

BLUFFTON, SC – CONTINUOUS MONITORING AND STORMWATER SAMPLING BY A MUNICIPALITY

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Abstract. Like other coastal communities, the Town of Bluffton is facing extreme development pressures. Knowing that land use change is associated with degradation in water quality, the Town Council is committed to maintaining the quality of the May River, an Outstanding Resource Waters. Various studies by the Town, the private sector and state agencies have led to a vast quantity of data regarding the water quality of the May River and a number of stormwater outfalls into the river.

However, these data are collected by various entities, under differing protocols, leading Bluffton to a data rich but information poor situation. The purpose of this paper is to document how the town arrived at this situation, how it is approaching this challenge of data management and how it plans to proceed in the future as an example for other communities.

To extract information from the data, the Town created a Technical Advisory Committee (TAC) comprised of experts within the fields of water quality monitoring, statistical analysis, and ecological modeling from NOAA, SCDNR, USGS and the University of South Carolina. The TAC has been charged with 1) providing an objective scientific review of the Town's monitoring program, 2) statistically analyzing the data from the Town's current project and additional data sources (DHEC and Palmetto Bluff data), including how they relate to previously collected data from the Baseline study (Van Dolah, et.al., 2004) and Stormwater study (BP Barber, 2007) and 3) directing future needs for monitoring within the May River watershed.

Currently, thanks to a \$15,000 matching grant from DHEC-OCRM, the Town and a private, residential community, Palmetto Bluff, are having the data they have collected compiled and statistically analyzed by SCDNR to address the following points 1) if significant changes in the condition of the May River have occurred since the Baseline study, 2) if there is evidence that stormwater runoff is affecting the May River and how it

compares to other drainage basins and 3) what monitoring efforts are most valuable and feasible to continue in the future.

In the near future, the Town anticipates these analyses will lead the TAC to recommend future monitoring studies, microbial source tracking of fecal "hot spots," and predictive land use models evaluating the relationship between upland development and water quality in the area. Additionally, the Town anticipates having a more cohesive metadata framework into which current data from disparate sources can be entered for future analyses.

Presenting the process of how the Town of Bluffton addressed its data management issues is important to share with other municipalities to highlight why data management should be incorporated into a monitoring program from the outset, including identifying existing sources of monitoring data and exploring the possibility to collaborate with other entities for monitoring and cost-sharing.

INTRODUCTION

Water quality is a pressing issue for the Southeast, especially in coastal areas that rely on high levels of water quality due to its economic impact on commercial and sport fisheries, recreational tourism, and shellfish harvesting. As more municipalities monitor their waters, they will face the challenges Bluffton currently is if they do not take data management into consideration in the design of their monitoring projects.

Not only does data management for the proposed project need to be considered, but data from other sources including state and federal government agencies, the private sector and other municipal jurisdictions also need to be identified. After identifying these sources, it is crucial to establish partnerships for data sharing and possibly cost-sharing as well. Identifying data sources assists a municipality in designing its program in a more cost-

effective and efficient manner by avoiding duplicate sampling efforts and potentially cost-sharing data collection and analyses.

Thus, the purpose of this paper is to document the history of water quality monitoring within the May River watershed and how it has led to a current situation of multitudes of data, but the lack of useful information regarding statistically significant changes within the watershed. This is a useful contribution to the field of water quality data management as it provides an option to solve the data rich, information poor situation and points out the pitfalls of disparate data sources and uncoordinated monitoring.

BACKGROUND

Located in the extreme southeastern portion of the state in Beaufort County, the Town of Bluffton has experienced explosive growth within the past ten (10) years. Beginning in 1998, through a series of annexations, the Town grew from one (1) square mile with a population of five hundred (500) to fifty-three (53) square miles with an estimated population of over 12,000. The Town is nearly bisected by the May River, a tidally influenced waterbody that has been designated as an Outstanding Resource Waters by the SC DHEC due to its economic, recreation and aesthetic value.

Town Council, in response to citizen concern about the effects that rapid development could have on the health of the river, funded the May River Baseline Study (Van Dolah, et.al., 2004) from 2002-2003. The Baseline study provided a summary of the current conditions within the May River via water quality and quantity analyses at USGS tidal gauge sites, seasonal grab samples at tidal and open water sites, sediment quality analyses, and benthic, nektonic and oyster community analyses. Data collected included, but were not limited to, turbidity, DO, nutrients, BOD, salinity, pH, metals, PAHs, PCBs, pesticides, benthic invertebrate, crustacean and fish communities and phytoplankton pigment relative to chlorophyll-*a*.

From this research twelve recommendations were given to the Town for future action, study and monitoring to protect the May River water quality in the face of anthropogenic land use changes. Several of the recommendations were as follow 1) conduct continuous monitoring of the May River to provide a dynamic record of how the estuary is responding to changing hydrologic conditions, 2) the water quality parameters that appear to be the most important to monitor include DO, salinity, turbidity, chlorophyll-*a*, pH, nutrients, fecal coliform and potentially total organic carbon and/or dissolved organic carbon and 3) prioritize sampling tidal creeks since they

represent a direct connection with the upland environment.

These recommendations led the Town to contract with BP Barber & Associates, Inc. to conduct the Stormwater Sampling study (BP Barber, 2007). This study collected eleven (11) rainfall-event triggered samples at six (6) outfalls from 2005-2006. The outfalls were chosen to represent differing land uses and geographical regions within the May River watershed as identified by the Baseline study. The eleven samples were tested for the following parameters fecal coliform, turbidity, phosphorus, TKN, ammonia, nitrate/nitrite, and total nitrogen. Several outfalls indicated elevated turbidity, fecal and nutrient levels. These findings prompted the recommendation that continuous monitoring, correlated with rainfall events, be conducted, along with continued stormwater sampling.

Simultaneously, Beaufort County was concluding its Stormwater Master Plan (Thomas & Hutton Engineering Company and Camp, Dresser, McKee, Inc., 2006) and developing additional monitoring recommendations for Beaufort County including 1) establishing baseline water quality data via ambient sampling and 2) identifying seasonal trends and overall trends over time using long-term ambient sampling data.

Following the recommendations made by the Baseline study, the Stormwater Sampling study and the County Stormwater Master Plan, the Town again worked with BP Barber to develop and execute the Town of Bluffton May River Watershed Monitoring study (BP Barber, 2008) conducted from April 2007 to April 2008.

The project objectives were to 1) collect baseline data for a number of standard parameters to determine statistically significant seasonal trends, 2) conduct water quality sampling at sites representative of the whole river and the changing land uses therein, 3) determine "action levels" for pollutants when significant trends are identified due to the lack of Federal/State standards, 4) create an "action plan" in response to an "action level" having been reached.

The continuous monitoring and stormwater sampling sites were chosen to represent the three distinct geographic regions of the May River identified by the Baseline study. The continuous sampling was conducted utilizing three (3) YSI data sondes that collected data at fifteen (15) minute intervals. Water quality parameters that were measured at all three sites included turbidity, DO, pH, salinity and temperature. Chlorophyll-*a* was also measured at the most eastern and western sonde sites.

The stormwater sampling locations were modified from the original stormwater sampling sites, however there were still six sites. Due to constraints with the laboratory sample-acceptance schedule, only two (2) samples were collected during the study period for the six sites. Parameters that were measured included nitrate/nitrite, ammonia, TKN, total nitrogen, total phosphorus, turbidity, total suspended solids, fecal coliform and *E. coli*.

Currently, the Town possesses a multitude of data from these studies. Additionally, there are historic data sets available from ambient and shellfish sites monitored by SC DHEC. Further data are available on the May River from the private sector, specifically Palmetto Bluff.

Palmetto Bluff is an approximately 20,000 acre private, residential community under development by Crescent Resources along the southern shores of the May River. Palmetto Bluff has collected data at four (4) stations within the open channel of the May River for a number of parameters including sediment chemistry and a number of water quality measures.

Nine (9) outfalls, including one (1) control site located outside the extent of current development, at select locations throughout the property were tested for the following stormwater quality parameters turbidity, total phosphorus, total nitrogen, fecal coliform, and salinity.

For comparative purposes there are also relevant data available from The Condition of South Carolina's Estuarine and Coastal Habitats During 2003-2004 (SCECAP) (Van Dolah, et.al., 2006) and other studies.

EXPERIMENTAL DESIGN FOR DECISION MAKING

The Town has recognized that while it has a great amount of water quality data regarding the May River it is at an impasse to determine if there are statistically significant trends in the data and where the most effective monitoring should continue. In response to these challenges, the Town evaluated its options and chose to create a Technical Advisory Committee (TAC). The TAC is comprised of experts within the fields of water quality monitoring, statistical analysis, and ecological modeling from NOAA, SC DNR, USGS and the University of South Carolina. Additional members of the TAC include representatives from state agencies, the private sector and concerned citizens.

The TAC has been charged with 1) providing an objective scientific review of the Town's monitoring program, 2) statistically analyzing the data from the Town's current project and additional data sources (DHEC and Palmetto Bluff data), including how they relate to previously collected data from the Baseline Report and Stormwater Study and 3) directing future needs for monitoring within the May River watershed.

The TAC was brought together and presented a complete historical overview of the Town's monitoring projects and the findings of those projects. Through a series of several meetings, a methodology to tackle the challenges the Town faces was developed and proposed. The proposed methodology included compiling existing data sources (properly QA/QC prior), statistically analyzing the data and developing a predictive spatial analysis model relating land use change to water quality.

This tactic will provide the necessary information on current water quality relative to the Baseline study, which will direct future monitoring. The "action levels" will be determined when statistically significant changes are detected for parameters that have no Federal/State standards. When an actionable level has been obtained, the TAC can provide guidance on developing an "action plan."

METHODS

With the support of a \$15,000 matching grant from DHEC-OCRM, the Town and Palmetto Bluff are entering into an agreement with SCDNR to have all the current sources of data compiled and statistically analyzed to determine 1) if significant changes in the condition of the May River have occurred since the Baseline study of 2002, 2) if there is evidence that stormwater runoff is affecting the May River and how it compares to other drainage basins and 3) what monitoring efforts are most valuable and feasible to continue in the future.

This is a monumental task as data exists from various sources, in various formats, and has been collected under various protocols. Additional data sources for water quality within the May River include SC Department of Health and Environmental Control's shellfish and ambient monitoring and Palmetto Bluff's May River open water sampling sites and stormwater runoff sampling from a number of locations within the development. Comparative data sets are available through SCECAP, LUCES, USES, Beaufort county monitoring, EMPACT, SCDNR Land Use Database and others. Data will be imported in an excel format and analyzed using a repeated measures ANOVA.

CONCLUSIONS

In the near future, the Town anticipates these analyses will provide the answers to many questions including 1) if significant water quality changes have occurred within the May River watershed, 2) if stormwater runoff carries pollutants at actionable levels and 3) how to direct future monitoring to clarify any issues and develop plans to attend to these issues. The Town expects the TAC to possibly recommend changes in the monitoring program, microbial source tracking of fecal "hot spots" and developing predictive land use model to explore what the relationship is between upland development and water quality in the area. Additionally, the Town anticipates having a more cohesive metadata framework into which current data from disparate sources can be entered for future analyses.

Presenting the process of how the Town of Bluffton addressed its data management issues is important to share with other municipalities to provide a "lessons learned" case study, thus alerting them to possible data management

issues they might incur in establishing a water quality monitoring project.

DISCUSSION & RECOMMENDATIONS

The process of creating a TAC and entering into the statistical and modeling phases of data analysis has highlighted the importance of having a comprehensive plan for data management prior to initiating projects. A municipality should identify potential data sources at the outset of designing its project. Other sources of data may include other jurisdictions, state and federal agencies and the private sector. The data these groups collect should be evaluated to determine if they may be useful in the proposed project. If so, the municipality should attempt to establish collaborative partnerships with these organizations to share data at a minimum and to possible cost-share data collection and/or analysis. The Town has established very productive partnerships with Beaufort County, SCDHEC and Palmetto Bluff.

Finally, a municipality should establish connections with experts in the field of water quality. This relationship is invaluable as most municipalities do not have the expertise on staff to adequately manage and analyze data of this magnitude. The Town of Bluffton has been extremely fortunate and grateful to have partnerships with NOAA, SCDNR, USGS, the University of South Carolina, Clemson University, DHEC-EQC, and DHEC-OCRM. The representatives of these agencies have provided technical support and advice for the Town's program and financial support for the necessary analyses. However, if the Town had not been able to forge these partnerships, it is worrisome to contemplate the alternatives.

While certainly each project has its own design constraints, it would be helpful for municipalities if a more formalized process for data management was disseminated. Many municipalities are trying to make sound policy decisions based upon the best science at hand, but yet there is a disconnect between science and policy-making that must be breached as we move forward in the field of water quality monitoring by municipalities.

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