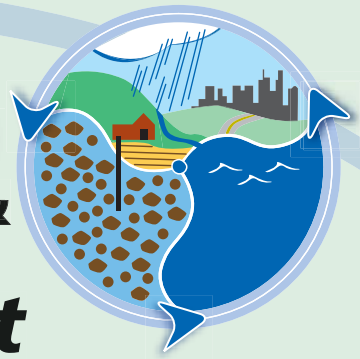



# Ground Water & Land Use Planning and Development



## Key Message

Ensuring enough quality water to support various land uses and economic development can be the driving force toward increased ground water protection efforts at the local level. As uses change from rural to urban or agricultural to suburban lifestyles, we must pay careful attention to how we modify the natural environment. Land-use decisions that fail to consider the long-term quality, availability, and susceptibility of ground water resources create conditions that contribute to loss of ground water recharge, overuse of water resources, and human health and ecological impacts resulting from ground water contamination. On the other hand, land-use practices that protect and conserve water resources and maintain or even increase aquifer recharge are key to maintaining long-term water availability and economic vitality.

Land-use planning and development decisions must routinely take into account such factors as the location, quality, yield, vulnerability, and recharge potential of aquifers and the projected availability of water for the long term. To be truly effective, this information must be incorporated into local comprehensive plans and policies. Fortunately, there is a growing body of land-use tools that provide effective ways to protect ground water and the environment as a whole, and to maintain and improve our quality of life. But it is essential that local decision makers have access to these tools and that they apply them to land-use planning, zoning, and land-acquisition decisions. When they do this, they can effectively protect and sustain their local ground water resources.



*A ground water spring emerges from a group of trees at the base of Fredrick's Hill in Middleton, Wisconsin, and flows south through a marsh to Lake Mendota. The marsh is being surrounded on all sides by housing developments. There is concern that paved surfaces and increased ground water pumping will threaten both the spring and the wetland.*



## Changing the Land-Use Paradigm

“*The health of our waters is the principal measure of how we live on the land.*”

Luna Leopold | Former Chief Hydrologist, USGS

# why Land Use matters to ground water...

**The long-term viability of any community is dependent on the availability and quality of its water.** Many communities throughout the United States are grappling with the challenge of meeting increasing water demands associated with population growth, economic development, and changing trends in water use. Many recognize that the manner in which they develop their local landscape has an immediate and dramatic impact on the quality and quantity of their water resources and that they need to utilize smart growth approaches to development.

Each time the use of a land area changes, it can affect the hydrologic makeup of the landscape. Highways, shopping centers, housing developments, industrial sites, businesses, agricultural operations, golf courses, feedlots, waste disposal sites, airports, ski slopes, and sewer systems (to name a few) have the potential to directly or indirectly impact the quantity or quality of both ground water and surface water.

These impacts are also cumulative. The more we modify the hydrologic cycle—runoff, evapotranspiration, infiltration—the more we risk reducing or losing water resources over time. The good news is that we can prevent and even repair many of these problems if we act quickly to institute science-based land-use management measures. Often, this is most doable at the local level, where governing bodies have sufficient authority to control land-use activities and conditions that threaten their ground water, particularly if it is an existing or potential drinking water source.

But doing the right thing by source water at the local level can be challenging. In some cases, communities do not have jurisdiction over the recharge areas that influence the supplies of ground water they use. Also, in too many instances there is insufficient guidance,

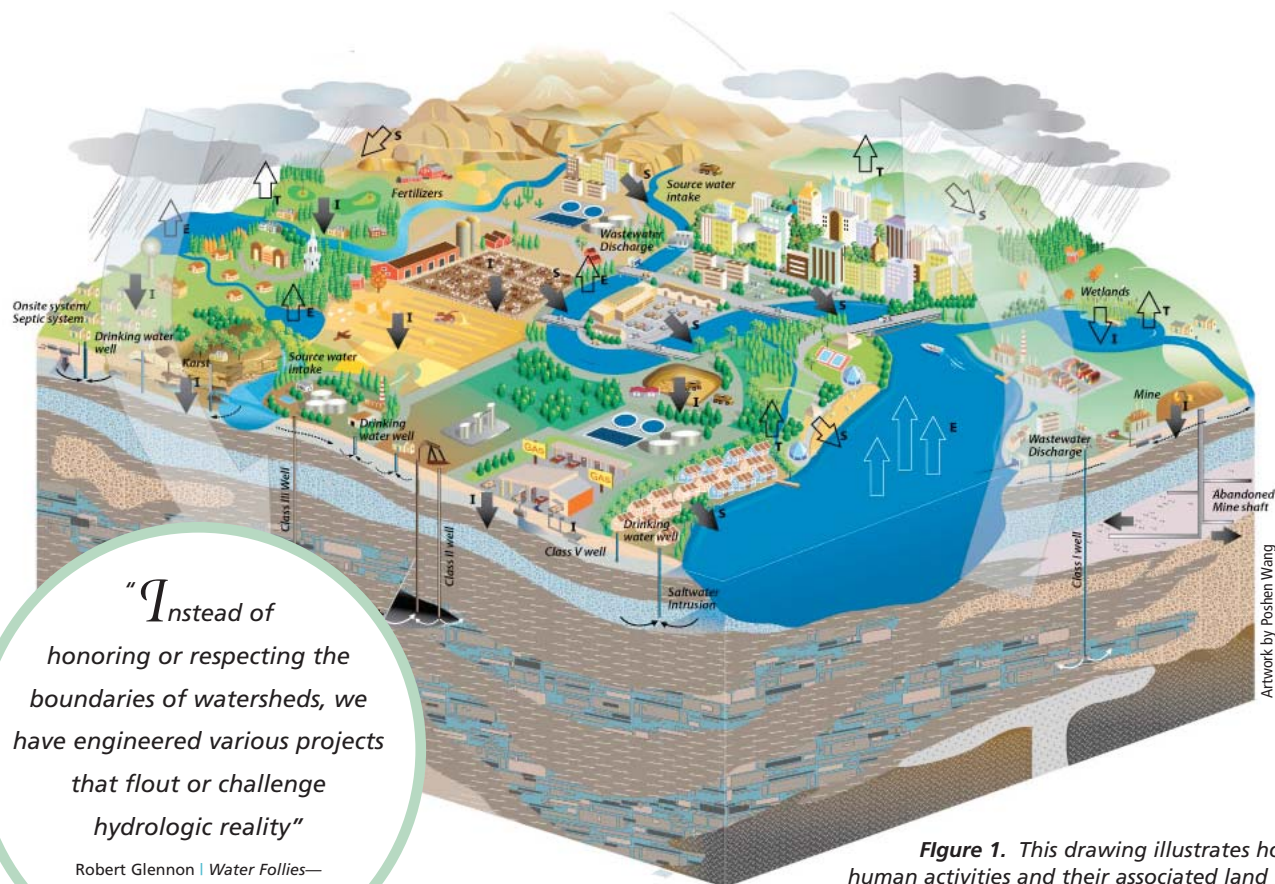
*The subdivision shown here near Belton, Missouri, typifies development patterns throughout the country. Many communities are beginning to realize that it is smart to incorporate ground water protection measures into their local planning and development decisions in order to protect the very resources that sustain them.*



Photo: © 2006 Craig L. Patterson



## GROUND WATER INTERACTIONS



*“Instead of honoring or respecting the boundaries of watersheds, we have engineered various projects that flout or challenge hydrologic reality”*

Robert Glennon | *Water Follies—Groundwater Pumping and the Fate of America's Freshwaters*

**Figure 1.** This drawing illustrates how human activities and their associated land development can impact ground water.

technical and scientific information, and assistance filtering down from the federal, state, and regional levels to the local level to enable the “people in the trenches” to make environmentally sound land-use decisions. Even if this information were available, many communities do not have the level of staff expertise needed to interpret ground water data needed to implement land-use tools for ground water protection.

Our challenge is to ensure that local decision makers have access to appropriate and instructive information that they can actually use. This can be accomplished through partnerships with state planning and environmental agencies and other entities, such as water suppliers, regional planning agencies, local watershed associations, land trusts, and programs such as the National Nonpoint Education for Municipal Officials (NEMO) Network, and the Cooperative State Research, Education, and Extension Service (CSREES).

### LAND USE AND THE NATURAL SYSTEM

Many land-development practices reconfigure landscapes and reroute both hydrologic systems and related habitats. For example, when we create new impervious surfaces, such as highways, parking lots, and buildings, and redirect the runoff to surface water, we prevent rain or snow from seeping into the soil and replenishing the underlying ground water. The resulting increased stream flow can cause property damage, stream bank and soil erosion, and water pollution from nonpoint sources as pollutants are swept into both surface and ground water by this runoff from land surfaces.

Intense development can also increase both surface and ground water use, which also modifies the hydrologic cycle. For example, overdraft of ground water leads to reduced stream flow in the surrounding area and can occasionally cause permanent damage to the aquifer owing to land subsidence.



Photo: Aaron Gustafson - <http://www.flickr.com/photos/aarongustafson/268094569/>



Bristol, California.

## LOCAL GOVERNMENT—WHERE THE RUBBER MEETS THE ROAD

Stewardship of our nation's ground water resources is the responsibility of all levels of government—but particularly local government. Though federal and state agencies have important roles to play in ground water protection, responsibility for land-use planning and regulations is primarily local. Therefore it is essential that those with the authority to make land-use decisions have access to the kind of information and assistance they need to plan responsibly, make informed decisions, and employ effective ground-water protection strategies.

The day-to-day decisions that affect ground water are typically made by dedicated but sometimes untrained volunteers (e.g., planning commissions and zoning boards, conservation commissions, health boards, wetlands commissions) and in a venue where there is often a high turnover rate. At a time when the importance of ground water is not universally recognized, these otherwise well-intentioned local decision makers may not know how important it is to consider the potential impacts of a proposed land-use activity on ground water. Furthermore, they may lack the proper data to support resource-protective decisions that may be economically or politically unpopular.

Local governments face an abundance of water resource management issues—drought, flooding, development pressure, stormwater and nonpoint-

source pollution, cross-boundary water disputes, and limitations on water withdrawal and discharge, including total maximum daily loads (TMDLs). For this reason alone, community leaders need an arsenal of effective and innovative land-use development approaches as they struggle to balance economic growth with natural resource protection and preservation of community character. Natural resource-based planning within a comprehensive, three-dimensional watershed framework is one of the best approaches to achieving that balance.

Recognizing that the economic health and well-being of their communities depend on the sustainability of their

water resources, some local officials are, in fact, looking to new approaches to development. By implementing laws and regulations already on the books, they are seizing on their ability to select from a growing collection of methods and technologies that have been developed to accommodate growth without destroying the very resources that sustain their communities. By adopting water policies that promote water-efficient growth, they are effectively taking giant leaps forward in reaching their water goals. In many respects, communities hold the ultimate power to determine the fate of water resources throughout the United States.

## Meshing Ground Water Protection with the Planning Process

It is an axiom in planning that *everything is related to everything else*. Thus local governments must think comprehensively and in a long-range framework. This is not something most people do naturally. It's hard to talk about saving land 25 years before it is threatened. It's difficult to think about protecting drinking water if it appears to be just fine. Why make the effort when there are so many other pressing matters? Comprehensive planning provides the community with a road map for getting to its long-term vision for itself. In the absence of such planning, a community can find itself perpetually reacting to undesirable development proposals and ultimately paying a high price to undo the cumulative effects of earlier decisions.



By thinking ahead and comprehensively, those interested in protecting ground water, working closely with urban planners, city managers, and others, can effectively plan for long-term protection. There are several points in the planning process where ground water protection issues and initiatives can be incorporated. These points include:

**Visioning**—A point in the planning process where local leaders visualize the goals as well as the effects of future actions. Planners, city managers, developers, and utility engineers need to be sure that ground water protection is “on the table” when they conduct long-range visioning processes for their communities. Visioning helps communities account for relationships between issues, avoiding piecemeal and reactionary approaches.

**Comprehensive Planning**—The framework that informs decisions about where and how development occurs and future public investments, and provides a selection of recommended management tools. Plans should contain meaningful and effective ground water protection goals, strategies, and metrics.

**Management Tools**—Ordinances, regulations, and incentives that are based on adopted plans.

**Site Design and Development Review**—A professional and technical review opportunity to provide ground water protection and site-development expertise to the decision-making process so that water resources are not compromised and onsite mitigation measures are encouraged.

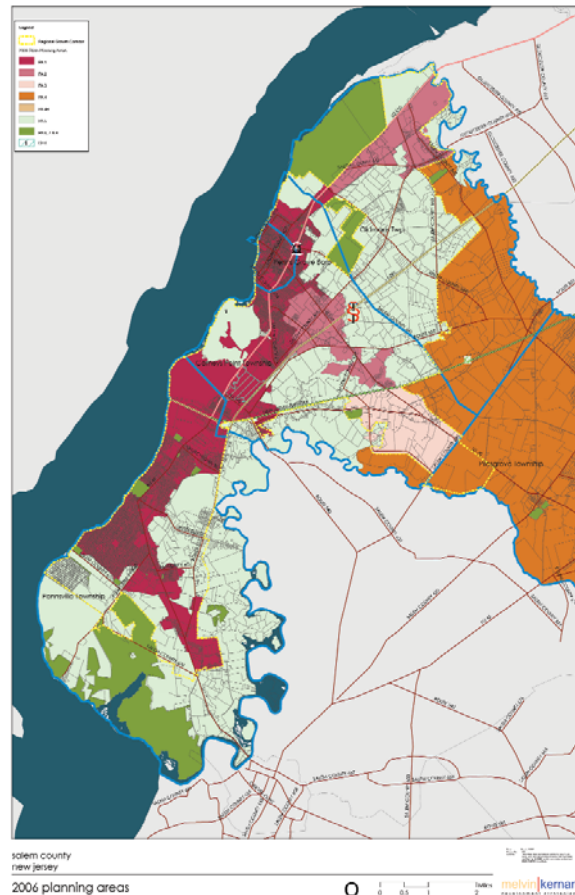
**Public Investment in Infrastructure**—A five-year capital improvements program (CIP). CIPs can include raised and planted medians, neighborhood parks, hazardous-site clearance, expanded and diversified transit, improved walking and biking facilities, urban forestry planning, roof gardens, rain gardens, greenways, upgraded sewer and water facilities, and additional landscaping for streets and sidewalks. These public investments may have a major impact on ground water, either positive or negative.

**Land Conservation Actions**—Ways to acquire open lands, forested land, or agricultural land either through municipal actions or through private land trusts.



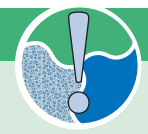
Photos: StateLine.Net - <http://www.flickr.com/photos/oldonline/425939071/>

*Planners and facilitators explain planning concepts to citizen participants at the City of Beloit, Wisconsin's, Comprehensive Plan Open House Workshop. Such visioning sessions allow citizens to provide input in identifying priorities for healthy, livable communities early in the planning process.*



**Figure 2.** Salem County, New Jersey's, natural features include six rivers, more than 34,000 acres of unique meadow and marshland, tidal and freshwater wetlands, 40 lakes and ponds, bay beaches, dunes, expansive woodlands, a critical underground aquifer, numerous streams, and important headwaters. County leadership is committed to preserving this rural character and is dedicated to pursuing balanced growth. In this State Plan Policy Map 2006, the growth corridor is shown by the yellow outline. Solid-colored areas indicate the various planning areas.

Source: <http://www.salemcountynj.gov/departments/publicinformationoffice/>



## LOCAL TOOLS FOR PROTECTING GROUND WATER

Using comprehensive long-term planning that incorporates water resource protection and infrastructure needs and availability, communities can: (1) encourage development in areas with adequate infrastructure and steer it away from sensitive natural areas such as ground water recharge areas; (2) integrate water budgeting into land-use planning; (3) ensure that developers put forward designs that reduce water demand per unit of development; and (4) implement land-management practices that preserve ground water recharge areas and help minimize the risk of ground water contamination.



*City of Melrose, Massachusetts, Towner's Pond conservation land.*

The following are examples of land-use planning tools local governments can use to protect ground water quality and quantity.

**Comprehensive Plan**—A community's official long-term vision for growth and development. Water resource protection goals should be clearly established in the plan. The most effective comprehensive plans integrate smart growth and water budget policies into their overall goals and objectives.

**Designated Growth Area or Urban Service Boundary**—A designation used to steer development toward areas with adequate infrastructure and away from sensitive natural areas.

**Zoning Ordinance**—The primary means by which communities control the type of development allowed in a particular area. The designation of permitted uses allows a community to, among other things, control incompatible uses, the size of open space, and population density; promote public health and welfare; and protect water resources. Zoning can help control ground water resource degradation within wellhead protection or ground water recharge areas.

**Overlay Protection Zone**—A zone designated by a community (e.g., wellhead protection zone) that can be used as a basis for restricting the locations and/or controlling the design, operation, and management of high-risk land uses. This tool is similar

to zoning regulations in its goal of defining the resource (e.g., watershed, recharge area) where development and high-risk land uses would threaten water quality.

**Transfer of Development Rights**—A plan prepared by a government entity designating land parcels from which development rights can be transferred to other areas. This allows for a variety of land uses (e.g., a gas station) while assuring that these uses are outside sensitive areas.

**Special Permit**—A type of permit that can be required to regulate certain uses and structures that may potentially degrade water and land quality.

**Development-Impact Fee**—A fee allocated and charged on new development for a pro rata share of infrastructure and governmental services. This can include financial consideration of additional water costs.

**Tax Benefit to Landowners**—A compensation (e.g., transfer of development rights, reduced property taxes) for preserving key watershed, ground water recharge, and other natural areas.

**Growth Control/Timing**—A tool that can be used to guide a community's growth, ideally in concert with its ability to support growth. The availability of ground water is an important consideration.



## LOCAL TOOLS FOR PROTECTING GROUND WATER (continued from page 6)

**Underground Storage Tank (UST) Regulations**—These measures are often adopted to enhance local water resource protection. They include prohibiting new residential USTs, removing existing residential USTs, and prohibiting new UST installations in ground water and surface water management areas.

**Well Construction/Closure Standards**—Standards for new well construction and for identification and closure of abandoned wells to prevent ground water from being contaminated. Well bores are a direct conduit to ground water.

**Non-Zoning Ordinances and Codes**—Many communities have the ability to adopt ordinances or codes that are designed to protect water resources. For example, ordinances can be written to tie development to sustainable water availability; promote water conservation by allowing for water rationing or conservation rates; or allow or require water reuse and gray-water use that is protective of ground water. Plumbing codes can be modified to allow water reuse or protect against potential ground water impairment.

**Subdivision and Site-Plan Review Regulations**—An authority that allows communities to set design and engineering standards and construction practices that must be met for subdivision and site-plan approval—powerful tools for controlling stormwater runoff and soil sedimentation and erosion.

**Low Impact Development (LID) Techniques**—The use of various site-design practices to conserve and protect natural resource systems and reduce infrastructure costs. This is a highly effective and creative approach to controlling nonpoint source pollution and preserving ground water recharge while also considering ground water quality.

**New Approaches to Stormwater Management**—Stormwater best management practices (BMPs), stormwater utilities, and stormwater management plans that are designed to conserve and protect both surface water and ground water and promote natural ground water recharge. (These approaches go hand in hand with LID techniques.) Ordinances that discourage the creation of additional impervious surfaces, encourage narrower street widths and natural stormwater management systems (e.g., grassy swales), and allow home clustering and other environmentally sensitive design techniques can help increase ground water recharge and at the same time manage its quality before it recharges aquifers.

**Multiyear Capital Improvements Program (CIP)**—A long-term planning technique that can be used as a ground water protection tool. Resource-protective components might include neighborhood parks, raised and planted street medians, expanded and diversified transit, improved walking and biking facilities, urban forestry planning, roof gardens, greenways, and upgraded sewer and water facilities.

**Critical Ground Water Areas for Land Conservation**—Acquiring land or conservation easements of open lands, forested land, or agricultural land either through municipal actions or private land trusts. Ways to secure land for conservation include purchasing land or development rights, targeting subdivision open space areas identified in a town open space or comprehensive plan, and using conservation easements, tax benefits, partnerships with land trusts, or transfer of development rights.

*Critical ground water areas can be identified and prioritized when planning for city parks and open space. This is the Parks and Open Space Plan for New Orleans, Louisiana.*

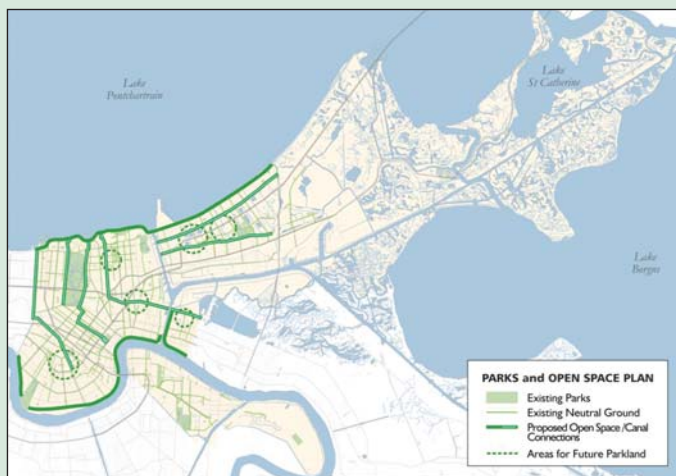


Photo: Bring New Orleans Back Commission  
<http://www.bringneworleansback.org/>



## THE BEAUTY OF "BROWNFIELDS"

A brownfield is generally defined as an abandoned or underused industrial or commercial property where redevelopment is complicated by actual or perceived environmental contamination. Brownfields vary in size, location, age, and past use, and can range from a small, abandoned corner gas station to a large, multi-acre former manufacturing plant that has been closed for years. These properties typically have lower levels of contamination that can be successfully addressed using standard environmental cleanup practices, but they are often stigmatized based on their past use. Cleaning up and reinvesting in these properties can take development pressure off of undeveloped, open

## Growing Recognition of the Value of Brownfields

Redeveloped, brownfields can:

- Be catalysts for community revitalization.
- Restore urban property to productive use, thus increasing property values.
- Increase job opportunities and local tax revenues.
- Improve public health and the environment.
- Utilize existing public infrastructure.
- Eliminate neighborhood blight, thus improving a community's image and long-term sustainability.

Photo: Mike Burns - <http://www.flickr.com/photos/eklektikos/22507252/>



**Redevelopment area of Dubuque, Iowa.**



**Eagle Point Park, Dubuque, Iowa.**

Photo: Todd Ehlers - <http://www.flickr.com/photos/eklektikos/22507252/>

*The revitalization of this brownfield area (left) can help direct growth in already developed areas, allowing critical undeveloped areas to stay preserved as open space and protecting valuable ground water recharge areas such as Eagle Point Park in Dubuque, Iowa, pictured on the right.*

land, and both improve and protect the environment.

USEPA's *Ground Water Use and Value Determination Guidance* (<http://www.epa.gov/region1/brownfields/guidance/grndwter.htm>) combines the goals of two major regional initiatives: the Superfund Beneficial Reuse Initiative and the Comprehensive Ground Water Protection Strategy. As part of the Superfund Beneficial Reuse Initiative, this guidance is intended to result in more informed and focused decision making, and more common sense, cost-effective ground water cleanups that will facilitate the beneficial reuse of contaminated properties.

Whereas in the past developers avoided these contamination hotspots, in recent years they have been more willing to work with state and local entities to find mitigation solutions in order to revitalize these properties. For example, whether developers receive state assistance or strike deals with other private parties to attend to contamination, they must address liability concerns. Getting financing is often difficult without some assurance that a property will not be haunted later by environmental liability. Many state environmental agencies now agree to write "comfort letters" to help establish whether environmental conditions at the site might be a barrier to redevelopment or transfer and ease liability concerns.





## GROW SMART WITH GROUND WATER IN MIND

“Smart growth” is emerging as a key approach to protecting ground water from development. It is an approach that serves the economy, the community, and the environment as an alternative to sprawl. It takes the terms of the development debate away from the traditional question of growth versus no growth to how and where new development is best accommodated while preserving ground water and other natural resources.

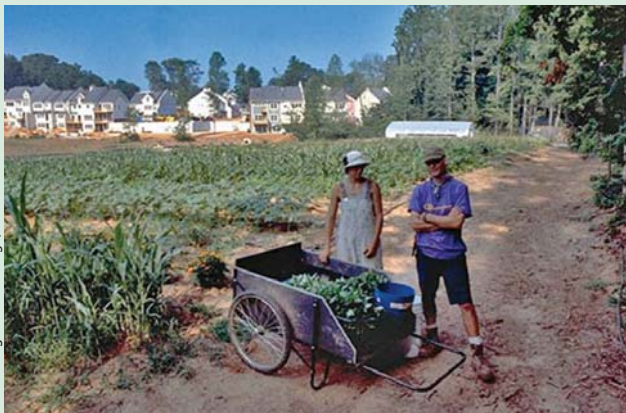


Photo: Village Habitat Design, LLC

*An organic garden that is part of a preserved open space designed into the East Lake Commons in Decatur, Georgia.*

Smart growth is about what people want their communities to be like—places to gather, vibrant streetscapes, transportation choices, residential choices. Ground water protection is just one benefit of following smart growth principles. These development practices support environmental goals by preserving open spaces and parkland and protecting critical habitat; improving transportation choices, including walking and bicycling; promoting brownfields redevelopment; and reducing impervious surfaces in order to improve water quality and help ensure adequate water supplies.

Smart growth is also about finding new ways to develop resourcefully and cost-effectively. Studies show that compact growth can help communities reduce water demand and save on water delivery costs. For example, encouraging compact development in areas where infrastructure already exists can ease both the demand for, and the cost of, water. Smaller lots mean less per capita demand. If development takes place in areas that are already served by existing services, then replacing and repairing that service system accomplishes two goals: it serves new customers and maintains service standards for established customers.

### Smart Growth Principles for Protecting Community Water Resources

- Establish community goals for water resources in the three-dimensional watershed.
- Direct development where most appropriate for comprehensive watershed health.
- Minimize adverse impacts of development on watershed health, including ground water.
- Promote opportunities for restoration (e.g., brownfields redevelopment).
- Assess and prevent unintended consequences of federal, state, and local decisions affecting three-dimensional watershed health.
- Plan for safe, adequate, and affordable water supplies as an integral part of growth.
- Consider the cumulative impacts of growth-management decisions on the three-dimensional watershed.
- Monitor and evaluate the success of initiatives.

*Adapted from USEPA. Protecting Water Resources with Smart Growth, May 2004.*

Today, successful brownfields projects are cropping up all over the United States. For example:

- **Jackson, Mississippi**, is revitalizing its downtown and preserving its heritage by cleaning up and redeveloping sites in the city’s historic district—the oldest post-emancipation African-American residential and commercial area intact today. The project strategy will include

selecting and assessing 100 sites, identifying redevelopment barriers, developing a comprehensive redevelopment plan for the sites, ensuring community involvement, and coordinating cleanup activities.

- HarborPark in **Kenosha, Wisconsin**, is a 69-acre redevelopment on the lakefront site of a former AMC-Jeep factory. The site is bounded



by downtown Kenosha, Lake Michigan, and the Southport Marina, which blends park and open space development with a new public museum, new residential housing, and a planned commercial district. With extensive community input, HarborPark provides year-round lakefront enjoyment including a public gathering space, public transportation via a trolley system, and pedestrian and biking paths.

- **Dubuque, Iowa**, underwent a transformation with the redevelopment of its port and waterfront area. Situated on the banks of the Mississippi River, Dubuque's once vibrant industrial and manufacturing port area fell into decline and disrepair. The city's efforts to redevelop the waterfront have turned the area into America's River Campus, complete with entertainment and recreational venues such as the Grand Harbor Resort and Waterpark, a riverfront casino, plaza, amphitheater, as well as open space and natural recreational areas. The city is using a federal brownfields cleanup grant to address a petroleum plume—resulting from former use as an aboveground petroleum storage tank yard—that is contaminating a five-acre area between the hotel and the riverfront casino. Petroleum hydrocarbons exist in the soil and ground water, and in order to return this property to productive use, cleanup was deemed necessary.

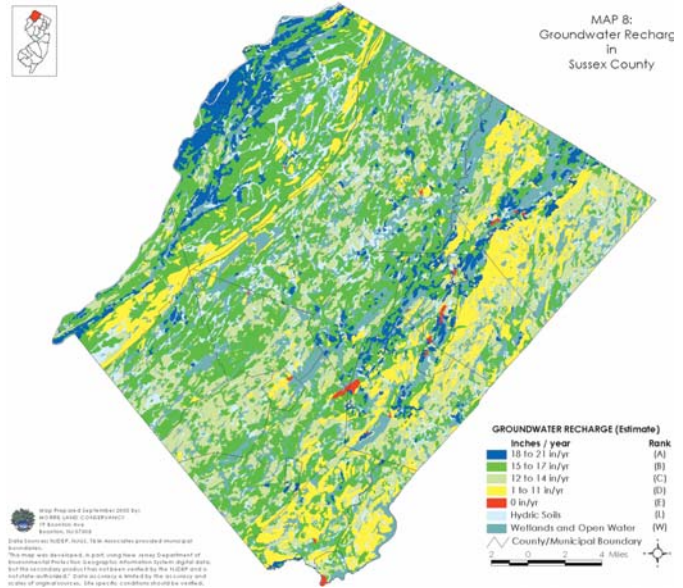
### WHAT DO LOCAL GOVERNMENTS NEED TO KNOW ABOUT GROUND WATER?

Local land-use decision makers need access to a range of water resource information so they have the tools to make land-use decisions that are based on a plan, and so they can effectively use other land-use tools, such as subdivision and zoning ordinances.

Technical information is necessary to determine:

- Where ground water resources are located (both current and future sources of drinking water and ground water resources that may be more suitable for other uses).
- Where ground water/surface water interaction is occurring.

## GROUND WATER RECHARGE IN SUSSEX COUNTY, NEW JERSEY



**Figure 3.** Highest ranking estimated ground water recharge is shown in blue and green (18 – 21 inches per year and 15 – 17 inches per year, respectively) with areas of lowest estimated recharge of 0 inches per year shown in red. Local governments need mapping information, such as recharge areas and aquifer vulnerability, as well as land use information that indicates potential sources of contamination in order to plan effectively with ground water resources in mind.

Source: Morris Land Conservancy 2003. <http://www.morrislandconservancy.org/JPG/Groundwater%20Recharge%20in%20Sussex%20County.jpg>

- How much ground water is sustainably available for human uses.
- How much ground water is needed to sustain healthy ecosystems.
- The location of ground water recharge areas.
- The quality of ground water and the most appropriate uses for the varying quality of ground water.

Tools such as Geographic Information System (GIS) overlay maps and remote-sensing technologies are particularly valuable for developing or revising comprehensive plans. Ground water characterization, monitoring information, data collection, and data analysis within delineated watershed boundaries are also key to an efficient and effective ground water management program.



## PROTECTING GROUND WATER RECHARGE AREAS IN NEW CASTLE COUNTY, DELAWARE

Since the late 1980s New Castle County has enacted measures to protect both ground water recharge areas and wellhead protection areas. Key components of this program include detailed and updated maps that are readily available to the public and to developers; limits on impervious cover within protected areas; prohibitions on storage of hazardous substances; options for flexibility, including developing clean ground water recharge basins; and the use of a technical advisory committee to advise the county on specific cases. The advisory committee meets monthly to advise the county on proposed developments within the critical areas to assure that the ground water resources are maintained at predevelopment quality and quantity.

### TEMPLATES FOR LOCAL GROUND WATER PROTECTION

There many examples of material that has been developed to assist local governments in protecting their water resources. Here are four excellent examples:

#### **Georgia's Water Resources Toolkit for Local Governments**

Georgia's *Water Resources Toolkit for Local Governments* website brings together a wide variety of useful information to help address the issues facing local governments. It is a basic educational tool for local officials and employees new to water resource management and, because of its comprehensive nature, is also a valuable resource for elected officials and water resource staff already familiar with water management concerns.

The website pulls together a wealth of resources to help local government officials address water management issues and relies heavily on the resources found on the Internet. This site will provide users access to the most current regulatory, educational, and decision support information available. It also provides users with a brief introduction to the issues as well as links to additional information. It would be impossible to provide sufficient printed information to adequately cover all the topics that are presented in the site.

To visit the website, go to: <http://www.georgiaplanning.com/watertoolkit/main.asp?PageID=3>

#### **LGEAN's Long-Term Hydrologic Impact Assessment (L-THIA) Model**

The Local Government Environmental Assistance Network (LGEAN), located at Purdue University, has developed a "Long-Term Hydrologic Impact Assessment" (L-THIA) model to assist local officials in considering the impact that land-use changes will have on a community's water quality. The model was developed as an accessible online tool that can be used to generate community awareness of potential long-term problems and to support planning aimed at minimizing disturbance of critical areas. The L-THIA model is packaged in the following ways, based on level of detail:

- **Basic L-THIA**—Users need only to input their location, soil type, and the type of land-use change taking place.
- **Impervious L-THIA**—Allows users to input the percentage of impervious cover of different land uses.
- **GIS L-THIA**—Enables users to download an ArcView GIS version of L-THIA for PCs.
- **Detailed Input L-THIA**—Enables users to input detailed and customized land uses.
- **Advanced Input L-THIA**—Enables users to input detailed and customized land uses and customized pollutant coefficients

To visit the website, go to: <http://www.ecn.purdue.edu/runoff/lthianew/>



### Community Planning & Zoning for Groundwater Protection in Michigan—A Guidebook for Local Officials.

This excellent guidebook was written by Lillian F. Dean and Mark A. Wyckoff for the Office of Water Resources, Michigan Department of Natural Resources. It was printed by the Michigan Society of Planning Officials (MSPO) with funding assistance from the W.K. Kellogg Foundation under the Groundwater Education in Michigan (GEM) program. The GEM project provides assistance and resources to organizations, schools, colleges, and elected officials around the state to stress the importance of ground water protection. MSPO uses the guidebook as a valuable reference in its courses for planning and zoning officials.

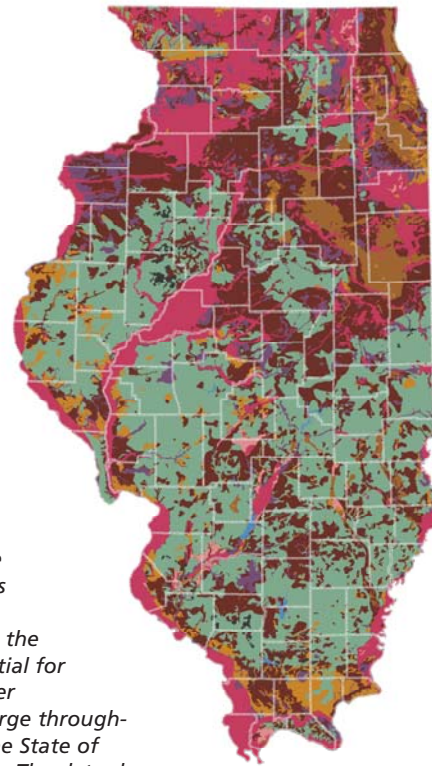
Access the guidebook at: <http://www.vbco.org/planningeduc0029.asp#INLINK002>

### The Land Information Access Association's Community Information Systems

Land Information Access Association (LIAA), a non-profit organization in Traverse City, Michigan, provides citizens and public officials access to information about the cultural and natural resources of their communities and provides tools necessary for informed land-use planning. LIAA's program

*Memphis, Tennessee, audience listens to their mayor's vision for the city at a Greening Greater Memphis Summit in February 2007. Groups and citizens signed a manifesto signifying their support and commitment for creating a region that is competitive, healthy, safe, and environmentally wise through the creation of more parks, greenlines, greenways, and outdoor recreation.*

## ILLINOIS STATEWIDE POTENTIAL FOR AQUIFER RECHARGE



**Figure 4.** This map shows the Potential for Aquifer Recharge throughout the State of Illinois. The data shown here, along with information on aquifer vulnerability and the locations of potential contamination sources, allowed the state to establish priority aquifers, as required under the Illinois Groundwater Protection Act. This information is extremely helpful to local communities as they plan for development or redevelopment.

Source: <http://www.epa.state.il.us/water/targeted-watershed/groundwater.html>

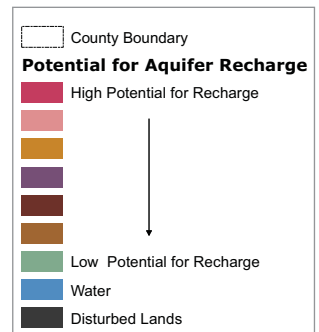


Photo: Gary Bridgman - <http://www.flickr.com/photos/wolfriver/411218053/in/photostream/>



Photo: Bill Vedra

**Ohio sprawl.**

“Building a Sense of Place” involves the development of Community Information Systems (CIS). CIS has enabled communities throughout Michigan to set up a number of innovative information resources, including touch-screen information kiosks and multimedia presentations on CD-ROM. CIS can deliver zoning ordinances, photographs of sites, information about local history, and links to local and regional agencies. Citizens can view community information contained in various databases of local, county, and state agencies. LIAA also works to make Geographic Information Systems (GIS) data available for a range of citizen needs.

For more information, go to:

<http://www.smartcommunities.ncat.org/toolkit/TCDDM/LIAA.htm>

## THE STATE ROLE IN LAND USE

Most state agencies recognize the pivotal role local governments play in managing water resources, and some states are more enabled than others to drive or assist in local planning decisions that further ground water protection. In its 2001 report *Environmental Protection: Federal Incentives Could Help Promote Land Use That Protects Air and Water Quality*, the U.S. General Accounting Office (GAO) reported that most states and localities do not comprehensively assess the impacts of existing land use or future development

on water quality and systematically factor such analysis into water quality protection and improvement plans. The relatively few jurisdictions that have the necessary resources and support from local decision makers and the public are more likely to do this.

Clearly, the more support local governments can get from state and regional agencies and research institutions the better. The GAO report specifically points to the lack of funding, technical staff, and public and

official support as important impediments to a greater assessment of the impact of land use on water quality. It says that analyzing the impacts of existing and future land uses on water quality is technically difficult and resource-intensive, and that neighboring jurisdictions often do not have, or will not share, funds and staff. The report also notes that “many local development codes, zoning laws, and building ordinances, as well as much state-planning legislation, are outdated, are not based on a consideration of the need for environmental protection, and do not allow for more innovative land-use practices that protect water quality.”

The report adds that while some jurisdictions with sufficient resources and public and official support have begun to employ land-use management practices and development strategies that limit adverse effects on water quality, many local land-use decision makers do not understand the relationship between their decisions and water quality, or they feel pressure to focus on economic development rather than environmental concerns.

Public agencies and research institutions that collect and analyze water-related data and other information can and should leverage their efforts by routinely making relevant material available to municipal land-use decision makers. Local governments also need the wherewithal to use this information. Geographic Information Systems (GIS) and other tools help local



land-use decision makers recognize the spatial link between land use and water resources and visualize the impacts of alternative land-use planning scenarios.

The states are key to supporting and bolstering local land-use decisions. Through statutes, planning enabling legislation, policies, model ordinances, and guidelines, states have varying means to:

- Address specific ground water management goals.
- Require state review of certain types of development proposals in order to:
  - encourage development practices that limit threats to ground water.
  - evaluate water usage/demand as well as water quality impacts.
  - educate planning and zoning boards on sensitive source water protection areas.
- Require local authorities to control potential contamination sources by:
  - establishing mechanisms such as construction standards, operation and maintenance standards, performance standards, and siting criteria.
  - providing educational and technical assistance and financial and other economic incentives for encouraging ground water protection.

States can enact statutes that enable (or require) local governments to make use of innovative land-use con-

### COORDINATION OF STATE GROUND WATER PROTECTION PROGRAMS WITH OTHER PROGRAMS

#### Land Use Planning

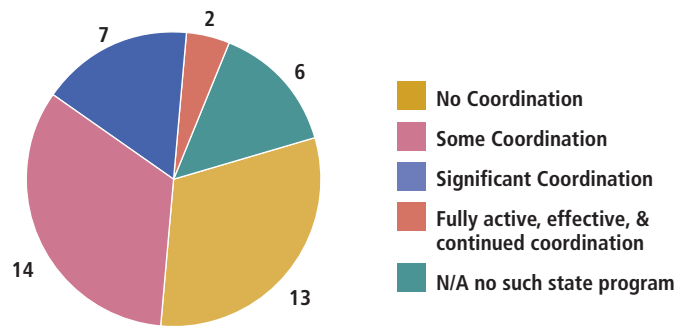


Figure 5. Only 2 of 42 state ground water programs reported having fully active, effective, and continued coordination with their own state-level land-use planning program, while 13 states reported no coordination at all between the ground water protection and land-use planning programs at the state level.

Source: GWPC-NGWA Survey of State Ground Water Programs, 2006.

trols to meet certain ground water and other water resources objectives. It is important that state legislatures provide these specific powers statutorily so that communities have the legal backing if they elect to move ahead with their own ordinances. A number of states are moving toward enacting statutes that call for adoption of “smart growth” principles that promote a more rational use of existing developed land and buildings in order to preserve natural, scenic, and historic resources.

States originally passed enabling legislation that gave local governments various types of permission to plan, but they did not require it. This generally

**Ground water is one of North Dakota's most valuable resources. It is considered essential for maintaining sensitive aquatic ecosystems (e.g., rivers, lakes, wetlands), industry, agriculture, small communities, and private homes. As communities continue to grow, they will need to give serious consideration to how new development will impact local ground water resources and adopt strategies and tools to protect ground water in order to sustain long-term economic and environmental viability.**



Photo: Ian T. Farragher



followed the model State Planning Enabling Act developed in the 1920s. Since then, many states have chosen to require one or more categories of local government to develop local comprehensive plans. Most states list elements that should or must be in a plan. The level of specificity and detail varies widely. ([http://www.ibhs.org/publications/downloads/20070327\\_095149\\_22013.pdf](http://www.ibhs.org/publications/downloads/20070327_095149_22013.pdf))

## How Can States Set the Stage for Water Resource Protection?

There are many examples of state-level planning requirements and guidance that advance the cause of water resources protection. Here are some examples from Florida, Arizona, and Colorado.

### Florida: Preservation 2000 Program

In Florida the purchase of natural, environmentally sensitive areas by both state and local governments has been the most successful land-use measure taken in protecting the state's vulnerable areas. Concerned that at the 1990 rate of development, some three million acres of wetlands and forests would be converted to other uses by the year 2020, dooming much of the state's freshwater aquifer recharge areas, unique ecological diversity, open space, and recreational lands, as well as many of the state's 548 species of endangered and threatened animals and plants, Florida lawmakers determined that the single most effective way to accomplish large-scale gains in the state's environmental well-being would be to substantially increase the level of funding for the state's land-acquisition programs. Thus Preservation 2000 (P2000), the most ambitious land-acquisition program in the United States, was created, establishing a mechanism for sup-

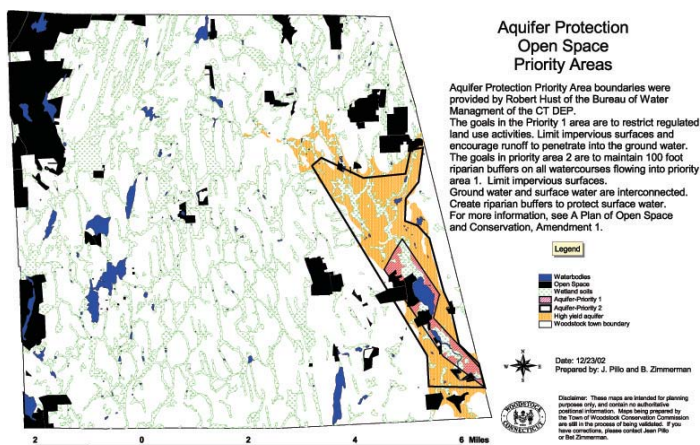
plemental funding of existing land acquisition programs.

So far, P2000 has preserved more than 1.75 million acres of conservation land throughout the state. The program has been successful in saving many of Florida's unique and fragile environmental habitats and spawning local community conservation efforts. More than 20 local governments have matched state funds to purchase environmentally sensitive lands to fulfill their conservation needs. (Source: <http://www.dep.state.fl.us/lands/acquisition/P2000/BACK-GRND.htm>)

Another Florida program more directly related to ground water is the "Spring Initiative Program," which allocates money to conduct hydrogeological research and to help in writing protective statutes and regulation to protect spring sheds in Florida, including submarine springs.

### Arizona: Groundwater Management Act

Rather than rely on water markets, a public trust doctrine, or some combination of the two, several jurisdictions around the country have crafted policies that specifically require a link between water availability and development. Perhaps the most sweeping such policy is Arizona's Groundwater Management Act (GMA), adopted by the legislature in 1980 in response to a growing concern over pumping and using ground water at a rate faster than it can naturally replenish itself. Ground water is the source for about half of the total annual demand for water in the state. Like most western states, agriculture accounts for about 70 percent of water use in Arizona, although this percentage is slowly decreasing as



**Figure 6.** The Connecticut Aquifer Protection Program recognizes that the most effective way to prevent contamination of the state's most prolific drinking water resources is to control land uses in areas that contribute recharge to the stratified-drift aquifers. In this map, Aquifer Protection Priority Area boundaries were provided to the local community by the Connecticut Department of Environmental Protection. Goals in the Priority 1 area (in pink) are to restrict regulated land-use activities, limit impervious surfaces, and encourage runoff penetration into the ground water. Goals in the Priority 2 area (thick black outline) are to maintain 100-foot riparian buffers on all watercourses flowing into the Priority 1 area and limit impervious surfaces, recognizing the interconnection of ground water and surface water.

Source: [http://www.woodstockconservation.org/images/mapsgif/priority\\_aquifer.gif](http://www.woodstockconservation.org/images/mapsgif/priority_aquifer.gif)



## CASE EXAMPLE



### THE USDA FOREST SERVICE'S BUDDING GROUND WATER PROGRAM

USDA Forest Service (USFS) lands comprise 193 million acres of forests and grasslands in 42 states and Puerto Rico and encompass the source water areas for many important rivers and local and regional aquifer systems. USFS lands are the largest source of municipal water supply in the United States, serving over 66 million people in 3,400 communities in 33 states. These lands are the largest single source of water in the continental United States—over 14 percent of available supply. At the same time, grazing and logging activities on USFS lands can have a significant effect on the distribution and availability of water. These lands also contain more than 38,000 abandoned or inactive mines and several hundred nonmining Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) cleanup sites.

#### The USFS Ground Water Program

The USFS has been experiencing increasing water development pressures on its lands and has recognized the need to take a more comprehensive view of its water resources and agency responsibilities, as well as build its in-house technical capacity. Thus, overcoming a 100-year orientation toward surface water, the agency initiated a ground water program in 2005. The program is organized around management of ground water-dependent resources and is conceptualized as a cooperative resource management effort with states, providing project-level technical assistance where needed.

While recognizing its ground water responsibilities, the agency has limited staffing, no specific ground water funding, and limited knowledge of the existing ground water resource base. Nevertheless, the

municipal demand increases and the agricultural economy declines.

The GMA created four “active management areas” (AMAs) around the state’s most populous areas. The primary intent of the GMA is to sustain a long-term balance between the amount of ground water withdrawn in each management area and the amount of natural and artificial recharge. This is accomplished

#### LAND USE IN GROUND WATER PWS AREAS IN THE STATE OF MAINE

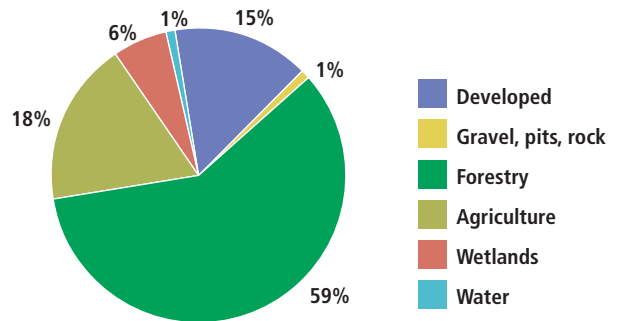


Figure 7. In Maine, land use in ground water source protection areas, based on an analysis of 1990 imagery, is about 15% developed, and almost 20% agriculture.

Source: <http://www.maine.gov/dhhs/leng/water/forms/Sections/Resolve029finalrpt.htm>

USFS is working to strengthen its program by:

- Establishing a clear internal policy.
- Educating USFS decision makers.
- Developing cooperative inventory and monitoring efforts for USFS ground water resources.
- Educating the public on the importance of ground water resources on public lands.
- Instituting constructive dialogue between the USFS and states on cooperative ground water resource management and national ground water issues.

The USFS Technical Guide to Managing Ground Water Resources is now available at:

[http://www.fs.fed.us/biology/resources/pubs/watershed/groundwater/ground\\_water\\_technical\\_guide\\_fs-881\\_march2007.pdf](http://www.fs.fed.us/biology/resources/pubs/watershed/groundwater/ground_water_technical_guide_fs-881_march2007.pdf)

through a combination of mandatory water conservation requirements and incentives to augment existing supplies. To help achieve the goal of “safe yield,” the GMA prevents new subdivisions from being approved in AMAs unless developers can prove that renewable water supplies are available for 100 years. Water managers in the state say the program is responsible for much of the substantial progress that has been made in fast-growing municipalities to





move away from ground water overdraft toward renewable water supplies, including water from the Colorado River and reuse of effluent. (Source: <http://www.lincolninst.edu/pubs/PubDetail.aspx?pubid=794>)

### **Colorado: Extraterritorial and Cooperative Powers for Municipalities**

Colorado has placed the majority of land-use responsibility and control at the local (county and municipal) level of government. For example, county and municipal planning commissions are required to prepare and adopt a comprehensive plan for the physical development of their jurisdictions. They also have broad authority to plan for and regulate the use of land, with no prescribed restrictions, conditions, or procedures.

In addition to the more typical statutes regarding the use of land within respective jurisdictions, the state has other statutes that give one jurisdiction certain powers over land-use activities in a different jurisdiction. Specifically, a municipality may construct waterworks outside its boundaries and protect the waterworks and water supply from pollution (up to five miles above the point from which the water is taken). Also, a municipality may establish, manage, and protect its park lands, recreation facilities, and conservation easements (including the water in those parks) located beyond city limits. (Source: <http://www.cde.state.co.us/artemis/loc6/LOC62L222006INTERNET.pdf>)

## **THE FEDERAL ROLE**

USEPA has been active in helping states and communities realize the economic, community, and environmental benefits of “smart growth” by providing communities with information, model programs, and analytical tools; working to remove federal barriers that could hinder smarter community growth; and creating new resources and incentives for states and communities pursuing smart growth. (<http://www.epa.gov/dced/>)

Besides USEPA, other federal agencies that have authorities and activities that can impact ground water include the Bureau of Land Management, U.S. Department of Agriculture (e.g., Forest Service), U.S.

Department of the Interior (e.g., National Park Service), U.S. Bureau of Mines, and the U.S. Department of Transportation. Many of these agencies have been directed by Congress to manage lands, in part, for water, watersheds, and streamflows.

## **PARTNERS FOR LAND-USE DECISION MAKERS**

Both states and local governments can and should promote and participate in partnerships among such entities as federal programs, planning regions, academic institutions, developers, nonprofit organizations, land trusts, businesses, construction companies, and others so that all parties work together to achieve comprehensive and effective approaches to maintaining sustainable water quality and quantity. Some examples and their websites are listed below.

### **NEMO**

The National Nonpoint Education for Municipal Officials (NEMO) Network is a confederation of 29 educational programs in 28 states dedicated to protecting natural resources through better land use and land-use planning. (<http://nemo.uconn.edu>).

### **Cooperative State Research, Education, Extension Services**

The Cooperative State Research, Education, and Extension Service (CSREES) is an agency within the U.S. Department of Agriculture. Natural Resources and Environment is a CSREES broad emphasis area. CSREES conducts its programs primarily in partnership with land-grant university scientists and cooperative extension faculty. (<http://www.csrees.usda.gov>)

### **The National Rural Water Association**

The NRWA is a nonprofit federation of State Rural Water Associations. Its mission is to provide support services to its state associations, which have more than 24,550 water and wastewater systems as members. (<http://www.nrwa.org/au.htm>)

### **The Groundwater Foundation**

This effective nonprofit organization initiated the Groundwater Guardian program and is dedicated to educating and motivating people to care for and about ground water. (<http://www.groundwater.org>)



### The National Association of Counties (NACo)

The NACo effort “Using GIS Tools to Link Land-Use Decisions to Water Resources Protection” is supported by USEPA and is designed to help county officials learn more about tools that model how different decisions influence the various systems in their community. Often dubbed “decision-support systems,” these geographic information system (GIS)–based tools work by bringing together data and models to create real-life scenarios depicting the benefits and consequences of various decision options. ([http://www.naco.org/Template.cfm?Section=New\\_Technical\\_Assistance&template=/ContentManagement/ContentDisplay.cfm&ContentID=21158](http://www.naco.org/Template.cfm?Section=New_Technical_Assistance&template=/ContentManagement/ContentDisplay.cfm&ContentID=21158))

### Land Conservation Partnerships

There are numerous partnership opportunities available to municipalities for protection of their ground water resources through public outreach, implementation support, and access to funding sources. Key among these are state, regional, and local nongovernmental organizations such as land trusts and watershed associations. Many of these organizations are tuned in to a larger support network of organizations with shared land and water protection goals. The following are examples of national land conservation organizations.

- **The Trust for Public Land (TPL)**—The TPL is a national, nonprofit, land conservation organization that conserves land for people to enjoy as parks, community gardens, historic sites, rural lands, and other natural places, ensuring livable communities for generations to come. TPL has played a major role in educating the public on source water protection. (<http://www.tpl.org>)
- **The Nature Conservancy (TNC)**—TNC works to preserve the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. As one of the nation’s preeminent land conservation organizations, TNC operates with the knowledge that unless we protect the natural areas that replenish water supplies, we won’t have the water we need for future generations. ([www.nature.org](http://www.nature.org))



Photo: Robert Whitlock

*Walking around Olympia, Washington, photographer Robert Whitlock noted: “Seeing this sign conjured up a few questions for me. For example: Why is there a ground water protection area? Is the destruction of ground water, one of our most valuable resources for life (along with air), an acceptable part of the current social and economic systems? What about the cost to future generations? How will recent development around the South Sound affect ground water? Currently, what is (are) the biggest threat(s) to ground waters?”*



## Recommended Actions



### To Congress:

- ▶ Support and provide funding to the USGS and state geologic surveys and water resource agencies to support increased ground water resource characterization. The availability of this kind of information will enable local and state governments to direct development in ways that are compatible with the quality, availability, and sustainability of water resources.
- ▶ Include ground water protection targets and continue to provide funding for federal conservation and revitalization programs (e.g., Environmental Quality Incentives Program, Conservation Reserve Program, Land and Water Conservation Fund, Army Corps of Engineers water resources funds, Urban Parks Restoration and Recovery program, EPA Brownfields grant program, EPA watershed grant programs, NOAA Coastal and Estuarine Land Preservation programs).

### To Federal Land Management Agencies (e.g., BLM, Forest Service, USDA):

- ▶ Direct program efforts toward managing lands in a manner that is protective of ground water and specifically focus conservation and protection programs on preserving land within critical ground water recharge and source water protection areas.

### To USGS:

- ▶ Support and conduct mapping of ground water resources for use by local governments.
- ▶ Support and conduct research to provide a scientific basis for understanding how specific land-use practices and land-use changes affect ground water, emphasizing local community needs.

### To USEPA:

- ▶ Enhance EPA Smart Growth/low-impact development outreach and assistance activities and materials to support ground water protection to the same extent as surface water protection, including the following:
  - Support research to provide a scientific basis for understanding how specific land-use practices and land-use changes affect ground water.
  - Encourage state water-quality programs and local governments to utilize available land-use tools to protect ground water.

### To Governors and State Legislatures:

- ▶ Enact legislation to develop state criteria for local governments to incorporate ground water and source water protection elements into zoning regulations and comprehensive planning processes.

### To Local Governments:

- ▶ Ensure that land-use policies and plans recognize and incorporate the protection of ground water resources as integral to sustaining the long-term social, economic, and environmental health of our communities.



Photo: Plum Creek [www.plumcreektx.com](http://www.plumcreektx.com)



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## Suggested Reading

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*Parking Spaces/Community Places: Finding the Balance Through Smart Growth Solutions*. USEPA, January 2006, EPA 231-K-06-001.

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Photo: Payton Chung - <http://www.flickr.com/photos/paytonc/79973436/>

*Suburban Honolulu stretches into the buildable surfaces of mountains and valleys northeast of the city.*