



# Making Groundwater Visible

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**F**or most of the public, groundwater is out of sight and out of mind. Groundwater, and the boundaries that define it as a water management unit, are physically invisible to humans – unless you’re in a cave, you can’t see it. This lack of physical visibility has contributed greatly to its lack of visibility in many discussions of water policy, governance and management.

In many parts of the world, the failure to manage groundwater in an integrated, sustainable way could have severe consequences. Depleted and/or contaminated water reserves contribute to regional conflicts and create public health hazards. Subsidence causes significant damage to critical infrastructure such as roads and levees. Entire economies, based on water dependent agriculture and industry, are at risk.

Groundwater constitutes more than 95 percent of Earth’s unfrozen freshwater. Given its vast reserves, broad geographical distribution, generally good quality and frequent availability at or near the point-of-use, it has become the foundation of many water management systems for drinking water, irrigation and municipal and industrial uses. Still, and despite its importance, groundwater is largely undervalued and narrowly perceived. Even while the interrelationship between groundwater and surface water is well established by science, institutions at all

levels struggle to effectively incorporate these concepts into laws, regulations and sustainable management.

An archaic piece of British common law, brought to the New World with the settlers, contributes to the problem. Under these laws, the owner of a piece of property owns the water beneath it. This has created situations nearly equivalent to telling a group of preschoolers that whoever can get their straws in the cup first will get the fruit punch. An 1861 court case in Ohio [Frazier v. Brown, 12 Ohio St. 294 (1861)] famously concluded that groundwater was too “secret, occult and concealed” to regulate. While water law has advanced somewhat, the aura of mystery remains. Even today, water dowsers (sometimes called water witches or diviners) are found using sticks and plumb bobs to suggest places to drill a well.

Recognizing a critical need to elevate groundwater discussions, in early 2016 the American Water Resources Association (AWRA) and the National Ground

Water Association (NGWA) joined forces to make more transparent and attract attention to groundwater issues. Together they launched the Groundwater Visibility Initiative.

These organizations understand that the stakes for properly managing groundwater could not be higher. Over two billion people get drinking water from groundwater. In the United States, about 38 percent of the population regularly depends upon groundwater for its drinking water supply and that same percentage is groundwater’s portion of irrigation water. Rural areas are often 100 percent dependent on groundwater.

Proper groundwater management may even contribute to improved national security. Corporate users have become very aware of the importance of the resource. Consider this statement about groundwater depletion from a decidedly corporate vantage point in a recent report by the Earth Security Group<sup>1</sup>:

*“The rapid depletion of aquifers is a systemic risk to one billion people in the world’s growing economies. Aquifers are shared across national borders and have the potential to spark conflict. Companies must act beyond their site operations and help improve groundwater governance if they are to ensure their sustainable growth.”*

## The Groundwater Visibility Initiative

In April 2016, AWRA and NGWA convened 25 water experts from across the United States and Canada in a day-long *Groundwater Visibility Initiative* workshop. This seminal event sought to discuss the best way to elevate groundwater's status in the international discourse on water policy, governance and management by crafting recommendations for action.

The attendees tackled an agenda consisting of provocative talks by recognized experts, panel discussions and breakout sessions. They articulated ways to better integrate groundwater into integrated water resources management and incorporate it into policies for agriculture, energy, environment, land-use planning and urban development.

## Workshop findings and recommendations

Following is a summary of the workshop findings and recommendations.

### 1. Governing and managing groundwater require working with people.

Governance is an important part of resilient aquifer management. Groundwater sustainability is a societal decision that involves tradeoffs and should be made through informed, transparent public participation.

Multidisciplinary teams and alliances among multiple governance/management associations can provide greater expertise to solve these problems. Communications programs are required to help overcome misperceptions about groundwater and surface water interactions and demonstrate their connectivity. Examples of good management and governance should be provided to decision-makers and other stakeholders.

### 2. Data and information are key.

Better data on water withdrawals and consumptive use are needed for both groundwater and surface water management. Different aquifers behave differently because of different geology, extent and hydroclimatic settings. This means monitoring and evaluation at appropriate spatiotemporal scales are necessary to understand trends in both quality and quantity. Data collection and analyses should be transparent.

### 3. Some "secrets" remain.

Groundwater and climate are inextricably linked through recharge rates and demand. Science needs to improve understanding of climate impacts on both supply (quantity and quality) and demand for groundwater and its interaction with surface water.

Long lag times for groundwater impacts and system responses must be accommodated for and understood.

### 4. We need to take care of what we have.

Ensure planning and investment incorporates infrastructure rehabilitation and maintenance.

### 5. Effective groundwater management is critical to an integrated water management portfolio adaptive and resilient to drought and climate change.

A diverse water management portfolio including groundwater, surface water, conservation, recycling, etc., will contribute to greater water security and less risk. Groundwater can support instream flows, ecosystems, recreation, sustainable supply for water users and subsidence avoidance. Groundwater also supports surface-water quality and mediates its temperature.

Managed aquifer recharge is a potentially critical element of drought mitigation planning. Groundwater systems should be analyzed for their resilience and vulnerability to climate perturbations. Projects should be reviewed from a long-term resilience perspective not a short-term one. In this context, groundwater management is especially important as a tool to buffer extremes, even if groundwater is not necessarily a readily-available backup supply.

Models need to be reviewed and adaptive. Collaborative modeling can be an effective tool to obtain buy-in from stakeholders.

In a fully integrated system, repurposing dams and flood control operations for recharge is another opportunity.

### 6. To be robust, agriculture, energy, environment, land-use planning and urban development sectors policies must incorporate groundwater considerations.

Groundwater problems typically do not have a single solution. Return flows from different sectors have significant intersection with groundwater management issues. Planning and management need to be integrated across all of the sectors. This means matching quality, quantity and use.

Land-use planning can be used to protect or enhance base flow of streams, floodplain management and groundwater recharge. Agricultural and open space districts can be an opportunity for a win-win; overlay zones for scenic protection, agricultural preservation, etc., to enhance recharge.

Water managers should consider innovative ways of education of and outreach to the agricultural sector, including: 1) key role of agricultural extension agents; 2) subsidy-based conservation programs; 3) self-regulation with performance-based criteria; 4) "grow-off challenges" through crop yield competitions with guarantees; 5) early adapter programs; and 6) professionally facilitated communication.

## Takeaway

Now is the time to disabuse society of its 'secret, occult and concealed' approach to groundwater. The path identified above will help provide the tools to do just that. The hard work of making groundwater visible has just begun. Stay tuned. ■

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## References

1 Foreword, 'Global Depletion of Aquifers', Chapter 4 in Earth Security Index 2016 Report, <http://tinyurl.com/zdot9dp>.