Principles for Managing the Southwest's Urban Water Environments

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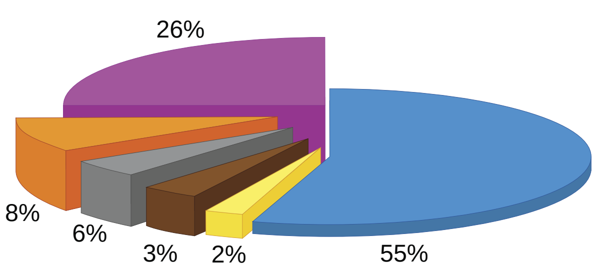
Photo: Joseph J. Donaldson, ASLA

Scene from Gilbert (Arizona)'s Riparian Preserve at Water Ranch.

Sustainable urban water management is a critical challenge for the Southwest and for rapidly growing arid regions throughout the world. In 2008, a National Science Foundation-supported workshop, "The Water Environment of Cities: Adapting to Change," developed guiding principles for urban water management (Baker and Holway, 2009). The workshop was attended by a dozen urban water experts from academia, water management institutions, and nonprofits. Five core principles emerged, summarized here with a focus on their application to southwestern cities.

Everything is Connected—Incorporate the Influence of Urbanization

Because the urban environment profoundly affects water quantity and quality, water managers must systematically consider all aspects of the hydrologic cycle, including interactions between land, water, and atmosphere within both the natural and built environments. Unfortunately, water is nearly always managed in a piecemeal fashion in which some of these interconnections are lost. A key recommendation of the workshop is that all cities—even those not currently under water stress—use water balances to guide water management. The water balance should include the local natural watershed as well as areas that contribute water to the city via constructed conduits, and the fate of water downstream of the city. As obvious as this might seem to an economist or your neighbor, few cities have managed their water using this basic hydrologic tool.



Sources of salt added to Phoenix's municipal water system. Adapted from Thompson and others, 2005.

However, comprehensive water balances are now developed in Arizona's five Active Management Areas (AMAs), which include several urban areas, under the 1980 Groundwater Management Act. The water balances did not arise out of visionary insight, but of utter necessity: groundwater levels had declined several hundred feet in some areas. By law, a new AMA management plan must be developed every 10 years. The law also established a "safe-yield" goal for four of the AMAs, though this is very much a work in progress.

Pollutants also can be managed at the level of the urban ecosystem using system-wide mass balances that allow exploration of broader ecosystem management strategies than traditional end-of-pipe treatment such as source reduction or recycling. For example, Thompson and others (2005) developed salt balances for six western water utilities as a means to identify management strategies for reducing salt input to recycled wastewater (see chart below).

In addition, adaptive management can play a larger role in urban water management. We now have systems of sensors, data storage and analysis, and real-time controls that can provide rapid feedback, allowing management practices to be regularly evaluated and adjusted. Unfortunately, the full potential of such systems for water management is not being realized.

Change is Inevitable

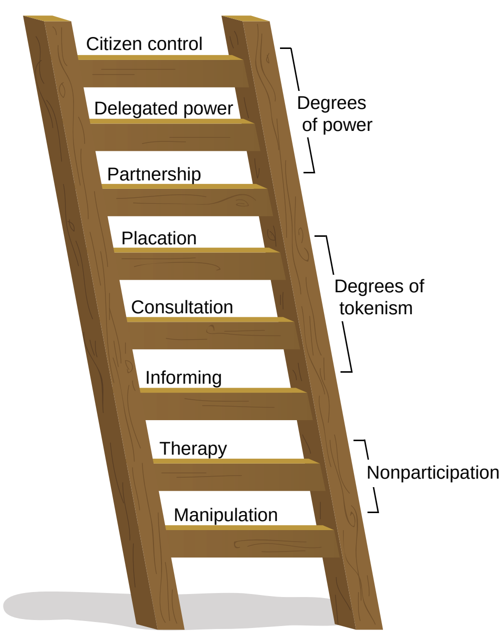
Change in the urban water environment is inevitable, but not always predictable. Nevertheless, water managers must plan for changes caused by many factors, including changes in biophysical systems (induced by drought or flooding), the built environment, governance, human culture and behavior, and economics. Profound hydrologic variations have occurred in the Southwest over the last 1,000 years. Some changes are reasonably predictable; others, such as floods, are more random but can be anticipated. Still others, such as climate change, are truly uncertain but can be managed by collecting data, considering alternative future scenarios, planning for the long term, managing adaptively, building redundancy and resilience into urban water systems, and building transparency into our institutions and decisions.

People are Part of the Ecosystem

The most effective water managers recognize and engage the multiple parties and interests who affect the urban water environment and are likewise affected by it. Many urban water managers do not actively engage the public; they may fear public engagement and rarely move beyond token stakeholder meetings. However, in areas such as the Minneapolis-St. Paul urban region, active citizen advisory committees guide the operation of watershed management districts and related organizations. The diagram below illustrates a widely referenced "ladder of civic engagement" (Arnstein, 1969). Which rung have the organizations in your community reached?

The workshop concurred on the value of developing a public vision for water management and using modern visualization and web tools to facilitate this process. The WaterSim computer model developed at Arizona State University is an example of a tool that allows individuals with no training in hydrology to visualize the effects of various water-management scenarios. (You can play too, at *watersim.asu.edu*).

Considering how water affects people also extends to recognizing the importance of the aesthetic and ecological functions of water in our urban areas (see photo, opposite page). Water features are nearly always a central attraction in great cities, as they create a sense of place and well-being, yet many southwestern cities are bereft of them.



Arstein's (1969) "ladder of civic engagement" (redrawn).

Institutional Structure Makes a Difference

Traditional local units of government are often poorly suited for managing water issues that cross political boundaries. Utility-type regional water-management entities nearly always focus on either municipal water supply or sewage treatment, but rarely address the full range of water management issues. Urban water is best managed by institutions that are responsive to the hydrologic setting; capable of working across political, social, and functional boundaries; and effective at engaging all stakeholders. Additionally, effective water-management institutions address all aspects of water in urban environments, incorporate sound science and adaptive management, focus on key decision-makers, incorporate flexibility in management, and engage the public early and often.

No single model of a water management institution would be suitable for all cities. Some key considerations in establishing effective institutions include: 1) What scale of institution is needed? 2) What scope of activities is needed? 3) What level of technical sophistication is required? 4) Is a permanent taxing authority needed? Two examples of urban water management institutions that incorporate at least some of the characteristics described above (or at least, their ideals!) are Arizona's AMAs that circumscribe most of the state's major cities and focus on groundwater, and the urban watershed districts throughout the Minneapolis-St. Paul metropolitan region that focus mainly on surface water.

Water Management Requires an Interdisciplinary Approach

Most workshop participants had attended a larger "Blue Water in Green Cities" workshop the previous year. There, many of the professionals representing a dozen different disciplines realized that despite their expertise, they were like the two blind men at opposite ends of the elephant in a well-known parable, knowing a great deal about the parts, but with neither understanding the whole. This piecemeal approach to urban water management has often led to problems, pointing to a profound need for more holistic thinking that reaches across multiple disciplines to include engineering, ecology, hydrology, geology, environmental psychology, economics, and law. Ultimately, we need to connect the dots to craft ecosystem-level management strategies for managing the urban environment. ■

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References

Arnstein, S., 1969. A ladder of civic participation. J. Amer. Inst. Planners, 35(4): 216-224.

Baker, L., P. Shananan, and J. Holway, 2009. Principles for managing the urban water environment in the 21st century. In Baker, L.A. (ed.), The Water Environment of Cities, Springer Scientific, Lowell, MA, 275-289.

Thompson, K., W. Christofferson, D. Robinette, and others, 2005. Characterizing and managing salinity loadings in reclaimed water systems, Amer. Water Works Assoc. Research Foundation, Denver, CO.