Virginia's
Rural Economic Analysis Program

Horizons

September/October 2002 Volume 14 Number 5

Sharing a Vision for Sharing the Water

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The recent drought has focused state leaders' attention on water supply issues. Yet, even in periods of normal rainfall, water supply issues are never far from the minds of local and regional citizens, officials, and water supply managers—or the local news headlines. Providing safe and reliable water for personal consumption or production processes is at the center of many heated disputes in Virginia and occurs in wet years as well as dry ones. This article will review the origins of these water use conflicts and describe a promising new approach to water supply planning called shared vision planning, which may help mitigate or overcome these disputes. The Rappahannock River Basin Commission is using a shared vision approach in a newly initiated regional water supply planning effort, and their experience could serve as a model for future state efforts to better plan and manage the Commonwealth's water resources.

Water Supply Planning

Planning and designing for water supply is challenging because it involves a complex mixture of technical analysis and value judgments (Lord 1979). Technical analysis is needed to determine how much water is available for use at different times of the year and to identify how this availability may change from year to year. When water supply reservoirs are part of a local water supply system, calculations must be made to determine reservoir storage capacity and identify how reservoir management can reduce natural variations in water availability (Cox 2002). Water supply and availability then need to be evaluated against future water demand. Determination of water demand requires developing estimates of future population and economic growth, patterns of water use across residential, commercial, industrial, and agricultural users, and how future water use may respond to short and long-term conservation efforts.

But water supply planning is more than a technical exercise. It also requires fundamental choices between competing uses. Water used to water lawns or to irrigate crops reduces the water available for instream uses (e.g., aquatic life support and recreation). Water pumped by an upstream locality may increase risks of water supply shortages or water supply costs (e.g. building new reservoirs) for a downstream locality. Balancing the use of water among different ends is fundamentally a political problem rather than technical one because balancing water uses involves judgments about what is an *acceptable* water use, what is an *acceptable* risk of future water supply shortages, and what is an *acceptable* physical and biological condition for a given river.

Conflict in water supply planning arises when disagreements occur about how water supplies should be shared among these competing uses. Furthermore, conflict can be very heated because participants in the water supply planning process hold deeply felt personal values and commitments. Local water supply managers view it as their professional obligation to provide a reliable and low-cost water service to their customers. Traditionally, water supply planners have accepted the basic philosophical proposition of "consumer sovereignty" – the consumer has the right to choose. While water supply planners are expected to encourage water conservation, decisions about how to use water (e.g., lawn watering and filling swimming pools) and whether to adopt water-reducing technology (e.g., front loading washing machines) have been left to the consumer.

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Horizons (ISSN 1075-9255) is a publication of the Rural Economic Analysis Program (REAP) in the Department of Agricultural and Applied Economics and the College of Agriculture and Life Sciences at Virginia Polytechnic Institute and State University. Please address all correspondence to REAP, Dept. of Ag. and Applied Econ. 0401, Virginia Tech, Blacksburg, VA 24061; phone: (540) 231-9443; email: reap01@vt.edu.

Historically, water supply managers have resisted delineating essential and nonessential water use in order to restrict or prohibit perceived "nonessential" uses. Water supply managers also strive to satisfy the wishes of the consumer with the smallest possible risk of a water shortage. Thus, water supply managers strive to design water systems capable of supplying water to satisfy consumer demand even in drought conditions. Other local government officials and residents may share the water managers' commitment to a reliable and low-cost water supply system for other reasons. For example, many in a given community may feel that the economic well-being of their community is dependent on building a water supply system capable of accommodating and attracting new businesses and economic growth. Given these values, it is not surprising that local governments and jurisdictions can become embroiled in disputes over how the water supply should be divided.

Increasingly, a new set of values and commitments are being added to this mix. State and federal government permits are required for major water supply projects, such as water storage reservoirs. Many of these permitting agencies, such as the Environmental Protection Agency, view protection of fish and aquatic resources (like wetlands) as their primary responsibility under current legislation. These agencies are supported by many citizens and local and national environmental groups. Together, these groups feel an overriding commitment to protect instream uses and are more willing to accept greater risks of water supply shortages for households and businesses in order to leave more water in streams and rivers. Furthermore, these groups feel no allegiance to the notion of consumer sovereignty and readily assert what they believe to be appropriate and inappropriate water uses or water use technologies.

Thus, water supply planning requires both sound technical analysis as well as political negotiation and decision-making. Technical analysis can provide participants with insights about the consequences of different management actions (e.g., what instream flows might be given consumptive water withdrawals) or the trade-offs facing policy participants (e.g., probability of a water shortage with different size reservoirs). Yet, technical analysis cannot determine what management options should be adopted or what trade-offs should be made. Too often, technical analysis becomes another weapon that partisans use to promote their positions and obscure issues rather than a tool to illuminate policy discussions. While great strides have been made in recent years in the technical sophistication of analytical techniques, conflict in water supply planning seems to be increasing, not decreasing. A central challenge in water supply policy is for technical analysis to better support the public deliberations that must occur in the water supply planning process (Shabman 1995).

Shared Vision Planning

A recent innovation in water supply planning is designed to mitigate conflict and facilitate agreements in water supply planning. The approach, called shared vision planning, was one of the products of the congressionally authorized national drought study (Institute for Water Resources 1995). Shared vision planning modifies traditional planning principles by integrating elements of collaborative negotiation into the standard planning process that evaluates alternative management strategies (Werick 2002).

In shared vision planning, participants representing a wide range of interests and objectives are asked to participate in a planning process built around development of a mathematical simulation model of a water basin. In the past, technical models were the domain of the scientists and technical analysts. In shared vision planning, participants are actively involved in developing the analytical methods that are used to describe and understand the water system. The shared vision model is an integrated, formal representation of the key components of a natural hydrologic system as modified by reservoirs and other human interventions. The model is intended to be designed, modified, and used by the planning participants themselves with the assistance of technical analysts rather than developed independently by technicians as has been common in the past. The components included in the model are identified by the planning participants and typically include such elements as instream flows, reservoir storage and release, water withdrawals for residential, commercial, or agricultural uses, and return flows. Once completed, the model should reflect the "shared vision" of the physical workings of the system. The model should be capable of addressing the problems important to planning

> Shared vision models are computer simulation models of water systems built, reviewed, and tested collaboratively with all stakeholders. The models represent not only the water infrastructure and operation, but also the most important effects of that system on society and the environment. Shared vision models take advantage of new, user friendly, graphical software to bridge the cap between specialized water models and human decision-making processes. Shared vision models [help]… overcome differences in background, values, and agency traditions. (Institute for Water Resources, 1995, p. xvi.)

participants and capable of assisting in the evaluation of alternative water management plans.

The shared vision process is facilitated by user-friendly graphical software that enables the technical representation of the water system to be transparent, flexible, and easy to use. Transparency allows nontechnical participants to clearly understand how the program works and easily identify how components in the model are related to each other (e.g., how instream flow is related to water withdrawals). Flexibility allows people to add new components to the model as new problems and needs arise. For instance, the software would allow participants to add fish habitat of certain fish species into calculations of instream flow. Ease of use includes the ability to change key assumptions in the analysis. A critical element in any water supply planning exercise is projecting future populations in the water basin. Of course, predicting what the population will be in a specific area 20 years in the future is subject to tremendous uncertainty and guesswork. A user-friendly shared vision model allows the user to easily change population projections to investigate consequences on future water users and instream flows.

Shared vision models can help overcome the challenges of the water supply planning process in a number of ways. The shared vision planning process allows participants to jointly learn about how a hydrologic system responds to change. If the process can construct technical models that are viewed as legitimate and credible, participants can focus on evaluating and debating the merits of management alternatives rather than arguing over whose numbers or models are correct. The shared vision model invites all participants to investigate alternative management options together. For example, participants can investigate what might happen to instream flows or water rates given different conservation programs. The results allow users to narrow the range of water supply management alternatives by identifying those alternatives that do, and do not, have significant impacts on problems of concern. Manipulating the model also encourages participants with different objectives and interests to identify management strategies that result in "win-win" outcomes. Finally, shared vision planning helps participants separate technical issues from value-based ones. Shared vision modeling does not eliminate all conflict, but properly implemented, it can facilitate joint learning and trust, clarify technical issues, and focus attention on the policy question of "what *should* be done."

Shared Vision Planning for the Rappahannock River Basin

A basin-wide water supply planning effort initiated by the Rappahannock River Basin Commission might serve as a model for future water supply planning efforts in Virginia (Mudd 2002). The Rappahannock River Basin Commission (RRBC) was created in 1998 by the Virginia General Assembly. The RRBC is made up of 25 local and state elected officials from representing political subdivisions throughout the basin (Figure 1). While the RRBC does not possess regulatory authority, the commission is charged with "promoting communication, coordination and education, and suggesting appropriate solutions to identified problems" related to water quality, quantity, and other natural resources (Section 62.1-69.27, Code of Virginia).

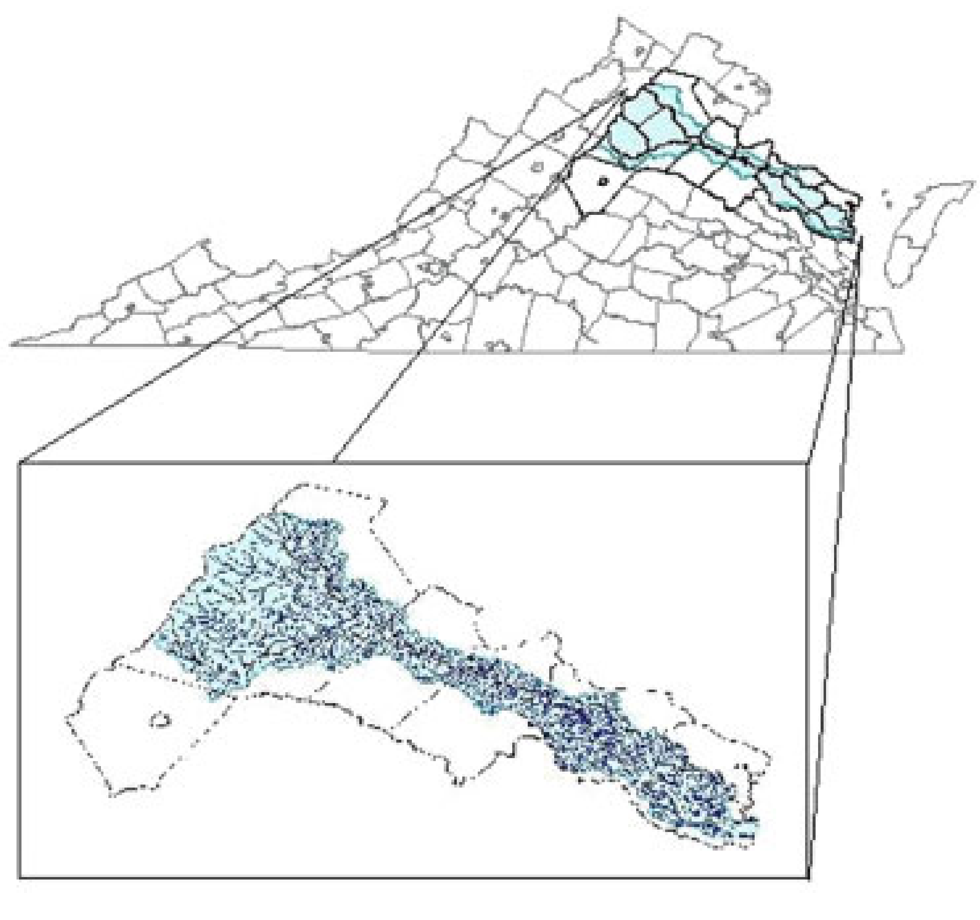

Figure 1. Rappahannock River Basin

Based on concerns of citizens and officials in the basin, the RRBC initiated a comprehensive, basin-wide water planning effort in 2001. The planning effort is designed to coordinate and plan for the water quantity management for multiple uses over the entire basin. The effort is organized around the shared vision modeling process. The shared vision modeling process involves a diverse set of interests that includes local government officials, local water supply managers, representatives from local nonprofit organizations, federal agencies (Corps of Engineers, Environmental Protection Agency, and Fish and Wildlife Service), and state agencies (Department of Environmental Quality, Department of Game and Inland Fisheries, and Department of Conservation and Recreation).

A team of water management specialists at Virginia Tech and the Institute for Water Resources is working with key stakeholders in the Basin to develop a prototype basin-wide river flow simulation model.[1] This shared vision model estimates instream flow in the Rappahannock under different assumptions about population; future water use by residential, commercial, industrial, and agricultural water users; reservoir management regimes; and implementation of water conservation measures.

The goal is to build a computer simulation model that all participants can understand and use to investigate the issues most important to everyone involved. The prototype model under development allows users to examine what might happen to the river flows in the Rappahannock under different weather conditions, future economic and demographic conditions, and water management programs. When a model is completed to the satisfaction of the participants, a shared vision model can facilitate learning, planning, and coordination. The simulation model can conduct a "virtual" drought to estimate river flows assuming conditions as severe as the current drought, but with an additional 250,000 people that might be living in the basin in the year 2030. Planning participants could to use the model to meet the challenge of devising options for stretching scarce water supplies. These options might include, but are not limited to, better coordinating and integrating local water supply systems and adopting water conservation programs of varying degrees of stringency. While the shared vision model does not provide an answer to what should be done in a future drought condition, it does provide the basis for identifying consequences of alternative courses of action, thereby facilitating the selection process.

To date, the shared vision effort in the Rappahannock Basin represents a start to a longer-term planning effort. The current prototype model will need further refinement and still must undergo a rigorous verification process to assure reasonable accuracy. Long-term, basin-wide planning is still in the preliminary stages. Yet, the spirit of mutual learning and a willingness to experiment with a new planning process has characterized the process to date and is itself an encouraging sign.

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[1] Partial funding for this effort was provided by the Rural Economic Analysis Program and the Virginia Water Resources Research Center.

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