

A STUDY OF THE SCIENCE, ECONOMICS, AND PERCEPTIONS RELATED TO IMPLEMENTATION OF TRADITIONAL AND INNOVATIVE STORMWATER BEST MANAGEMENT PRACTICES IN COASTAL SOUTH CAROLINA

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Abstract. Stormwater Best Management Practices (BMPs) are used primarily to reduce runoff volumes and pollutant concentrations. There are many types of innovative stormwater BMPs in use nationally, but few are implemented in residential areas in South Carolina (SC). The goal of this project is to expand knowledge in the area of innovative BMP implementation in coastal SC and to understand why innovative BMPs are not more widely utilized.

To find answers, this research examined professional perceptions of stormwater management in SC, and specifically, the perceptions professionals have of innovative stormwater BMPs in coastal SC residential areas. A questionnaire was developed and a survey conducted that focused on three groups: “private sector” professionals, “regulatory” professionals, and “developers and builders.” A total of thirty-two respondents were interviewed with a minimum of ten per group. Survey data was used to compare perceptions among the three groups on stormwater management, innovative practices, and perceived obstacles to implementing innovative BMPs. Relationships of statistical significance between the variables from the questions were determined with a Crosstabulation Contingency Table and the Pearson Chi Square test. Areas of central tendency are illustrated

using a Frequency Distribution Table for responses from the survey questions.

The results reveal a host of obstacles that may explain why innovative BMPs are not frequently used in SC. The results suggest that changing the regulatory standards, (quality over quantity), used to address stormwater runoff could alleviate some of the regulatory barriers. More funding for stormwater regulatory programs and improving the speed and efficiency of the permitting process could also encourage innovation. Other obstacles appear to be related to a general lack of knowledge on innovative BMP performance and cost.

INTRODUCTION

The concept of using stormwater BMPs to abate the deleterious impacts of pollutant runoff have been in existence for over forty years. Over the course of this time many advances have been made in the development and application of BMPs and to understanding the impacts of stormwater runoff on coastal ecosystems. Despite these advances, only a limited number mitigation approaches are currently utilized by the development community in SC. One may ask why developers are not quickly adopting innovative BMPs. The regulation regimes are in place and innovative practices are being advocated by governmental and nongovernmental entities. To begin to answer this question one must start investigating obstacles to implementing innovative BMPs.

The goal of this project is to expand knowledge in the area of innovative BMP implementation in coastal SC and find why innovative BMPs are not more widely utilized. The main objective is to understand the obstacles that hinder implementation and engender negative perceptions of innovative BMPs in coastal SC. The study proposes to address this issue by investigating the perceptions held by professionals involved in stormwater management in coastal SC. Three groups of professionals were selected to be interviewed: developers and builders, regulatory managers, and private sector professionals (e.g. engineers and stormwater BMP manufacturers). The results of these interviews have been used to answer several primary research questions:

- ❑ What perceptions do regulatory professionals, developers, and private sector professionals have of stormwater management practices and how do they vary?
- ❑ What do the groups perceive to be the obstacles in using innovative BMPs?
- ❑ Do the results indicate that resources are needed to increase awareness and promotion of innovative stormwater BMPs?
- ❑ What recommendations can this study provide to stormwater professionals?

The author anticipates the study will be useful to stormwater managers in the public sector, to developers in the planning stages of a project, and to consultants and engineers in the business of recommending and implementing stormwater management projects. The study will identify perceived obstacles and thus create opportunities for professionals to address issues related to innovative stormwater management in the early planning stages of a project. Other key contributions can be found in the recommendation section of this paper.

METHODS

In order to determine perceptions of stormwater practices across private sector, regulatory, and development communities a survey was developed and administered by telephone or in person. The surveying techniques used in the interviews combine the schedule-structured interview approach and the focused interview approach. The schedule-structured interview is characterized by questions, wording, and sequence that are fixed and identical for each respondent (Frankfort-Nachmias and Nachmias 1992). The focused interview approach encourages respondents to take liberty in expressing their specific opinions on certain topics (Frankfort-Nachimias and Nachmias 1992). Direct questions were developed before the interview and used to obtain the key pieces of information being sought. Probing questions, which are also open-ended questions, were asked to motivate the respondents to elaborate or clarify an answer or explain the reasons behind an answer, and to help focus the interview on the central subject (Frankfort-Nachimias and Nachmias 1992).

In order to gather an accurately represented sample, a non-proportional quota sampling method was employed (Trochim, 2002). Using this method, one specifies the minimum number of sampled units one wants in each category. In this study a minimum of ten people from each group were surveyed. With this method one is not concerned with having numbers that match the proportions to the population. Instead, one is simply trying to assure that enough individuals from each of these small groups are interviewed so that a representative sample is achieved. In other words, this method is the “non-probabilistic analogue of stratified random sampling” used to assure small groups are adequately sampled (Trochim, 2002).

A scaling method was selected to measure the responses. The method that was deemed most appropriate for this study is the Liekert Scale. The Liekert scaling method is designed to measure a person’s attitudes (Frankfort-Nachimias and Nachmias 1992). Each question on the survey is scaled in like manner and scored with the results statistically analyzed. The results of each

group are also compared to the total results of all respondents surveyed.

The open-ended question responses were coded using an inductive coding method into generalized responses that enabled the author to conduct nonparametric analysis. Statistical analyses are used to reveal data trends, central tendencies, and areas of significance. A Frequency Distribution Table is used to show areas of central tendency and dispersion. In addition, a Crosstabulation Table or contingency table was developed and a Chi Square test performed to show statistically significant relationships among the variables.

RESULTS

Open-ended Questions

The first question in the survey assessed respondents’ perceptions (positive or negative) of stormwater management in their respective communities. The Frequency Distribution Table indicates that 75% of respondents have positive perceptions of stormwater management in their community. The individual responses, before coding, reveal that respondents in the developer and builder group and private sector group cited positive reasons that relate to how stormwater management “benefits” quality of life which included the environment, property values, public good, or other economic reasons. The regulatory group also cited similar reasons, but unlike the other two groups, there are six responses related to having a positive perception because of the “positive need” for having stormwater management. This result indicates that a significant majority of those surveyed believe that stormwater management is a positive endeavor.

Another question surveyed the respondent’s opinion on which group has the most influence on deciding which BMPs are implemented. The Frequency Distribution Table indicates that, all groups combined, 53.1% thought that regulatory group has the most influence. Engineers were cited by 40.6% as having the most influence. The median score indicates that the regulatory group was most frequently selected. The regulatory group most often chose the “engineer” group as being most influential. The developer and private sector groups both had scores indicating the “regulatory” group as being most influential.

The next question relates to obstacles to innovative BMP implementation and the nature of those barriers. The Frequency Distribution Table revealed that a majority of all respondents (59.4%) believed that regulatory issues are responsible, in some fashion, for difficulties in implementing innovative BMPs. Issues related to cost were cited by (15.6%) and two other categories of barriers were cited at both (12.5%) each — with one being

related to lack of resources (e.g. either knowledge or funding of regulatory programs) and the other with the general lack of research on innovative BMPs in SC.

The regulatory group indicated that the most considerable obstacle to innovative BMP implementation is the lack of resources and funding to effectively implement current stormwater permitting and related programs to support innovative BMP use. In addition, the regulatory group often cited more funding is needed for applied research on BMP performance. Conversely, the developer and builder and private sector groups tended to point the finger at various regulatory barriers as to the difficulty in implementing innovative practices. The coded responses indicate the most common regulatory obstacle cited was timeliness in the permitting process.

Closed-ended Questions

The next group of questions are closed ended questions. The first eight questions relate to how certain factors influence the implementation of an innovative BMP. Respondents from every group tended to statistically agree on the importance of the factors surveyed. Factors deemed important when considering an innovative BMP included meeting regulatory guidelines, cost, available research and scientific support, general awareness of new technologies, and the importance of maintenance. The results from the Crosstabulation tables and Chi Square tests revealed that only the third question (C) had a relationship of significance between the responses of all three groups.

The third question asks respondents if they think decision makers not being aware of innovative BMP options as a factor that may influence implementation of innovative BMPs. This question had a mean response of 4.16, which translates to all groups combined “agreeing” that this is an important factor. However, 40% of the private sector professional group “disagreed,” to the importance of this factor. According to the Chi Square test, this 40% represents a variable that has a statistically significant relationship with the three groups. In other words, the 40% is significant when compared to the (1) respondent in the developer group who answered similarly and (0) “disagrees” from the regulatory group.

Half of the respondents either disagreed (40.6%) or were undecided (9.4%) on the question of whether engineering and consulting firms do not offer enough innovative solutions. Statistically significant relationships between variables were not found by Chi Square, and the consensus was distributed fairly evenly among the three groups. Many respondents either agreed or were undecided (total mean score 3.84, which translates to the “undecided” choice) on the impact that a BMP can have on property values as a factor influencing innovative BMP implementation. The Crosstabulation table revealed that developers (100% of the developer group agreed that this

is an important factor), while only 70% of the private sector group agreed. The other scores reflected either undecided or disagree.

The next three questions ask about the following issues: The importance of stormwater BMP research, whether respondents feel there is a disconnect between what users expect from BMPs and what can actually be accomplished by a BMP, and whether innovative BMPs are more cost effective and efficient than traditional BMPs (e.g. ponds, swales, etc.). A total of 97% from all three groups agreed that more applied research should be conducted on innovative and even traditional BMPs in SC. The Frequency Distribution Table revealed that all three groups tended to agree (total mean score of 4.69 translates to “agree”) on the value and the need for additional research on innovative BMPs. Another question asks whether there is a disconnect between what stormwater professionals and developers expect from a BMP, in terms of performance and application, and what a BMP can actually deliver based on its design and the science behind its development and application. The Chi Square test did not reveal any statistical significance among the variables in the table. The Frequency Distribution table reveals a total mean of 3.53, which translates to “undecided” for all groups. The Crosstabulation table revealed that 45.5% of respondents from the developer group disagree with this question compared to 25% of all respondents total that disagree. Only 36.4% of developers agreed with this statement while 90.9% in the regulatory group and 60% in the private sector group agree there is a disconnect.

The final question in this series asks whether respondents believe that innovative BMPs can be more cost effective and efficient in the “long term” than traditional BMPs. Respondents from all three groups tended to be “undecided” on this question. The total mean score for all three groups was 3.2, which translates to “undecided.” A total for all groups (40.6%) agreed with this question, but 34.4% of the total was undecided and 25% disagreed. The Chi Square tests did not reveal any statistical significance in responses given among the three groups. The results of the perceptual study also indicate that professionals from all three categories surveyed are aware, in varying degree, of Low Impact Development (LID) type practices. It is also interesting to read the Frequency Distribution table for “barriers to innovative BMP implementation.” Cost was cited by only 15.6% of total respondents as an obstacle, while various regulatory reasons were cited by 59.4%.

Contact Information for Results

More information can be obtained from John Martin at SCDHEC, Bureau of Water: (803)-898-4350 or martinj1@sc.dhec.gov. Information can also be obtained in the following Masters Thesis by the authors: Martin, J., D. Tufford, B. Davis, and D. Porter, 2008. *A Study Of*

The Science, Economics, and Perceptions Related To Implementation Of Traditional and Innovative Stormwater Best Management Practices In Coastal South Carolina. University of South Carolina, School of the Environment. Columbia, SC.

CONCLUSIONS

The final conclusions that can be drawn from the surveys conducted can be summarized as follows:

- I. The majority (total of 75%) view stormwater management as a worthwhile endeavor.
- II. The “regulatory” group chose “engineers” as the most influential group in deciding which BMPs are implemented. While the “developer and builder” and “private sector” groups chose the “regulatory” group as most influential.
- III. Cost was not cited as a statistically significant barrier in innovative BMP implementation by any of the groups.
- IV. Only the developer and builder group (100%) considered the impact that a BMP can have on property values as an important factor influencing innovative BMP implementation.
- V. The 97% of all respondents agree that more applied research on stormwater BMP performance should be conducted in SC.
- VI. On whether a disconnect exists, between what professionals expect in terms of stormwater BMP performance and application, and what is actually possible — the results indicate: A mean of (3.53), or “undecided” for all groups.
- VII. On whether innovative BMPs can be more efficient and cost effective in the “long term” than traditional BMPs. The total score for all groups is “undecided” (mean score of 3.22)

SUMMARY

A host of obstacles were revealed as to why innovative BMPs are not frequently utilized in SC. Some obstacles can be removed by changing the stormwater regulatory standards. Other obstacles are due to a lack of knowledge on the subject and the need for more research

The results demonstrate that, when it comes to promoting innovative BMPs, many in the regulatory community believe resources needed to properly administer stormwater regulations are lacking. Regulatory respondents also think that evaluating innovative BMPs can be complicated by inadequate performance data. In addition, there is a consensus that

“meeting the letter of the law” can be difficult for many innovative BMPs. The developer and private sector groups view regulatory obstacles as the primary hurdle.

Regulatory agencies and the regulated community can begin to address the aforementioned issues by persuading legislators of the need for change in the regulatory standards to emphasize water quality over quantity and more funding for research. More education and outreach efforts need to be implemented by state and federal regulatory agencies in partnership with county and local government. Regulatory agencies should take the lead on forging relationships with the regulated community to ensure innovative stormwater practices are promoted and feasible to implement.

RECOMMENDATIONS.

The recommendations resulting from this study are summarized as follows:

- I. Regulatory changes are needed in SC that emphasize water quality over quantity.
- II. More funding is needed to aid stormwater management programs. The permitting process needs to be streamlined for innovative BMPs.
- III. Public outreach and education is needed to make the public aware of the importance of stormwater management, especially source controls.
- IV. The regulated and regulatory communities need to improve communication channels and forge relationships that will engender cooperation in efforts to implement innovative stormwater management.

LITERATURE CITED

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