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A Case Study of Stakeholder Participation in Source Water Protection

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ABSTRACT

This project presents a practical application of Integrated Water Resource Management (IWRM) principles at the local level. Tampa Bay Water (TBW) is a regional water authority that provides wholesale water to three cities and counties in west central Florida. Previous analysis had identified over 300 source water protection alternatives that could be included in a source water protection program. We developed a design process that was both objective and participatory. A series of iterative surveys were conducted first of Tampa Bay Water technical staff, then with a technical advisory group made up of representatives from state and local government, local universities, business groups, non-profit groups, and community stakeholders. Surveys were designed to identify preferred source water protection alternatives, but also to characterize each option (near term impacts vs. long term, water quality effects vs. water quantity, implementing agency, negative impacts, etc.). Participants were allowed to view a summary of the responses and comments of other participants between iterations of the survey, which increased consensus levels in the final round of the survey. In addition, determining the characteristics associated with effective alternatives enabled us to identify alternatives that are strong in those characteristics but may not have received high ranks. As a result of this process, 18 source water protection alternatives were selected for cost benefit analysis. The final step allows policy-makers to make decisions based on the relative environmental, social, scientific and financial implications of each alternative.

Key Words: IWRM, stakeholder, survey

INTRODUCTION

One of the four principles of integrated water resources management established at Dublin in 1992 states:

> "Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels." (Global Water Partnership, 2000)

Since that time, integrated water resource management has evolved to recognize the importance of environmental factors and elements of natural water systems, as well as multiple stakeholder viewpoints. Because of the complexity of integrated water management a key benefit of a participatory approach is the incorporation of skills and viewpoints across a wide range of disciplines with specialized knowledge in different aspects of water management.

This project presents a practical application of the participatory principle, and identifies a technique for synthesizing the input of technical staff and stakeholders into an integrated source water protection plan. The process developed relies on three phases to construct the plan. The first phase builds on input from in-house technical staff. The second phase incorporates input from a wide variety of stakeholders. The result of the second phase is a list of alternatives suitable for further analysis in the third phase. The third phase involved cost-benefit analysis of a short list of alternatives followed by selection of program alternatives to pursue. This paper discusses the first two of these phases.

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Tampa Bay Water (hereafter, the Agency) is a regional water supply authority that provides wholesale water to three cities and three counties in the Tampa Bay region. It is a non-profit, special district of the state created by interlocal agreement among member governments. The Agency utilizes surface water, groundwater, and desalinated water as sources for the public drinking water system. The diversity of source waters reduces an over-reliance on any one source, but requires the development of a comprehensive Integrated Source Water Protection Plan (Plan).

The purpose of the Plan is to identify and prioritize projects/programs under Agency purview for their possible implementation in the Tampa Bay Water area to protect source waters. As a starting point, a comprehensive list of over 300 potential Plan options was compiled from existing Tampa Bay Water programs, reports and documents, internet searches and literature reviews to identify the full range of possible protective measures to prevent, quantify, reduce, or mitigate potential contamination of source water quality.

Phase 1

An expert panel was assembled using eight staff members from Tampa Bay Water. Staff included geologists, chemists, biologists, engineers, and planners, with experience ranging from several years to more than 20 years. A series of one-on-one meetings with members of the Tampa Bay Water senior management and technical staff were conducted to refine information on existing and potential source water protection strategies. Once accurate descriptions of each strategy alternative were finalized, a survey was administered to the panel. The objective of the survey was to garner the collective wisdom of the group and to form a group judgment of what makes a protection strategy effective.

The survey presented options for protecting water supplies from multiple sources, including groundwater, surface water and desalination water. Categories of program/project alternatives included:

- Resource Monitoring and Assessment
- Planning, Research and Technical Assistance
- Communication/Education Initiatives
- Regulation
- Land Acquisition

In the survey, each staff member was asked to answer nine questions about each option for each source water type (See List below). Respondents were also allowed to enter comments for any question in the survey. The nine questions listed in Figure 1 were designed to identify the attributes that the respondents associate with source water protection options that they considered effective. For example, one respondent may consider options which have impacts over the long-term as the most effective, while another respondent may consider options that protect water quality as the most effective overall protection measure. This identification process was intended to help define how agency technical staff perceive program effectiveness.

List of Questions.

1. How effective is this alternative in achieving source water protection?
2. How effective is this alternative in protecting water quality?
3. How effective is this alternative in protecting water quantity?
4. Is this alternative likely to benefit one or more groups or places?
5. Is this alternative likely to negatively impact one or more groups or places?
6. Is this alternative more likely to have the most impact in the near future (< 5 years) or over the long term?
7. Are there regulatory barriers to implementation that would prevent the alternative from being effective?
8. Are there policy or other barriers to implementation that would prevent the alternative from being effective?
9. Which of the following entities is most likely to be able to effectively implement the alternative?

Question 1("How effective is this alternative in achieving source water protection?") is the predominant evaluation of overall effectiveness. For Questions 2 and 3 (hereafter Q2, Q3 etc.), respondents faced choices which were the same as for Question 1 – Effective, Somewhat Effective, or Not Effective. The specific characteristics that affect how a respondent answered Question 1 come from Questions 2-9 in Figure 1. They include type of water affected, project duration, negative impacts, agency implementing the project, and so on.

Results of Agency Survey

Initial analysis found that an Effective answer to Q2 (quality) was much more likely to predict an Effective response to Q1, compared to Q3 (quantity). Having established this relationship from several aspects, testing moved on to other criteria to determine which remaining questions were most likely to accurately predict an Effective Q2 or Q3, as well as which were

most likely to accurately predict Q1 overall, once source water type was held constant (surface water, groundwater, desalination).

Overall, the factor most strongly associated with an effective plan option was the degree to which that option effectively protected source water quality (Q2). Effectiveness in protecting source water quantity (Q3) followed in magnitude. Programs implemented by Federal Regulators were also significantly more likely to be deemed effective, although State and Municipal implementers were also positively correlated with effectiveness. Programs with negative impacts on particular groups or places were less likely to be deemed effective, as were program options with delayed or more long-term impacts. When Question 2 (Quality) was selected as Effective, implementation by Member Governments or State Regulators and Long-Term impacts had the largest effects both by magnitude and statistically. Notably, Long-term effects had a negative effect.

For Question 3, the largest factors included Tampa Bay Water's impact on implementation, a "Yes" answer to Q8 (policy barriers), State regulatory regime (Q9), and Long-term Impacts (again, negative). The "Yes" answer to policy barriers (Q8) could reflect a number of options. Respondents may either believe that the most effective options for achieving effectiveness in Quantity issues have policy barriers, but the barriers are immaterial to overall effectiveness, or the options are so effective that policy barriers are overcome. Similarly, the strong negative effects on Long-Term impacts may be interpreted several ways. One premise could be that Quantity, which Tampa Bay Water has strong influence over, is perceived as a real-time operation more so than long-term. Another explanation could be that Long-Term plans for sources of water are more or less set, and considered a given by respondents, such that options for *protecting* the source water are perceived as more imminent in nature, by definition creating a preference for short-term (defined here as less than five years) options.

Once the type of source water was held constant, different relationships emerged. For groundwater, the determinants of Overall Effectiveness (Q1) and Quality Effectiveness (Q2) were nearly identical to the overall portfolio of options. For Surface Water and Desalination options, Long Term effects became a much stronger predictor of effectiveness, while the impact of various regulatory regimes on an option's effectiveness changed order.

Two lists of options were generated from survey results using both a 'top down' and a 'bottom up' statistical analysis. The 'top down' methodology relied on respondents' rankings for each source water protection option to generate a list of plan options by rank order. The 'bottom up' methodology used regression analysis to identify the underlying factors (such as near term or long term impacts) associated with programs rated effective. A second list of plan options was generated based on predicted effectiveness from the regression model. The resulting lists were very similar. While individual program options sometimes differed, the "types" or "categories" of options were very similar.

LIMDEP was used to estimate a Probit model (Green, 1995), with output showing the probability that a project is deemed effective based on specific characteristics. Thus the impact and statistical significance of each characteristic on effectiveness could be determined. Equation 1 shows the relationship being modeled. Z is a measure of the probability that a respondent chose the most effective rating for a particular option, and depends on characteristics X of that option. When $Z > 0$, the probability of a respondent choosing the most effective rating is greater than 50 percent, and the model predicts the event $Y = 1$. If $Z < 0$, the probability of a respondent choosing the most effective rating is less than 50 percent, and the model predicts the non-event $Y=0$.

$$Z = b'X + e, \; e \sim N(0,1). \qquad (1)$$

The predicted effectiveness score from the regression was used to generate a list of program options using the underlying factor weights to differentiate options. In general, an option would receive the highest overall effectiveness rating if it was effective in protecting both water quality and water quantity, it was implemented in the near term by federal regulators, and it had few negative impacts. While few options fit that exact description, the technique can help to differentiate options with both positive and negative attributes. Consider, for example, two options with the same average effectiveness score. One has strong negative effects on one or more groups or communities, and is implemented by a municipality, while the other is believed to have minor negative effects, and is implemented federally. The prioritization model based on the weights of the underlying factors would give the option with minor negative effects and federal implementation a higher likelihood of successful implementation and overall effectiveness.

While the survey was used directly to determine the most suitable options for further study, the survey process provided important insight into issues that are vital for effective integrated water resource management. For example, the consistent negative rating given to projects with delayed benefits provided insight into community goals. This aspect influenced the choice of discount rate in the cost benefit analysis.

Phase 2

Phase 2 relied on input from stakeholders to reduce the list of options suitable for further economic analysis. The stakeholder Technical Advisory Committee consisted of 20 participants including municipal planners, engineers, biologists, geologists, and environmental experts. State, city and county governments were represented, as well as universities and civic organizations. The phase 1 survey was simplified to five questions identifying the effect of impacts to constituents and non-constituents, the role of the agency implementing the program, and significant obstacles to effective implementation. An additional section asking respondents to rank their top four program alternatives was included in the survey.

A Delphi-based process of using iterative surveys to generate consensus was used in this phase (Pill, 1971, and Rowe and Wright, 1999). Operating with the understanding that the survey process generates information from a wide range of experts that is relevant to other participants, the results of the first survey were summarized and presented to TAC members prior to administration of the next survey. Comments played an important role in this process. Unlimited space was provided for comments on each question, and participants in all phases were encouraged to write comments. Comments were summarized using examples of strongly in favor, strongly opposed, weakly in favor, and weakly opposed, but all comments were made available unedited as well.

The results of the iterative process showed two general tendencies that were consistent with our expectations. First, support coalesced around the more highly rated projects from the first TAC survey, reducing the overall variation in the results. Second, the rating for some projects changed precipitously, likely as a result of respondents learning additional information, especially from detailed comments, concerning program alternatives.

Regression analysis of alternatives rated "Effective" show several factors that predict when an alternative will be deemed effective. Alternatives rated as Effective on average had the following characteristics:

1) Are considered feasible, and do not have significant obstacles to implementation.
2) Have a positive impact on constituents.
3) Are implemented by the Agency.
4) Are implemented by Federal Regulators (very strong effect, but few alternatives fit this description).
5) Implemented by State regulators rather than Member Governments.
6) Are more likely to appear in participants' top two rankings of four best.

Results of Stakeholder Surveys

The Stakeholder surveys produced enlightening results. While Stakeholders frequently found the same options as effective, their perceptions of likelihood of successful implementation were often different. A notable example includes stakeholder surveys that overwhelmingly viewed implementation by Agency as preferable to implementation by any other agency for all project types. For stakeholders, implementation of program options by the Agency was a strong predictor of effectiveness, and in fact, a negative predictor of any rating below effective. Based on accompanying comments, stakeholders tended to view the Agency as both objective and focused on the preservation of clean water.

For the same options, Agency staff were more likely to view member government or State regulator implementation as positive predictors of successful implementation. The only exception was for options which agency technical staff deemed most effective from quantity perspectives. The Agency has been highly successful in developing a balanced portfolio of source water assets, including surface water, ground water, reservoir storage, and desalination sources. Consequently, positive effectiveness impacts from Agency implementation of program options affecting water quantity are readily justifiable.

This significant difference reflects the disparate goals and challenges facing the agency, versus those facing the stakeholders. In this case, the variation probably reflects a challenge facing the agency in its efforts to protect source waters; namely, its dependence on other agencies to enforce the regulations that preserve the health of source waters. Agency technical staff expend considerable time and resources reviewing and guiding permitting and regulatory decisions from other agencies with respect to source water impacts. When a potential problem is identified, the agency must rely on actions by other agencies to address the issue. This is a very practical example of how diverse stakeholder perspectives are likely to impact the success of any long-term plan.

In another instance, Best Management Practices (BMP's) moved down in effectiveness rankings from the first survey. This removed them from the top items to be considered, and was consistent with comments from the first round that, while BMP's were considered very effective, others were considered in a better position to implement and the agency could better spend resources elsewhere.

CONCLUSIONS

This project used a combination of interviews and iterative surveys to develop a short list of source water protection options for the Agency. While sophisticated statistical techniques were used to identify the most effective program options, the importance of the survey process itself must be emphasized. The survey of Agency technical staff and external stakeholders provided guidance for the final cost benefit analysis. More importantly, it guided program options to directly address vulnerability in the implementation process identified in the survey process including the Agency's reliance on other institutions to address source water problems. In order to address this issue, a government liaison position was added to the short list of source water protection options (which subsequently ranked very highly in cost benefit analysis.) For stakeholders, the survey process was used not only to develop a short list of options, but also to inform and build consensus. The wide range of expertise that was brought to bear on the issues, not only within the Agency, but also in the community, was invaluable in balancing the disparate costs and benefits inherent in source water protection programs. Detailed survey comments were found to be very effective in sharing expertise on specific options, and played an important role in the iterative process of reaching consensus.

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