers in the installation at locations with high visibility to target audiences (Beectree HOA property, Wessex HOA property).

The watershed resident survey was delayed, as the complicated survey design required many focus groups and iterations before it could be finalized and distributed. While the information was intended to be used to develop a watershed financing plan, the project team has since realized that distribution of the survey results, education, and discussions with Town of Cary staff and BCWA must occur first. That is beyond the scope of this grant project and will occur in the future. Suggestions for how to finance watershed restoration based on the survey results are included within this report instead.

Regarding the budget, the budgeted amounts towards the tasks of working with the BCWA and conducting the workshops and outreach campaigns were somewhat arbitrarily split up in the Exhibit E template provided by the sponsor. It was difficult to exactly meet the budgets for those 2 tasks given how inextricably linked they were- slightly more time was spent on the workshops and outreach materials, but this tiny change did not affect or change the intended deliverables.

## Lessons Learned and Next Steps

The rainscape application and implementation process:

- We intended to establish a clear way to cost share with applicants by offering fixed amounts of rebates for assistance, as has been done in places like Montgomery County, MD, or in the City of Raleigh. In our case, we found it easier to develop the project individually. As we did not provide the market costs of Rainscapes, it's possible that homeowners really had no idea whether a rebate would be helpful or not. Also, some of the rainscapes were not clearly offered in the local market. Rain garden and conservation design do not yet appear to be services that many landscape professionals in the Triangle are providing, which we learned through feedback from homeowners and discussions with some local landscaping companies that regularly contract with HOAs in the watershed. Some people had the ability to hire a contractor to do work, while others needed help every step of the way and could not afford to hire a contractor. Since NCSU had access to wholesale plants at nurseries, it was most practical for NCSU to use grant funds (from CWMTF for the public demonstration projects, from an EPA grant for other projects) to purchase plants. Homeowners supplemented with their own plants relocated from their landscape or purchased on their own with guidance as to what would work. There is a Lowes Home Improvement store in the watershed, but their selection of plants that would work in raingardens was very limited. Rather than shopping around at various home improvement stores and nurseries, we preferred to buy all our plants at one that had the selection we needed.
- What do homeowners need to actually disconnect and install "rainscapes" (BMPs)
  - The type of assistance required by homeowners to actually get rainscapes in the ground varied widely.

- All needed technical information on what rainscapes are, how they are designed and installed, where they could work on their property, and how they are maintained. Some homeowners took this information and ran with it, either installing them by hand, or by hiring contractors for excavation.
- All needed assistance with a rain garden design and advice on which types of plants are appropriate for a rain garden.
- Some needed significant technical and financial assistance in getting rain gardens and rain barrels installed.
- An important lesson- while technical information is essential, just providing fact sheets on how to design and install a rainscape will not result in many rainscapes in the ground.
- Many homeowners were very interested in doing the right thing with their landscaping, and once they had the resources to do so, implemented rainscapes on their property.
- Our target audience seemed to fall into 2 categories- 1) those who would offer up their property for projects to be designed, installed and paid for directly by us; 2) those who had the financial means and desire to pay for the installation, but needed assistance with design and installation. Many seemed quite willing to pay their landscaping contractor to do them, but their landscapers didn't seem to offer those services or understand rain gardens.
- Resources needed:
  - Subsidies of 65-85% of the cost of a rain garden, for the average homeowner to install a rain garden or conservation planting. The average willingness to pay was \$194 for a rain garden, and \$219 for a conservation planting.
  - Landscaping companies with capacity for designing and installing raingardens to meet the growing demand and help lead the charge in offering these environmentally friendly services to homeowners and HOAs.
  - Easy to find and read outreach materials (such as fact sheets provided by this grant)
  - Nurseries and home improvement stores that are informed of which plants can thrive in rain gardens and which ones are drought tolerant and native. More education and involvement with these potential partners are needed.
  - Turn-key raingarden design and installation services, either provided by landscaping companies or other entities.
  - Financial assistance (rebates) was not an incentive to our particular target audience. It's possible that homeowners would be more interested in the rebates offered if there were turn-key professionals who they could employ to

design and install rainscapes, and then get a rebate for the services. Such a turn-key service is apparently not available at this time.

- What do Homeowner Associations (HOAs) need to engage in installing rainscapes
  - HOAs are very conscious of their budgets and are not likely willing to pay solely for retrofit BMPs that are not required, or to increase HOA fees in order to install retrofits, unless long-term maintenance costs decrease as a result.
  - However, once educated about natural resource issues and opportunities to improve community aesthetics while also improving water resources, and provided with technical and financial assistance, HOA Boards were found to be interested in partnering on projects.
  - BMPs that are sold as visually improving neighborhood landscaping, and/or reducing unsightly erosion, and that do not significantly increase maintenance costs may be well accepted.
  - Attractive rain garden designs and plantings are important for selling them to HOAs.
  - Educating the HOA Board and Property Manager on maintenance is imperative.
  - We found that HOAs folded the BMPs into maintenance that was already being conducted by their landscaping contractors. BMPs on HOA properties have been well maintained so far.
  - Cisterns were not well received by our target HOA Boards for 2 reasons:
    - They were construed as being unattractive, thus recommended by one HOA Board to only be approved if located out of sight of the road or many neighbors.
    - The subject area is served by a Town of Cary reclaimed water line, so many homeowners already received reduced water rates for irrigating property, which reduced incentives for installing rainwater harvesting.

#### *Implementing future programs to engage residents*

- Long term adoption of the methods developed and tested in this campaign are best undertaken by an entity with a long-term stake and authority, and stable funding source. Potential entities include Wake County (perhaps via SWCD or the Environmental Dept.), Town of Cary, or a non-profit organization.

#### *Engaging residents in financing watershed restoration*

- The percentage of survey respondents in the watershed who expressed willingness to pay for an improvement in Black Creek's environmental health was quite high. Most respondents were willing to pay *something* to see the watershed partially or fully restored.

- The survey indicated respondents were willing to pay an average of \$194 for a 10ft x10ft rain garden, (requires ~ 65-95% subsidy); about \$219 for a 10ft. x 10 ft conservation planting (65-85% subsidy); and \$49 for three 65 gallon rain barrels (requires 80-90% subsidy).
- Survey respondents were willing to pay a stormwater utility fee of \$3.56 per month to see Black Creek reach partial restoration.
- Survey respondents were willing to pay a stormwater utility fee of \$4.64 per month to see Black Creek reach full restoration.
- Though almost half the respondents were not aware Black Creek had any environmental problems at the outset of the survey, once educated about the problems and available solutions, most expressed willingness to take action.
- This high willingness to pay for improving Black Creek presents an opportunity to increase participation and raise funds for restoring Black Creek watershed- whether through a municipally controlled stormwater utility fee, or through a voluntary program.

### **Conclusions and Next steps**

As evidenced by survey results and the reception of homeowners and HOAs after they've learned of the issues through workshops and presentations, the demand for installing rainscapes has been created and is increasing. The amount of rainscapes installed has only been limited by the time we had to identify and install them, and not by any lack of demand or willingness to install them by homeowners and HOAs.

While the project team has received a new EPA grant to move forward with watershed restoration activities in Black Creek watershed, the focus for the new grant is to engage a yet untapped audience, business and institutional landowners. The increased awareness and support of residents should help with making these new contacts and sharing the benefits of engaging in watershed restoration activities. The project team has no funding to continue installing residential rain gardens, but do intend to continue distributing the fact sheets and making presentations to HOAs and community groups, and providing advice on an as-needed basis. As evidenced by the residential willingness to pay survey, once educated about Black Creek's issues and how to engage in solutions, most homeowners expressed willingness to pay something to help improve Black Creek. Hopefully the demand for rain garden design and installation will continue to grow, and can be met in the near future by local governments and private businesses. Ideally some local landscaping companies will increase their capacity for rain garden design and installation, and advertise those services, and local stores will stock more plants that are suitable for rain gardens. Future programming efforts could tap into the desire of residents to improve the creek by setting up a voluntary or regulatory funding structure, and implementing retrofits with the proceeds. Possible programs for funding could include a Town stormwater utility fee, a watershed improvement district, or a voluntary membership program. A program to install residential best management practice retrofits would likely need to provide significant subsidies to homeowners, though our research indicates that if such a program were undertaken, there would be many potential participants.

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## Appendices

Rainscape Fact sheet series

Rainscape Application

Watershed Survey

Workshop announcement sample