2013 GROUNDWATER FOUNDATION NATIONAL CONFERENCE

Tools for Groundwater Sustainability: Working Together to Meet the Challenges

CONFERENCE PROCEEDINGS

October 15-17, 2013
Mission Inn Resort
Howey-in-the-Hills, Florida

www.groundwater.org

TOOLS FOR GROUNDWATER SUSTAINABILITY: WORKING TOGETHER TO MEET THE CHALLENGES

The Groundwater Foundation's 2013 National Conference

TUESDAY, OCTOBER 15

12:00 p.m. **Conference registration desk opens** *Exhibit area opens for display setup*

3:00 – 4:00 p.m. **Groundwater Guardian Workshop** – presented by The Groundwater Foundation
(El Moro A)

4:00 – 5:00 p.m. **Groundwater Education Opportunities and Tools** – presented by The Groundwater Foundation
(El Moro B)

6:30 p.m. **Networking Dinner**
Welcome by Lake County Commissioner Sean Parks
(El Gitano)

WEDNESDAY, OCTOBER 16

7:30 a.m. **Conference registration desk opens** *Exhibits open*
(Los Reyes Foyer)

8:00 a.m. **General Session**
(Serra A)

Tools for Groundwater Sustainability: What is Needed?
Jane Griffin, The Groundwater Foundation, Lincoln, NE

Panel Discussion – How Do We Achieve Sustainability?
Tim McLelland, Hamilton to New Baltimore Groundwater Consortium, Fairfield, OH
Mitch Bishop, Southern Nevada Water Authority, Las Vegas, NV
Ken Herd, Southwest Florida Water Management District, Brooksville, FL
Christine Spitzley, Tri-County Regional Planning, Lansing, MI

9:00 a.m. **Keeping the Pump Primed: Aquifer Sustainability**
John Jansen, PhD, PG, Cardno ENTRIX, Milwaukee, WI (NGWA McEllhiney Lecture Series)

10:00 a.m. **Networking Break** *Exhibits open*
(Los Reyes Foyer)

10:30 a.m. **General Session**
(Serra A)

Groundwater Sustainability: A Collaborative Approach
Tom Bartol, St. Johns River Water Management District, Palatka, FL

11:00 a.m. **Principles of Estimating the Multiple Efficiency: A Tool for Decision Support in the Process of Choosing Actions for the Protection of Water Catchments**
Rachid Harbouze, Mediterranean Agronomic Institute of Montpellier, Montpellier, France

11:30 a.m. **Groundwater Guardian and Green Site Celebration Luncheon**
(Cortes/DeSoto)

1:00 p.m. **General Session**
(Serra A)

Michigan Byproduct Synergy: Economic Development or Wellhead Protection Tool?
Christine Spitzley, Tri-County Regional Planning, Lansing, MI

1:30 p.m. **Developing Meaningful Collaborations through a Community-Based Groundwater Monitoring Research Program**
Teresa E. Thornton, PhD, Oxbridge Academy of the Palm Beaches, West Palm Beach, FL

2:00 p.m. **Evaluating Sustainability in the Tampa Bay Area**
Warren Hogg, Tampa Bay Water, Clearwater, FL

2:30 p.m. **Networking Break** *Exhibits Open*
(Los Reyes Foyer)

3:00 p.m. **General Session**
(Serra A)

Challenges Associated with Creating a Sustainable Water Use Plan for the State of New Jersey
Joseph J. Hochreiter, CFWP; Senior Environmental Consulting LLC, Yardley, PA

3:30 p.m. **Creative Partnerships for Sustainable Groundwater Management**
Jason Mickel, Southwest Florida Water Management District, Brooksville, FL

4:00 p.m. **Aquifer Watch: A New Educational and Aquifer Data-Gathering Program in Florida**
George H. Edwards, CPG, AquiferWatch Inc., Gainesville, FL

4:30 p.m. **Growing Groundwater Awareness**
Jane Griffin, The Groundwater Foundation, Lincoln, NE

***The originally scheduled presenter, Robert Swanson of the US Geological Survey Nebraska Water Science Center, Lincoln, NE, (presenting Custom Networks from USGS Groundwater Watch Provide Information for Multiple Missions by) was unable to attend due to the Federal government shutdown.*

6:00p.m. **Networking Dinner**
(Plaza de la Fontana)

THURSDAY, OCTOBER 17

8:00 a.m. **Networking Opportunities** *Exhibits Open*
(Los Reyes Foyer)

8:30 a.m. **Sparkplug Breakfast**
(DeSoto D)
Breakfast speaker: James Burks, Senninger Irrigation, Clermont, FL

9:30 a.m. **Break**
(Los Reyes Foyer)

9:45 a.m. **General Session**
(Serra A)

Essential Elements of Groundwater Sustainability
Cindy Kreifels, The Groundwater Foundation, Lincoln, NE

10:00 a.m. **Panel Discussion – Community Education and Engagement**
Jay Beaumont, Orange County, NY
Alys Brockway, Hernando County Utilities, Brooksville, FL
Jane Griffin, The Groundwater Foundation, Lincoln, NE
Cathy Lotzer, Marshfield Utilities, Marshfield, WI

11:00 a.m. **What Do We Know Now? Where Do We Go From Here?**
Christine Owen, Tampa Bay Water, Clearwater, FL

11:30 a.m. **Conference Wrap Up and Prize Drawings**
Were you able to chat with and visit all the exhibitors during breaks? If so, you will be eligible to win a variety of prizes!

12:00 p.m. **Conference Adjourns**

Support for the 2013 Groundwater Foundation National Conference provided by:

NATIONAL CONFERENCE CO-SPONSOR

Senninger Irrigation, Inc.

SUPPORTING SPONSORS

Southern Nevada Water Authority
Valmont Irrigation

ADDITIONAL CONFERENCE SUPPORT

Marshfield Utilities
Lake County Board of County Commissioners, Florida

BACK TO AGENDA

Groundwater Guardian Workshop

Groundwater Foundation National Conference
Tuesday, October 15, 2013
3:00 – 4:00 p.m.
Mission Inn Resort – El Moro A

AGENDA

1. Welcome
2. Groundwater Guardian Program Overview
3. Introductions and Community Overview
   a. Current Groundwater Guardians
   b. Other Community Representatives
4. Small Group Discussions
   a. Community representatives will be paired with Groundwater Guardians to discuss how the program has worked in their community, their community's concerns and issues, their team, and their activities.
5. Next Steps
6. Adjourn

Suggested Discussion Items

- What are some unique things about your community's groundwater situation?
- How did your community get started in groundwater education and protection?
- What has been your most successful groundwater education or protection activity? Why?
- What has been your least successful groundwater education or protection activity? Why?
- What challenges has your community faced? How have they been overcome?
- What kind of support have you seen from the community at large for your efforts? How have you been able to garner support?

BACK TO AGENDA

Groundwater Education Opportunities and Tools Workshop

Groundwater Foundation National Conference
Tuesday, October 15, 2013
4:00 – 5:00 p.m.
Mission Inn Resort – El Moro B

AGENDA

1. Welcome and Introductions
2. Groundwater Education: How and Why
3. Hands-on Activities
    a. Awesome Aquifer (aquifer modeling kit)
        i. Instructions and videos can be found on our website at http://www.groundwater.org/kids/more.html (see Awesome Aquifer and Training About Protecting the Source TAPS).
    b. Learning about Sink Holes
        i. Instructions and videos can be found on our website at http://www.groundwater.org/kids/more.html (see Awesome Aquifer and Training About Protecting the Source TAPS).
    c. Clean Water Challenge
        i. Instructions on Clean Water Challenge can be found on our website at http://www.groundwater.org/kids/trythis.html.
4. Introduction to new Girl Scout curriculum
    a. Information and instructions about these activities can be found on our website: http://www.groundwater.org/kids/ (follow the link in the menu bar to Girl Scouts)
5. Overview of new Division C Science Olympiad event, Hydrogeology: Water for the World
    a. Information and instructions about these activities can be found on our website: http://www.groundwater.org/kids/ (follow the link in the menu bar to Science Olympiad)

For any questions about our activities or how to purchase supplies please contact us at info@groundwater.org or 402-434-2740.

BACK TO AGENDA

SPEAKER BIO

SEAN PARKS

Sean has a Bachelor's degree in Environmental Science and a Master's degree in Engineering Management from the Florida Institute of Technology. He is certified as an urban and regional planner by the American Institute of Certified Planners (AICP) and is a Qualified Environmental Professional (QEP). Sean is also a Certified Horticultural Professional (FCHP), and was elected in 2004 to the Lake County Water Authority.

An ardent leader and supporter of economic development and business friendly initiatives, Sean's interest in serving the citizens of Lake County also focuses on public safety, parks and recreation and water resources.

BACK TO AGENDA

SPEAKER BIO

JANE GRIFFIN

Jane Griffin serves as president of The Groundwater Foundation, a national nonprofit organization whose mission is to educate people and inspire action to ensure sustainable, clean groundwater for future generations. The Groundwater Foundation is based in Lincoln, Nebraska and is a well-respected voice for groundwater education and citizen involvement. Griffin's background includes a B.A. from Smith College in Northampton, MA and a diploma from the Universita' Internazionale dell'Arte in Florence, Italy. Griffin's professional experiences reflect her awareness of the need to educate people to create knowledge of the world around us. She has accomplished this goal through her work with the Make-A-Wish Foundation of Nebraska, the Nebraska Art Association Board, and by co-founding an Italian language school for both adults and children.

PANEL DISCUSSION

How Do We Achieve Sustainability?

PANELISTS

Tim McLelland, Hamilton to New Baltimore Groundwater Consortium, Fairfield, OH

Mitch Bishop, Southern Nevada Water Authority, Las Vegas, NV

Ken Herd, Southwest Florida Water Management District, Brooksville, FL

Chistine Spiztley, Tri-County Regional Planning, Lansing, MI

MODERATOR

Jane Griffin, The Groundwater Foundation, Lincoln, NE

BACK TO AGENDA

SPEAKER BIO

TIM McLELLAND

Tim McLelland is the manager for the Hamilton to New Baltimore Ground Water Consortium in Fairfield, OH. Tim manages a program that has both challenges and opportunities associated with a collaborative approach to Source Water Protection efforts by multiple public water systems and two private companies. Like many communities, the Consortium has to address existing polluted sites, along with sites that have the potential to pollute ground water and sand and gravel active mining operations and former mining operations in or near the wellfields. The Consortium recognizes the need for Source Water Protection and long-term sustainability of the aquifer and has successfully implemented a cost effective way to address each aspect of Source Water Protection Management as a unified group.

Tim has 5 years of combined experience with hazardous materials and waste cleanup as well as Environmental Consulting and 13 years experience managing the Hamilton to New Baltimore Ground Water Consortium Source Water Protection Program.

Tim holds a Bachelor of Science in Environmental Science, Geology Concentration and Earth Science Minor from Morehead State University in Morehead, Kentucky. He is a member of The Groundwater Foundation, the American Water Works Association, and the National Ground Water Association, and serves as Chair of the Hamilton to New Baltimore Ground Water Consortium, Chair of the Ground Water Consortium Public Education Committee, Chair of the Butler County Children's Water Festival, Co-Chair of the Hamilton Earth Day Annual Event, Co-Chair of the Clean Sweep of the Great Miami River Annual Event, and Co-Chair of the Great Miami River Days Annual Event.

BACK TO AGENDA

SPEAKER BIO

MITCH BISHOP

Mitch Bishop coordinates the Southern Nevada Water Authority's Groundwater Management Program and its advisory committee. He has worked for the Water Authority since 2000.

Mitch graduated from UNLV with a bachelor's degree in Communications and a master's degree in Public Administration. He serves on the Groundwater Foundation's Groundwater Guardian Council and on the Colorado River Water Users Association Board of Trustees. Previously, he served on the International Association for Public Participation Board of Trustees. He also volunteers with the Boy Scouts of America.

Mitch and his wife, Kim, have six children. He has lived in Las Vegas since 1979.

BACK TO AGENDA

SPEAKER BIO

KEN HERD

Ken Herd currently serves as Water Resources Bureau Chief for the Southwest Florida Water Management District. As bureau chief of Water Resources, Herd oversees the Water Supply, Resource Evaluation, and Engineering and Watershed Management sections. This bureau provides technical expertise to support all four areas of responsibility of the District. Various programs include water conservation, reclaimed water, alternative water supplies, groundwater modeling, water storage, surface water modeling and flood protection.

Herd served as Water Supply program director since arriving at the District in 2008. From 1986 to 2008, Herd worked for West Coast Regional Water Supply Authority/Tampa Bay Water serving as project engineer, engineering manager and director of Operations and Facilities. Herd also served as program manager of the $1 billion Master Water Plan and project director of the Tampa Bay Seawater Desalination Remediation Project.

Herd's education includes a Bachelor and Master of Science in civil engineering from the University of Kentucky. He is a registered professional engineer in Florida. Herd is a member of the International Desalination Association and recently served on the WateReuse Research Foundation Project Advisory Committee for Desalination Permitting. Herd also participated in the National Research Council Committee on the Advancement of Desalination Technology and was a 5-year member of the National Academies' Water Science and Technology Board.

BACK TO AGENDA

SPEAKER BIO

CHRISTINE SPITZLEY

Christine graduated from Michigan State University with a B.S. in Urban Planning. Since 1990 she has served as the Environmental Programs Planner at Tri-County Regional Planning Commission (TCRPC). TCRPC is located in Lansing, Michigan; the heart of Michigan's Lower Peninsula. Prior to joining TCRPC, she spent three years working for the Ingham County Economic Development Department and Controller's office.

In her role at Tri-County Regional Planning Commission she works with seventy-five municipalities, three counties and various authorities and boards to create effective, economical programs to protect the environment. Projects have included solid waste plans, land use planning, air quality, watershed planning, an annual children=s water festival, groundwater protection, abandoned wells and wellhead protection programs. She is also responsible for the fund raising/grant writing, administration and reporting required to fund and execute these programs.

She is an AICP member of the American Planning Association. She is also a member of the Michigan Section American Water Works Association where she served three as a trustee, co-chaired the Management and Administrative Practices, Safe Water in Ecuador, Youth Education and Audit Committees, and has served on the Planning and Strategy, Program, Community Awareness, Conference Planning, Nominating, and Education Committees. She also served on the Groundwater Guardian Council and is a past President of the Mason Public Schools Foundation. She is certified as a grant writer, reviewer and consultant.

QUESTION 1:

What does groundwater sustainability mean to you?

QUESTION 2:

What do you see as the most important things that will need to happen to move your community/area to groundwater sustainability?

QUESTION 3:

What is the biggest barrier to groundwater sustainability for your community/area? What needs to happen to move past this barrier?

BACK TO AGENDA

QUESTION/ANSWER

BACK TO AGENDA

SPEAKER BIO

JOHN JANSEN

Mr. Jansen has a B.S. in Geology and a M.S. and Ph.D. in Geological Sciences with an emphasis in hydrogeology and geophysics, all from the University of Wisconsin-Milwaukee. He is a Principal and Senior Hydrogeologist for Cardno ENTRIX. John works on a wide variety of ground water projects around the country specializing in high capacity wells and groundwater resource management. He received the NGWA Keith A. Anderson Award in 2012 for service to NGWA and the groundwater industry and is the speaker for the 2013 NGWA McEllhiney Distinguished Lecture Series in Water Well Technology. John holds three U.S. Patents on water well-related technologies and is the lead author of the chapter on borehole geophysics in the third edition of Groundwater and Wells published in 2007. He is a Professional Geologist in seven states, and a Registered Geophysicist in California. He is a member of the Advisory Council on Water Information, a federal advisory committee advising the US government on water research priorities, where he had been active in the development of a national groundwater monitoring network.

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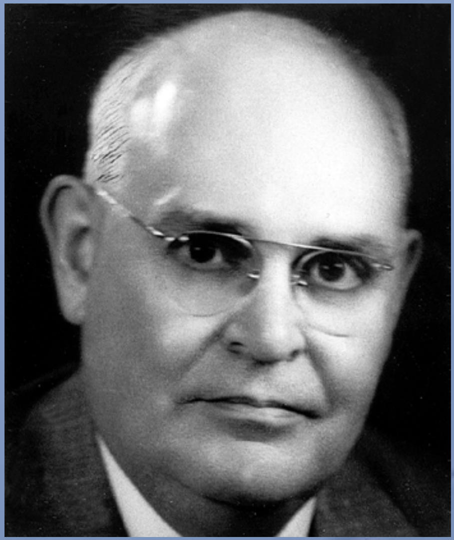
William A. McEllhiney Distinguished Lecture Series in Water Well Technology



National Ground Water Research and Educational Foundation's McEllhiney Lecture Series is supported by a grant from Franklin Electric.

Franklin Electric

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To foster professional excellence in water well technology, the National Ground Water Research and Educational Foundation, has established the William A. McEllhiney Distinguished Lecture Series in Water Well Technology.

Initiated in 2000, the lecture series honors William A. McEllhiney, who was the founding president of the National Ground Water Association in 1948, and a groundwater contractor and civil engineer from Brookfield, Illinois.

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2013 McEllhiney Lecture

Keeping the Pump Primed: Aquifer Sustainability

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What is Sustainability?

- The term sustainability is commonly tossed about, but what does it mean for your well field?
- Your aquifer is the only part of your water system you can’t replace. Are you maintaining it?
- **The one common thing about all unsustainable systems is that they don’t last.**

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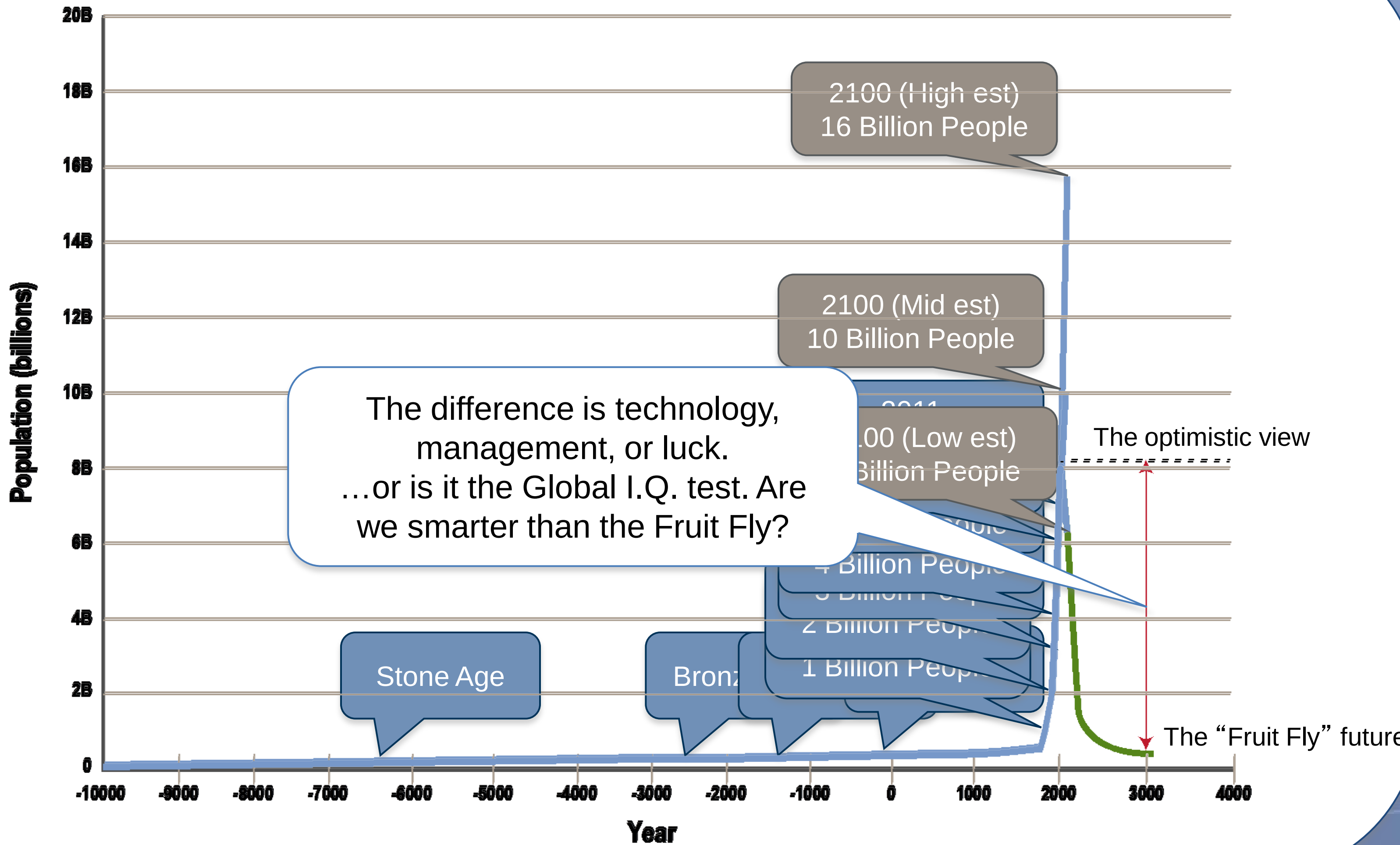
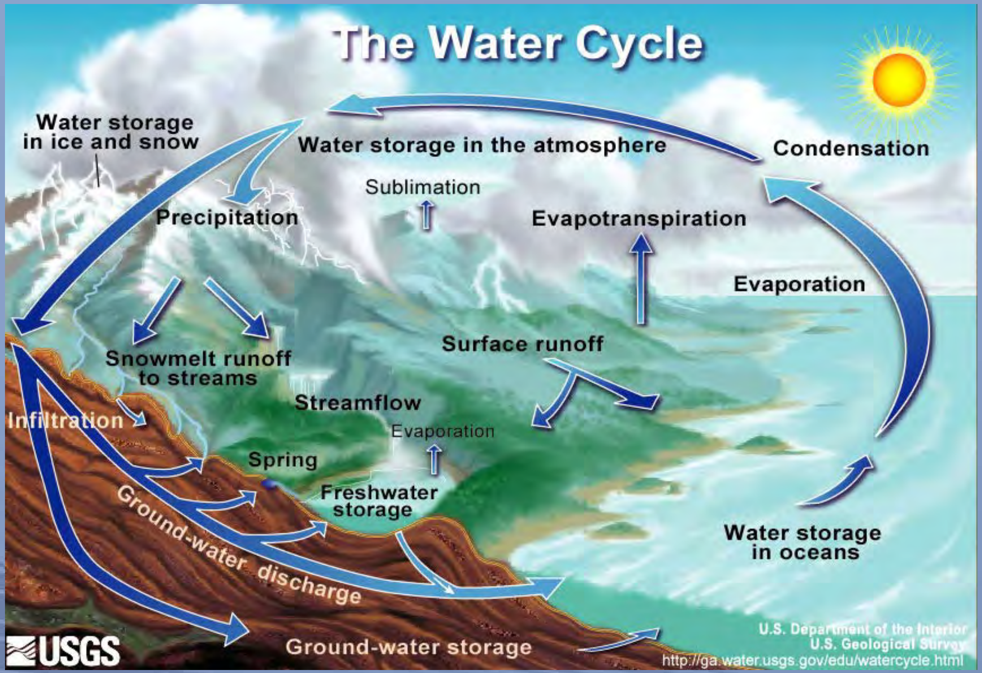
Global Population



Definitions of Sustainability



- “The capacity to endure” (Wikipedia)
- “Equity over time” (Robert Gilman, Context Institute)
- “Sustainable development …meets the needs of the present without compromising the ability of future generations to meet their own needs” (UN Brundtland Commission)

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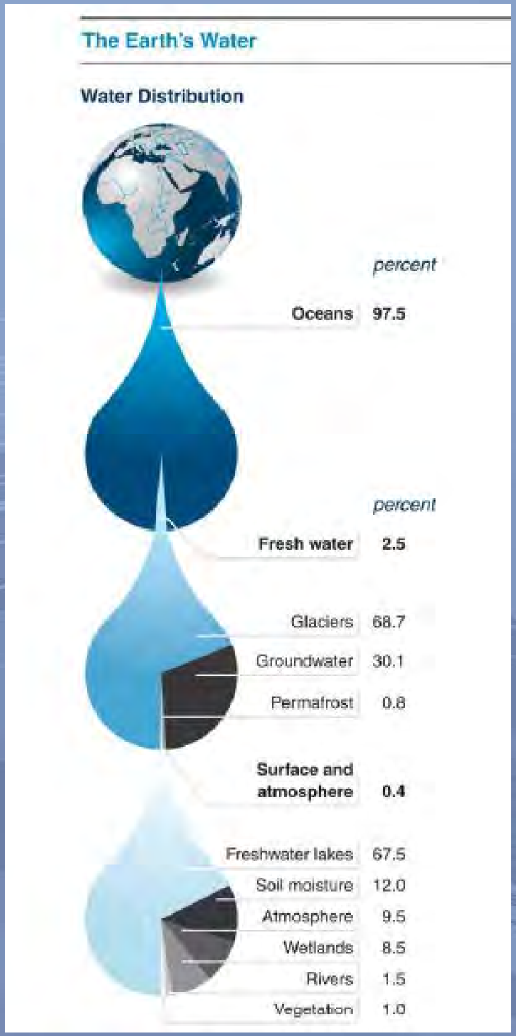
Global Water Resources



Source: World Bank

- 332.5 million cubic miles of water on Earth
  - 1 cubic mile =1.1 trillion gallons
- 97.5% in the oceans
- Only 2.5 % is fresh water
- 1.7% in Glaciers (68.7% of fresh water)
- 0.75% is Groundwater (30.1% of fresh water)
- 0.01% is surface water and in the atmosphere (0.4% of fresh water)

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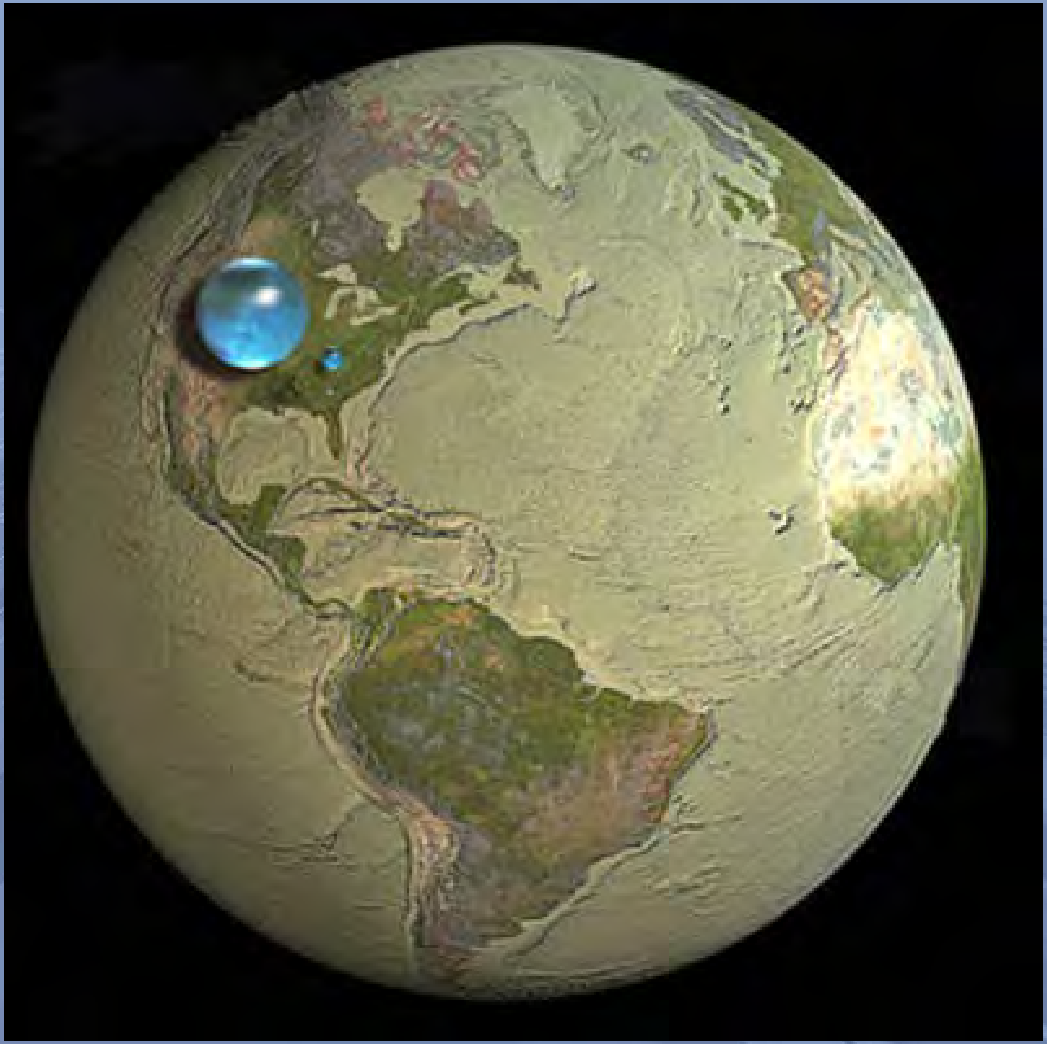
Fresh Water is a Finite Resource



- All the world's fresh water fits in ball 860 miles in diameter
- All groundwater, lakes, swamps and rivers fit in a ball 169.5 miles in diameter
- All lakes and rivers fit in a ball 34.9 miles in diameter

Credit: Howard Perlman, USGS; globe illustration by Jack Cook, Woods Hole Oceanographic Institution

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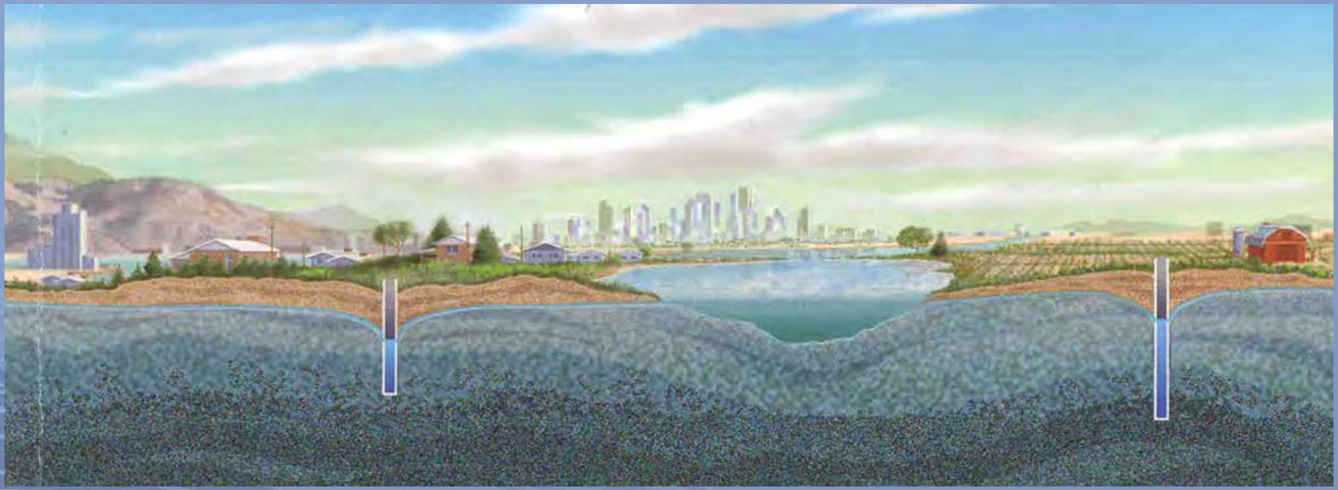
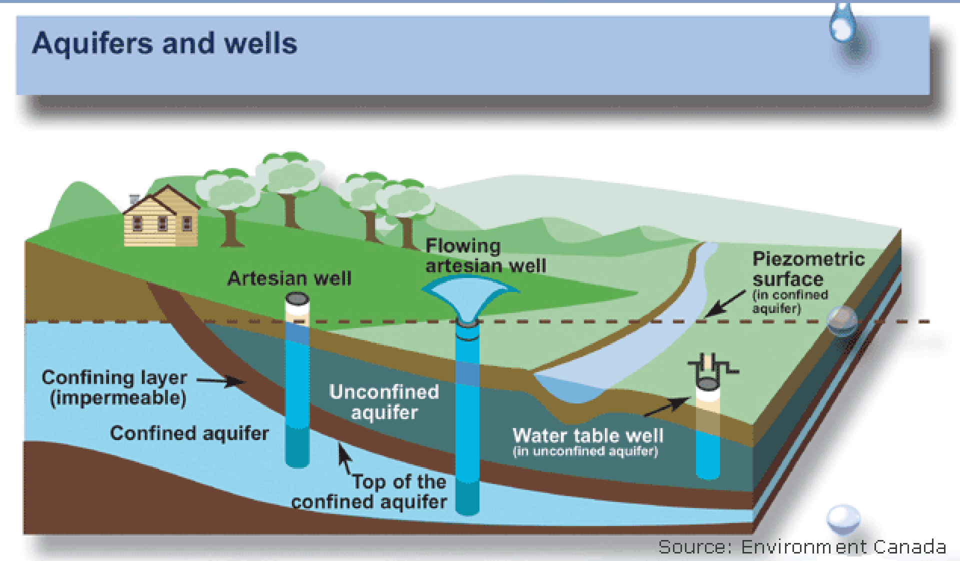
To Be Effective, Groundwater Management Must Consider Environmental, Social, and Economic Needs



Because any use of ground water changes the subsurface and surface environment (that is, the water must come from somewhere), the public should determine the tradeoff between ground-water use and changes to the environment and set a threshold for what level of change becomes undesirable. As development of land and water resources intensifies, it is increasingly apparent that development of either ground water or surface water affects the other.

U.S. Geological Survey Circular 1186

Groundwater Has a Unique Role In Water Management



A key feature of some aquifers and ground-water systems is the large volume of ground water in storage, which allows the possibility of using aquifers for temporary storage, that is, managing inflow and outflow of ground water in storage in a manner similar to surface-water reservoirs.

U.S. Geological Survey Circular 1186

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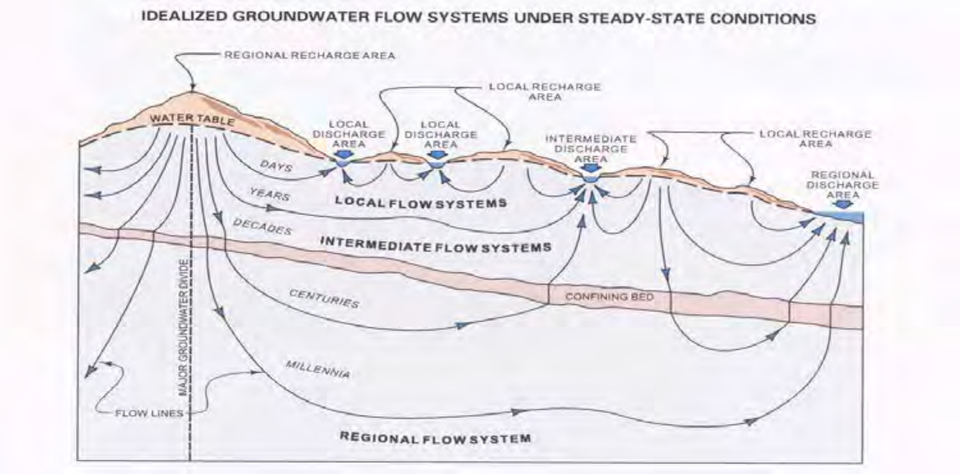
Groundwater is Nature's Canteen

- It stores water when there is an excess
- It releases water when there is a shortage
- It allows us to live in places with no surface water
- It is a critical tool that allows us to move across the planet and thrive in places that would otherwise be uninhabitable

Regional Vs. Local Flow Cells



- Most recharge flows through shallow aquifers in local flow cell
- Some water flows deeper to a regional flow cell
- Some regional aquifers have confining units covering a portion of the aquifer
- Pumping an aquifer will affect surface water somewhere
- Location, magnitude, and time scale of impact will vary for each well and each aquifer
- Shallow aquifers generally show impacts faster than deeper aquifers
- Regional and confined aquifers often have long delays between pumping and the manifestation of the impacts
- Impacts often remote from location of pumping

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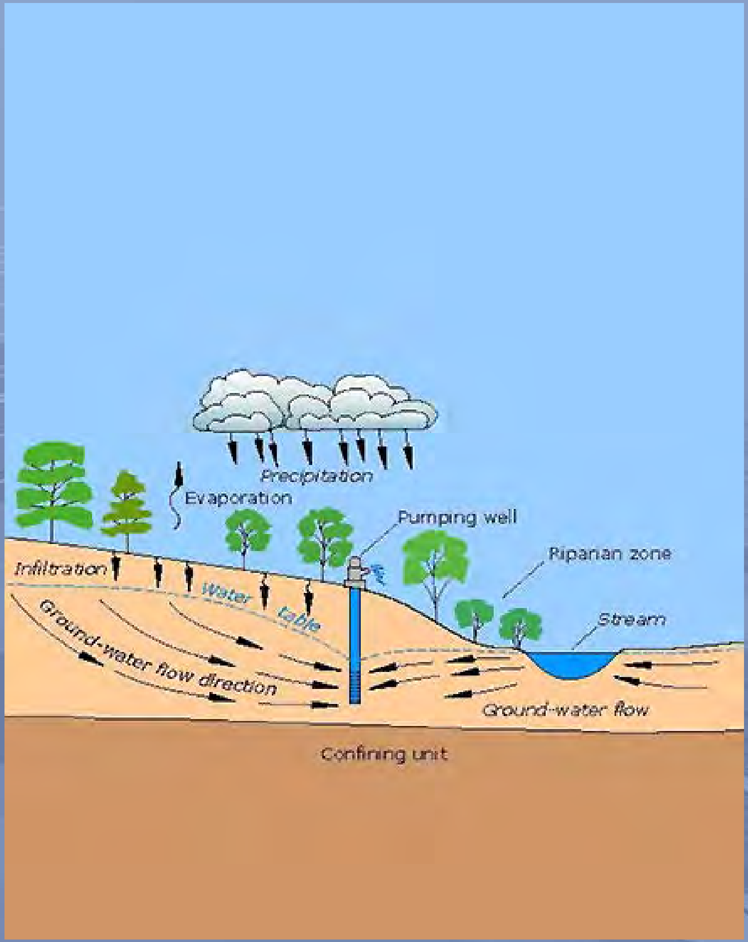
It is impossible to use a natural resource without impacting it



Source:USGS

- Zero human impact means no human use
- The best we can do is understand the impacts, minimize the impacts we can, and manage the impacts we can't minimize
- Resources are finite, so management will come early by choice or later out of dire necessity

- Zero impact is not a practical or desirable goal

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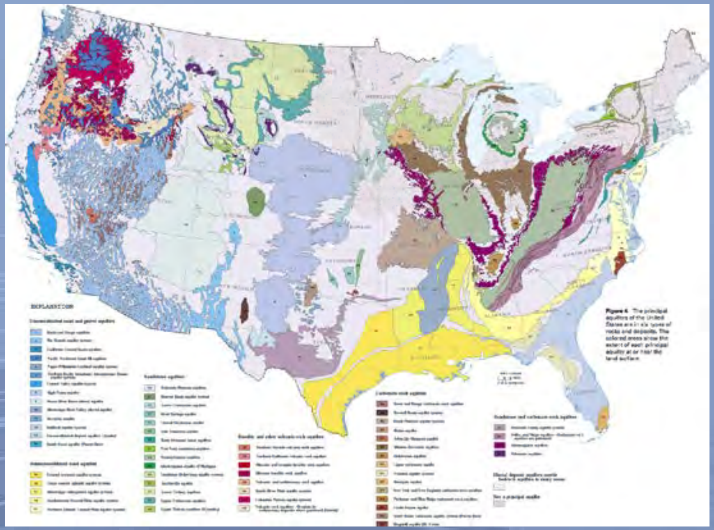
Regional Aquifer Systems Create the Illusion of Limitless Supply



- *Sustainability may not be a viable management concept for confined aquifers"*

(P.A. Macfarlane, Kansas Geological Survey, 1998)

- The Ogallalla has been over drafted for decades
- The Coastal Aquifers have been over pumped and induced salt water intrusion
- Basins in the southwest have experienced tens of feet of subsidence
- Northern Illinois and Southeastern Wisconsin have been over pumping their major aquifer for decades
- Impacts of pumping may take decades to be detected as lost discharge or induced recharge
- Economies based on aquifer mining can be difficult or impossible to change
- Costs climb until new technology or new sources are available or pumping curtailed by market forces

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Many Regions Have Been Drawing Down the Canteen for Decades

"Something can be wrong and still make sense…There is never a shortage of practical, hard-headed people making one wrong decision after another because it makes sense"
(Robert Hass, Former Poet Laureate of US)

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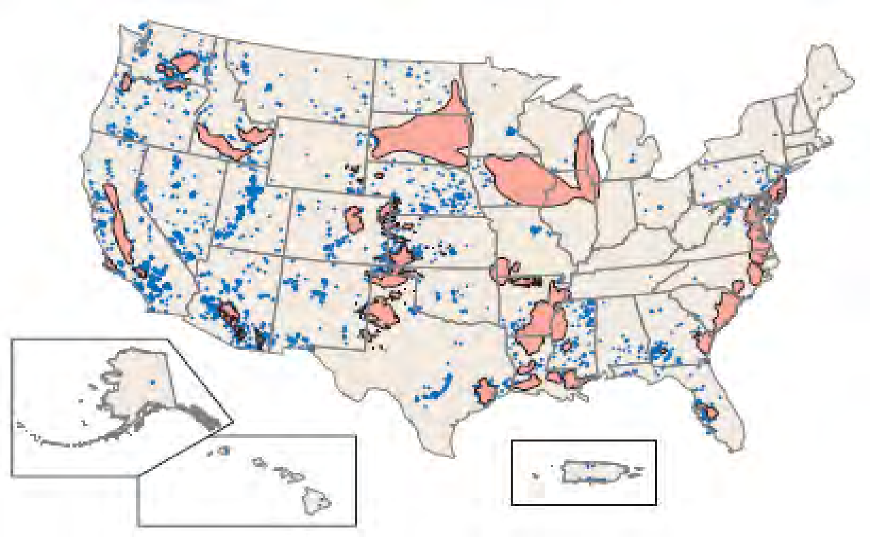
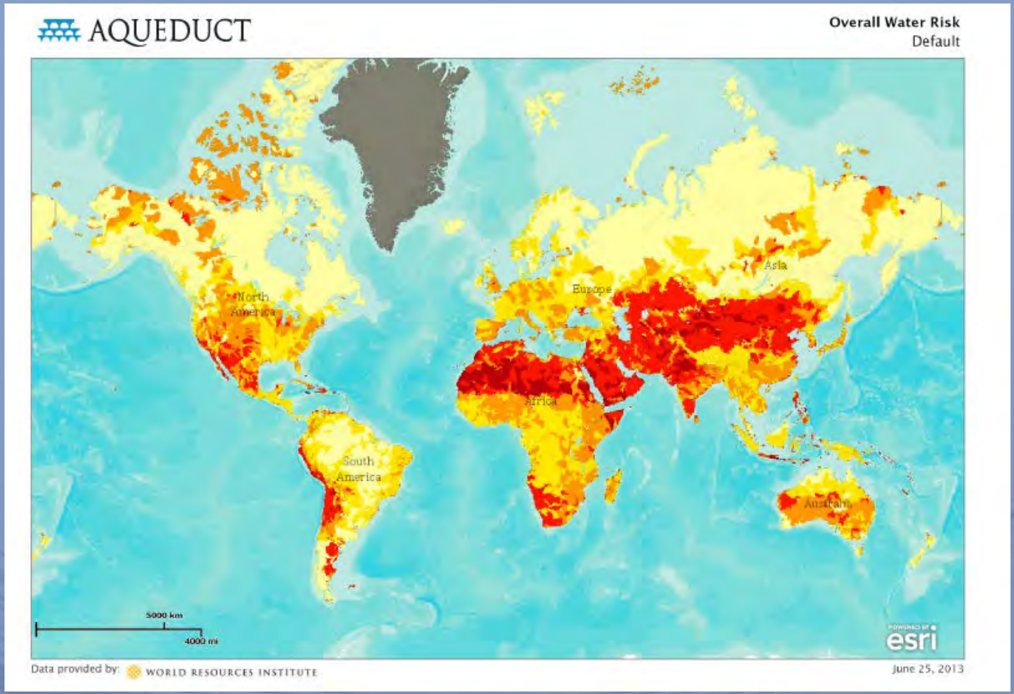
Areas with Sustainability Issues





- Groundwater levels declines documented in nearly every state (SOGW 2009)
- Water quality changes from chemical use in every state (SOGW 2009)
- 36 states facing water shortages now or within 10 years (GAO 2003)
- More than half the states are dealing with water shortages now or within 20 years (NGWA 2004)

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Aquifer Management Varies By State

- Most states manage groundwater but for many different goals
- As of 2005, only about 30% of states incorporate sustainability into water management plans (Viessman and Feather, 2006)
- Some states manage at the point of discharge to sustain surface water quantity and quality (FL, Edwards Aquifer Authority)
- Many western states manage to protect senior surface water rights (Tributary Groundwater in CO)
- Some western states ignore connection between surface water and groundwater (Percolating Groundwater in AZ)
- Some allow controlled depletion (Non-tributary groundwater in CO)
- Some states are trying "Regulated Riparian" approach (MN)
- Texas is a new local and flexible model (with and alphabet soup issue) GMAs set DFCs to determine MAG using their GAMs
- California is the most complex with Riparian, Appropriative, Prescriptive, Overlying, Pueblo, and Reserved rights

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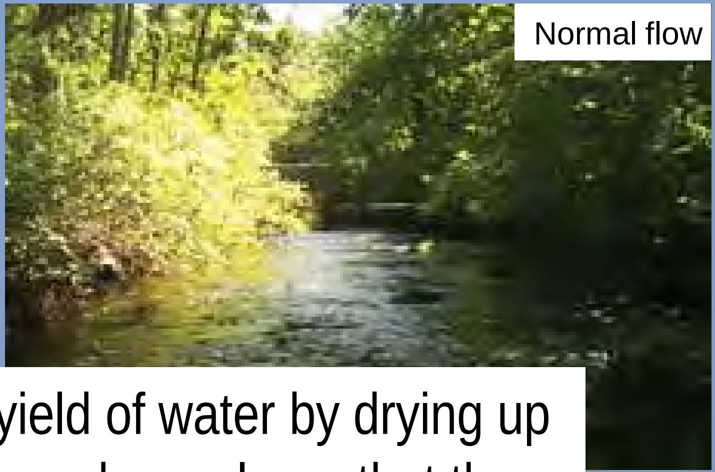
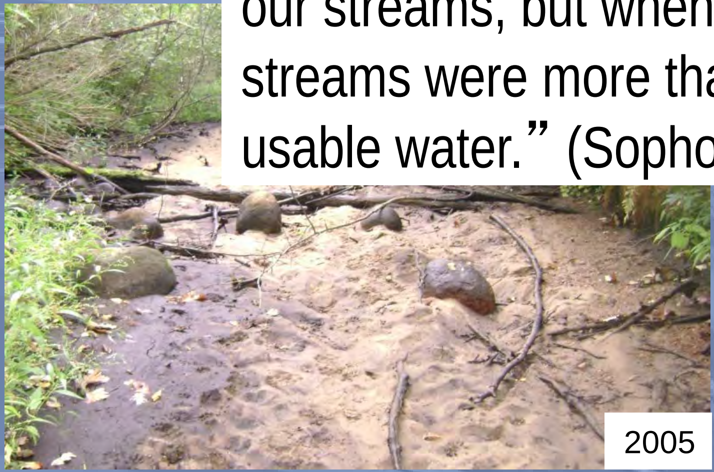
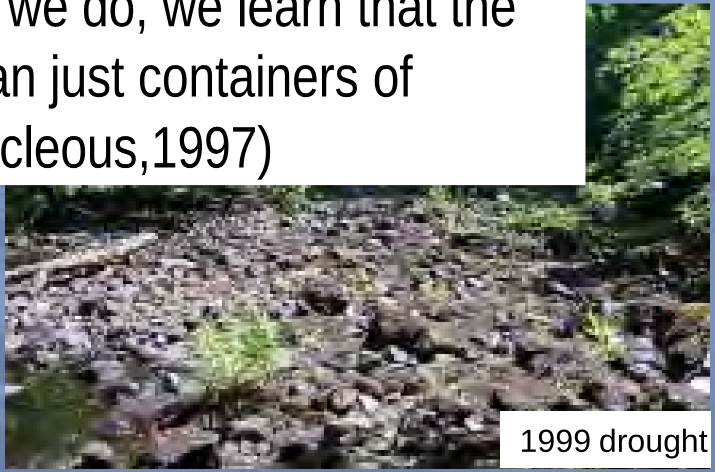
Stream Flow Impacts From Pumping



We can maximize our yield of water by drying up our streams, but when we do, we learn that the streams were more than just containers of usable water.” (Sophocleous,1997)





Little Plover River, Portage County, WI

View of the Ipswich River near South Middleton, Massachusetts (USGS)

Regional Pumping Has Depleted Surface Water in Much of Florida

The same dock in 1990.

Source: U.S. Geological Survey Circular 1186

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White Springs - Recent

Historic Drawdown in the Northeast GMA

Figure 13. Deep aquifer potentiometric surface map of the northeastern GMA for the 2004-2005 period before the first switchover by the Town of Scott. Numbers indicate water level elevations above mean sea level. Two distinct cones of depression are visible here with the Central Brown County cone centered near Allouez and the Fox Cities cone to the southwest near Kimberly-Kaukauna.

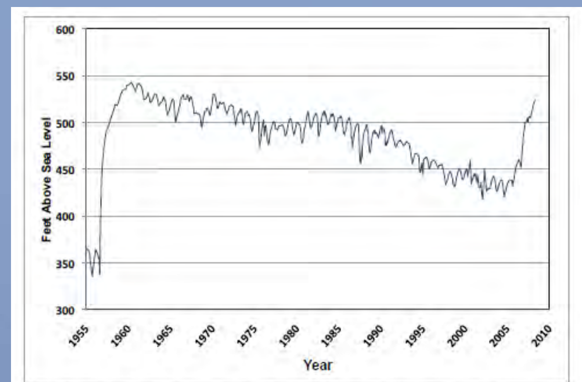
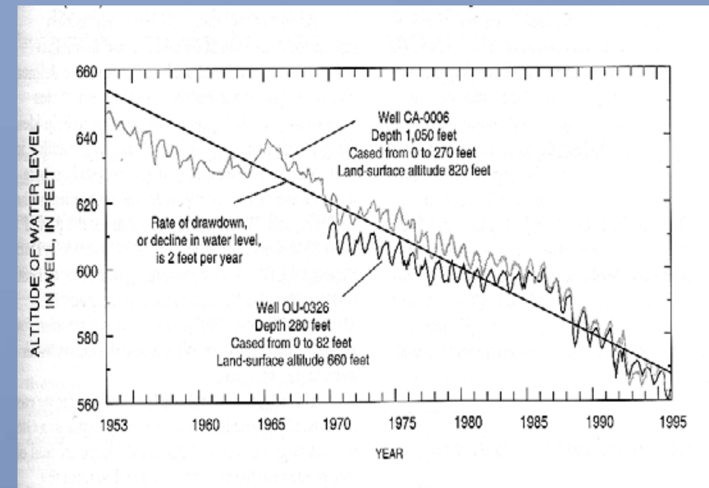


Figure 3. Water levels over a 54-year period in Well BN-76, Green Bay, WI. The water level recovery events of 1957 and 2007 are both illustrated in this hydrograph.



- Decades of over pumping caused over 400 feet of drawdown by 1957
- Green Bay switched to Lake water 1957
- Pumping dropped from 13mgd to less than 6 mgd
- Water levels recovered by over 200 feet
- Suburban and industrial pumping rose to 14 to 16 mgd by 2005
- Water levels dropped to near 1957 levels
- Fox Valley cone continued to decline 2 feet/yr, over 150 feet of drawdown

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Recovery in Brown County

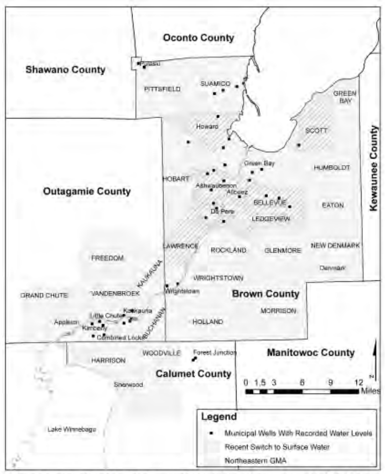


Figure 4. Townships and cities of the Northeastern GMA, with emphasis on municipalities that recently switched from groundwater to surface water. Black dots represent municipal wells for which water levels were recorded after the switch to surface water.

•Between 2005 and 2008, 8 communities in Brown County switched to lake water
•Pumping reduced to 4mgd
•Water levels recovered 100 feet in 2009
•An additional 60 to 70 feet expected in next few years

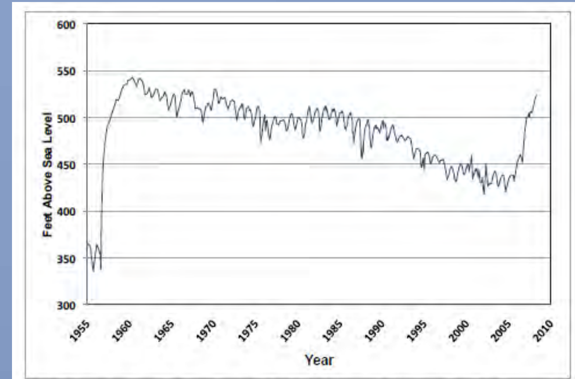


Figure 3. Water levels over a 54-year period in Well BN-76, Green Bay, WI. The water level recovery events of 1957 and 2007 are both illustrated in this hydrograph.

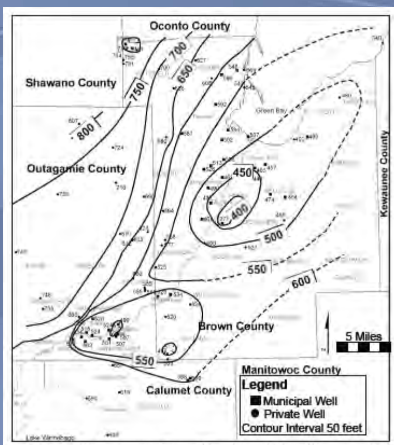
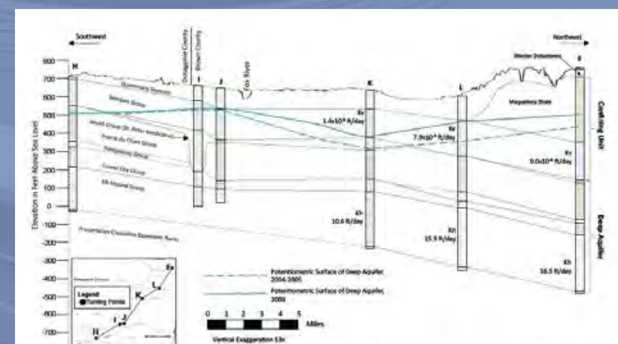


Figure 14. Deep aquifer potentiometric surface map of the northeastern GMA for 2008, approximately one year after the major switch to surface water by CBCWA communities in 2007. Numbers indicate water level elevations above mean sea level. Two distinct cones of depression are still visible, with the Central Brown County cone centered near Allouez and the Fox Cities cone to the southwest near Kimberly-Kaukauna. Significant recovery of water levels has occurred in the Central Brown County cone of depression.

GREAT NEWS, BUT:
•Future industrial pumpage may increase drawdown
•Fox Valley cone not recovering
•Sulfide zone becoming exposed that may liberate more Arsenic



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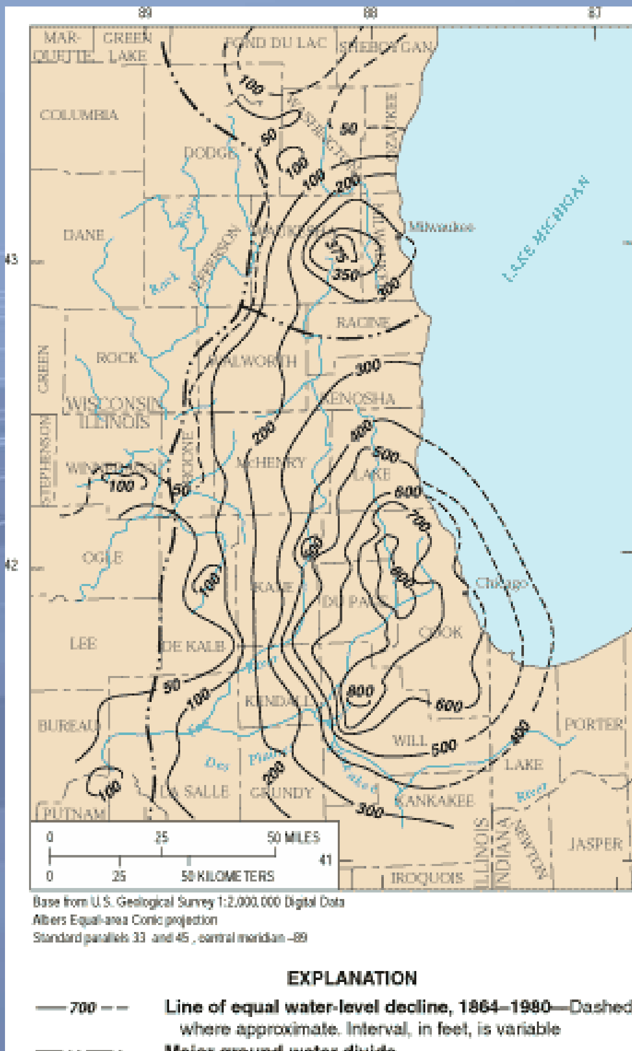
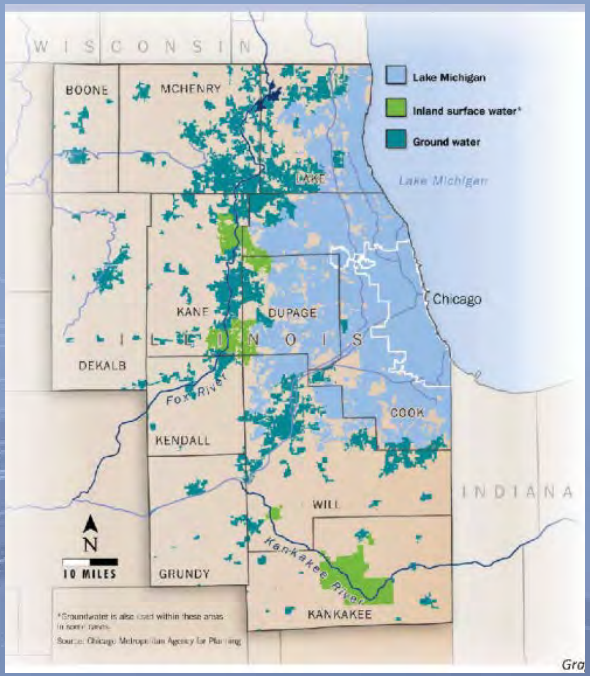
Regional Aquifer Mining in the Chicago and Milwaukee Area



- Pumping from Confined Sandstone Aquifer stated in late 1800s
- Initial wells flowed at over 1,000 gpm
- By 1980 water levels in aquifer were 800 feet deep in Chicago area and almost 400 feet deep In Milwaukee area



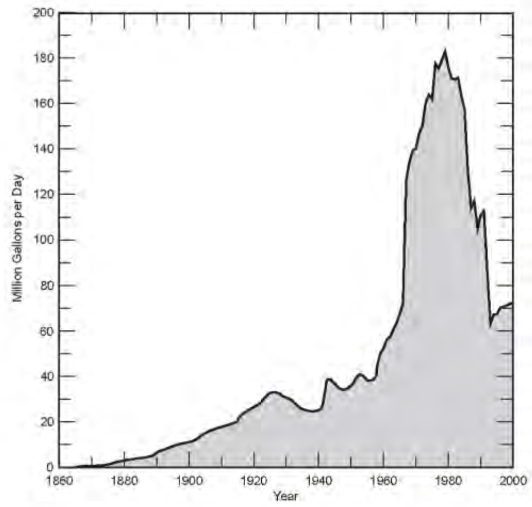


Figure 3. Estimates of historical pumpage from the Cambrian-Ordovician aquifers in the eight-county Chicago region

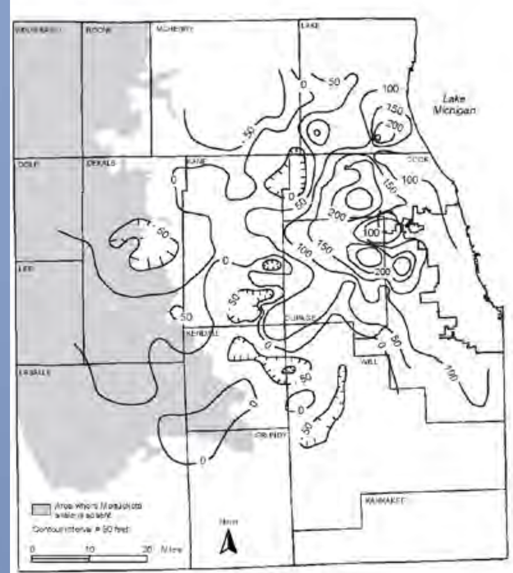


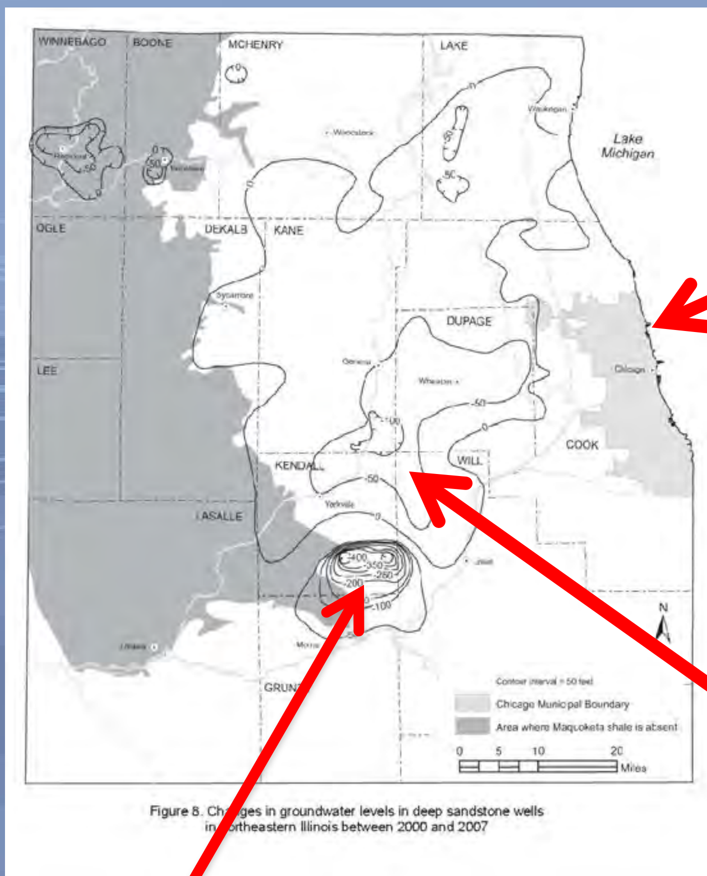
Figure 11. Changes in groundwater level in deep bedrock wells in northeastern Illinois between 1980 and 2000

- Situation was not sustainable
- Lake water extended to suburbs

Pumpage from sandstone dropped to about 60 mgd by 1990

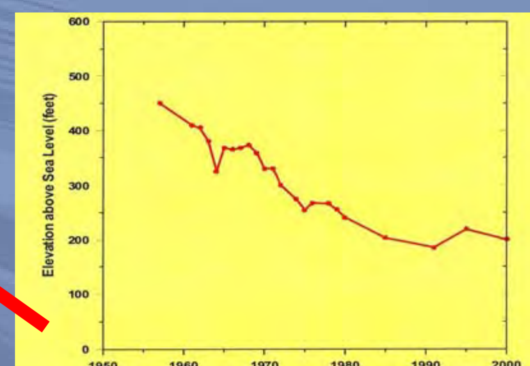
Head in the Sandstone Aquifer recovered by over 200 feet in places by 2000

Sandstone Aquifer Still Declining In West and South



400 feet of drawdown between 2000 and 2007

Recovery in Cook County



Aquifer Still Declining In West and South

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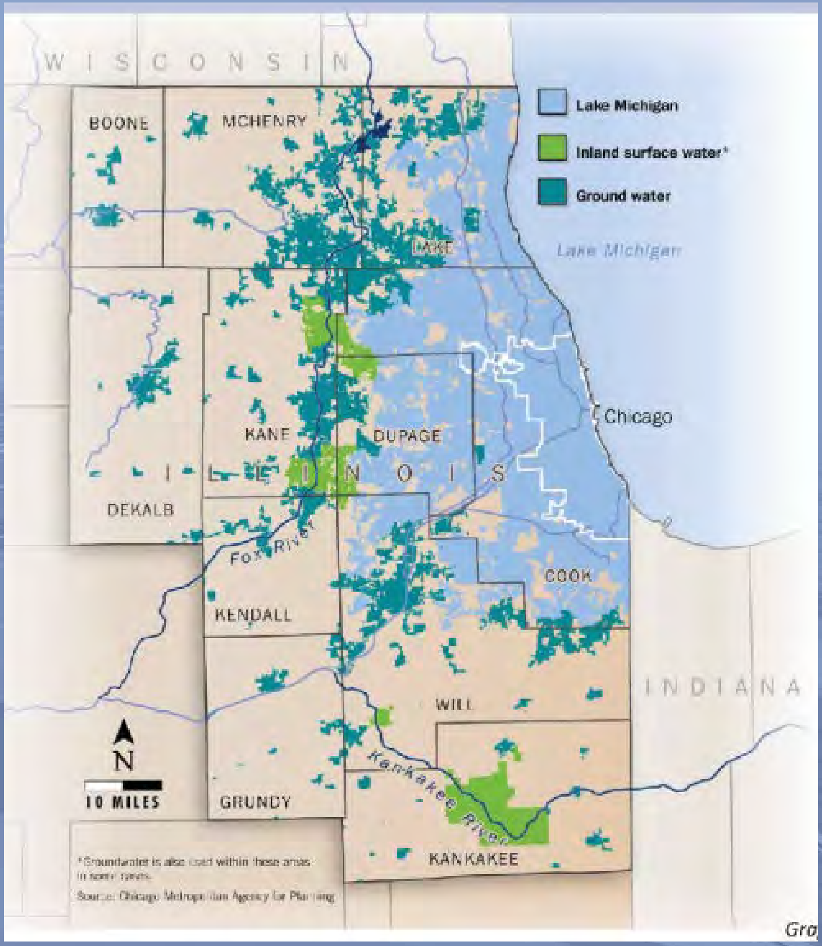
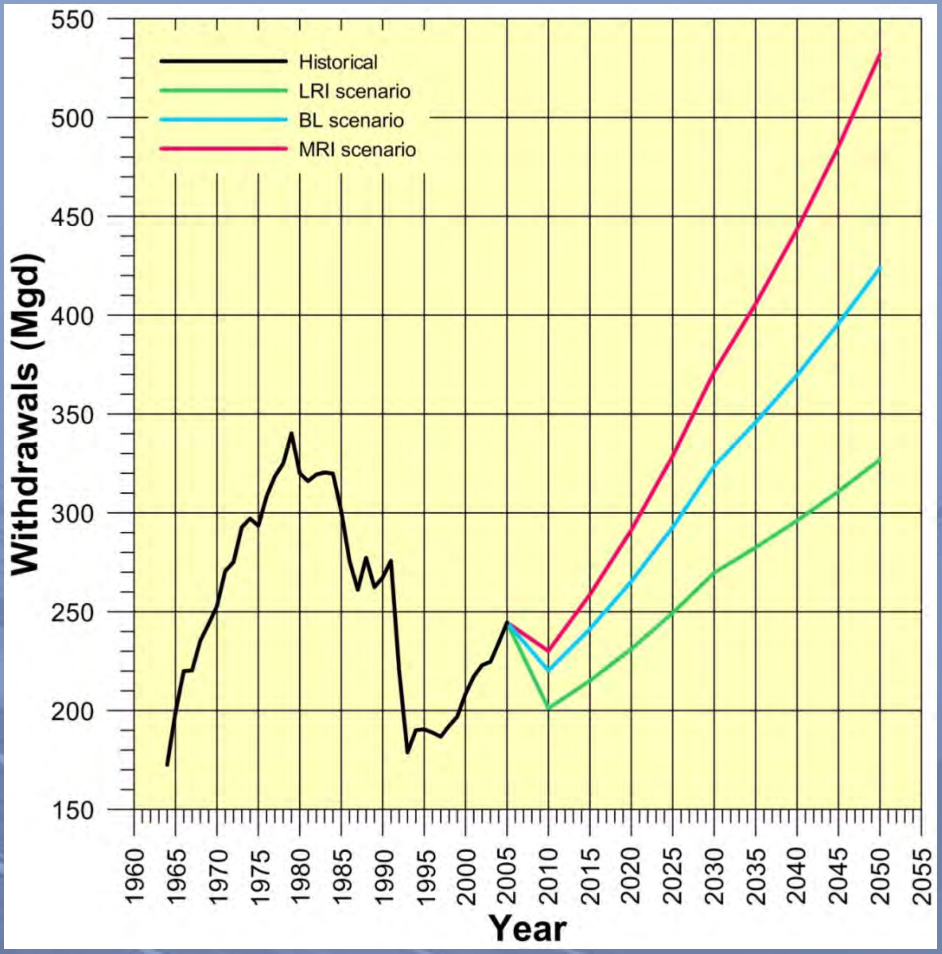
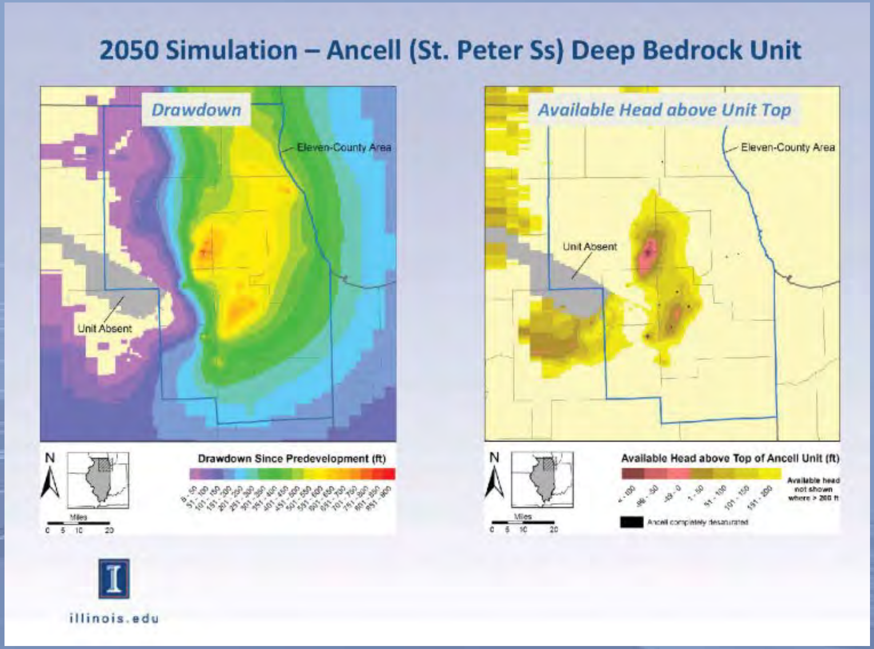
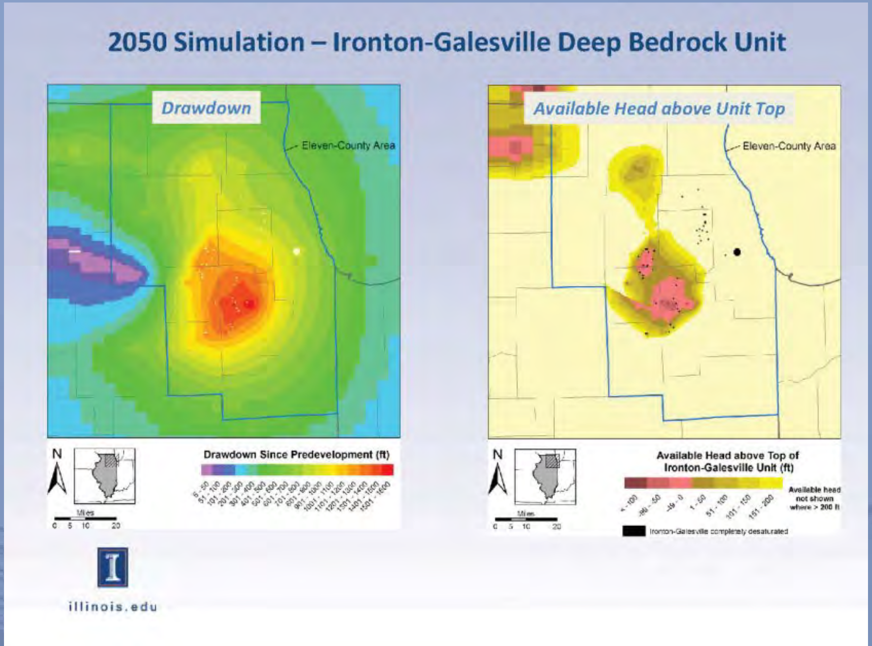
Projected Increase in Groundwater Use





Projected Drawdown in Sandstone Aquifer





- Drawdown up to 1,000
- Water levels below top of aquifer in places
- Exposing aquifer to air can liberate arsenic and other metals
- Small areas of aquifer totally dewatered

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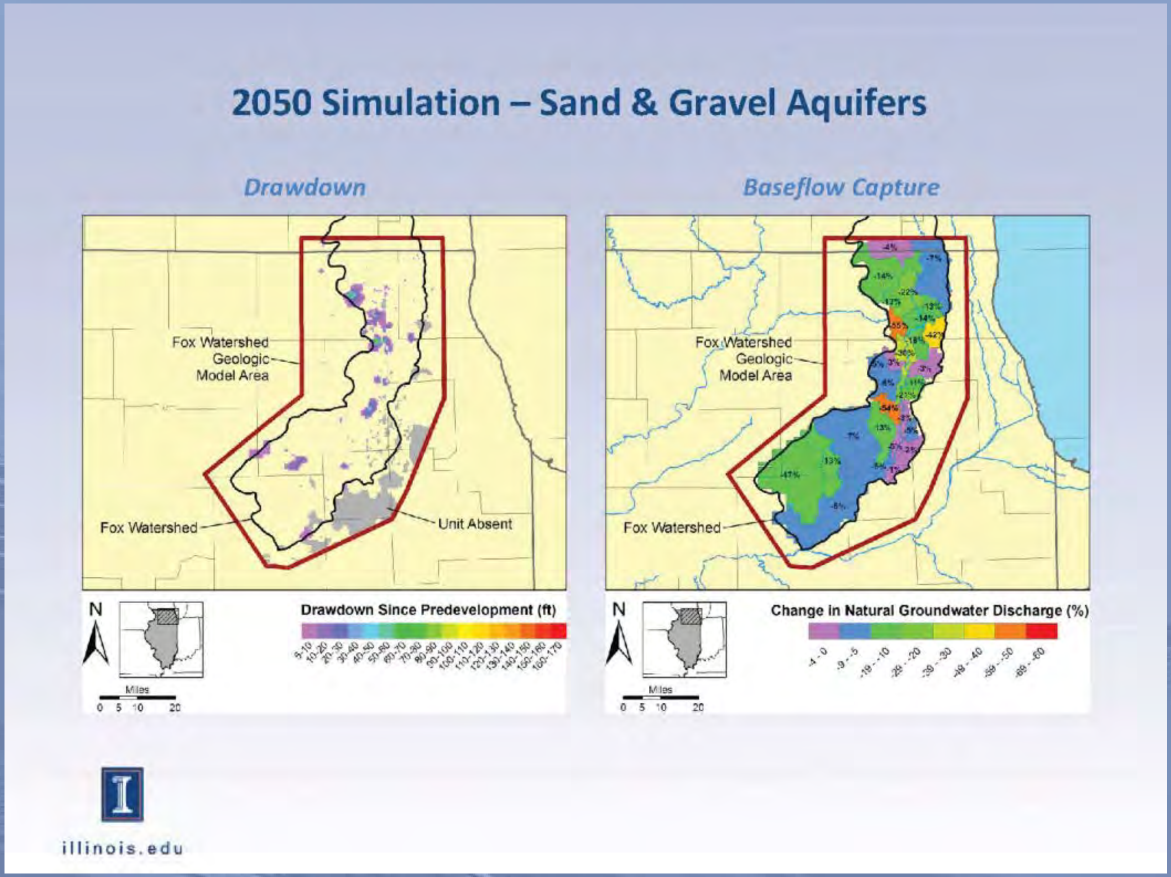
Predicted Impacts To Shallow Aquifer and Stream Flow



- Drawdown limited to 10 to 20 feet
- Base flow reduced by up to 50%

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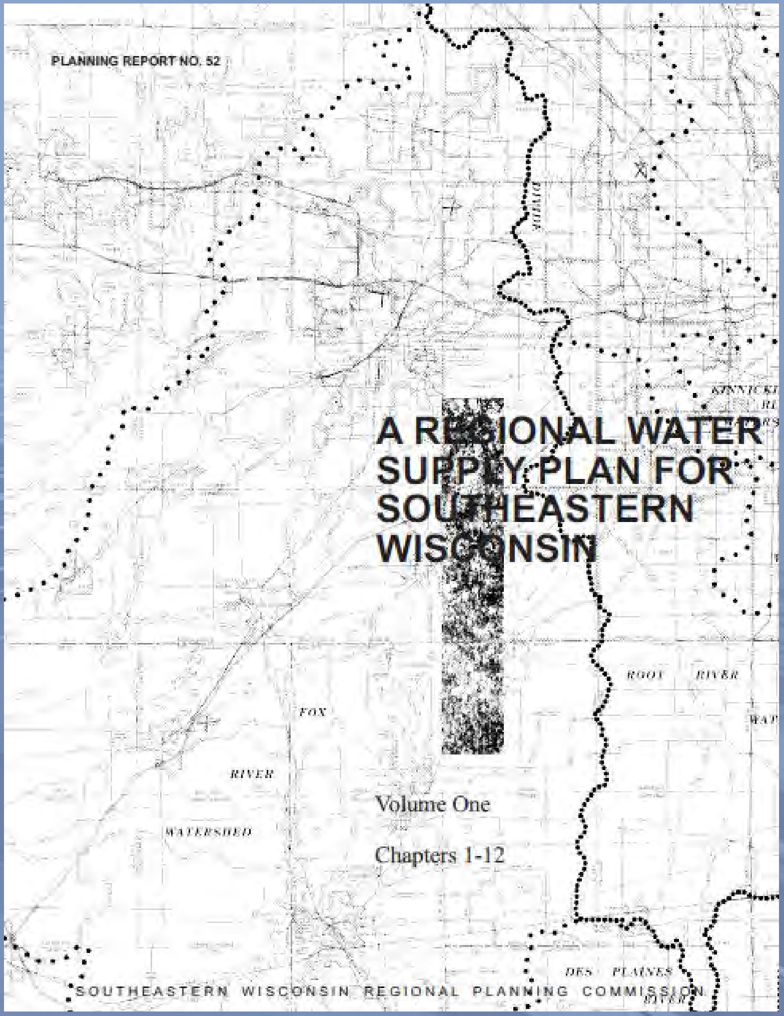
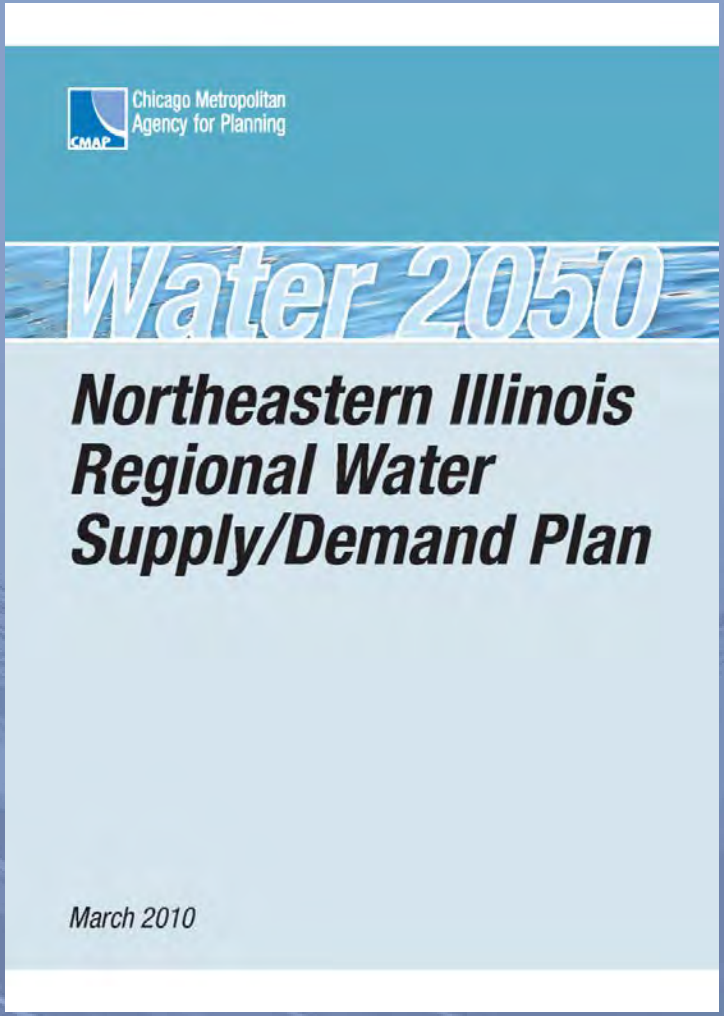
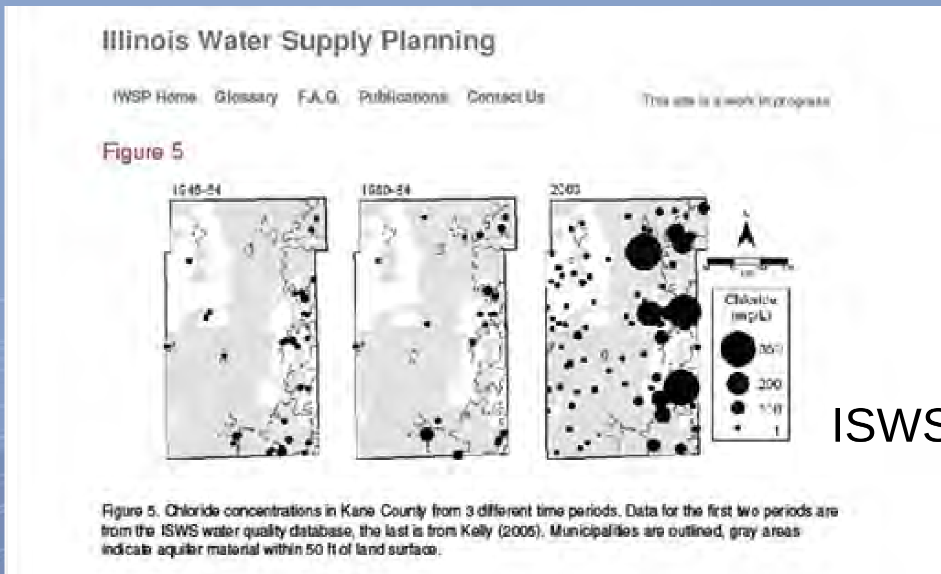
Need for Regional Planning is Clear

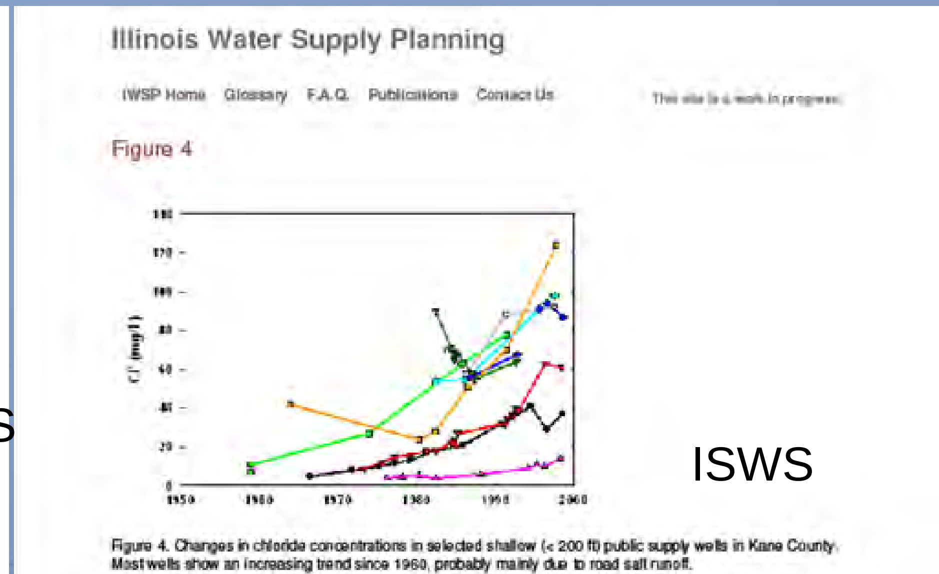




Sustainability Means Managing Water Quality, Too



ISWS



ISWS

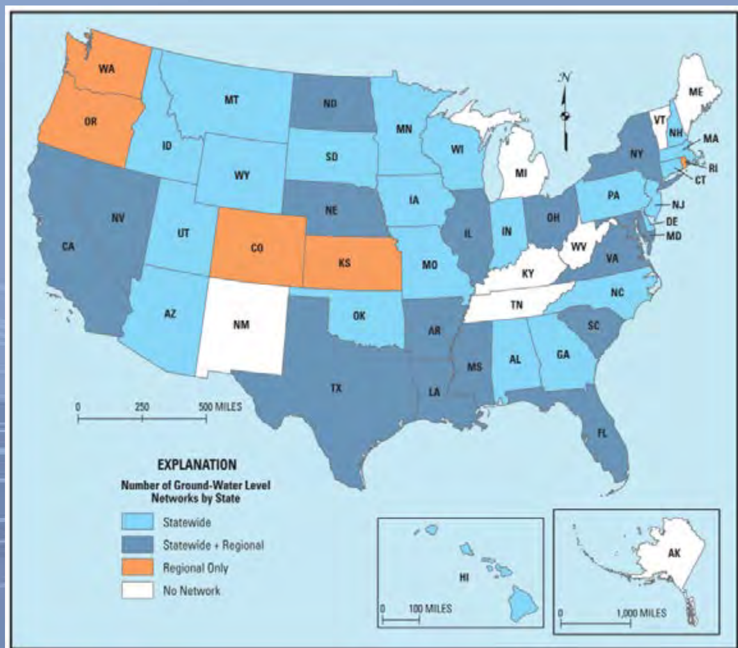
- Chloride levels rising in sand and gravel aquifer in many areas of upper Midwest
- Road salt is the usual culprit
- Time lag of years to decades may make solving the problem by source reduction too little and too late

You Can't Manage What You Don't Measure

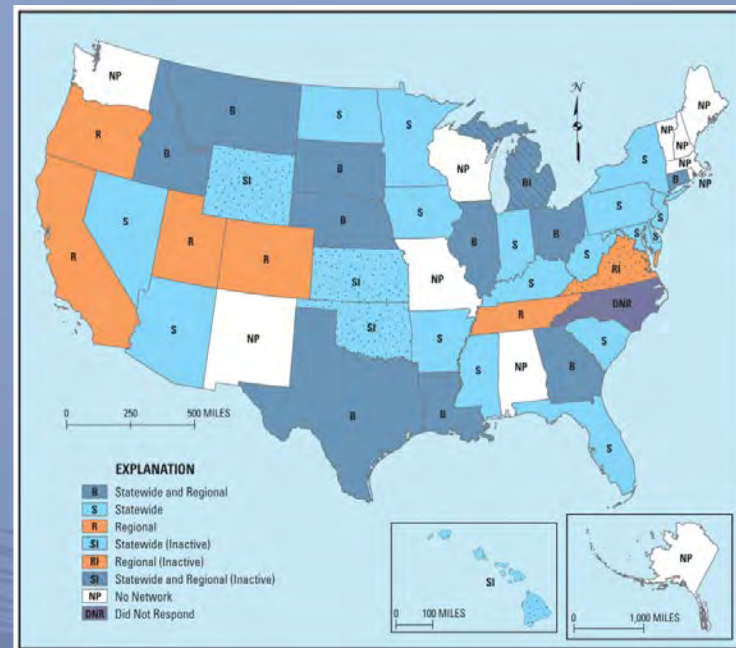
The foundation of any good ground-water analysis, including those analyses whose objective is to propose and evaluate alternative management strategies, is the availability of high-quality data.

U.S. Geological Survey Circular 1186

National Groundwater Monitoring Network



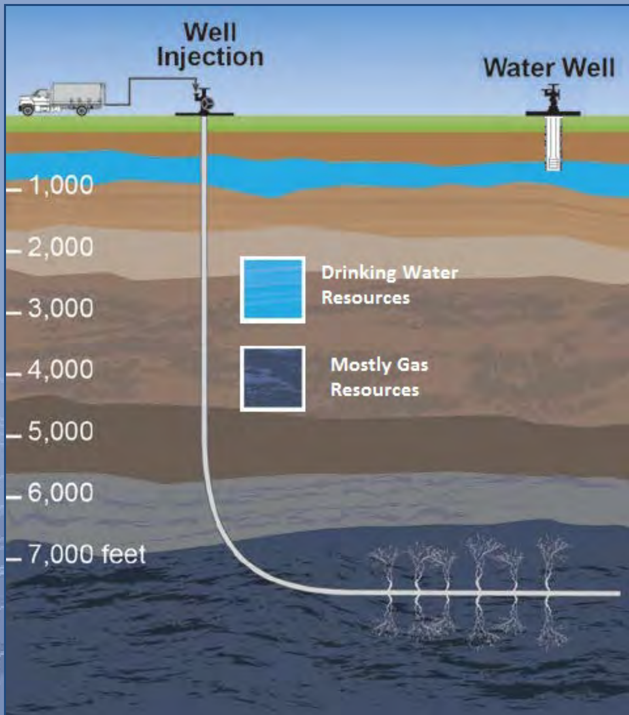
Water Level Monitoring



Water Quality Monitoring

- Proposed by ACWI in 2006 with backing from NGWA
- Pilot projects in 6 states completed in 2010
- Looking for funding for national implementation

Monitoring Needs for Oil and Gas Development



- **Fracing has created much anxiety and controversy**
- **Though some risks are overstated, legitimate concerns exist**
- **Spills, grout and casing failures, and water availability have been problems in several states**
- **Baseline monitoring that considers hydrogeologic conditions and exposure pathways are beneficial for all parties**

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If the creator divided us to prevent us from dominating his creation, perhaps he will let us come together to save what's left.

(Samuel Bingham)

You *can* change the way the world sucks!

(Anonymous high school student following 911)

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Refilling the Canteen for a Sustainable Future

Innovative approaches that have been undertaken to enhance the sustainability of ground-water resources typically involve some combination of use of aquifers as storage reservoirs, conjunctive use of surface water and ground water, artificial recharge of water through wells or surface spreading, and the use of recycled or reclaimed water

U.S. Geological Survey Circular 1186

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Conservation is Always The Best Place to Start

- Using water more efficiently saves water and money
- Water left in the aquifer is available for another day or someone else
- Some efficiency can be found within the home, but the biggest gains come from agriculture and industrial users
- Pricing signals generally the most effective

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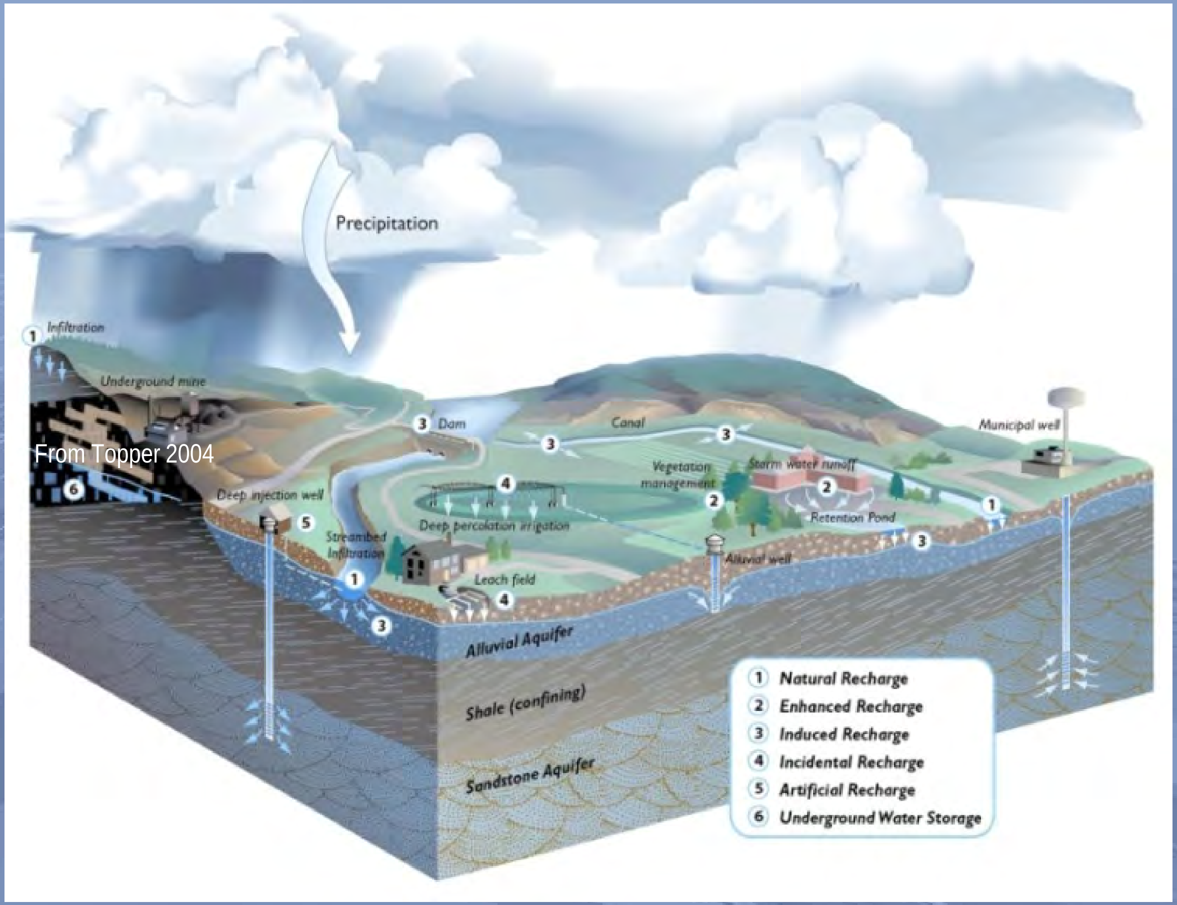
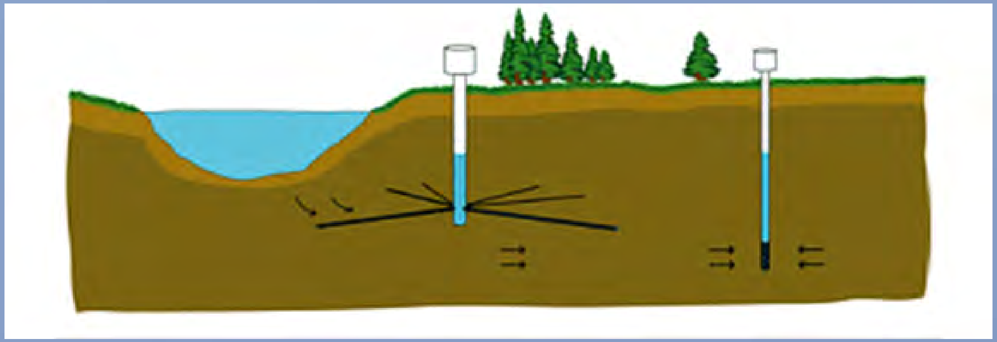
Aquifer Recharge: Refilling the Canteen



Topper, et al, 2004

- Surface infiltration
- Subsurface infiltration
- Direct injection
- Enhanced recharge
- Aquifer Storage and Recovery (ASR)
- River Bank Filtration (RBF)
- Water Banking

River Bank Filtration (RBF)



- Place well field next to river to induce recharge for some or all of production
- Improves water quality over direct surface water intake
- Increase yield of well field by inducing recharge from surface water
- Can use vertical wells next to river or horizontal or inclined well under river
- River bed provides filtration and earns disinfection credits from USEPA
- River Bank Filtration common in Europe and could be used more extensively here to move water to and from receiving bodies in a short flow cell
- Essentially water recycling with natural buffers
- Used extensively along Ohio River and Missouri River

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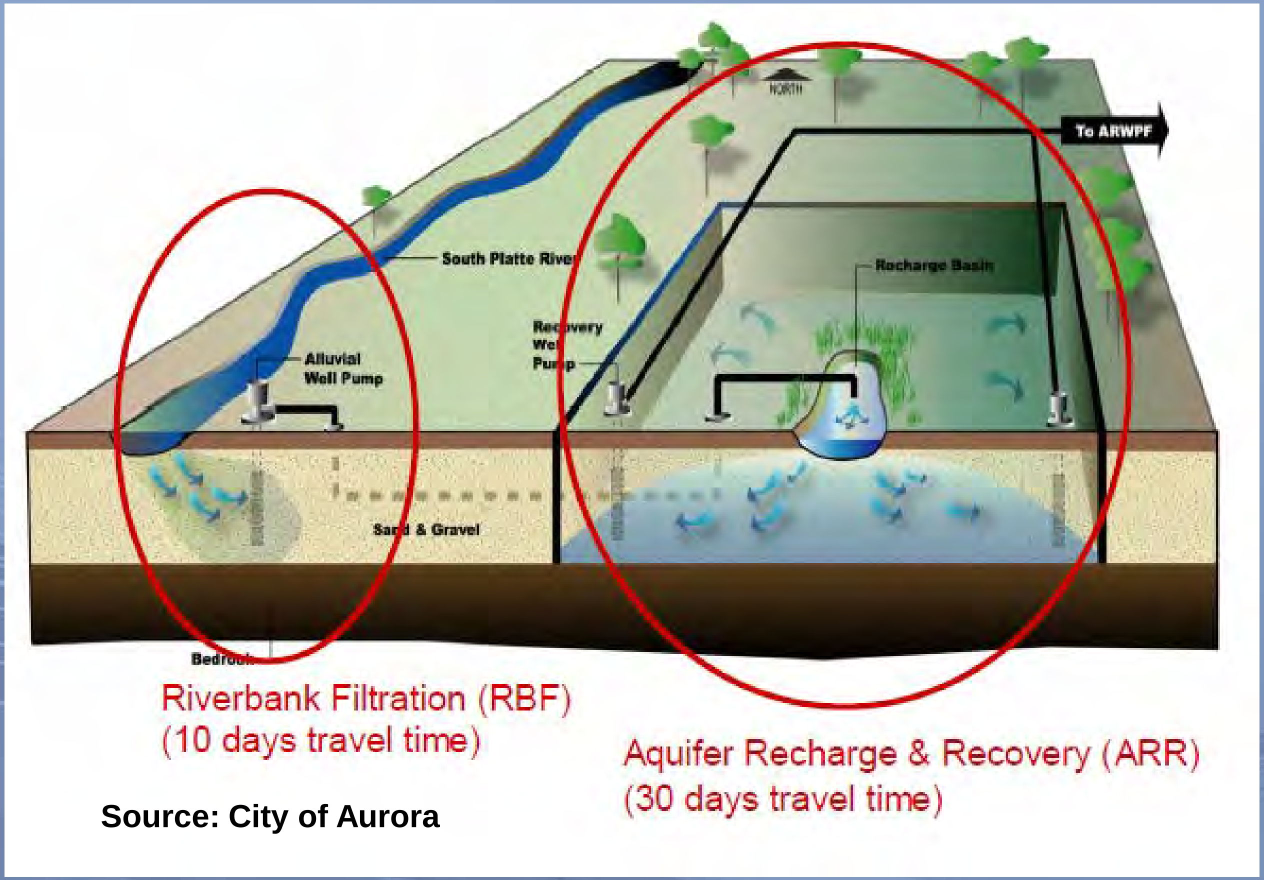
Prairie Waters Aquifer Recharge System



- **Draws water from Platte River Alluvium (RBF)**
- **Stores water in aquifer inside slurry wall "vault" (fluke of CO law)**
- **Recover water with wells inside storage area**
- **$660M cost, stores 10,000 af, expandable to 50,000 af**
- **On line in 2012, Drought Resistance**

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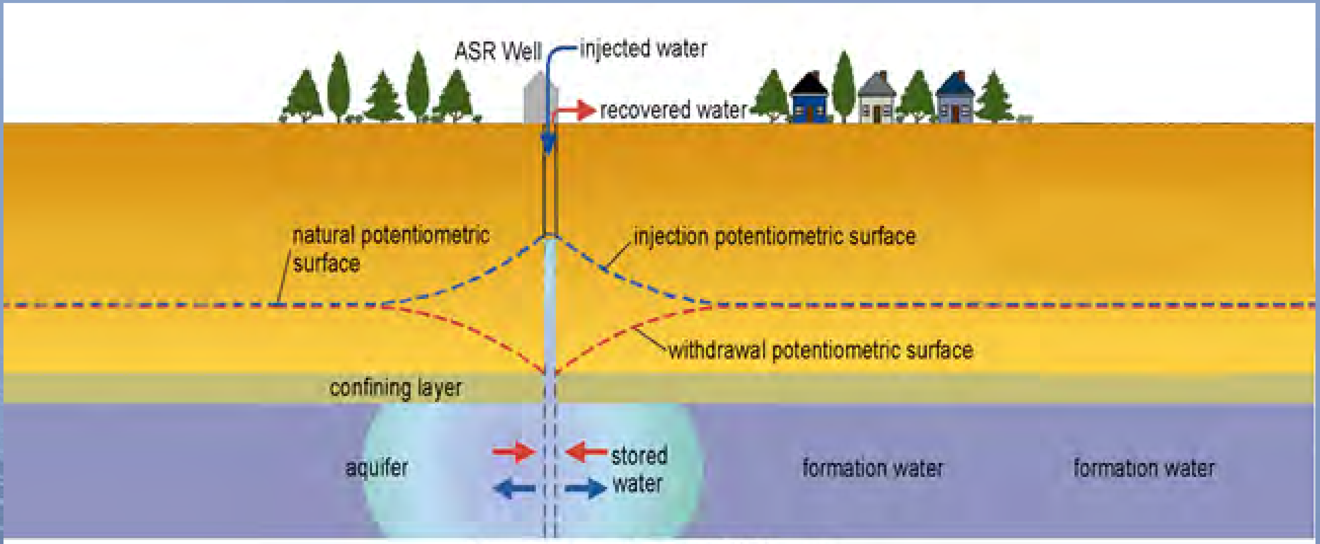
Aquifer Storage and Recovery



Cross section of a typical ASR system

- Treated drinking water injected into aquifer through well
- Builds "bubble" of treated water in aquifer
- Water recovered by pumping well with minimal additional treatment
- Capacity ranges from 0.5 mgd to over 100 mgd
- Some systems have problems with water quality or plugging

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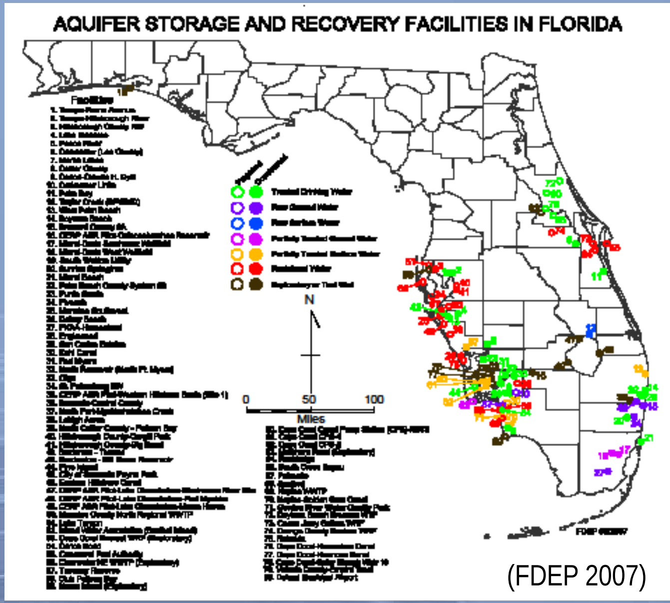
ASR Wells in the United States



(FDEP 2007)

Figure 2. ASR Wellfields in the United States, July 2003

(SJRWMD 2004)

- Florida~80 systems
- ~150 wells
- 12 fully permitted
- Others in testing or operation with Letter of Authorization

(EPA 2009)

- ~307 ASR systems in US in 2009
- Multiple wells at most sites
- 542 ASR wells capable of operation
- 14 wells non-functional
- 65 wells plugged and abandoned

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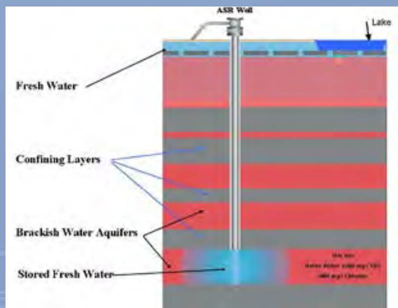
Marco Lakes, Florida ASR Project



Project Goals

- Capture and utilization of freshwater that was being lost to tide
- Subsurface storage of freshwater in a brackish water aquifer
- Sustainable and secure water supply

Project Highlights

- Annual Storage Capacity of ~1.5 billion gallons
- High Recovery Efficiency (currently 80% with higher expectations)
- Flexible Expansion Capacity

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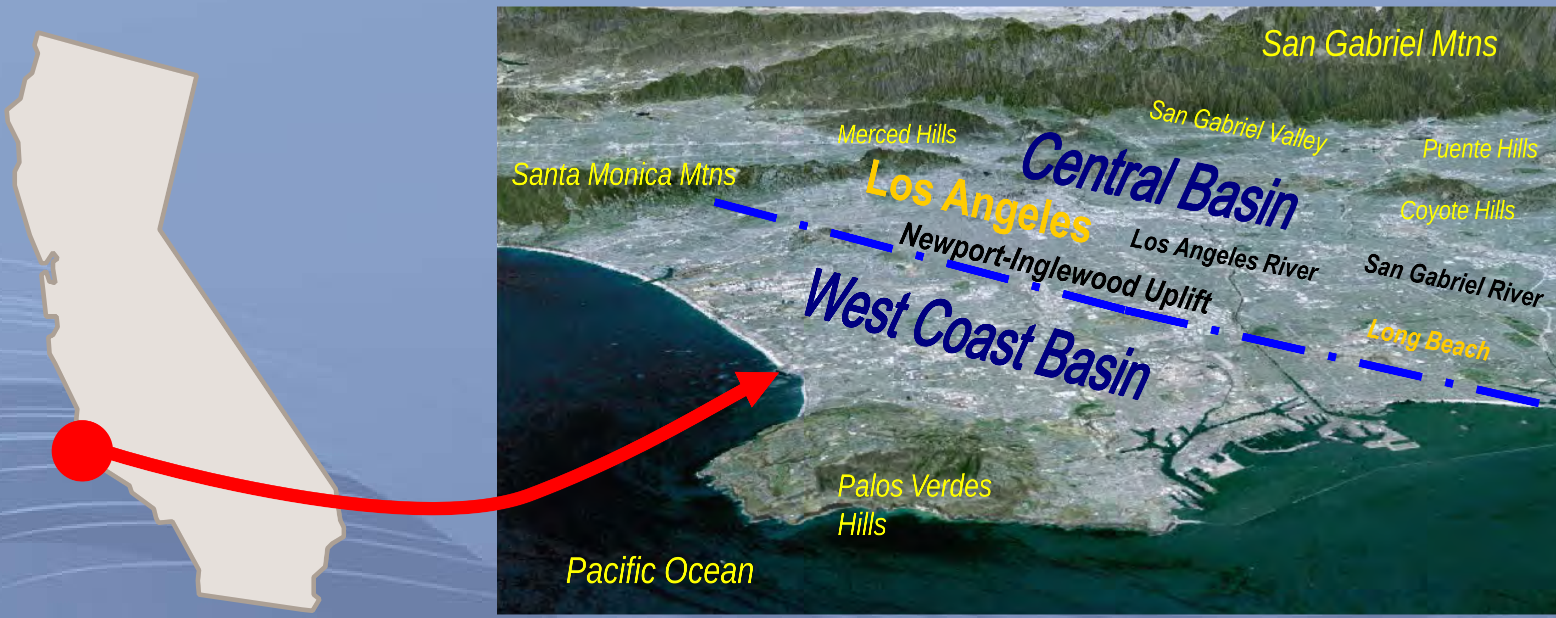
Central & West Coast Basins in Coastal Los Angeles County



- 400 Water Wells Pumping 250,000 acre feet per year
- Area = 420 mi^2
- 4 Million People

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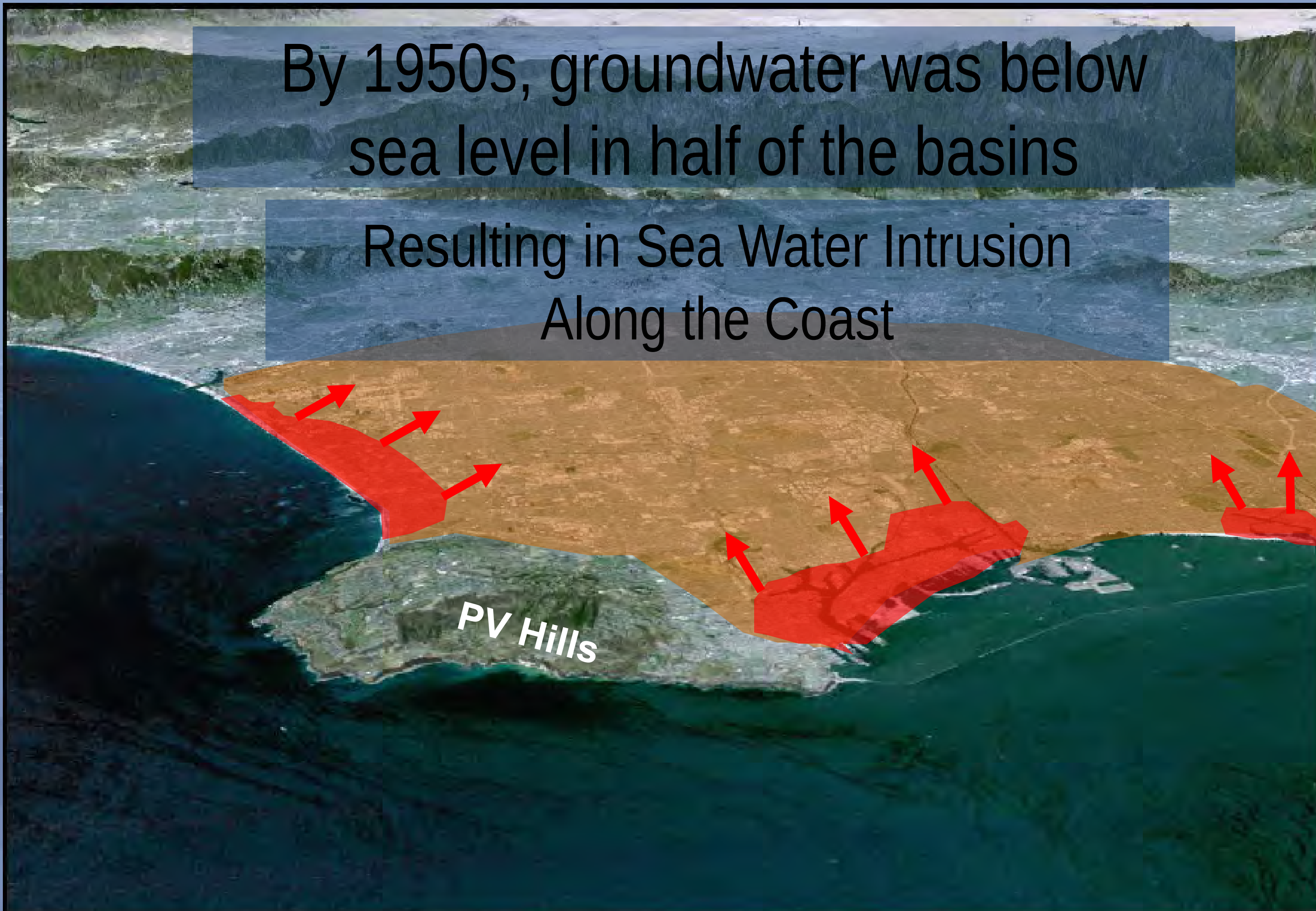
By 1950s, groundwater was below sea level in half of the basins

Resulting in Sea Water Intrusion Along the Coast



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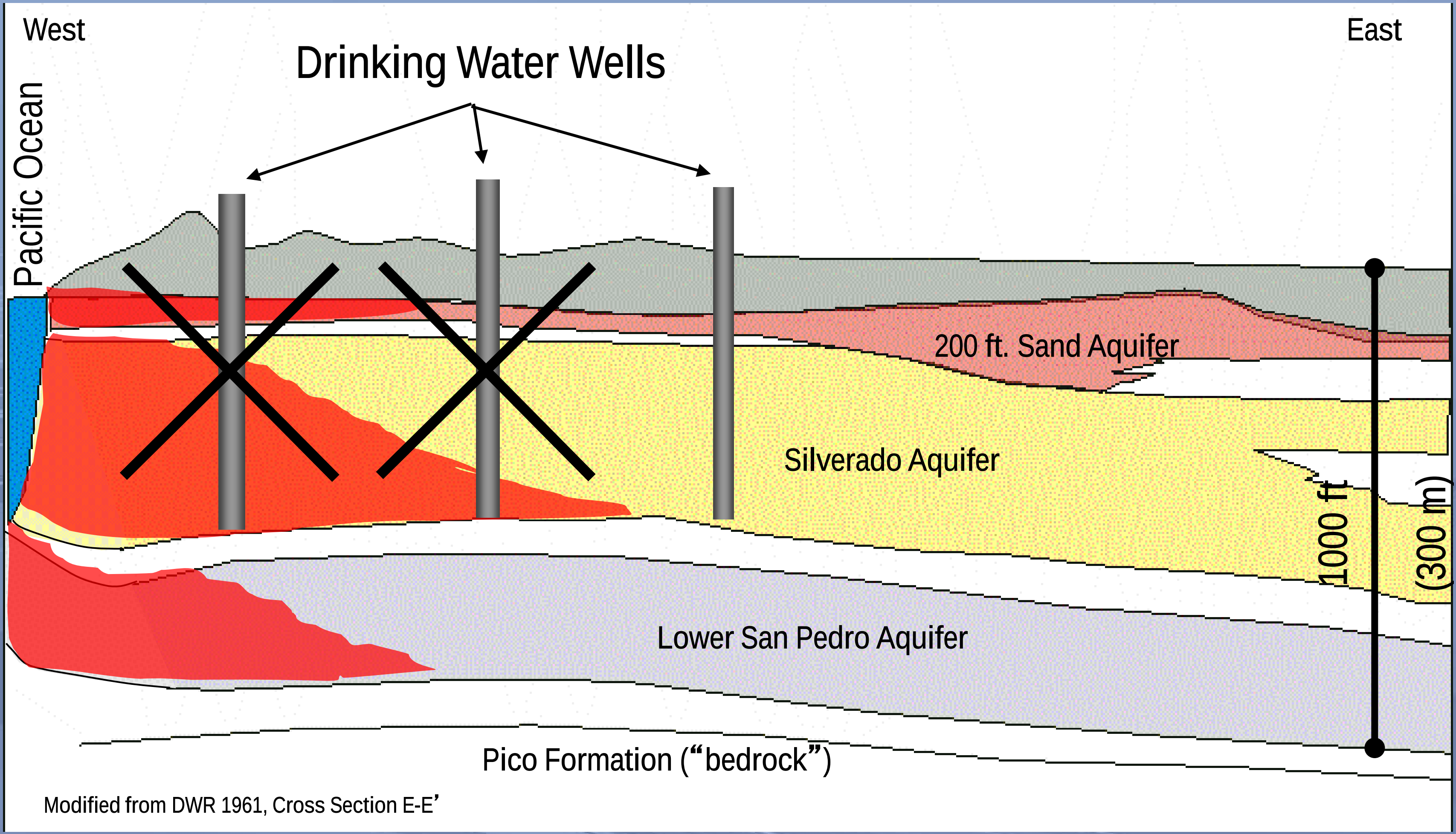
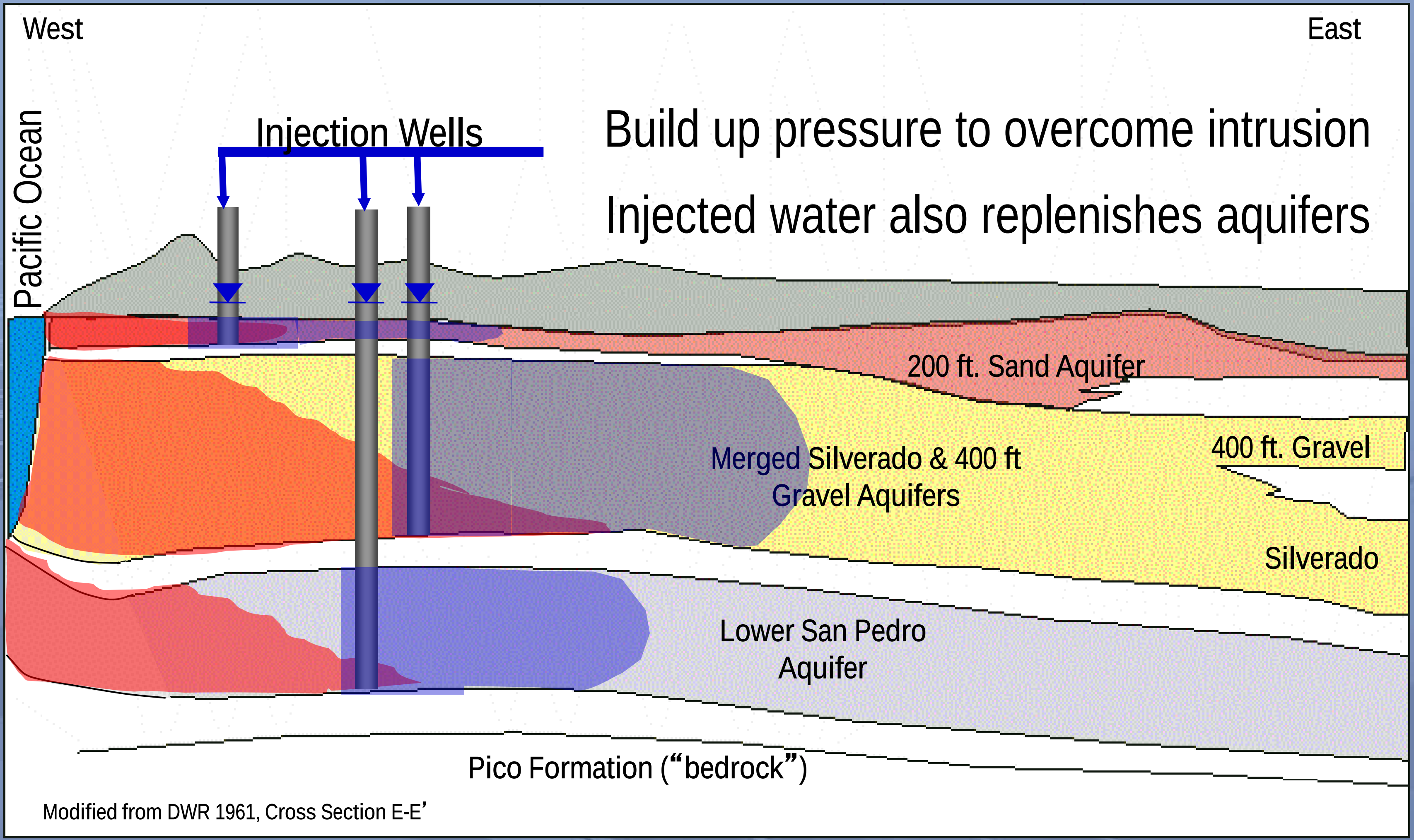
Sea Water Intrusion



Seawater Barrier Wells



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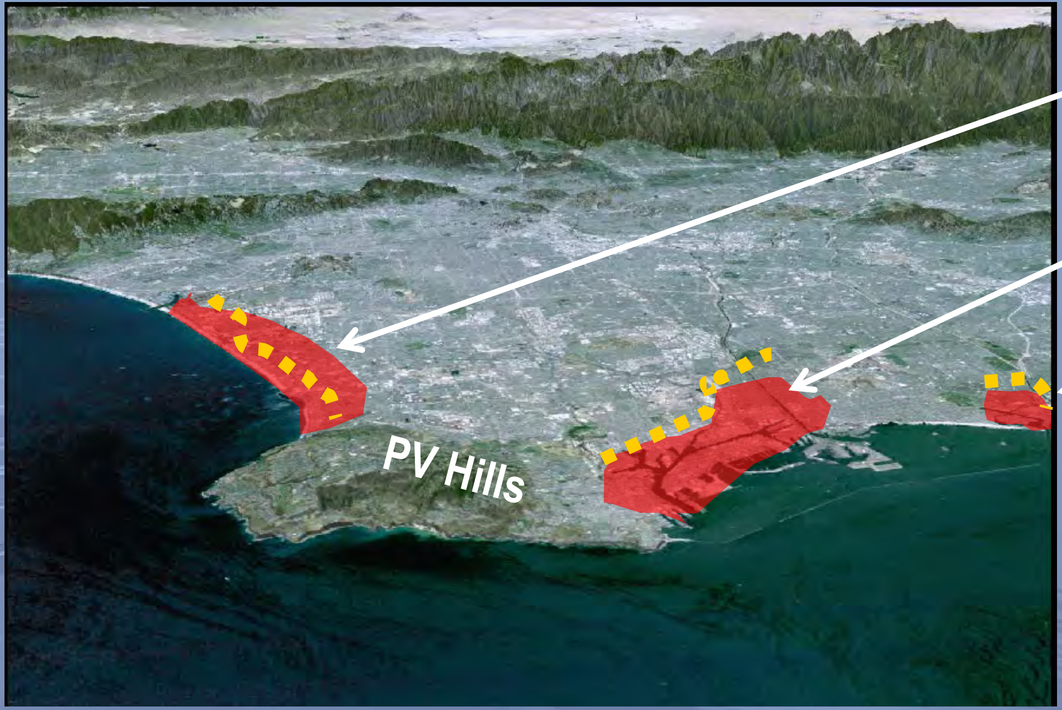
Sea Water Barrier Wells - LACFCD



- West Coast Basin Barrier Project 1950s
- Dominguez Gap Barrier Project 1970s
- Alamitos Gap Barrier Project 1960s
- Nearly 300 injection wells, 16 mile overall length

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Water for the Barriers

WIN
WATER INDEPENDENCE NOW

- Treated Drinking Water (potable) from MWD (imported water):
  - Exclusive source 1953 – 1995.
  - Partial Source 1995 – Present.
  - 1.5 Million acre-feet to date.
- Advanced Treated Recycled Water:
  - Since 1995 at West Coast Barrier (WBMWD).
  - Since 2005 at Alamitos Barrier (WRD).
  - Since 2006 at Dominguez Barrier (City of LA).
  - 132,000 acre-feet to date.
- Goal is to move towards 100% recycled water at all three barriers (Water Independence Now– WIN).

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Orange County Water District Water Recharge and Recycling System

- 70 mgd of recycled water (expanding to over 100 mgd)
- Advanced treatment on waste water (RO, Microfiltration, UV)
- Recharge basins
- Capturing storm water from Santa Ana River with two rubber dams
- $400M capital investment
- Provided water reliability in latest drought
- Uses less energy and lower cost than imported water

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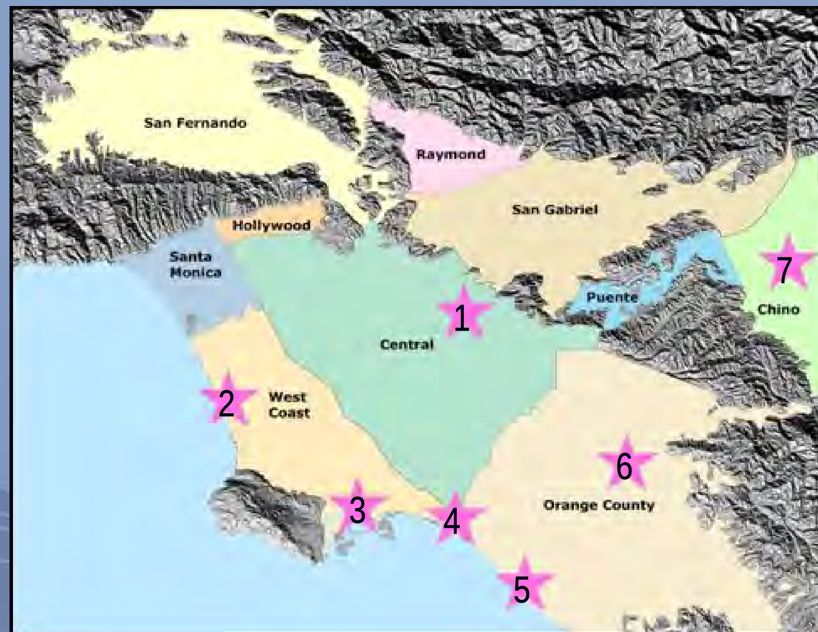
Major Recycled Water Recharge Projects in So. Cal.



Project	Amount of Recycled Water Acre feet/Year	Project Start Date
[1] Montebello Forebay Groundwater Recharge Project (Spreading Basins)	50,000	1962
[2] West Coast Basin Barrier Project (Injection)	14,000	1994
[7] Chino Basin Groundwater Recharge Project (Spreading Basins)	21,000	Phase I 2005 Phase II 2007
[4] Alamitos Barrier Project (Injection)	3,360	2005
[3] Dominguez Gap Barrier Project (Injection)	5,600	2006
[5,6] Orange County Groundwater Replenishment System Spreading Basins and Seawater Barrier Injection Wells	72,000	2008

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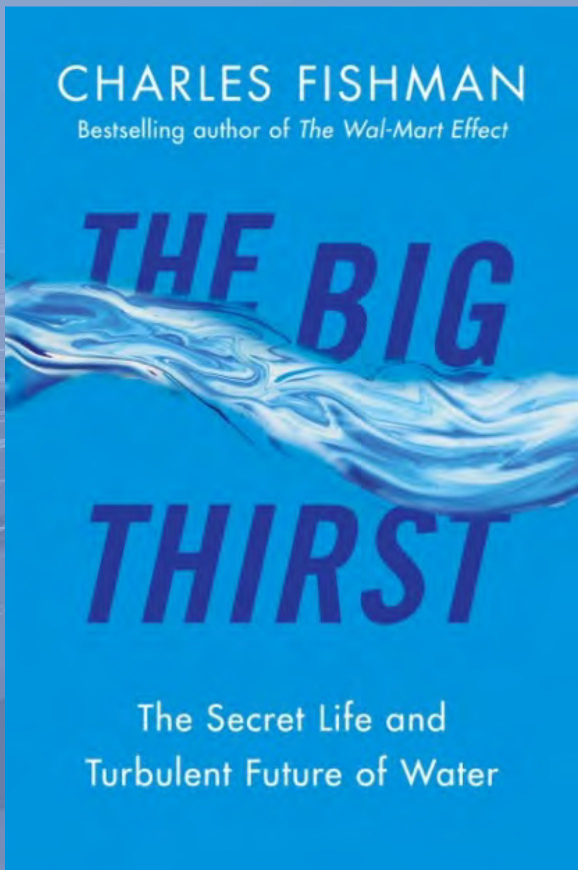
Attitudes on Water Are Changing

- Historically water has been free
- We pay only for the cost of delivery
- Free has meant “no value” in most economic decisions
- Cumulative impacts of past decision and rising demand are forcing new appreciation of the value of water and our dependency on its place in the environment

Attitudes on Water Are Changing



"Many civilizations have been crippled or destroyed by an inability to understand water or manage it. We have the huge advantage over the generation of people who come before us, because we understand water and can use it smartly. Everything about water is about to change-except of course water itself. It is our fate that hangs on how we approach water-the quality of our lives, the very resilience of our society, the character of our humanity. Water itself will be fine. Water will remain exuberantly wet."

(From "The Big Thirst", Charles Fishman 2011)

You are a vital and integral resource for groundwater's future

Established in 1994, the National Ground Water Research and Educational Foundation is operated by the National Ground Water Association as a 501(c)(3) public foundation and is focused on conducting educational, research, and other charitable activities related to a broader public understanding of groundwater.

The Foundation is an arm of NGWA that is focused on activities related to a broader understanding of groundwater.

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You are a vital and integral resource for groundwater's future

For more information visit us on the web at www.ngwa.org or write us at the address below.

NGWREF
601 Dempsey Road
Westerville, Ohio 43081
USA
Phone/ 614 898.7791
Fax/ 614 898.7786

Email/ ngwref@ngwa.org

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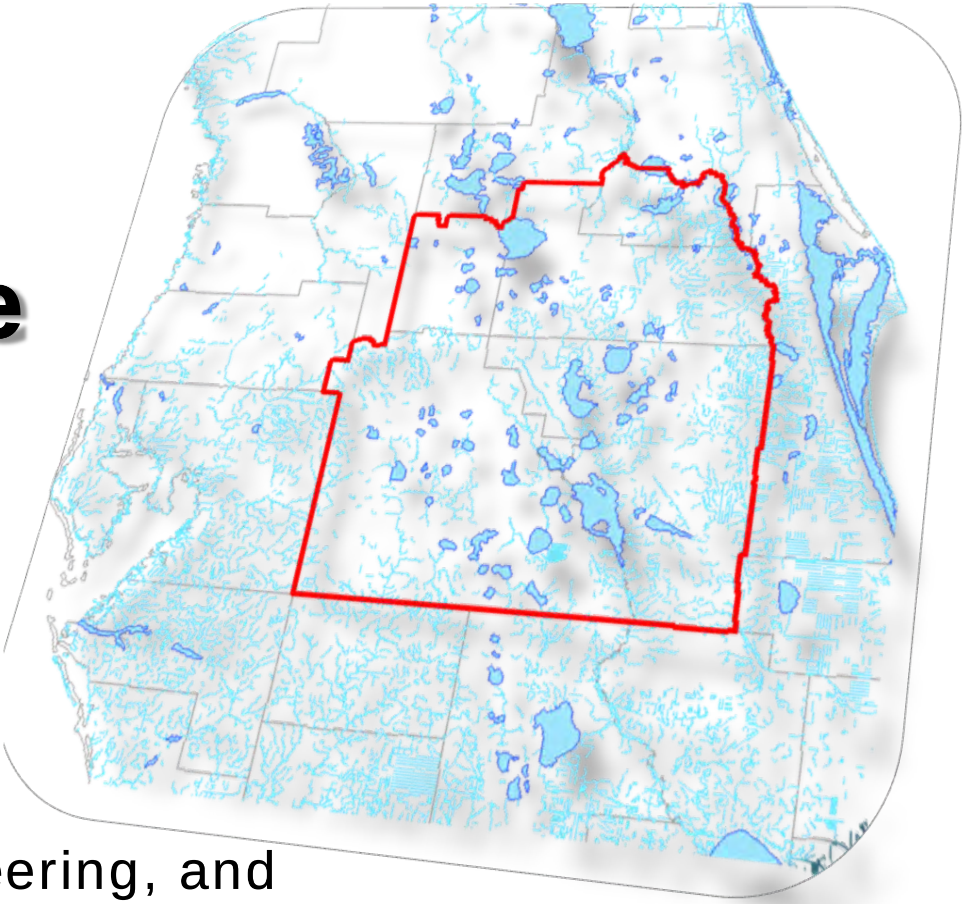
SPEAKER BIO

TOM BARTOL

Tom Bartol is Chief of the Bureau of Water Supply at the St. Johns River Water Management District. His degrees include a Bachelor of Science in civil engineering from the U.S. Air Force Academy and a Master of Science from Purdue University. Bartol is a registered professional engineer in Florida and he has over thirty years experience in civil and environmental engineering in both the public and private sectors. At the water management district, he is responsible for water supply and the minimum flows and levels (MFL) programs. For the Central Florida Water Initiative, Bartol is leading the team that is preparing the three-District water supply plan.

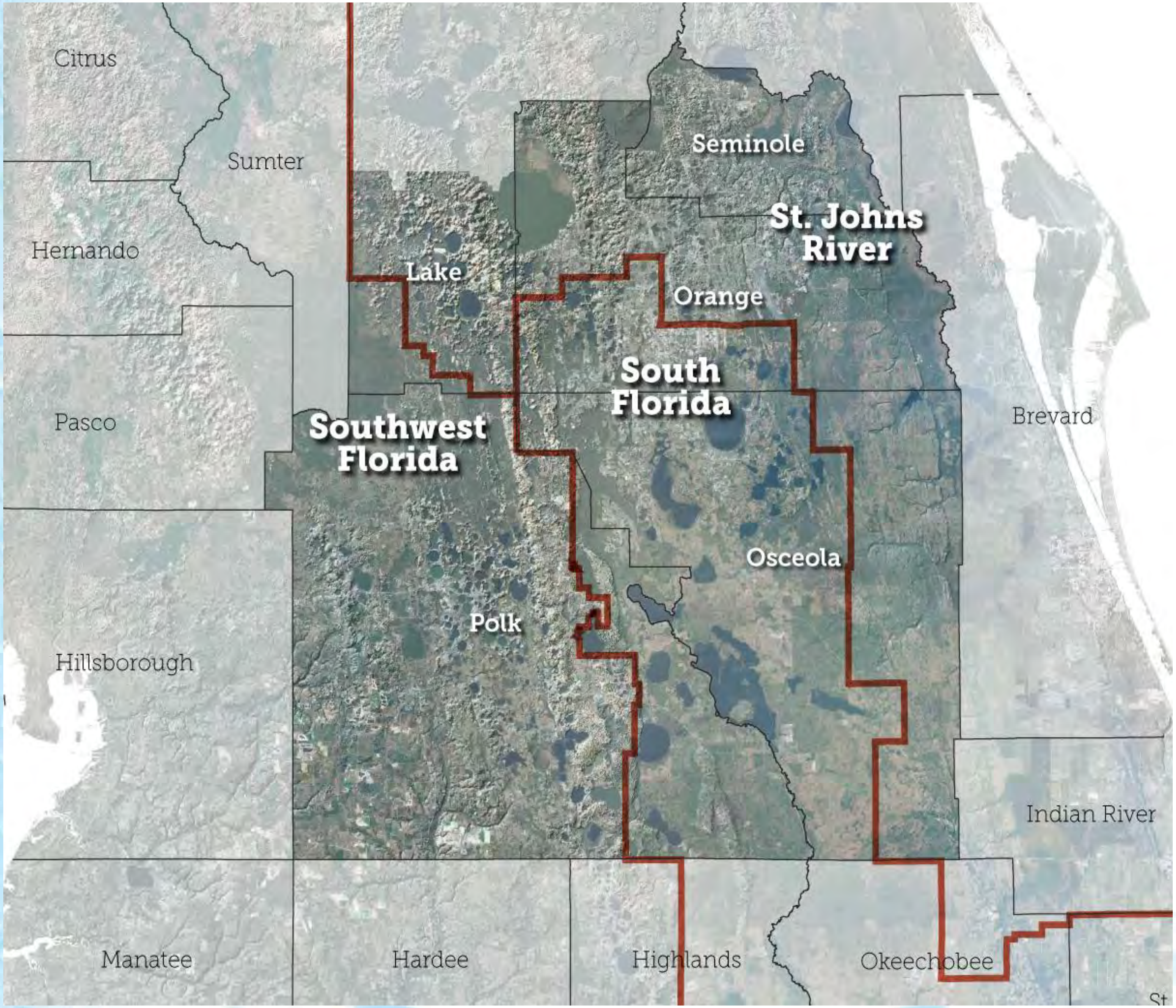
Groundwater Sustainability: A Collaborative Approach



Tom Bartol, P.E
Assistant Director
Division of Regulatory, Engineering, and Environmental Services
St. Johns River Water Management District

Today's Presentation

- What is a regional water supply plan?
- What are the components?
- Evaluation findings
- Importance of public involvement
- Opportunities for public participation



Citrus
Sumter
Hernando
Pasco
Hillsborough
Manatee
Hardee
Highlands
Okeechobee
Seminole
St. Johns River
Lake
Orange
South Florida
Southwest Florida
Brevard
Osceola
Polk
Indian River

CFWI Governance

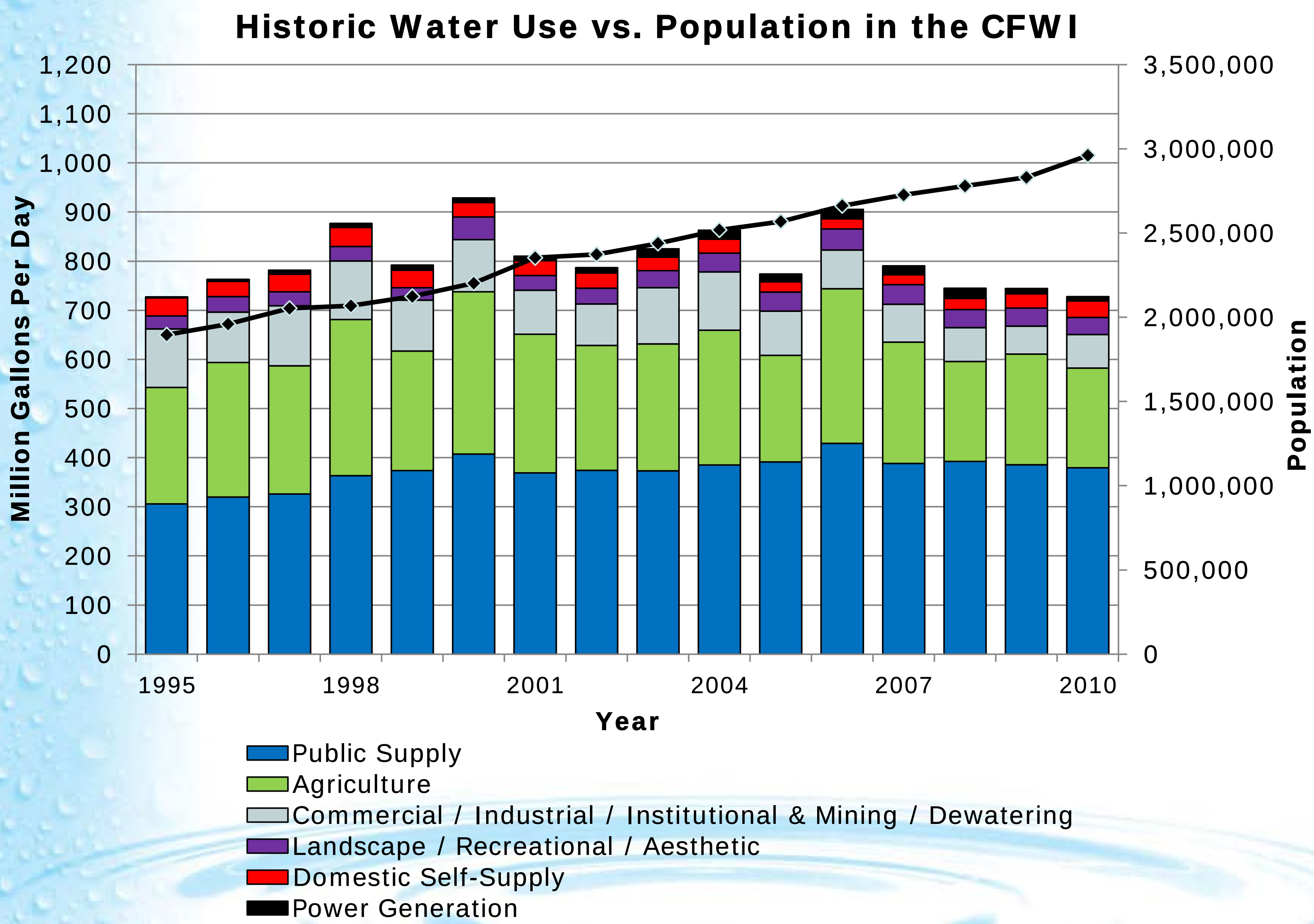
- Steering Committee
  - One representative each from:
    - Utilities, St. Johns River, South Florida & Southwest Florida water management districts' Governing Boards (3), Florida Department of Environmental Protection and Florida Department of Agriculture & Consumer Services
- Management Oversight Committee
- Technical Oversight Committee
- Technical Teams (6)

What Are the Challenges?

1. Reaching sustainable groundwater limits
2. Meeting future demands on the area's water resources
3. Overlapping regulatory programs

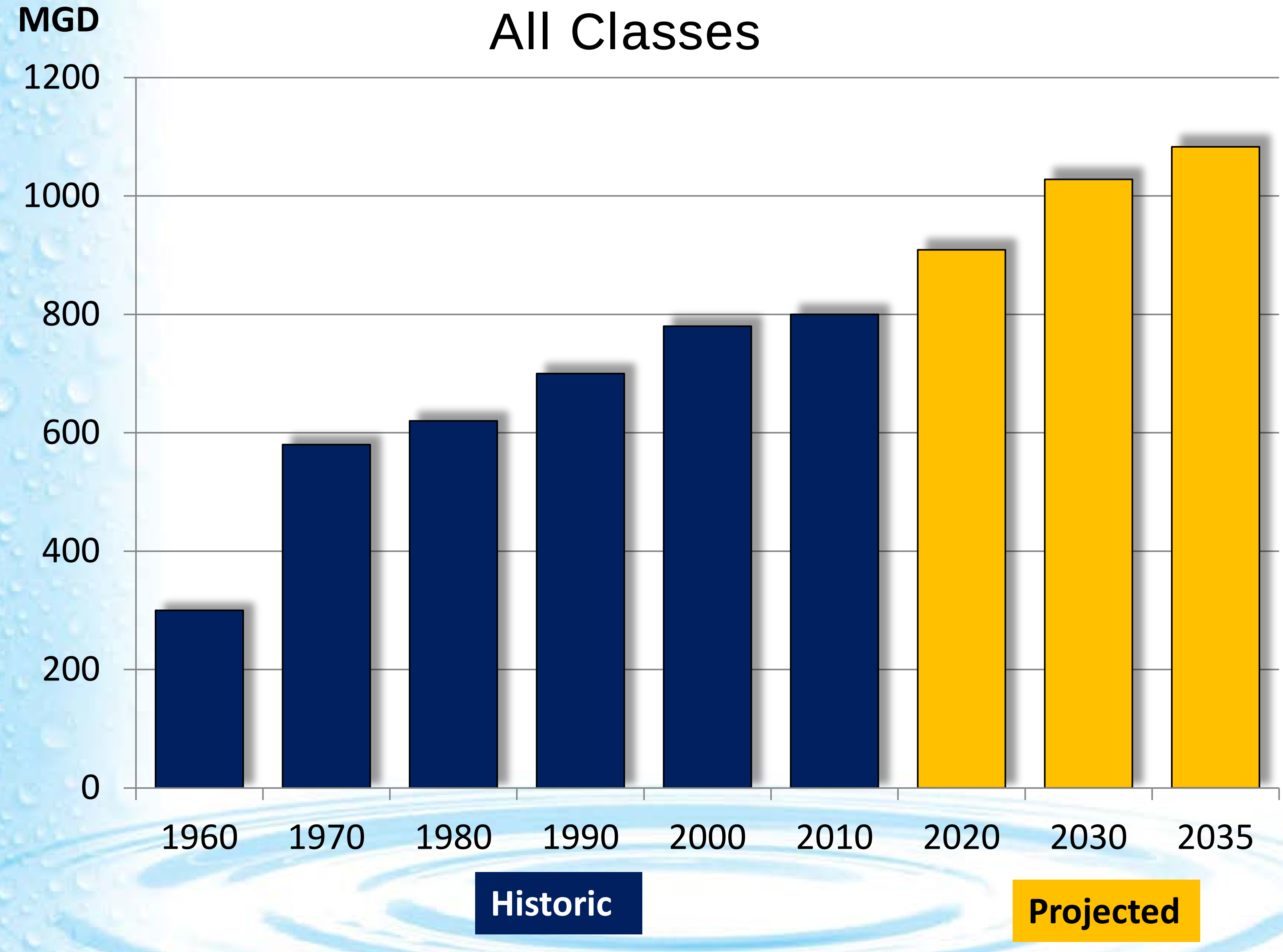
Addressing the Challenges

- One shared groundwater model
- One coordinated strategy for Minimum Flows & Levels (MFLs) prevention & recovery
- One Regional Water Supply Plan (RWSP)

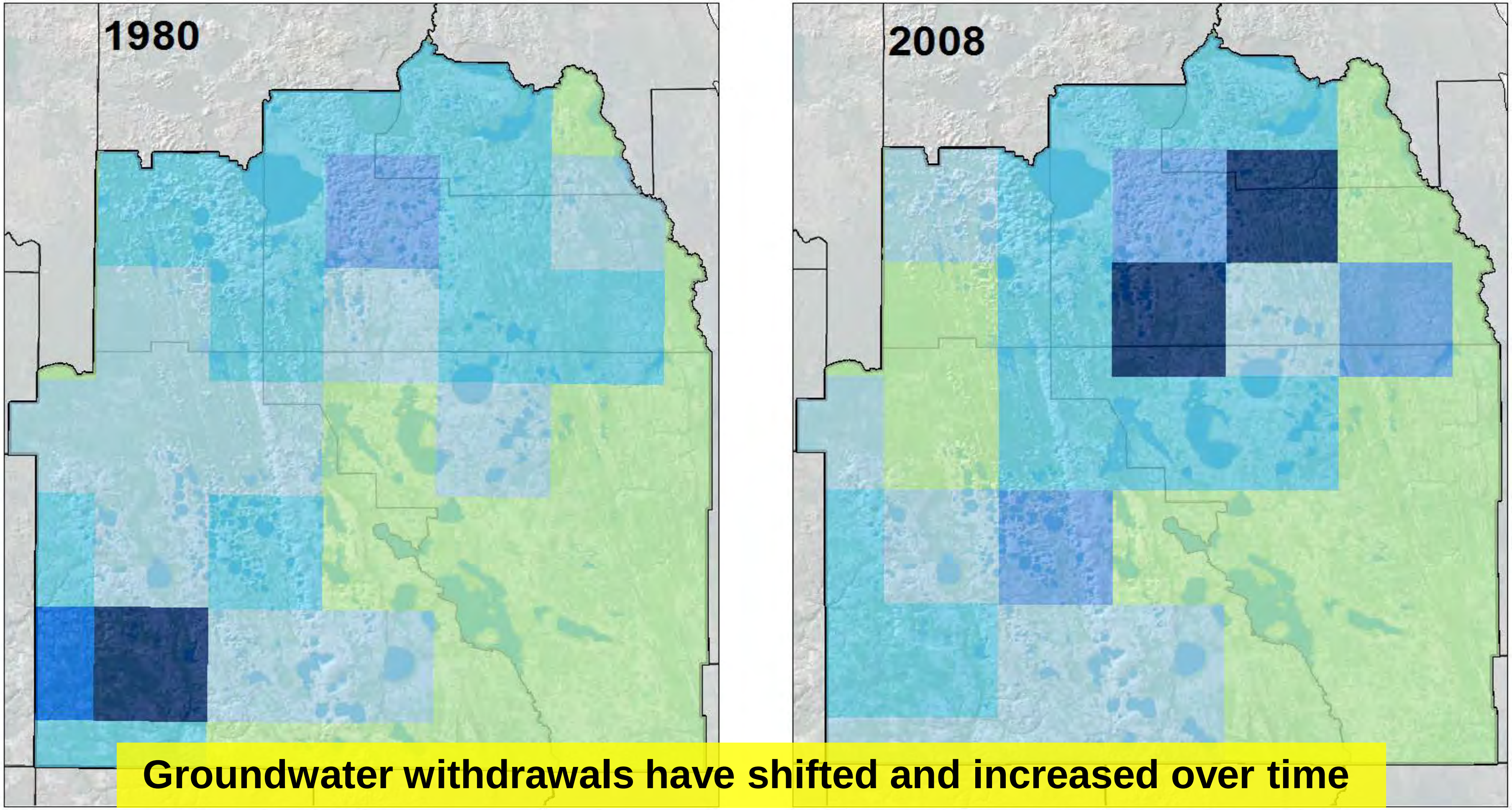

Historic Water Use vs. Population in the CFWI
Million Gallons Per Day
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Population
1995
1998
2001
2004
2007
2010
Year
Public Supply
Agriculture
Commercial / Industrial / Institutional & Mining / Dewatering
Landscape / Recreational / Aesthetic
Domestic Self-Supply
Power Generation

Water Use

All Classes



Generalized Map of Historical Groundwater Withdrawals



Groundwater withdrawals have shifted and increased over time

Withdrawals in Gallons per Day per Square Mile

< 32,000
32,000 - 97,000
97,000 - 194,000
194,000 - 291,000
291,000 - 388,000
> 388,000

One Plan for CFWI Region

- Developing first-ever regional water supply plan for CFWI
- Ensuring protection of the water resources and related natural systems
- Identifying sustainable water supply for all water uses in the CFWI through the 20-year planning horizon (2035)

Regional Water Supply Plan

- Demands from all categories
  - 20-year planning horizon
- Evaluation of water resources
- How to meet the demands
  - Potential sources
  - Project options
- Funding mechanisms
- Update every 5 years

Water Resource Evaluation

- Future demands estimated and aquifer changes evaluated
- Availability of groundwater determined from multiple measuring sticks to ensure protection of water resources and existing water users

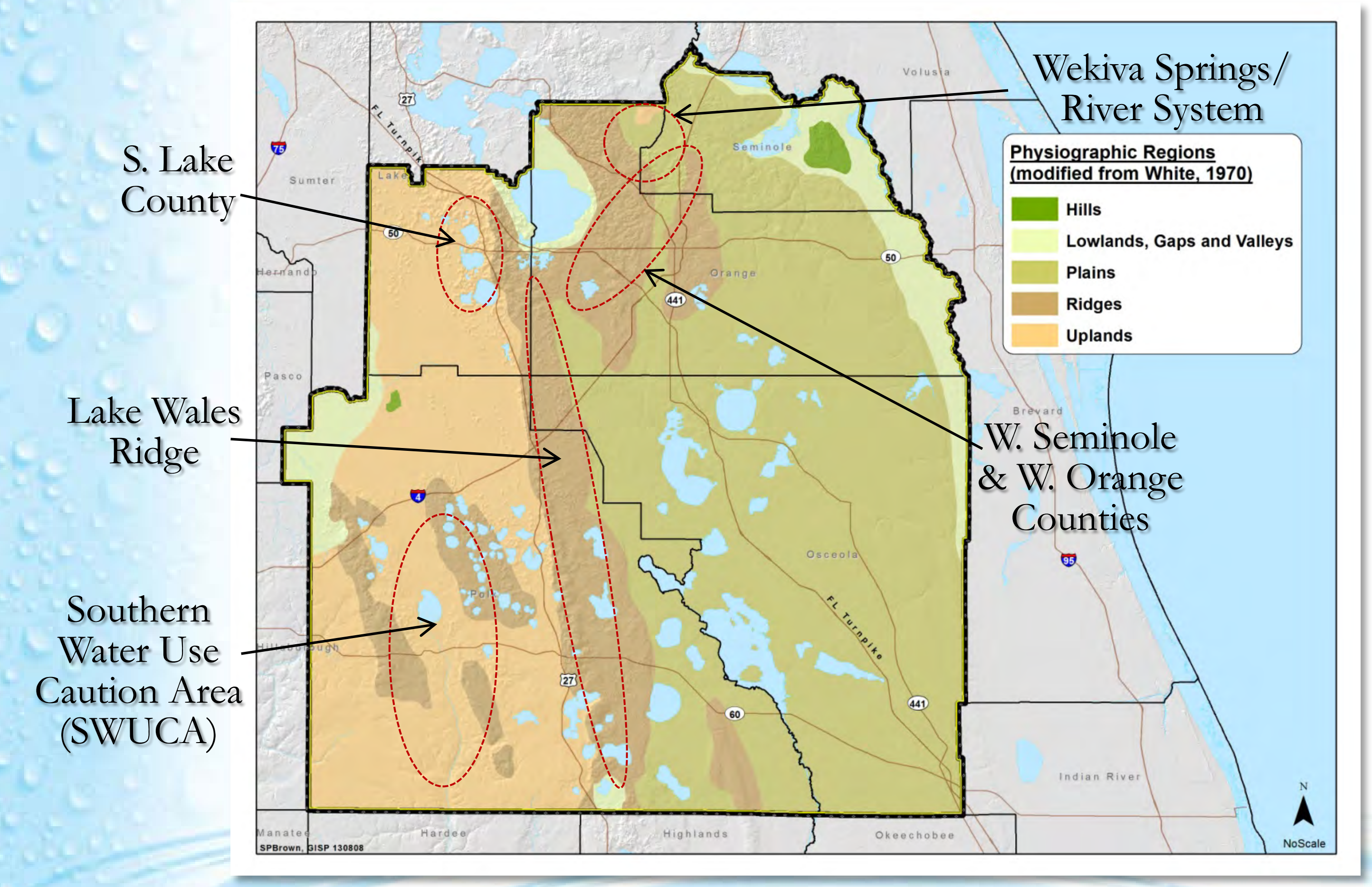
Groundwater Availability Measuring Sticks

- Water bodies with established and proposed minimum flows and levels (MFLs) within the CFWI
  - Regulatory constraints including Southern Water Use Caution Area (in Polk County)
- Non-MFL lakes/wetlands
- Non-MFL springs
- Aquifer water quality/saltwater intrusion

Findings

- Traditional groundwater sources can meet some, but not all projected and currently permitted needs in the CFWI.

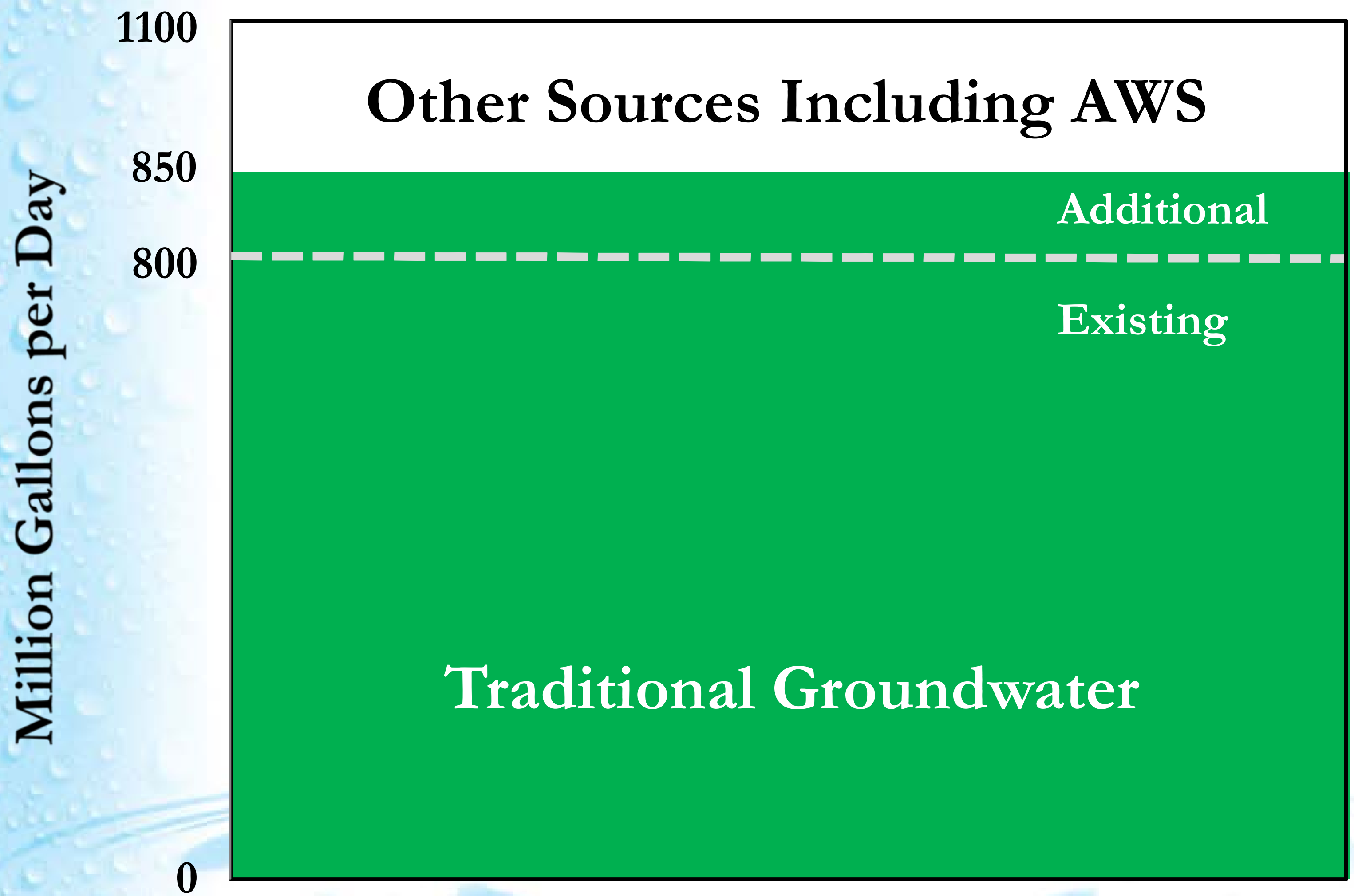
Primary Areas Susceptible to Groundwater Withdrawals



CFWI Planning Level Groundwater Availability Estimates

- 800 mgd
  - Average groundwater use (1995 to 2010)
  - Includes some management activities
- 850 mgd
  - Sustainable level of traditional groundwater sources available for water supply without causing unacceptable harm to water resources and associated natural systems
- 250 mgd
  - Amount of new water supply options needed in the RWSP (difference between 2035 projected demands and sustainable level using existing sources)

Sources to Meet 2035 Demands



Water Supply Options

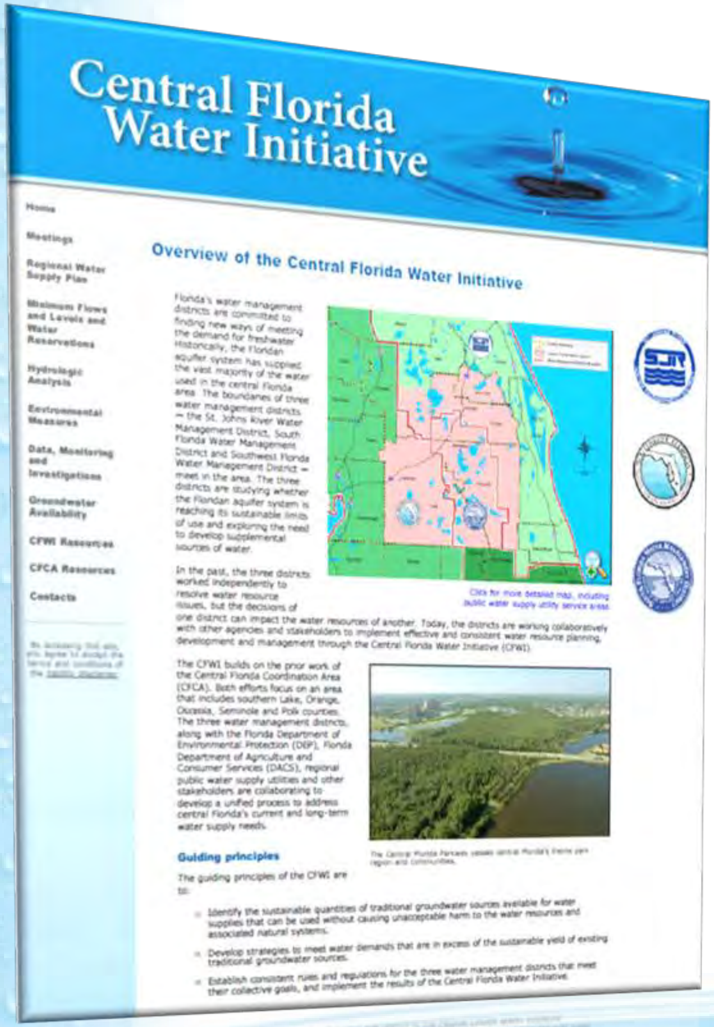
- Conservation
- Brackish Groundwater
- Surface Water
- Sea Water
- Reclaimed Water
- Storage Capacity

Water Supply Projects Identified

- Reclaimed Water - 81
- Brackish Water - 35
- Surface Water - 16
- Management Strategies - 3

Public Involvement Schedule

Components	Time Frame
Briefings/Presentations	Ongoing
Technical Methods Workshop Osceola Heritage Park (Osceola)	Nov. 7, 2013 10 a.m.– noon
Draft RWSP Public Workshop Clermont Community Center (Lake)	Dec. 12, 2013 4–7 p.m.
Draft RWSP to WMD Governing Boards St. Johns River WMD South Florida WMD Southwest Florida WMD	Dec. 2013 Dec. 10 Dec. 12 Dec. 17



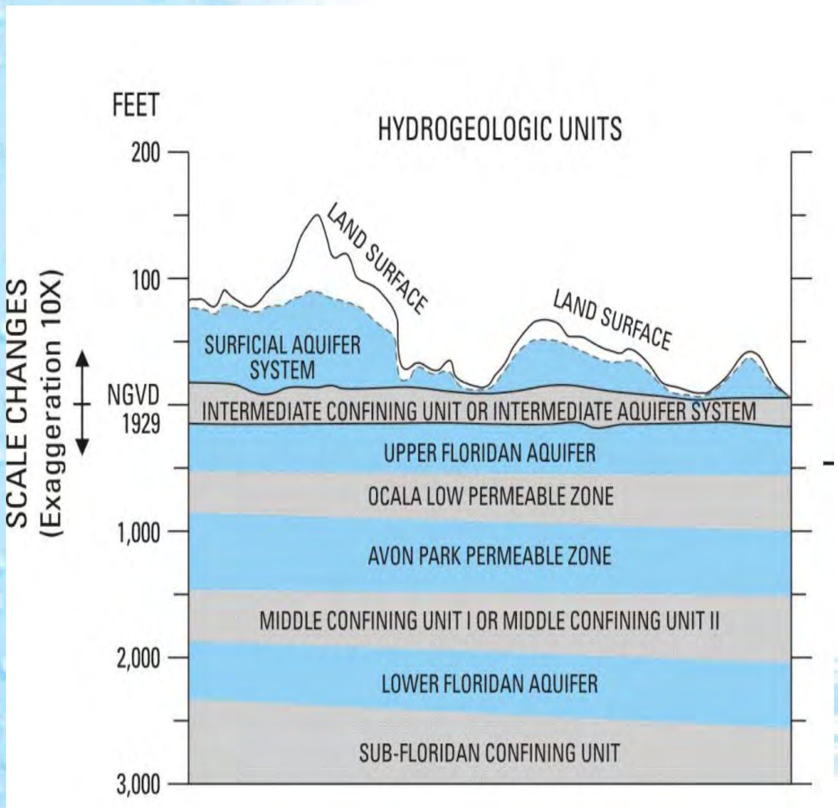
Questions may be sent to the contacts listed on the home page of the CFWI website at any time.

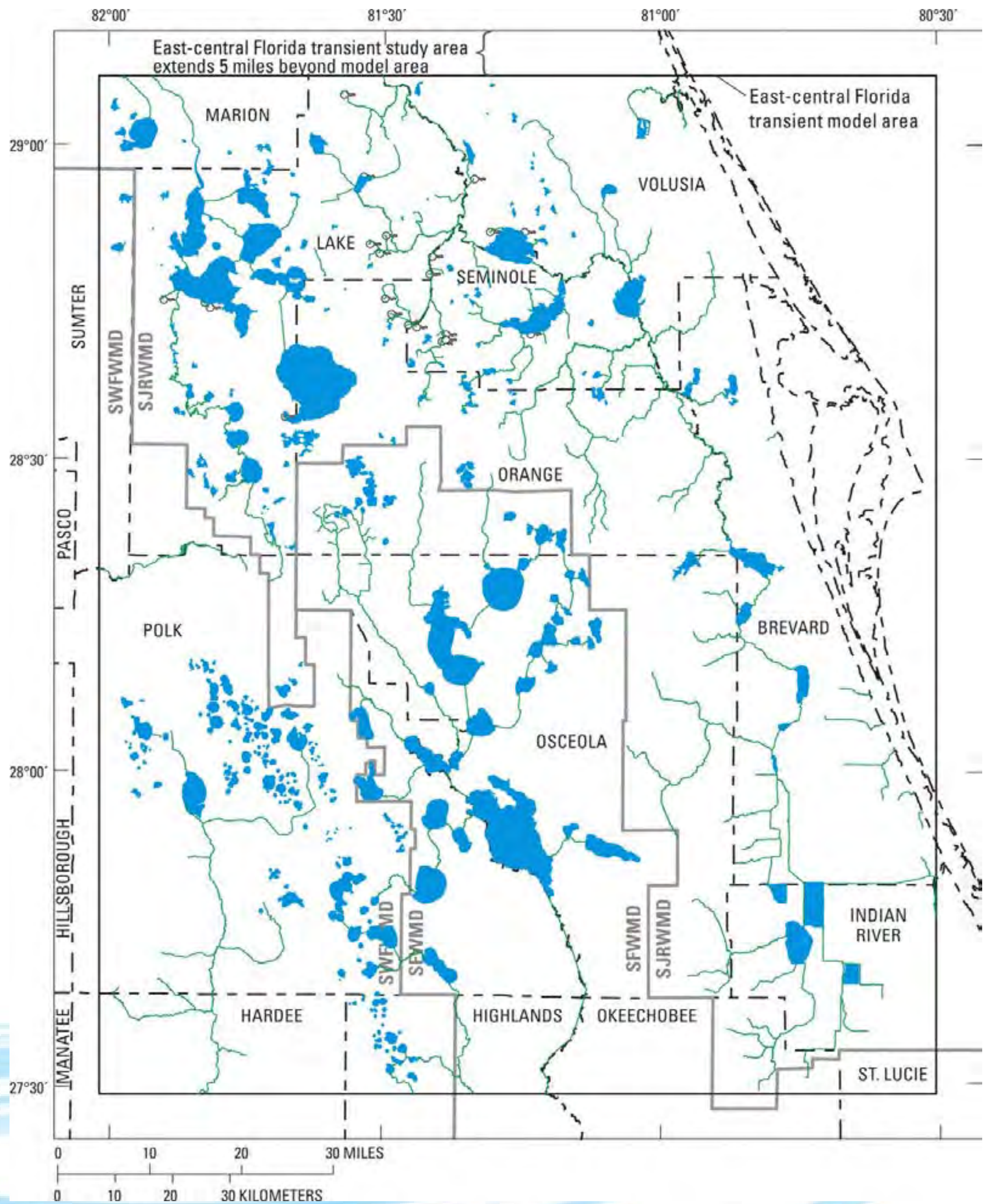
Additional information can be found at ***cfwiwater.com***

ECFT Groundwater Modeling

- Co funded collaborative work with USGS
- Technical oversight from Hydrologic Assessment Team (HAT), SFWMD, SWFWMD, and Utility Consultants
- Supporting Central Florida Water Initiative for Regional Water Supply Planning
- Large Transient groundwater flow model development that simulates many rivers and lakes
- All three Districts are to be responsible for model execution and upkeep to support CFWI process and other regulatory process that result

East Central Florida Transient (ECFT) Modeling Project

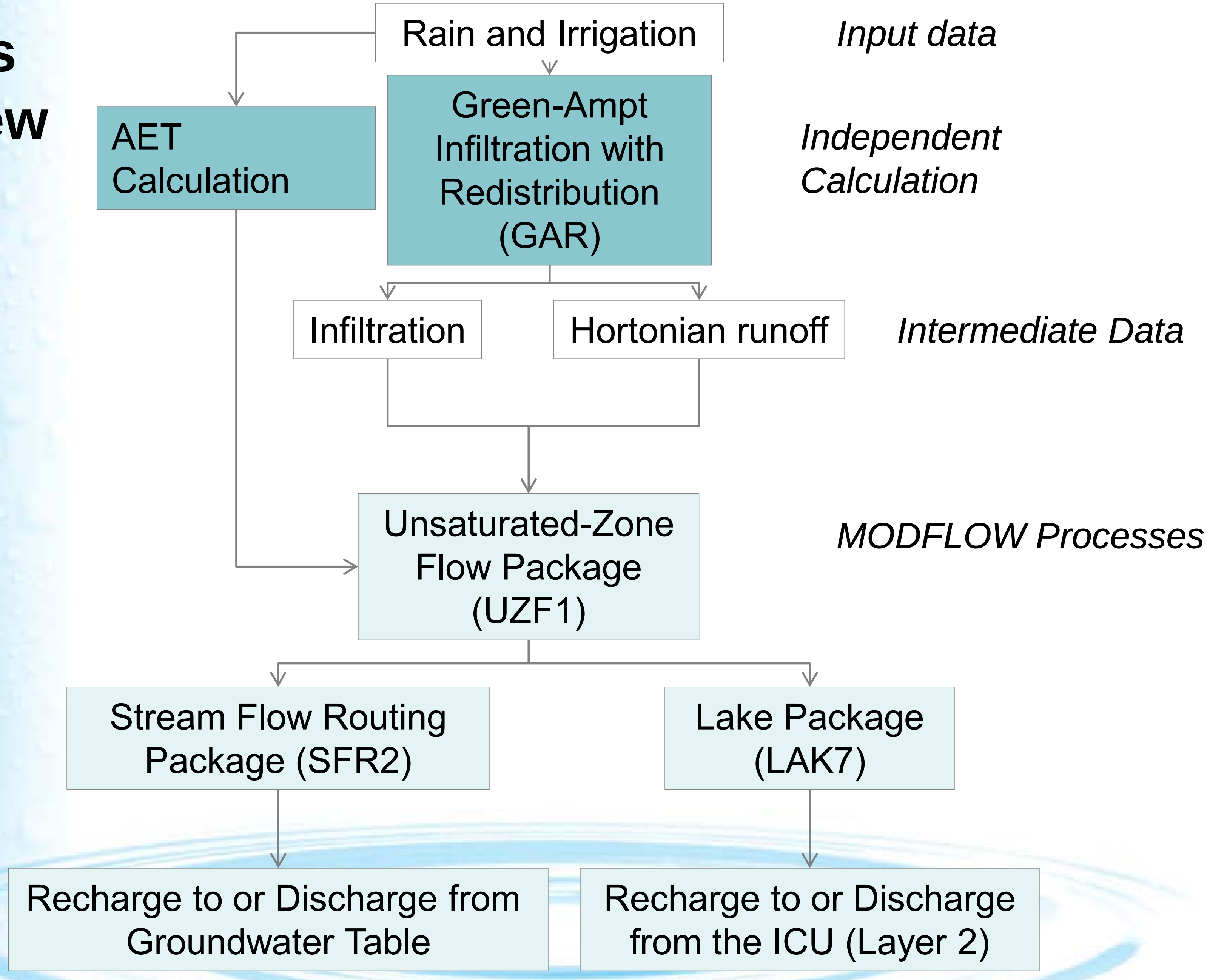




ECFT Model

- Transient Model
- 12 Years Monthly Water Use
- Covers over 10,300 Square Miles
- Contains 7 layers
- Withdrawal scenarios reflect rainfall conditions

Process Overview



Next Steps for ECFT

- Development of a user group to guide future model enhancements and model use.
- Expansion and recalibration of the model to address identified limitations.
- Create process for updating water use to provide the most current information for regulatory impact evaluations.

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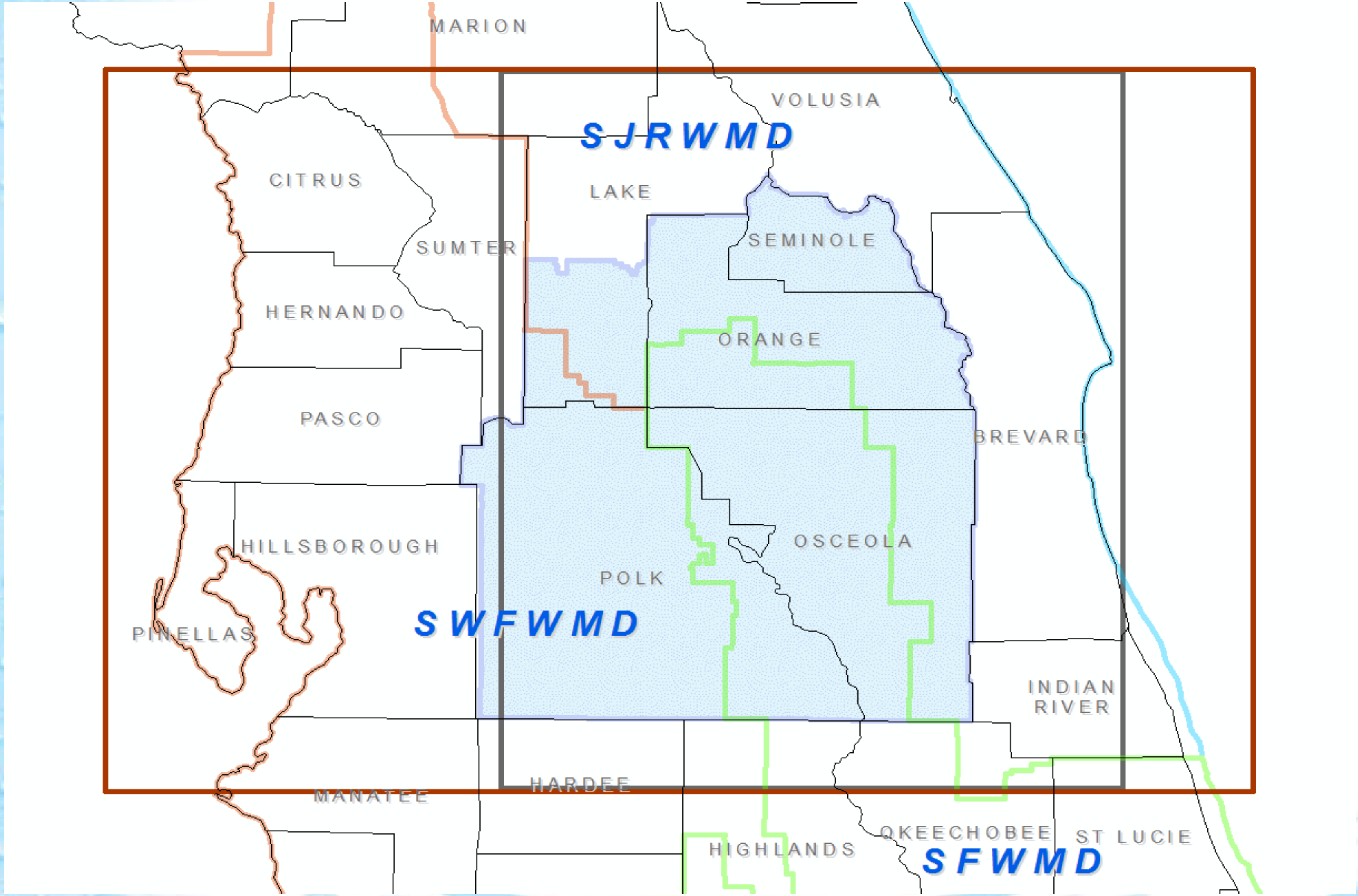
ECFT Expansion



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SPEAKER BIO

RACHID HARBOUZE

Rachid Harbouze is a PhD Student at the University of Bourgogne in Dijon, France. He holds an agroeconomic engineering degree. He is currently a Temporary Assistant for Teaching and Research at the University of Bourgogne in Dijon. Previously, he was a Temporary Assistant in Teaching and Research at Montpellier 1 University and a Project Coordinator for Project OptiProtecEau.

Université Montpellier 1

Principles of estimating the multiple efficiency: a tool for decision support in the process of choosing actions for the protection of water catchments.

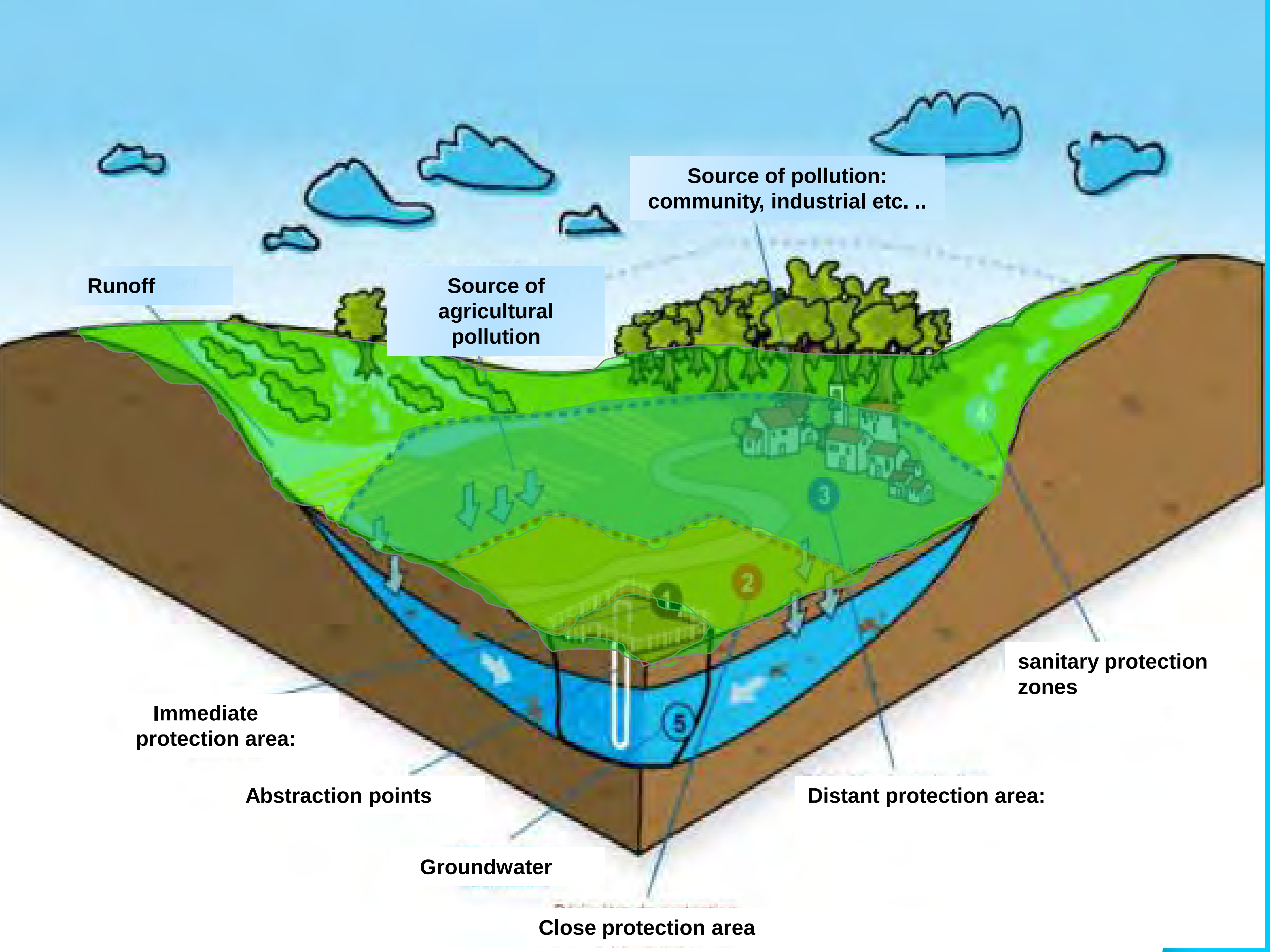
Wednesday 16, October 2013 **groundwater Conference**

Context

The quality of the water supply is currently more of an issue for a number of abstraction points; in 2008, more than 8% of the French population were supplied water at least once that had been contaminated with pesticides at concentrations higher than those admitted by drinking water quality standards.

- **Curative measures involving water treatment to ensure that it meets regulatory requirements.**

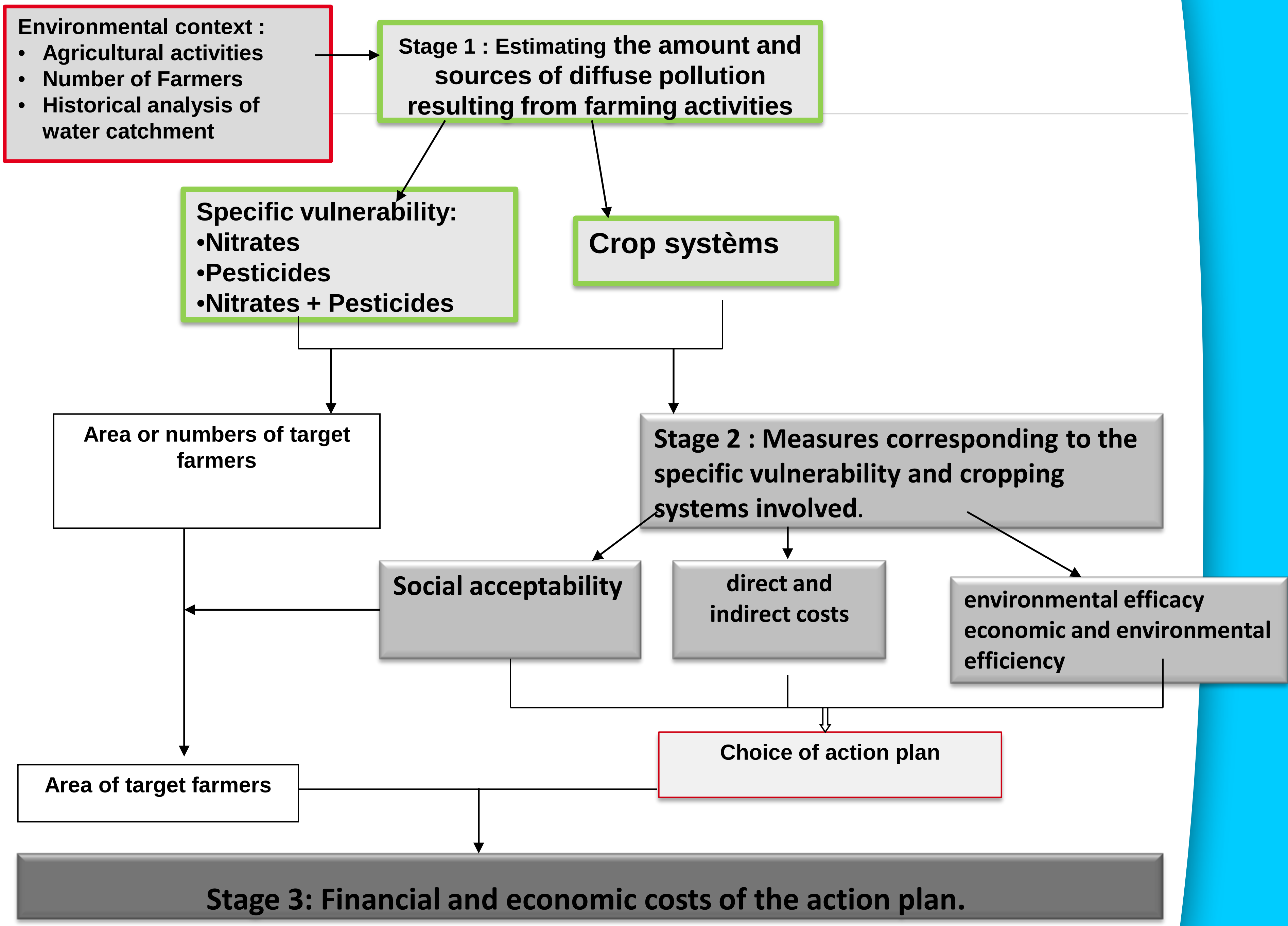
- **Preventive measures by delineating wellhead protection areas (WHPAs) or sanitary protection zones (SPZs) around catchment areas;**


Source of pollution: community, industrial etc. ..
Runoff
Source of agricultural pollution
3
2
1
4
5
sanitary protection zones
Immediate protection area:
Abstraction points
Distant protection area:
Groundwater
Close protection area

Delineating wellhead protection areas for drinking water implies regulating current and future activities in the close protection area.

When applied to farming activities, these measures require compensation, but in most cases they consist of *agroenvironmental measures* that farmers adopt willingly in an effort to reduce agricultural pollution.

a way in which local authorities wishing to achieve an overall advantage (in terms of drinking water standards) can weigh up alternatives before choosing the most economically acceptable solution.



Environmental context :
Agricultural activities
Number of Farmers
Historical analysis of water catchment
Stage 1 : Estimating the amount and sources of diffuse pollution resulting from farming activities
Specific vulnerability:
•Nitrates
•Pesticides
•Nitrates + Pesticides
Crop systèms
Area or numbers of target farmers
Stage 2 : Measures corresponding to the specific vulnerability and cropping systems involved.
Social acceptability
direct and indirect costs
environmental efficacy economic and environmental efficiency
Choice of action plan
Area of target farmers
Stage 3: Financial and economic costs of the action plan.

Measuring economic and environmental efficiency

The concept of efficiency is often used to characterize resource use; one can say that efficiency is a ratio representing the performance of a process which transforms a set of inputs into a set of outputs.

It corresponds to the difference between the maximum possible production, taking into account the inputs consumed, and the actual production (Boussemart, 1994).

technical efficiency : **the maximum level of output (production) observed for a determined level of inputs (production factors), given the range of alternative technologies available to the farmer.**

Allocative efficiency : **evaluates the manner in which companies choose the proportions of different inputs as a function of the prices proposed by the market.**

Environmental efficiency: **this is defined as "the ratio of the minimum feasible use to the observed use of an environmentally detrimental input, for given levels of desirable outputs and conventional inputs" (Reinhard, Lowell and Thijssen, 1999).**

Measuring the economic and environmental efficiency of agro-environmental measures.

The goal is to assess, at the scale of individual farms:

1) The impact of contracting to apply an AEM (simulating the effect of modifying existing practices) on the farm's overall economic efficiency and also on the partial efficiency of each activity: efficiency "Phy" for the phytosanitary protection activity, efficiency "N" for the fertilisation activity, etc.

2) The impact of contracting to apply an AEM on the farm's overall environmental efficiency, to see whether the contract improves the indicators of the risk of environmental toxicity (IRET).

Variables	Units	Before AEM 2007-2008	With AEM 2009-2013
Outputs		Economic efficiency and partial efficiency with no contract	Economic efficiency and partial efficiency with contract
Income	€/Ha		
Inputs			
Labour	€/Ha		
Mechanisation	€/Ha		
Water irrigation	€/Ha		
Seeds	€/Ha		
Pesticides	€/Ha		
Others			

Variables	Units	Before AEM	With AEM
Outputs		Environmental efficiency with no contract	Environmental efficiency with contract
Income	€/Ha		
Inputs			
Insecticide	$IRET_H$/Ha $IRET_{HH}$/Ha		
Herbicide	$IRET_H$/Ha $IRET_{HH}$/Ha		
Fungicide	$IRET_H$/Ha $IRET_{HH}$/Ha		

IRET : indicators of the risk of environmental toxicity

Expected Results

Farmers	Economic efficiency		Environmental efficiency	
	Before AEM	With AEM	Before AEM	With AEM
Farm N 1	0,7	0,9	0,5	0,7
Farm N 2	0,8	0,8	0,85	0,6
………… …………				
Farm N 60	0,2	0,5	0,6	0,6

expected Results

Inefficient Farmers	Partial Economic efficiency											
	Before AEM						With AEM					
	E_{Lab}	$E_{Méc}$	E_{Irr}	E_{Eng}	E_{Phyto}	E_{others}	E_{Lab}	$E_{Méc}$	E_{Irr}	E_{Eng}	E_{Phyto}	E_{others}
Farm x 1	0,95	0,90	0,4	0,85	0,75	0,9	0,95	0,85	0, 3	0,9	0,90	0,9
Farm x 2												
………… …………												
Farm xn												

Crops	contract	Efficiency class (%)	Income (€/Ha)	Labour (€/Ha)	Mechanization (€/Ha)	Irrigation (€/Ha)	Seed (€/Ha)	Phyto (€/Ha)	others (€/Ha)
Crop N	With	80%-100%							
		60%-80%							
		40%-60%							
		20%-40%							
	Befor	80%-100%							
		60%-80%							
		40%-60%							
		20%-40%							

Conclusion:

The approach developed here enables decision-makers to introduce the notion of efficiency when choosing agro-environmental measures, thus facilitating an assessment of the economic and environmental impact for a farm to accept a contractual obligation to apply an AEM.

It is difficult to place a monetary value on environmental impacts, but the Data Envelopment Analysis method can be used to incorporate environmental impacts, via the use of variables (indicators) that need not be translated into financial terms.

OPTI PROTEC EAU, a collaborative research & development project

Developing a decision-support tool for optimising the designation of drinking water catchment protection areas using groundwater sources.

Project presentation

October 2013

Contents

- Introduction
  - A collaborative project
  - Goals of the project
  - Potential users of the tool
- Overview of the tool
- Innovative features and limitations of the tool

Introduction

Un projet collaboratif

- **4 partners with complementary expertise**:
  - **CEREG INGÉNIERIE**: a medium-sized engineering consultant for local authorities, developers and industrialists (diagnostics, preliminary studies, technical support)
  - **VEOLIA ENVIRONNEMENT**: an operator of water-supply systems, managing water-treatment plants and groundwater pumping sites
- **2 laboratories**:
  - **HYDROSCIENCES** (UMR CNRS, IRD, UM1, UM2): water science research
  - **CIHEAM-IAMM**: education and research in agronomy, economics, the social sciences and managing rural development in the Mediterranean region
- **project (1 million €) funded by :**
  - Région Languedoc-Roussillon
  - Oséo
  - Fonds Feder
  - Fonds propres (pour les entreprises)
- Duration of the project : **3 years** $\rightarrow$ **end: december 2013**

Project objective 1/2

- Overall objective: **To design <u>decision-suport</u> software, specifically as regards <u>optimising the designation of drinking water catchment protection areas using groundwater sources</u>**

- To offer methodological support and a single procedure
  - integrating regulatory, technical, financial, political, social, resource-sharing aspects, etc.
  - defining (or proposing) “minimal optimal” protection
  - highlighting the factors with the greatest impact on the protection area
- achieving the best technical choices in the shortest possible time

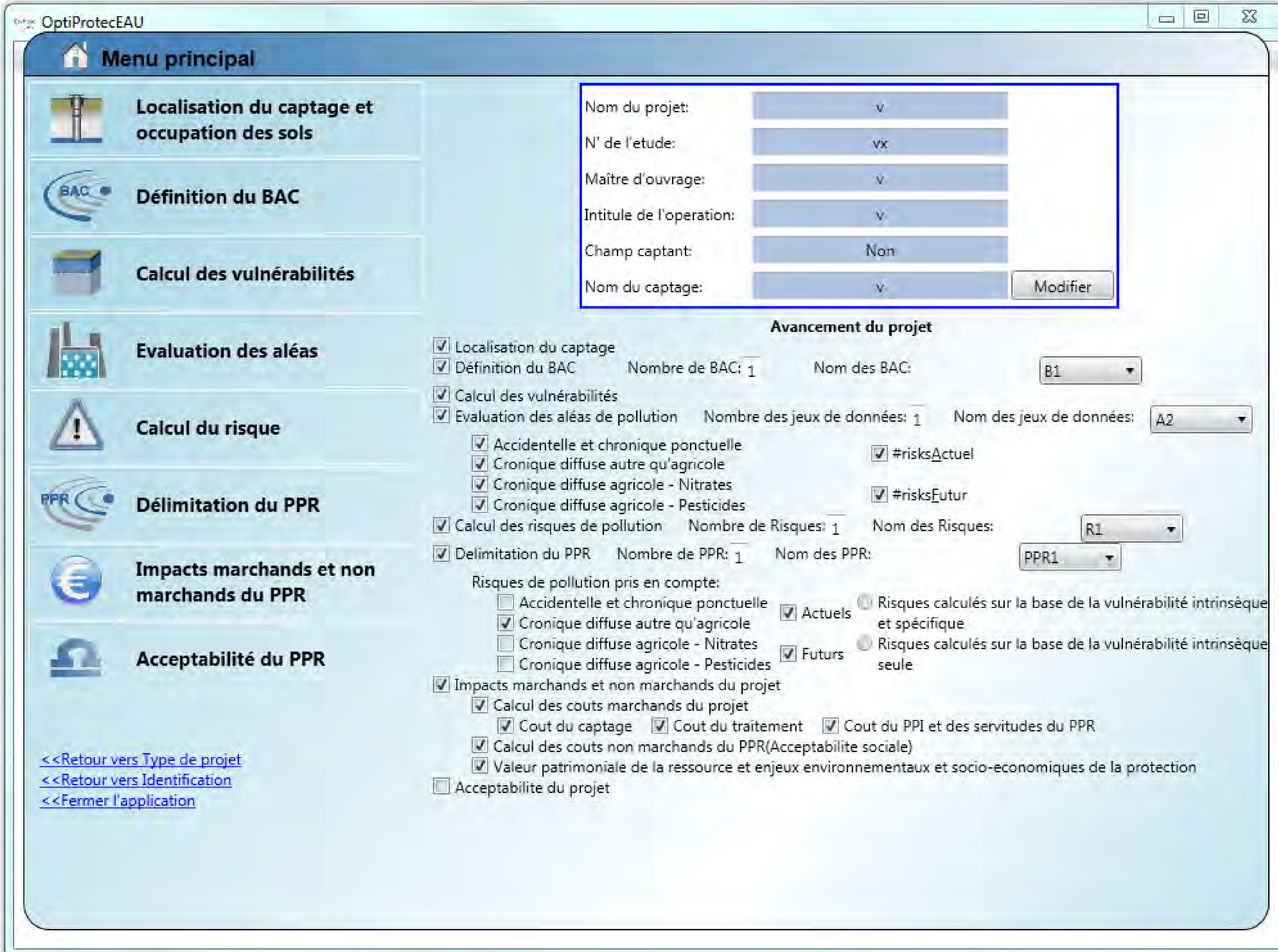
Project objective 2/2

- To propose a new service offer for providing local authorities with better quality advice
  - upstream, as part of pre-projects for the creation of extraction sites:
    - → test different scenarios for protection areas by modifying certain aspects of the project (positioning the extraction site, processing plants, etc.)
    - → achieving the best trade-off between risk, cost, social and political acceptability, sound management of the resource and technical constraints
  - downstream, for existing protection areas:
    - → modify the protection to suit new constraints (regulations, changing land use, development projects, etc.)
    - → compare a number of extraction points in a given area defined by a local or regional authority: the tool can be used to check that protection areas are valid and meet the same criteria
    - → assist in policy-making regarding development and land use

Utilisateurs potentiels de l'outil

- **Developers and local authorities,** which usually lack a clear vision and assessment criteria (constraints and financial costs)
- Individuals **responsible for the production or distribution of water to the public**
- **engineering consultants** who carry out studies for contracting authorities
- certified **hydro-geologists** who will be able to use the software as a guide and to provide support for their expertise
- **Government departments, local authorities and public institutions** (Water Authorities) involved in the designation of protection areas

However, it is not intended to replace the expertise of the hydro-geologist, nor the prerogatives of government or local authority technical departments


OptiProtecEAU
Menu principal
Localisation du captage et occupation des sols
Définition du BAC
Calcul des vulnérabilités
Evaluation des aléas
Calcul du risque
Délimitation du PPR
Impacts marchands et non marchands du PPR
Acceptabilité du PPR
<<Retour vers Type de projet
<<Retour vers Identification
<<Fermer l'application
Nom du projet: v
N' de l'etude: vx
Maître d'ouvrage: v
Intitule de l'operation: v
Champ captant: Non
Nom du captage: v
Modifier
Avancement du projet
Localisation du captage
Définition du BAC
Nombre de BAC: 1
Nom des BAC: B1
Calcul des vulnérabilités
Evaluation des aléas de pollution
Nombre des jeux de données: 1
Nom des jeux de données: A2
Accidentelle et chronique ponctuelle
Cronique diffuse autre qu'agricole
Cronique diffuse agricole - Nitrates
Cronique diffuse agricole - Pesticides
#risksActuel
#risksFutur
Calcul des risques de pollution
Nombre de Risques: 1
Nom des Risques: R1
Delimitation du PPR
Nombre de PPR: 1
Nom des PPR: PPR1
Risques de pollution pris en compte:
Accidentelle et chronique ponctuelle
Cronique diffuse autre qu'agricole
Cronique diffuse agricole - Nitrates
Cronique diffuse agricole - Pesticides
Actuels
Futurs
Risques calculés sur la base de la vulnérabilité intrinsèque et spécifique
Risques calculés sur la base de la vulnérabilité intrinsèque seule
Impacts marchands et non marchands du projet
Calcul des couts marchands du projet
Cout du captage
Cout du traitement
Cout du PPI et des servitudes du PPR
Calcul des couts non marchands du PPR(Acceptabilite sociale)
Valeur patrimoniale de la ressource et enjeux environnementaux et socio-economiques de la protection
Acceptabilite du projet

Innovative aspects and limitations of the software

Innovative aspects

- An all-in-one solution that takes into account:
  - hydro-geological aspects
  - pollution, irrespective of type
  - financial and social aspects
- A tool offering a common hydro-geological method, whatever the context
  - A vulnerability analysis grid
  - Intrinsic but also specific vulnerability
  - Takes into account changing activities and land use
  - Pollution flows and the toxicity of different substances
  - Delineation of the Inner Protection Area

The software's limitations

- The software cannot be used to calculate concentrations of pollutants at the extraction point based on flows at the source of the pollution
- The software has not been designed for extraction catchment area studies for priority extraction points, but specific modules could be developed for this purpose.

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Thank you for your attention

BACK TO AGENDA

GROUNDWATER GUARDIAN AND GREEN SITE CELEBRATION LUNCHEON

Welcome

Lunch

Groundwater Guardian Remarks

Phil Peters Award Presentations

Mission Inn Green Site Presentation

Closing Remarks and Toast

2013 Groundwater Foundation National Conference

BACK TO AGENDA

SPEAKER BIO

CHRISTINE SPITZLEY

Christine graduated from Michigan State University with a B.S. in Urban Planning. Since 1990 she has served as the Environmental Programs Planner at Tri-County Regional Planning Commission (TCRPC). TCRPC is located in Lansing, Michigan; the heart of Michigan's Lower Peninsula. Prior to joining TCRPC, she spent three years working for the Ingham County Economic Development Department and Controller's office.

In her role at Tri-County Regional Planning Commission she works with seventy-five municipalities, three counties and various authorities and boards to create effective, economical programs to protect the environment. Projects have included solid waste plans, land use planning, air quality, watershed planning, an annual children=s water festival, groundwater protection, abandoned wells and wellhead protection programs. She is also responsible for the fund raising/grant writing, administration and reporting required to fund and execute these programs.

She is an AICP member of the American Planning Association. She is also a member of the Michigan Section American Water Works Association where she served three as a trustee, co-chaired the Management and Administrative Practices, Safe Water in Ecuador, Youth Education and Audit Committees, and has served on the Planning and Strategy, Program, Community Awareness, Conference Planning, Nominating, and Education Committees. She also served on the Groundwater Guardian Council and is a past President of the Mason Public Schools Foundation. She is certified as a grant writer, reviewer and consultant.

Meet Your Match

Reducing costs, reducing waste through ByProduct Synergy

Christine V. Spitzley, AICP
Tri-County Regional Planning Commission

Michigan ByProduct Synergy

Christine V. Spitzley, AICP

- B.S. in Urban and Regional Planning
- 25 years of Program Management:

  - Economic development
  - Transportation
  - Land use
  - Air quality
  - Fair housing
  - Water

Michigan ByProduct Synergy

Tri-County Regional Planning Commission

Serving since 1956

- Lansing
- Clinton, Eaton & Ingham Counties
- Population 450,000
- Programming
  - Transportation
  - Economic development
  - Data
  - Environment
  - Land use

Michigan ByProduct Synergy

Michigan Wellhead Protection

- Michigan Department of Environmental Quality
- Voluntary
- Over 200 programs
- First plans adopted 1990's
- Seven steps

Seven Elements of WHP

1. Roles and Responsibilities
2. Wellhead Protection Area Delineation
3. Potential Sources of Contamination
4. Wellhead Protection Area Management
5. Emergency Response Plan
6. New Wells
7. Public Education and Outreach

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Potential Sources of Contamination

- 4,000 identified sites
- 75 point evaluation tool
- Mapped using Arc Viewer
- Trained planning and utility staff
- Offered training to site owners

Michigan ByProduct Synergy

Next Step –ByProduct Synergy

- Cost reductions
- Risk avoidance
- Enhanced competitive advantage

ByProduct Synergy (BPS)

Matches by-product streams from one facility to another facility's needs

- Repurposes what is traditionally considered "waste"
- Creates revenues and savings
- Addresses social and environmental impacts

NOT your typical waste management program!

Michigan ByProduct Synergy

Michigan ByProduct Synergy

- Hosted by TCRPC, Lansing, MI
- Serves entire state
- Grant funded – multiple sources
- Currently funded into 2015
- Priority for EPA and MDEQ

Michigan ByProduct Synergy

Impetus for TCRPC's involvement

- Logical fit within our current programming
- Triple Bottom Line: Social, Environment, Financial
- Long term relationships in business and environment
- Quickly adapt and flex programs as needed
- Ideal geographic location

Michigan ByProduct Synergy

How does it work?

BPS brings entities together to "meet their match.” Your byproduct may be someone else's valued supply.

- **Stakeholders** provide expertise, support, marketing, etc.
- **Participants** bring a waste stream to the table, or are looking for inputs
- **Innovators** look at new ways to use, change, repurpose

We provide a forum for information and idea exchange. You take it from there.

Michigan ByProduct Synergy

Stakeholders

- Guiding Body
- Ideas
- Expertise
- Connections
- Funding

Michigan ByProduct Synergy

Participants

- People with stuff
- People who want stuff
- People who process stuff
- First meeting September 18

Michigan ByProduct Synergy

Innovators

- Universities
- Associations/Trade Groups
- Businesses
- Nonprofits
- Individuals

Michigan ByProduct Synergy

Initial BPS Participants

- Working Bugs
- Lansing Board of Water and Light
- Dow
- General Motors
- Detroit Dirt
- Michigan State University
- Michigan Packaging Corporation
- Delhi Charter Township
- East Lansing Meridian Water and Sewer Authority
- Wacker Chemical Corporation
- Potter Park Zoo
- Granger
- Consumers
- Goodwill Green Works

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1st Participant Meeting September 18

- Breakfast/Networking
- Short Overview of BPS
- “Speed Dating” matches
- More networking
- Over 10 potential synergies identified in an hour

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In the following week…

Ten additional entities expressed an interest in participating.

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Our Job: Making Connections

- Recruit participants
- Seek out experts and innovators to develop/guide new uses
- Build relationships and networks
- Secure Funding
- Figure out how to make it work

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Learn the technical, financial, and cultural ins and outs of dozens of businesses, industries, processes and sciences.

Michigan ByProduct Synergy

Which means:

- Spend your days pondering reuses for things you didn't even know existed 6 months, weeks or days ago.
- Reach a new level of humble asking endless rookie questions.
- Cursing transportation costs and systems.
- Your office becomes a sea of yellow sticky notes, white board musings, dozens of scribbled legal pads, piles of business cards and samples of byproducts.
- You find yourself asking to dumpster dive after meetings with strangers.

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Building the BPS Network

- Very time intensive
- Strong networking
- Methodical follow up and follow through
- New approach to old relationships

Example: Foundry Association

- Retirement luncheon with an EJ Salesperson
- Board member had unrelated meeting with EJ President at AWWA
- Conference Call with EJ
- Visit to EJ
- Invite to Foundry Association
- Another visit to EJ
- Visit to Resource Recovery Corporation

Meanwhile…back in my office

- Research
  - Foundry
  - Foundry Sand
  - Foundry Sand Reuses
  - Foundry Sand Reuse Barriers

Keys to Successful BPS

- **Collaboration** – producers and consumers share what others might value
- **Motivation** – project stakeholders must be able to see the potential and make it their own
- **Communication and Participation** – must permeate all levels of organization

BPS vs. traditional “waste exchange program”

- "Old School" waste exchange still has value
- BPS = *transformation* of waste into new input or product

    Transportation-Energy-Communication

- Social applications
- Environmental metrics
- Sustainability

Michigan ByProduct Synergy

Transformation of waste

- Thinking about waste in new ways
- Consider previously unconsidered alternatives
- Redefine "reuse" (e.g.: tires)

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Social applications

- Goodwill/Peckham
  - Jobs
  - Training
  - Goods
- Environmental justice
  - Landfill space
  - Raw materials
  - Pollution

Environmental metrics: quantify benefits

- Landfill diversion
- CO_2 reduction
- Energy savings
- Hazardous waste reduction
- Water use reduction
- Reduction in virgin material use

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Sustainability

- Low cost
- Diverse
- Evolving
- Open forum
- Dissemination

Examples of ByProduct Synergies

Bulk Bag Reuse

Two companies have identified a BPS opportunity involving the use of bulk bags from Company A by Company B which displaces the need for use of new bags. Ordinarily, the bulk bag would be disposed in a landfill. (Source: USBCSD)

Examples of ByProduct Synergies

- **Foundry Sand to Soil Amendments**
- Two companies have identified a BPS opportunity involving the use of foundry sand from Company A by Company B for soil amendments, displacing the need for use of virgin sand. Ordinarily, the foundry sand would be disposed in a landfill. (Source: USBCSD)

Examples of ByProduct Synergies

Filter Cake to Brick Colorant

Two companies have identified a BPS opportunity involving the use of filter cake from three facilities of Company A by Company B for brick colorant, which displaces the need for use of virgin brick colorant material. Ordinarily, the filter cake would be disposed in a landfill. (Source: USBCSD)

Examples of ByProduct Synergies

Off-specification Cement for Land Stabilization

Two companies have identified a synergy involving the use of off-specification cement from Company A for use by Company B for land stabilization. This synergy displaces the need for use of virgin stabilization materials. (Source: USBCSD)

Examples of Waste Streams in MI ByProduct Synergy Program

- Zoo waste
- Cellulose
- Foundry sand
- Food waste
- 300,000 red rubber bands
- Bullet proof glass
- Foundry sand
- Calcium carbonate
- Glass
- Slag
- Activated carbon
- Black carbon
- Furniture
- Polystyrene
- Train backhauls
- Railroad shipping facilities
- Plastic strapping

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What's in it for my organization? And by association my drinking water.

- Reduces emissions, and energy, raw material and disposal costs
- Improves productivity, profitability, regulatory compliance and community relations
- Develops new products and markets
- Protects environment and natural resources

Michigan ByProduct Synergy

Immediate BPS Goals

- Vocal advocates and recruiters for BPS
- Double BPS Participants for January 2014 Meeting from 15 to 30
- Coordinate specific technical assistance for identified potential synergies
- Utilize grant funding for site surveys of 5-10 small to medium companies in 2014
- Hold additional Participant Meetings in the Spring and Fall of 2014

BACK TO AGENDA

Let’s find your match!

Michigan ByProduct Synergy

BACK TO AGENDA

SPEAKER BIO

TERESA THORNTON

Dr. Teresa Thornton is a hydro-geochemist and social scientist that has been teaching science since 1994. Focusing her curriculum on water resources, she taught pre-service teachers and forest resource undergraduates how to teach science in both classic and alternative settings. Her focus has been on kinesthetic, experiential, brain-based learning that fosters the natural desire to understand the interconnectedness of the classical sciences and the social sciences. Dr. Thornton is also the Co-Founder and Executive Director of the GET WET! program. This program, now in seven states, pairs local stakeholders and educational institutions to promote groundwater protection through private well testing and land-use remediation. She has published in geology, water science, and education journals and has had the privilege of speaking at national and international conferences on both drinking water source protection and STEM education.

Assuring Collaborative Communities in Groundwater Education and Research

Teresa Ellen Thornton, M.S. Ph.D.

The Groundwater National Conference

Orlando, FL

October 16, 2013

Threats to Groundwater

- Increasing development and demand
- Pesticides, fertilizers, historical contaminants, etc.
- Climate change
  - Precipitation changes
    - Saltwater intrusion in coastal communities
    - Chemically concentrated, scarce groundwater (decreased recharge)
- Natural contaminants

http://spacing.ca/votes/?cat=42

http://facstaff.unca.edu/chennon/images/ocean.jpg

Private Well Water

- In the US, 15 million homes use private wells (NGWA.ORG)
- Approximately 500,000 new residential wells are constructed annually (NGWA.ORG)
- In Florida 90% of people use groundwater as a drinking source
- 5% of the population rely on private wells (Approximately 795,000 people)
- Limited to no regulations or enforcement for water quality testing
- Little incentive for homeowners to test wells

GET WET!

<u>G</u>roundwater **<u>E</u>**ducation **<u>T</u>**hrough **<u>W</u>**ater **<u>E</u>**valuation and **<u>T</u>**esting

GOALS:

•Collect data on groundwater quality (students).

•Build interest in the community (schools).

•Educate public to the need for private well testing

•Establish groundwater monitoring network.
-Through random sampling of wells

GET WET!

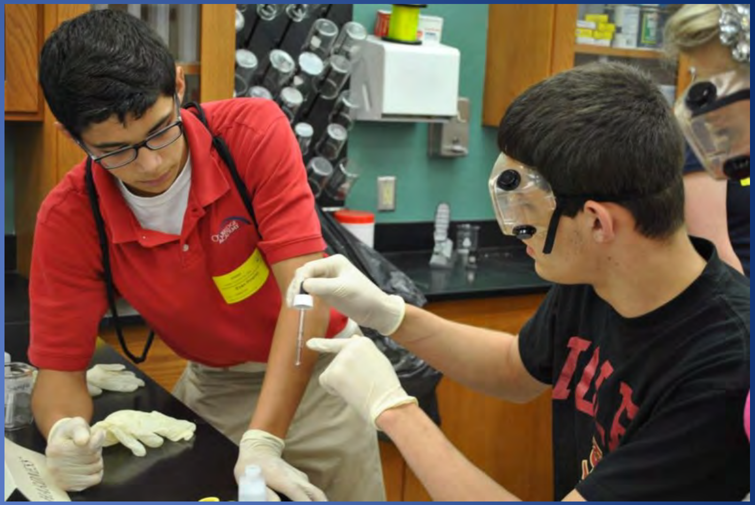
EDUCATIONAL GOALS:

Students:

- Field sampling techniques
- Laboratory skills
- Computer competence in Excel, Word, PowerPoint and a GIS program

- Internet research capabilities
- Mapping abilities
- Water chemistry
- An understanding why conservation and commitment to a healthy environment takes an entire community

GET WET!



The Numbers:

- 9 years old
- 7 states
- 44+ towns, 23+ schools
- 100+ teachers and pre-service teachers
- 1000’s of 5th-12th students
- 100’s of Professional and Community Volunteers

GET WET!

- K-12 Students (and indirectly their household members)
- Teachers
- Administrators
- State Employees
- Watershed associations, conservation commissions, & ENGOs
- County or town employees
- Local business owners
- College professors & undergraduate students
- Parents, retirees, and other community members

GET WET! Locations

MAINE

Penobscot Watershed (3 towns)

Androscoggin Watershed (3 towns)

Frenchman Bay Watershed (4 towns)

Nezinscot River Watershed (3 towns)

Acton Watershed

Androscoggin County

Sagadahoc County

NEW HAMPSHIRE

Connecticut River Watershed (4 towns)

Ossipee Watershed (6 towns)

Wakefield Watershed

VERMONT

Connecticut River Watershed (2 towns)

RHODE ISLAND

Scituate Watershed (4 towns)

CONNECTICUT

Pawcatuck Watershed (3 towns)

NEW YORK

WallKill River Watershed (4 towns)

Pine Bush Watershed

Valley Central Watersheds

Enlarged City School District of Middletown Watersheds

Port Jervis Watersheds

FLORIDA

Okeechobee Watershed (3 towns)

GET WET!

Step 1: Full day training for educators & local citizen volunteers

GET WET!

Step 2: Educate and train Students

http://www.usawaterquality.org/NewEngland/Focus_Areas/well/

GET WET!

Students pre-visit presentation includes:

- Drinking water sources
- Hydrologic cycle
- Private well types
- How a well can become contaminated
- Potential contamination sources
- Testing parameters
- Student’s role in GET WET!
- How to sample well water

GET WET!

Step 3a: Field sampling and testing

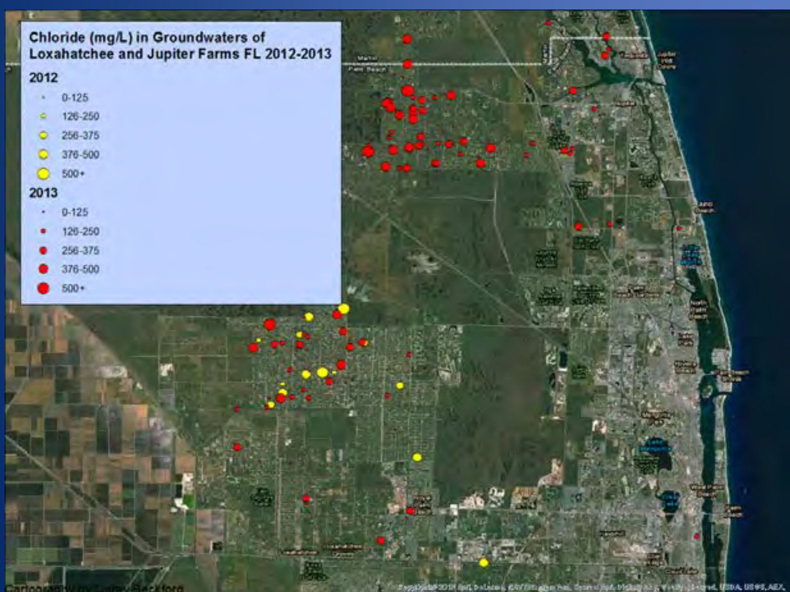
GET WET!

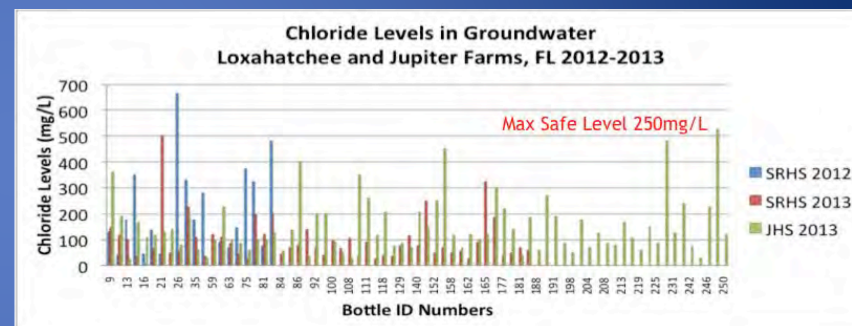
Parameters students test for:

- Chloride
- Nitrates
- Total Iron or Total Metals
- Hardness ($CaCO_3$)
- Conductivity
- pH

GET WET!

Step 3b: Data analysis and mapping





Chloride Statistics
Jupiter High School
Unfiltered Private Well Water
February 2013

Mean	159.29
Median	120
Mode	85
Range	25-480
Standard Deviation	107.01

GET WET!

Step 4: Students analyze results and create PowerPoint presentation

GET WET!

Parameters of PowerPoint:

- Land-use issues
- Local geology
- Groundwater inputs
- Specific local water concerns

- Results in graph form and mapped in a GIS program
- Parameters we did NOT test

GET WET!

Step 5: Presentation at public meeting

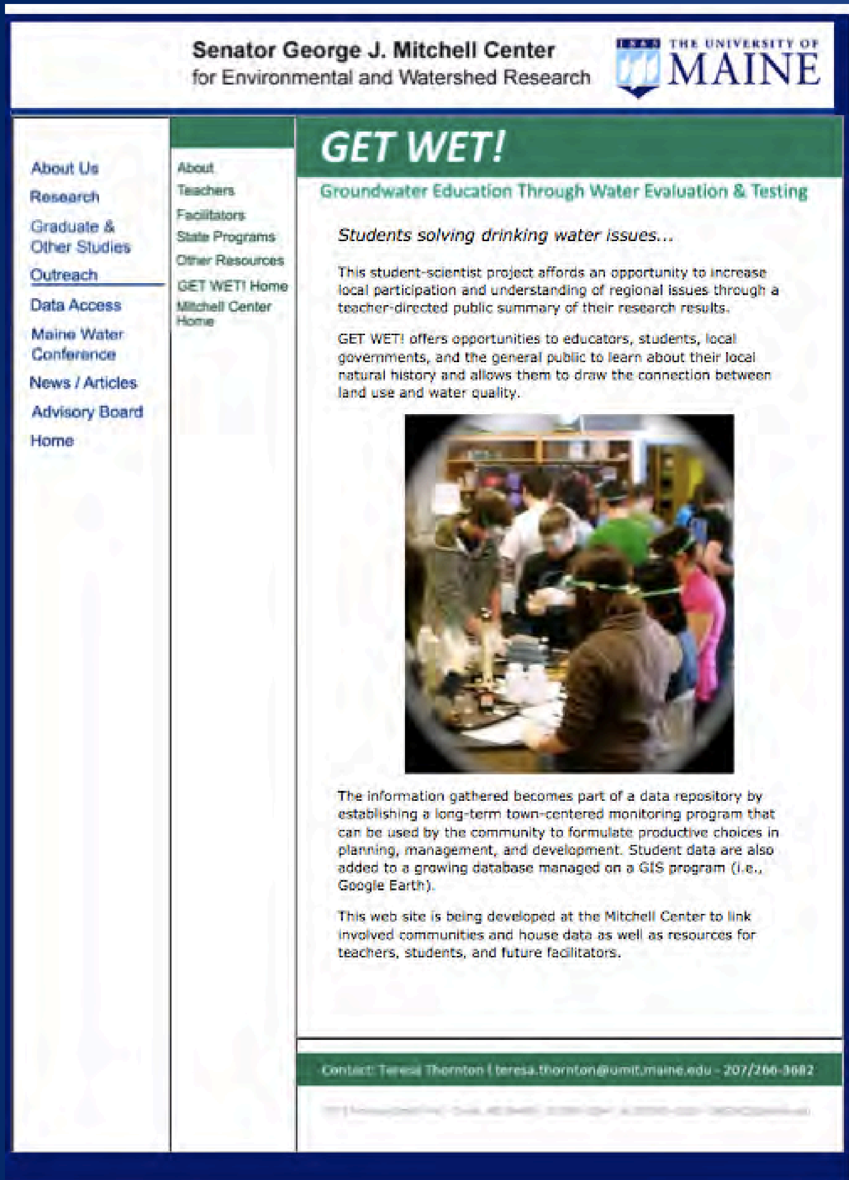
Date, time, and location determined by teacher

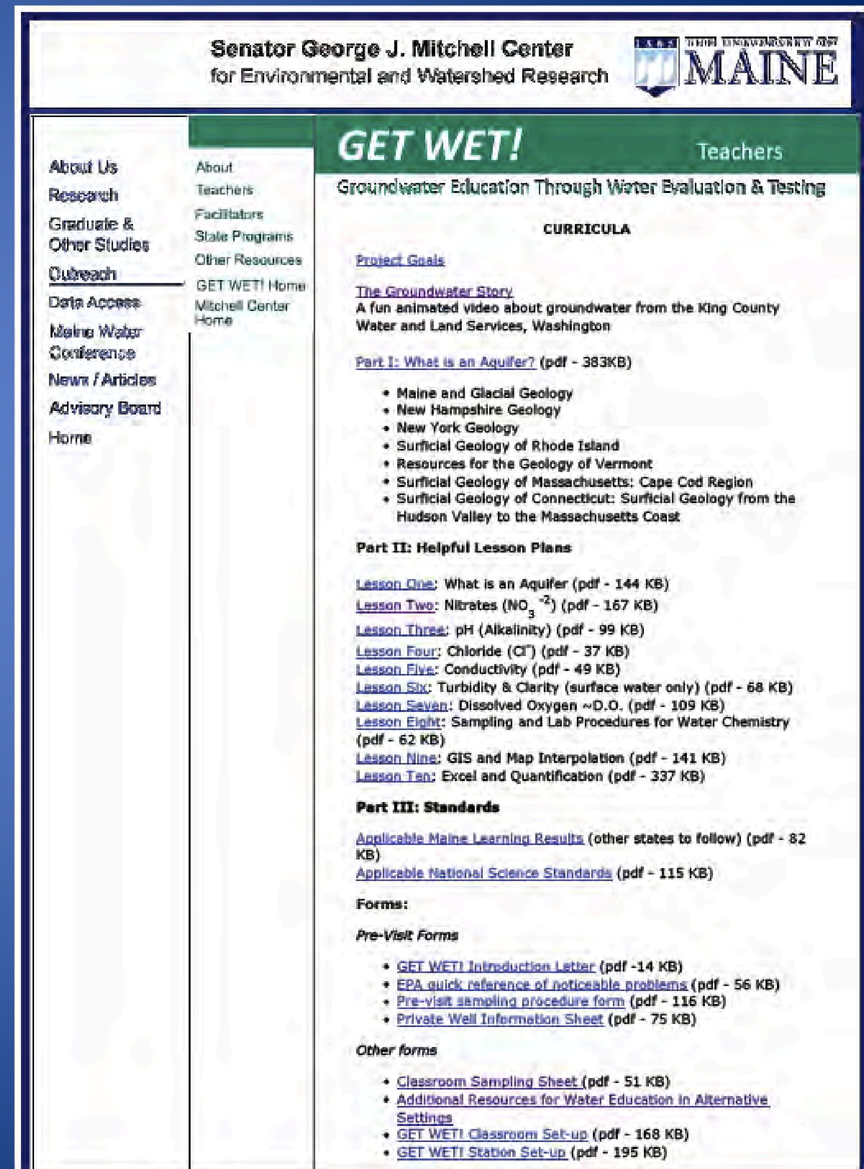
http://livingindryden.org/2005/03/

GET WET! Benefits

- Gain the attention of local officials
- Effective means to introduce students to local government
- Encourages social responsibility and a sense of place
- A more effective way of connecting student education to real world scenarios, theoretical science to practical science
- Connects the students to the community and gives them an opportunity to have a deeper understanding of science and community concerns
- Students will better comprehend what is needed to be stewards of and in their communities
- Careers in the fields of science, politics, engineering, and environmental protection.

GET WET! Website





- Activities and curriculum
- Forms and PowerPoints

Measurable Actions Towards Groundwater Protection

Measureable Actions

- Increased awareness of drinking water concerns (all states)
- Community Based Environmental Monitoring Research (CBEMR) networks continue to grow: NH, RI, CT, ME, NY, FL
- Continued GET WET! and added towns: NH, RI, CT, ME, NY, FL
- Salt storage moved and covered: NH, NY, RI
- Septic system modifications: RI (grant), ME, NY, NH, FL

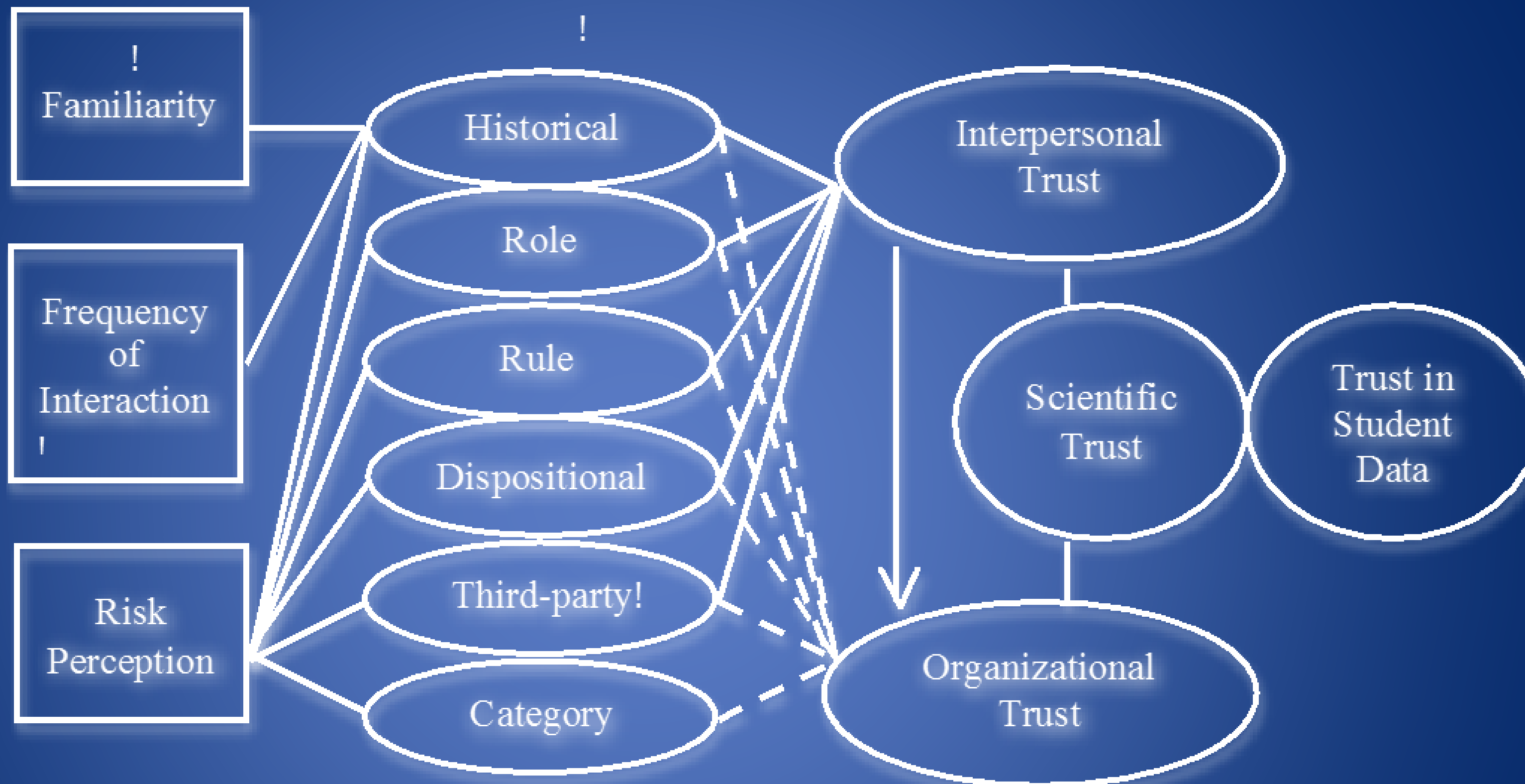
- Historic contaminants previously unknown to community: VT, RI, ME, NH, FL
- Seasonal flooding effects: CT
- New well testing laws: RI

*2013 FL Communicate the need to properly use filtration systems

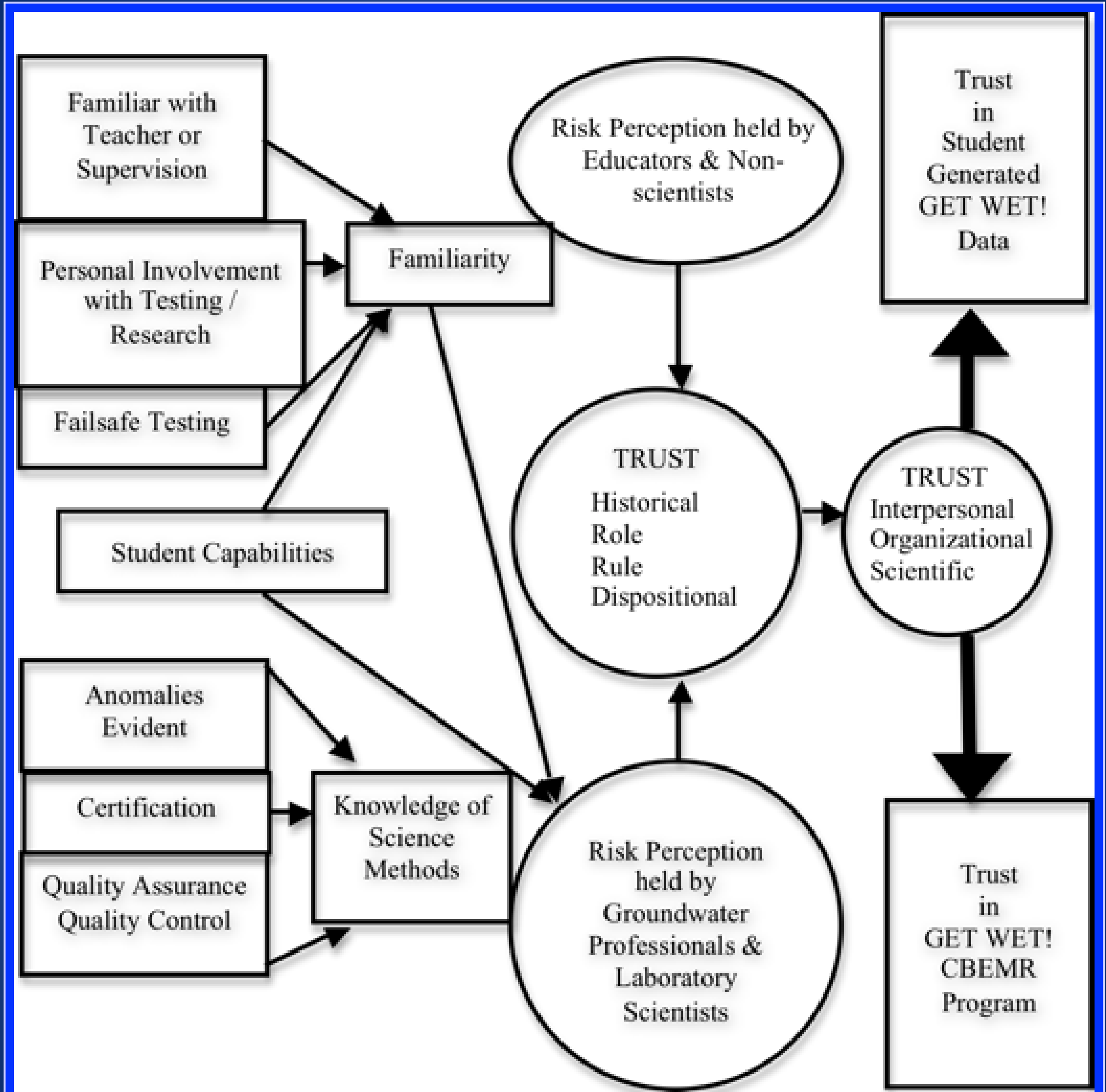
What do professionals need to trust CBEMR research?

Trust

Trust: Literature Review



What Defined Trust



Trust Results

Community perceptions of student data:

- Most participants felt that the community would trust the data because it came from trusted individuals with whom the community was already familiar.
- Some participants felt that community members would decide to trust the CBEMR or student-generated data based on their own worldview.
- They also felt that if someone thinks that they may have to change their behaviors based on the CBEMR results, they may chose not to accept the data.

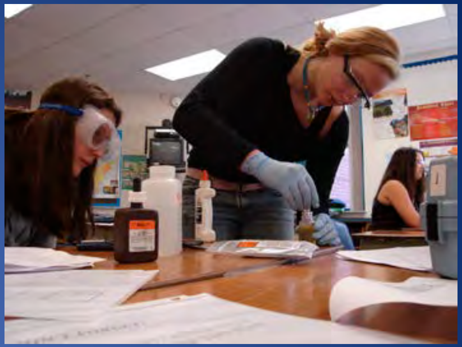
Trust Results

Participant perceptions of CBEMR program:

- There was a consensus among all participants that the program was an efficient way of disseminating important drinking water information throughout the community.
- They felt that using the school as a center of the project allowed for a diverse group of people to be involved and to hear the message.
- Most volunteers considered professionals in their field as valuable sources of knowledge.

Implications

For future CBEMRs:



- Using schools is a trusted method of information dissemination

- ***Consecutive years of success with QA/QC validation of student-generated data may change laboratory scientists' perceptions****

* Peckenham, J. M., **Thornton, T.,** and Peckenham, P. 2012. "Validation of Student Generated Data for Assessment of Groundwater Quality." Journal of Science Education and Technology. Vol. 21 No. 2: 287-294.

Part II

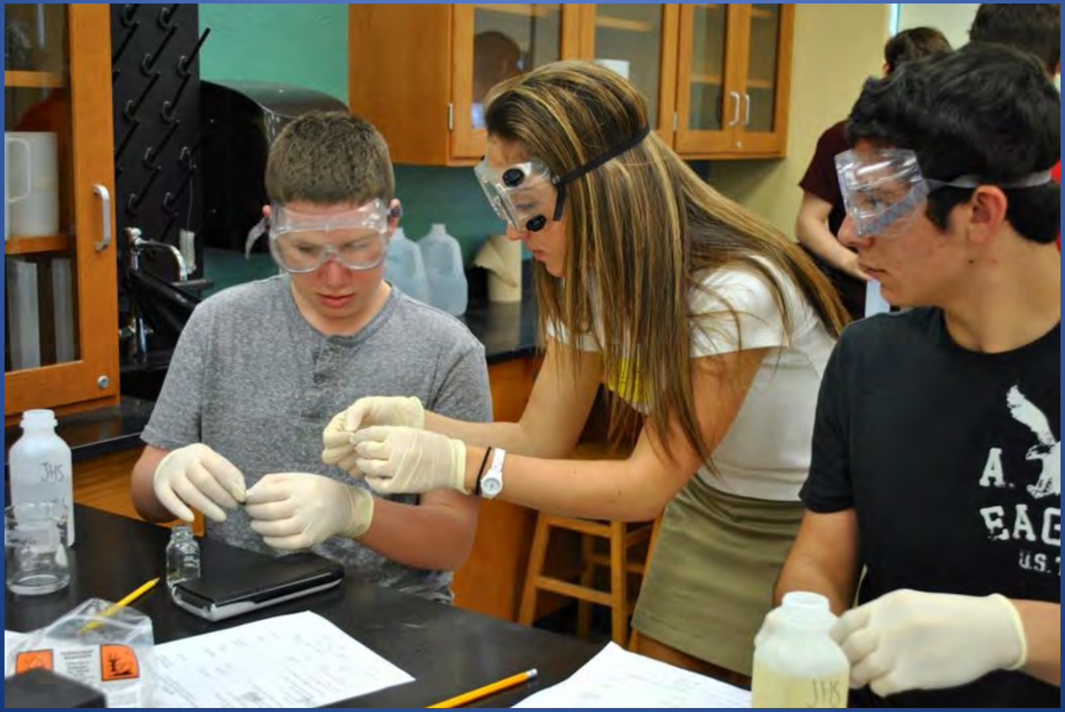
What motivates professionals to volunteer in K-12?

Multidimensional Model of Volunteerism

Volunteers do not give of their time for one reason.

Often people volunteer for many reasons.

Widjaja (2010)



Quotes: Multi-dimensional

Social

“It was fun and I thought that it was interesting to meet new people, you know, that worked with [groundwater]… though with this [experience] in particular, to volunteer my time using what I do everyday in my career, with mapping and things like that, and showing kids what I do and how doing something like this can help, and, you know, provide valuable information for other people. I just like that connection and it is cool that it involves what I do for work and not just something I believe in [like running a marathon for a cancer association], which is fine, and is good too…it was cool to integrate a couple of things you know. Something I believe in and my career.”

GIS Technician and Local Business Representative, New Hampshire

Quotes: Multi-dimensional

Career Expertise

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Quotes: Multi-dimensional

Intrinsic - Altruistic

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GIS Technician and Local Business Representative, New Hampshire

Quotes: Multi-dimensional

Raise Awareness

"I think it's a great idea because it involves the community at every level, all at the same time; it focuses on the high school, where the students get more deeply involved; then, it gives them a tie to their community and it makes them interested…it will bring the community together, and raise the level of awareness."

USGS Employee, Connecticut

Quotes: Multi-dimensional

School-community connection

“I think it’s a great idea because it involves the community at every level, all at the same time; it focuses on the high school, where the students get more deeply involved; then, it gives them a tie to their community and it makes them interested…it will bring the community together, and raise the level of awareness.”

USGS Employee, Connecticut

Quotes: Multi-dimensional

Social

"I guess getting out and meeting new people helps me to understand different socio-economic groups, different social groups… that section of the populace that doesn't have access to the education [and] experience that I've had—that's part of it. Part of it is warm fuzzies; Part of it is balancing the economic impact of the industry. Part of it is also learning more about the environmental resources of the state."

Health Department Employee, Rhode Island

Quotes: Multi-dimensional

Career Expertise

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Quotes: Multi-dimensional

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Quotes: Multi-dimensional

Costs

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Quotes: Multi-dimensional

Learn something new

“I guess getting out and meeting new people helps me to understand different socio-economic groups, different social groups… that section of the populace that doesn’t have access to the education [and] experience that I’ve had—that’s part of it. Part of it is warm fuzzies; Part of it is balancing the economic impact of the industry. Part of it is also learning more about the environmental resources of the state.”

Health Department Employee, Rhode Island

Social Factors

"…we made so many connections in the community…If I did not have the information having to do with the whole *GET WET!* program… I would not have appreciated what [that parent] knew or how I could tie it in [to my classroom curriculum]."

Connecticut Educator #1

"… So I wrote [an editorial in the local] paper about that and in retrospect [it] had a lot to do with the *GET WET!* program …I have been pretty interested in and adamant about talking to people [water concerns]."

New Hampshire Community Volunteer

Social Factors

“[A positive outcome to participation in the CBMER] was the relationship that I was able to develop with [Teacher #2] and to connect on some level with [Teacher #3] because I did want to have closer ties with people within the school department as well as [the principal] and the school committee in case [Teacher #1] leaves I can still [have people] aware of our programs … [and] a greater depth of exposure to the resources that are available to them.”

Rhode Island ENGO Representative

“I think once one person spoke with someone and then there were others and there were more and more connections being made…”

New Hampshire Educator #1

Results

<table>
<tr><th colspan="4">Motivations for Volunteering in a School-Centered CBEMR Project</th></tr>
<tr><td rowspan="12">Intrinsic</td><td colspan="3">Personal request</td></tr>
<tr><td colspan="3">Sense of value</td></tr>
<tr><td colspan="3">Enjoyment</td></tr>
<tr><td colspan="3">Working with youth</td></tr>
<tr><td colspan="3">Career awareness</td></tr>
<tr><td colspan="3">Share a sense of community</td></tr>
<tr><td colspan="3">Learn something new</td></tr>
<tr><td rowspan="3">Environmental:</td><td>Preservation</td><td></td></tr>
<tr><td rowspan="2">Awareness:</td><td>through parental involvement</td></tr>
<tr><td>through local officials</td></tr>
<tr><td colspan="3">School-community connection</td></tr>
<tr><td colspan="3">Empowerment of students and community members</td></tr>
<tr><td rowspan="4">Extrinsic</td><td colspan="3">Professional goals</td></tr>
<tr><td colspan="3">Career advancement</td></tr>
<tr><td colspan="3">Cost Savings</td></tr>
<tr><td colspan="3">Time allotment</td></tr>
<tr><td rowspan="4">Intrinsic and Extrinsic</td><td colspan="3">Career expertise sharing</td></tr>
<tr><td colspan="3">Social networking</td></tr>
<tr><td colspan="3">Science education elevation</td></tr>
<tr><td colspan="3">Promote organization's goals</td></tr>
</table>

Personal Growth was not mentioned

Retention of Professional Volunteers

Feed them!

- Career expertise
- Flexible time
- Offer flexible opportunities for volunteers
- Social factors
- Volunteers like the process, goals, and benefits of the program
- Program has clear objectives, specific roles and goals, and an opportunity to see outcomes in a reasonable time
- Environmental Health Factors
- Educational Factors

Are the motivations of student volunteers the same as the adults?

Student Participation/Motivation

Altruistic

"… the ability to contribute to other communities and help out other schools "

-12th Grade

Sense of Value

"Interested in experiment and being a part of something that means something in the science world "

-11th Grade

Student Retention

Enjoyment

"Because I loved it the first year!"

-12th Grade

Social

"Really liked it. Everything seemed to be beneficial for me. I got to experience a different group of people, different way of learning, I got to teach them and it was fun for me. "

-11th Grade

Student Retention/Motivation

Learn Something New

"Of course! It's gathering data…you can see how the problem has progressed over the years [and you can] see if maybe they did something about it or if they are still unaware of what is going on."

-11^{th} Grade

"It was fun teaching other kids how to test their water…[to] get the end result of what contaminated [their] water and [to find] where the mass contamination may be"

-11^{th} Grade

Effects of Participation

Additional Course Work Post Participation		
20 %	3/15	Began Independent Water Research (2 Females/1 Male)
60%	9/15	Signed up for Additional Water Courses
56%	5/9	Females that signed up for additional water related courses
33%	2/6	Females that did not sign up for additional water related courses

Effects of Participation: Additional Coursework

"Well, in college hopefully I can take more [water] courses"

-12th Grade

"The research I am doing is water but it is also economics and I love that they go they go hand in hand. When I grow up, I want to major in economics, but if I see an opportunity to do economics and something water related I would totally do it"

11th Grade

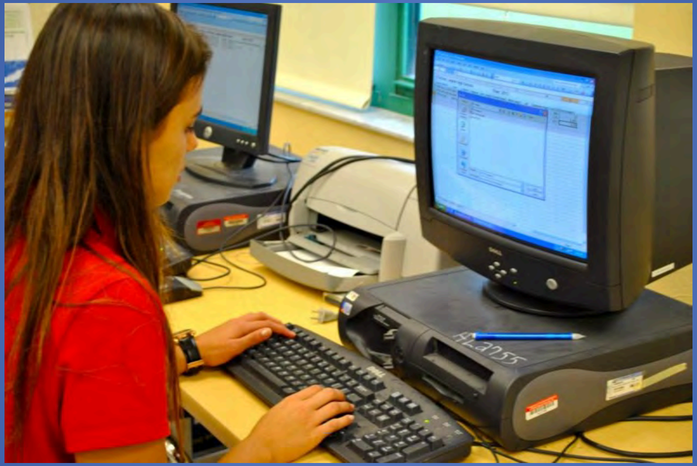
"Yeah, I can see myself helping out more and possibly bringing the GET WET program to other places such as college and learning more on groundwater"

-12th Grade

Effects of Participation: Social Networks

"Yes. For the second year when we did the PowerPoint I got to talk to management facilitators and I got to talk with them one on one. Feels pretty cool to have started a professional social network. If I have anything related to water , if I do any projects or if I need to know something…"

-11th Grade



"I think, in the sense of my social network, [I feel] I am more knowledgeable and I think I can have a conversation [with professionals] now"

-12th Grade

Effects of Participation: Collaboration Between Schools

"I think at first when we said we have this project for you they weren't willing to work, but then they realized it was their water they realized these are contaminants that are in MY WATER then they started to care and they were very wiling to cooperate and look at the results /statistics and say WOW this is in my water, this is my health "

-11th Grade

Effects of Participation: Collaboration Between Schools

"It is better that we are not adults because we can relate to the students more and we are more likely to know what mistakes are likely to occur in whatever experiment you are teaching. They asked me questions and I was able to answer."

-11th Grade

"Collaborative effort and the people work well together. It is like two different communities coming together. I felt like we were teaching them something as well as them teaching us because we were able to test their groundwater and learn about their stuff"

-12th Grade

Effects of Participation: Knowledge Gained

"To filter my water!! You can ingest a lot of toxins you don't know about! "

-11th Grade

"I have learned A LOT I that has made me aware of the water I drink and shower in and cook with!"

-12 Grade

"It has influenced me on many levels because now I am testing my own water and everything in it and it has prompted me to educate others"

-12 Grade

"Yes. I will go somewhere and will kind of want to test it"

- -12 Grade

Effects of Participation: Knowledge Gained

"...when I am drinking something that taste funny [I think] maybe it is this maybe it is that. I know more about systems now. I had no idea septic systems affected your water . I had no idea what a septic system was. I didn't know we had public water. I did not know that we had to filter it. I didn't know water bottles were bad. I didn't know any of that."

-11th Grade

"Oh yes! I am much more careful where I shower and what I shower in , what I would swim in , everything! What I would drink. "

-12th Grade

How Can Communities Improve How they Address Their Groundwater Issues?

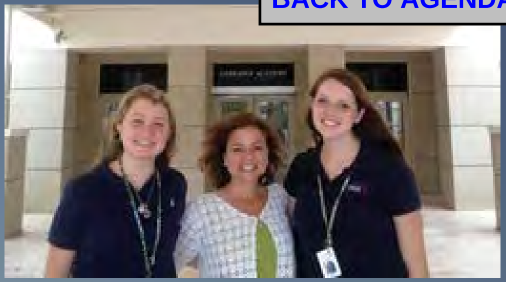
"Get involved, actually test their systems, test their water, and take the initiative to do something about it. Don't just leave it"	"Educate the population better on the issues"	"I think we are helping that issue and they could notice where … they need to be careful [of land use]"	"I don't think they know that they have issues"

11th and 12th Grade Students

Summary of Student Volunteerism

- Students begin to see that water issues are social, economic, and political, as well as environmental
- Students felt that CBMER made learning enjoyable
- Students were able to personalize the lesson via health concerns
- Students’ motivations are also multi-dimensional
  - Career Expertise for adults *vs* sharing knowledge for students
  - Being connected to “real” science for students
  - Social Aspects are very important for both adults and students
    - Social networking or as students say “making new friends”
    - Inviting friends to participate
    - FUN!

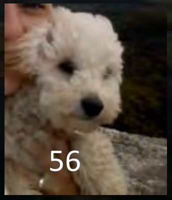
BACK TO AGENDA



THANK YOU!

Questions?

teresathorntonphd@gmail.com
561-727-0211
teresathorntonphd.webs.com



BACK TO AGENDA

SPEAKER BIO

WARREN HOGG

Warren Hogg, P.G. is the Permitting Manager for Tampa Bay Water. He holds an M.S. in Geology from the University of South Florida (1991) and a B.S. Geology from the University of West Georgia (1986). He is a registered Professional Geologist in Florida.

Mr. Hogg has been employed by Tampa Bay Water on a full-time basis for the past 25 years and has held the position of Evaluation and Permitting Manager for the past 19 years. His experience includes project management, water supply planning, resource evaluation studies (evaluation of environmental impact and sustainability), and permitting activities. Mr. Hogg's current responsibilities with Tampa Bay Water include management and planning for the following areas: Water Use Permitting; wetland permitting, mitigation and restoration; water resource evaluations; production and monitor well construction and testing; and environmental monitoring and assessment programs.

TAMPA BAY WATER
Supplying Water To The Region

Evaluating Groundwater Sustainability in the Tampa Bay Area

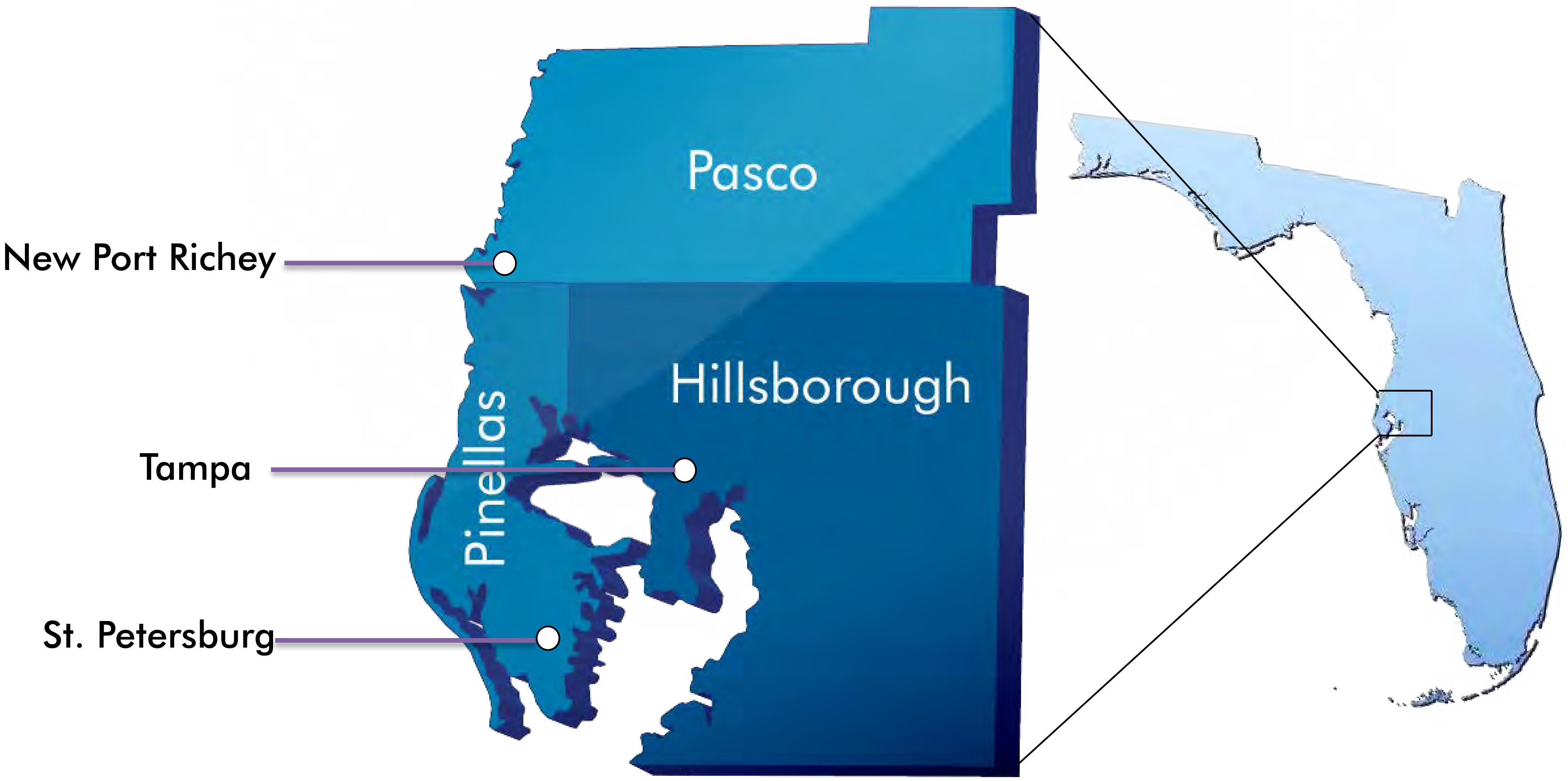
Groundwater Foundation National Conference

October 15-17, 2013

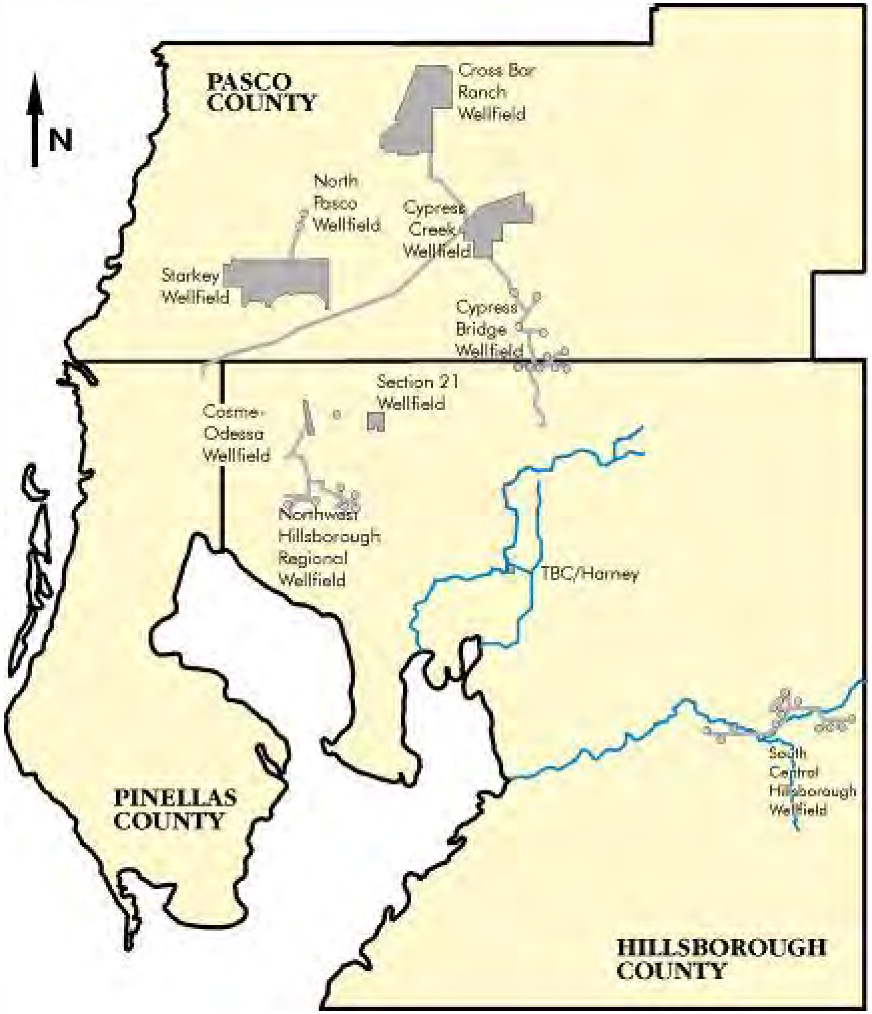
Evaluation of Sustainability

- **Case study – expansion and management**
- **Current environmental evaluation**
- **Future considerations**

Who We Are


New Port Richey
Tampa
St. Petersburg
Pasco
Hillsborough
Pinellas

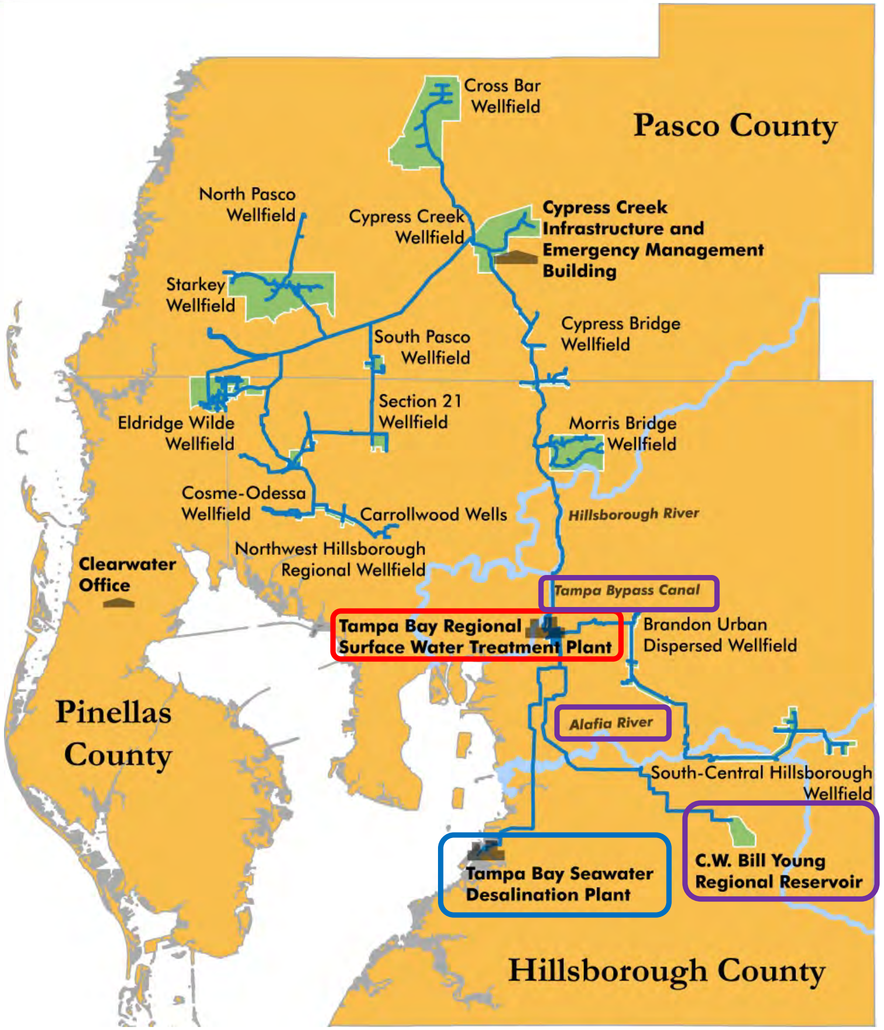
Regional Water Supply System-1998



Environmental Conditions in Tampa Bay Area During 1990's

The Regional Water Supply System - today

An integrated, *flexible* system that produces a *sustainable and reliable* water supply



The Region's First Alternative Supplies

Tampa Bypass Canal

Regional Surface Water Treatment Plant

Alafia River

Storage Adds Reliability, Drought Resistance

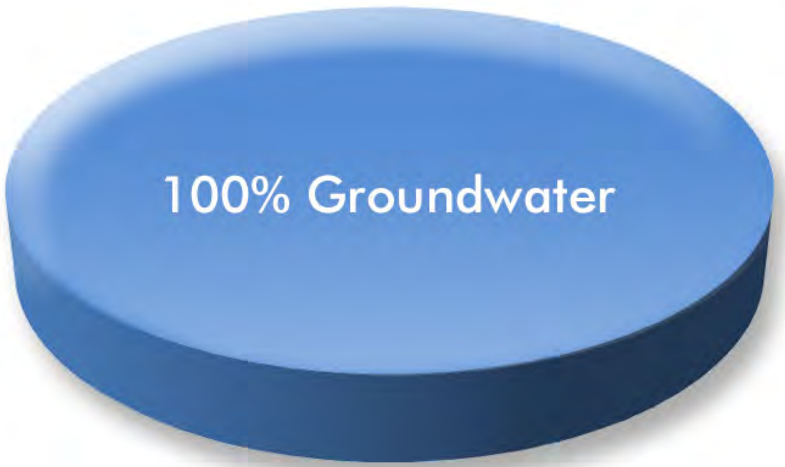
TAMPA BAY WATER

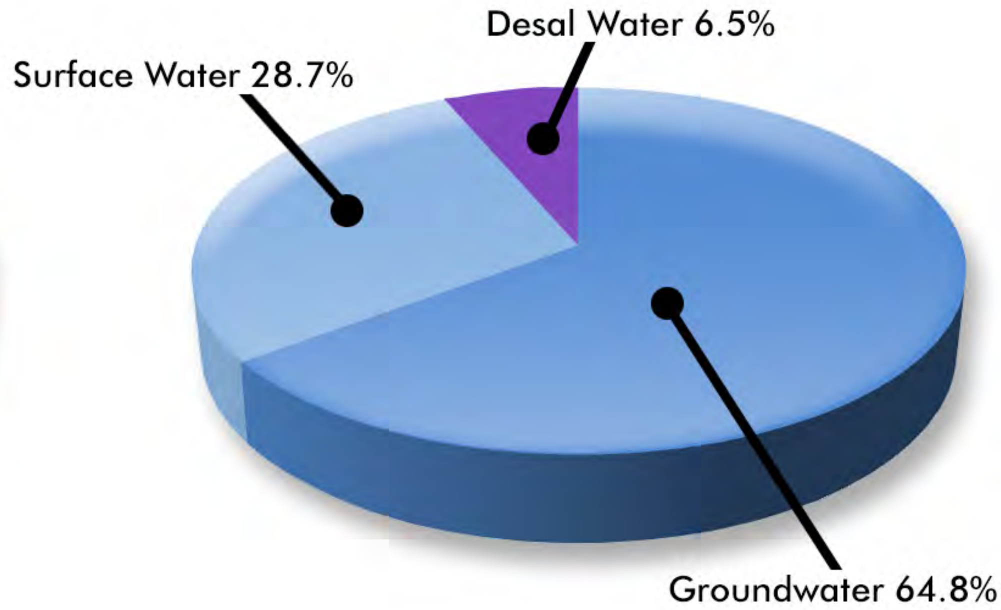
Tampa Bay Seawater Desalination

A Unique, Complex System

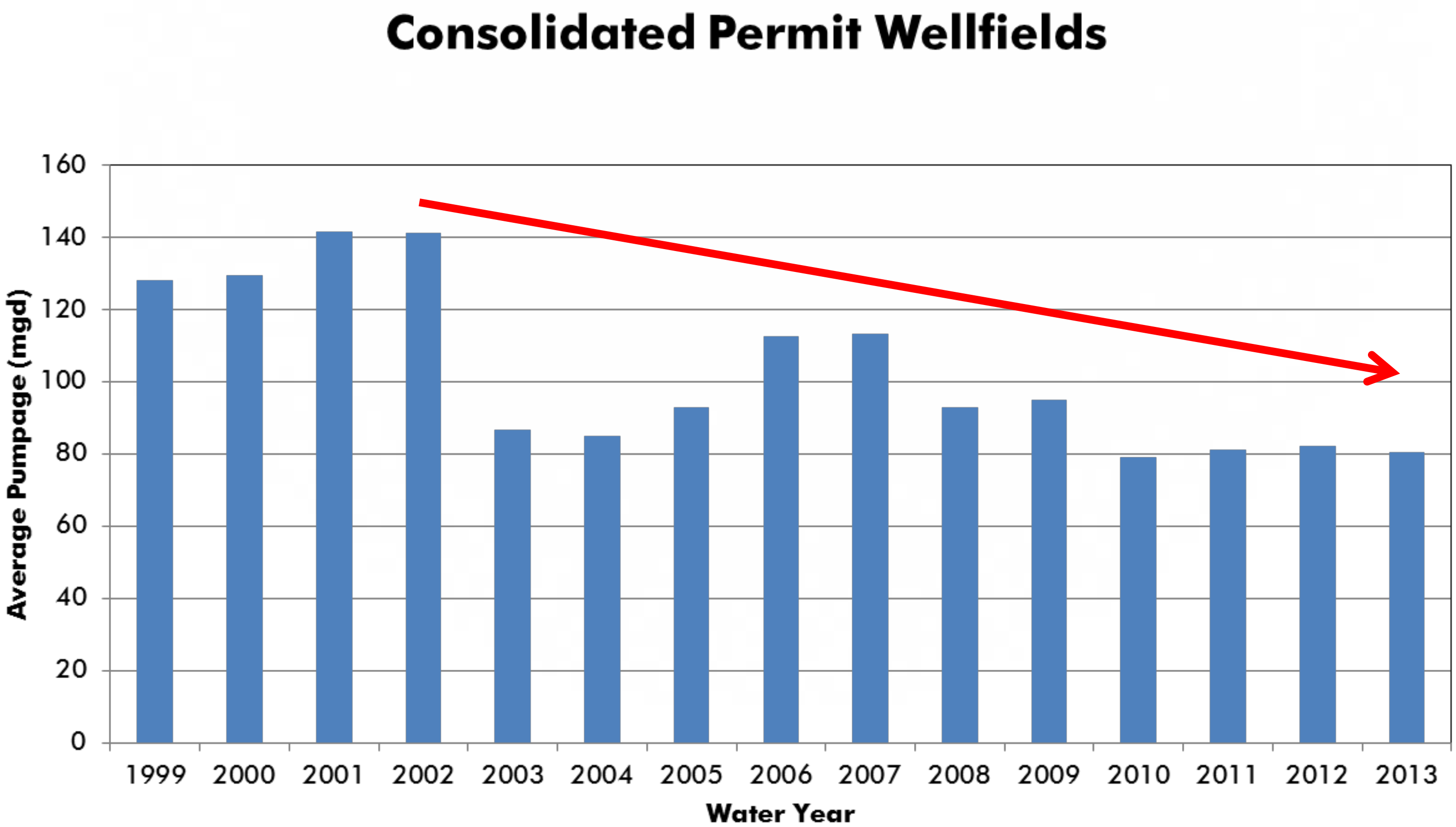
- Three sources of supply, plus reservoir
- Eight treatment facilities
- Seven pumping stations
- Over 295 miles of large diameter pipe
- 21 Member Government delivery points
- 17 contractual water quality parameters
- Daily Flow variation: 140 mg to 260 mg

Water Supply Sources

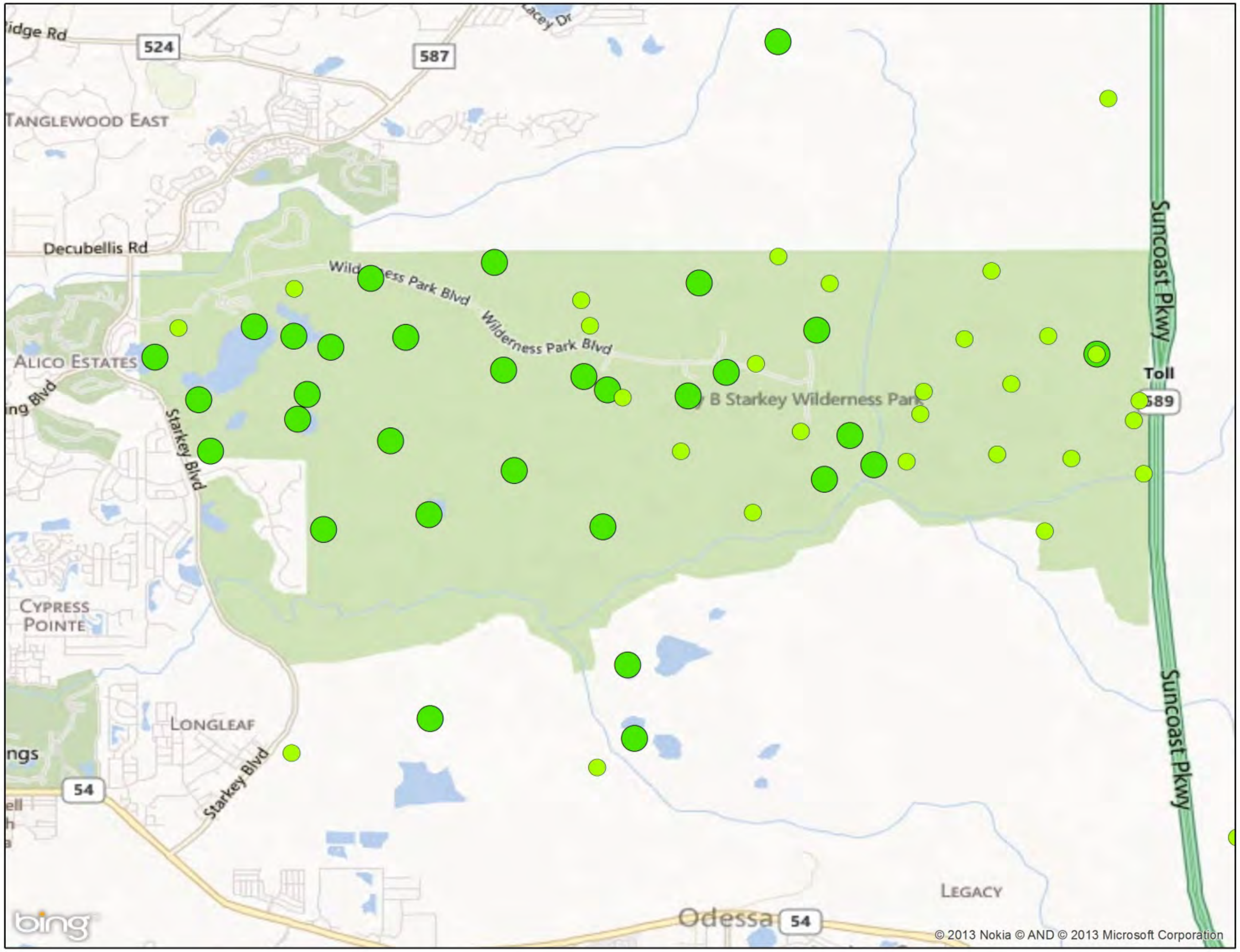




Pumpage has been reduced



Wetland water levels improve



Wetland Levels Improve

Water Year 2002	Current

Lakes Levels Improve

Water Year 2002

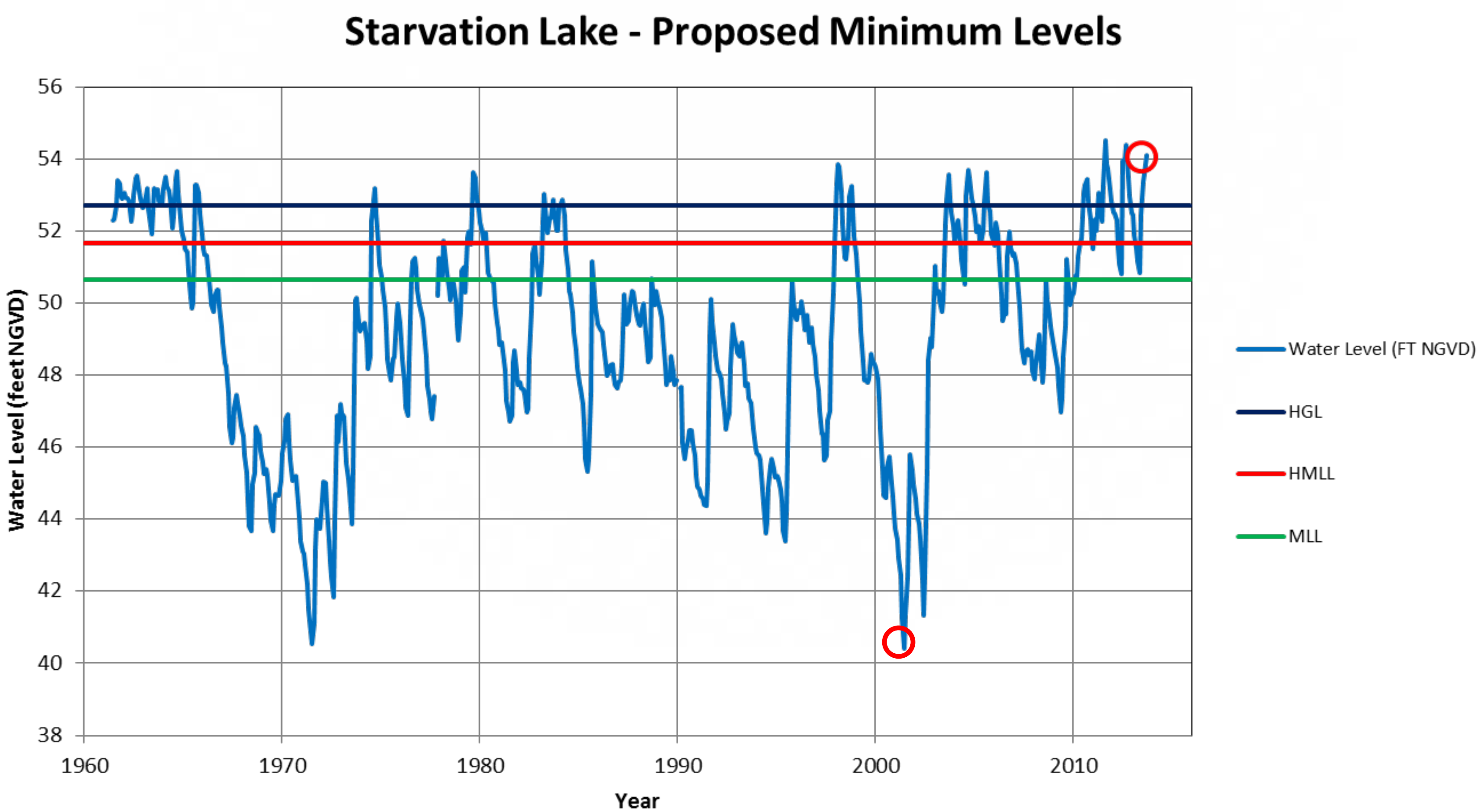
Current

Section 21 Wellfield

Starvation Lake - 2001

Starvation Lake – 2013

Starvation Lake – Water Level



Current Environmental Evaluation

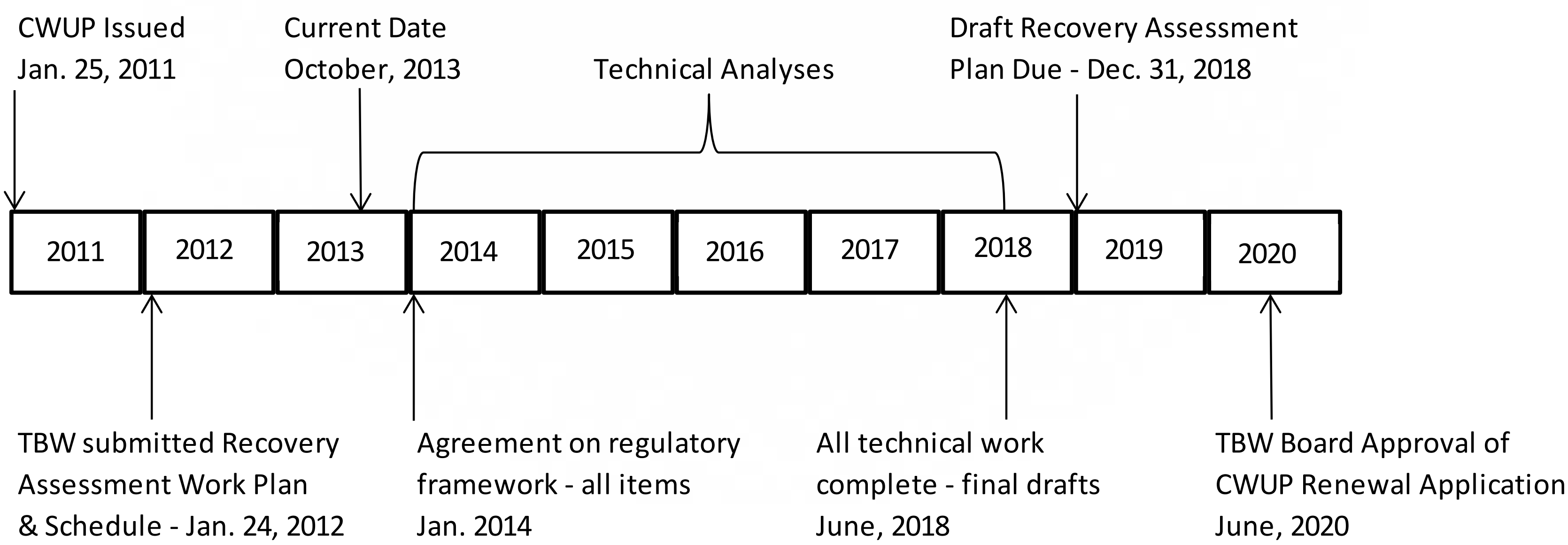
- Document environmental recovery
- Evaluation based on scientific metrics
- Meet permitting rule requirements

MBR-60 (2005)

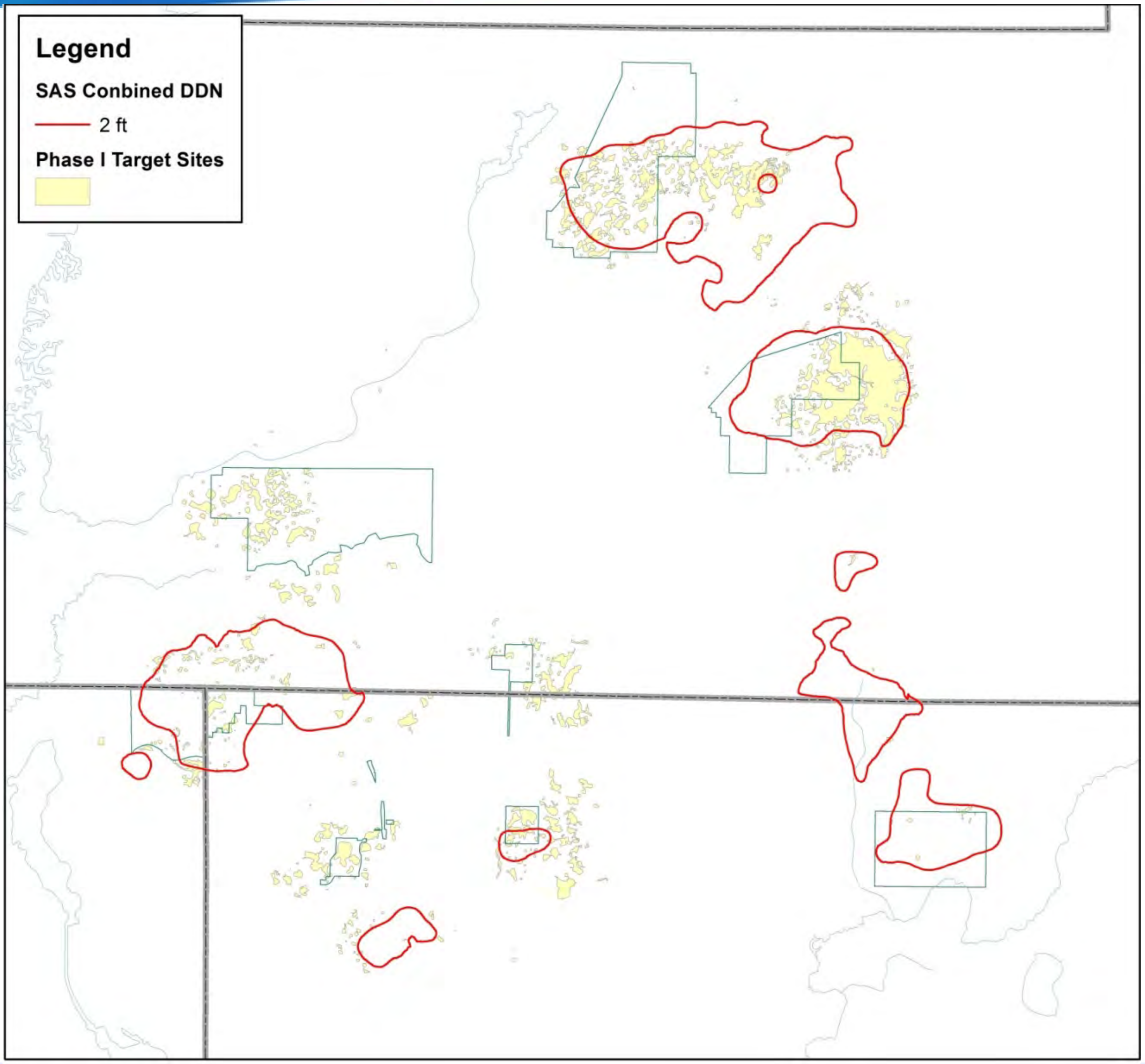
MBR-60 (2013)

Timeline for Assessment

CWUP Recovery Assessment Timeline

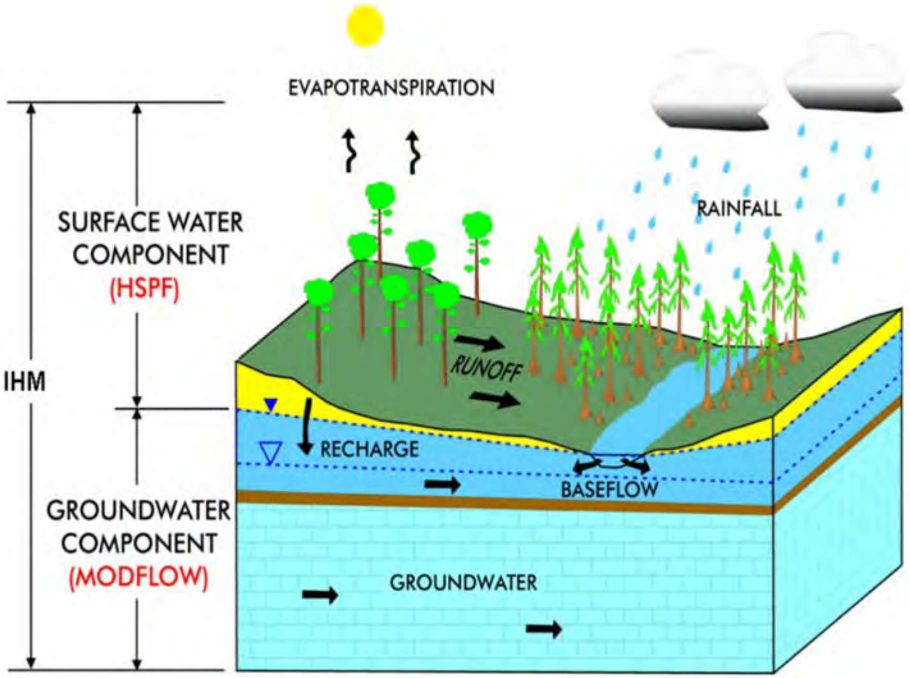


Proposed Area of Evaluation



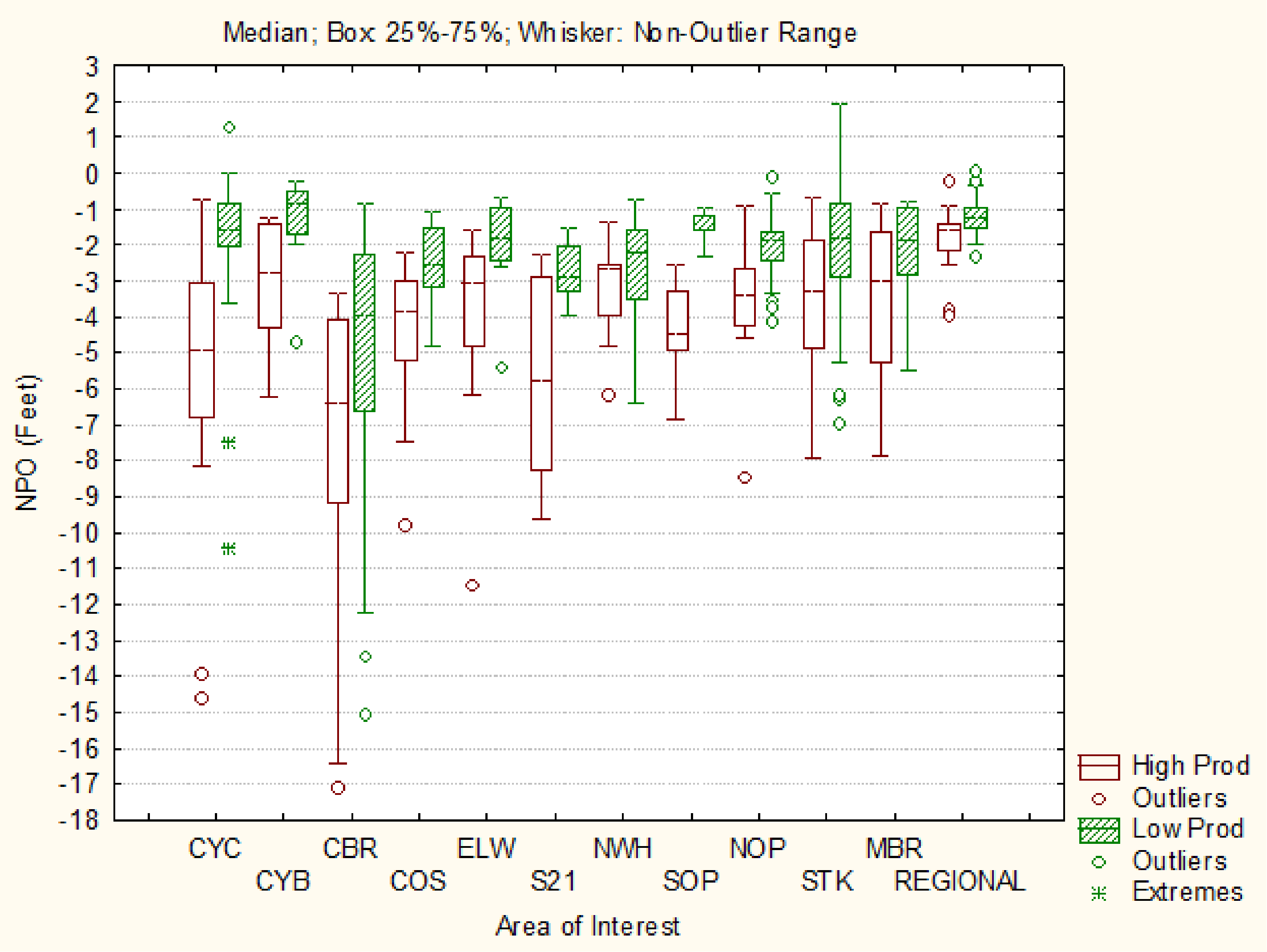
Integrated Northern Tampa Bay Model

- State of the art computer model
- Simulates surface water and groundwater flow systems
- Covers 4000 square miles



Integrated hydrologic model

Graphs of Statistical Analyses



Are We There Yet?

- Sustainability is a continuous evaluation
  - Population/demand fluctuations
  - Regulatory changes
  - Climate change

BACK TO AGENDA

SPEAKER BIO

JOSEPH HOCHREITER

With almost 40 years of experience, including the U.S. Geological Survey (Hydrologist, Water Resources Division) and Principal Scientist at two leading environmental consulting firms (ERM and BBL), Mr. Hochreiter has directed the design, management, and technical oversight of a number of regional aquifer studies, significant site assessments, and environmental remediation projects in the eastern United States. He has his BA degree in Liberal Arts from Temple University, and did graduate work at Drexel University in Environmental Engineering and Science. He has been a Certified Ground Water Professional by the National Ground Water Association since 1988 and sits on the Steering Committee of the NJLSRPA. With over 30 publications in the scientific literature, he served for three years on the editorial board of the scientific journal Ground Water. For the past 8 years he's been Principal Scientist of his own consulting firm, Senior Environmental Consulting, LLC [see www.seniorenvironmental.com]

Mr. Hochreiter provides expert services in cases involving environmental litigation. His areas of expertise include USEPA regulatory programs (RCRA Corrective Action, CERCLA/SARA); New Jersey regulatory programs (ISRA, NJ Spill Act, Brownfields, UST); Water Supply science and policy; and Remediation Technology assessment and selection. In New Jersey, he specializes in strategic consulting to private-sector clients as a senior-level, non-LSRP practitioner. He also serves the members of the Brownfields Development Area (BDA) in Perth Amboy as their Waterfront-BDA coordinator.

SENIOR ENVIRONMENTAL CONSULTING LLC

Challenges Associated with Creating a Sustainable Water-Use Plan for the State of New Jersey

Joseph Hochreiter, CGWP (1)

Fred Sickels (2)

Joseph Mattle (3)

(1) Principal Scientist, Senior Environmental Consulting, LLC
(2) Director, Division of Water Supply/Geoscience, NJDEP
(3) Env. Engineer, Div. of Water Supply/Geoscience, NJDEP

Groundwater Foundation's National Conference 2013: Tools for Groundwater Sustainability

Disclaimer

Please note that the current 2013 Water Supply Plan is strictly a **"Staff Draft"** at this time as it has not been officially commented on or released by DEP Management for public viewing. This presentation may not express the overall policies, direction or conclusions that the DEP will ultimately support.

Water Supply Management in NJ

Advantages:

- *Ample rainfall (45 inches/year)*
- *Substantial historic infrastructure investment*

Challenges:

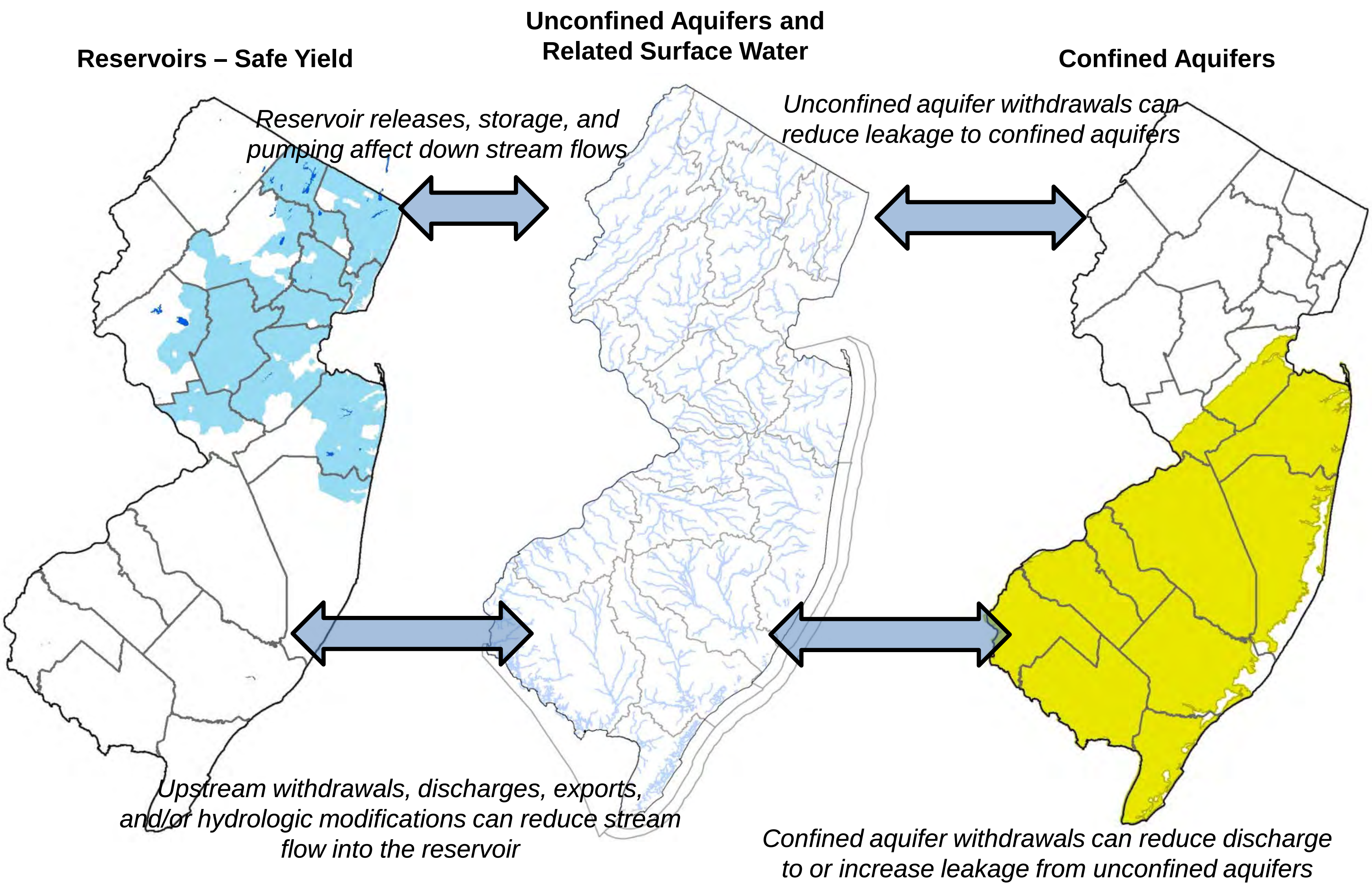
- *Recurring droughts*
- *Limited space for new conventional water supplies, such as reservoirs*
- *Declining ground water levels; salinity threats along coast*
- *Water Quality Issues impacting Water Quantity decisions*
- *Integration with other State and Regional Planning initiatives (e.g. WQMPs, Pinelands/Highlands RMP)*
- *Limited awareness re: value to conserve ("Water is Cheap")*
- *Limited current infrastructure financing*
- *Maintenance of Base Flow to Protect Sensitive Ecology*

Water Supply Plan Components

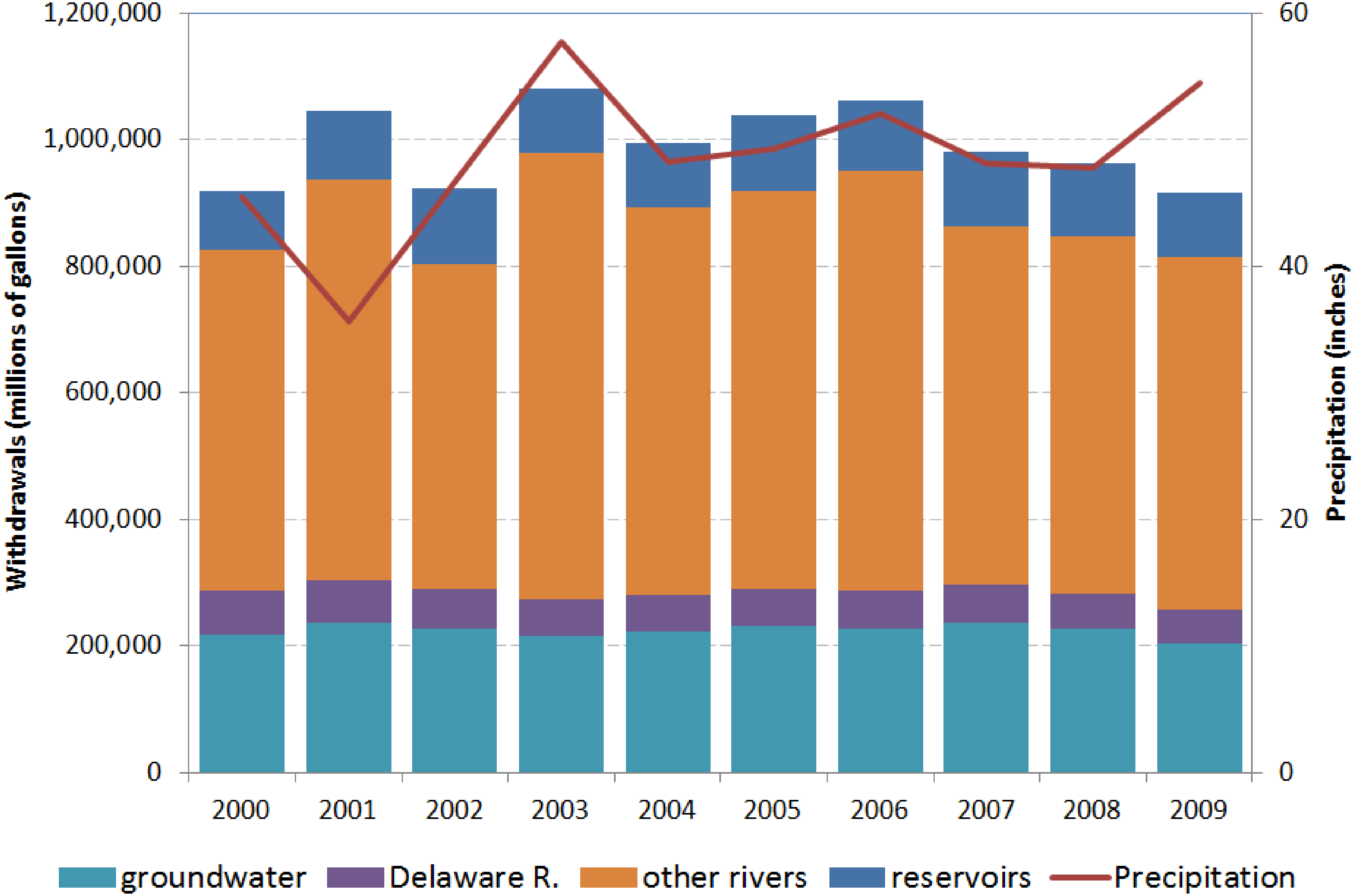
- Hydrologic Data
  - Water Use/Demand
  - Total availability
  - Remaining Water
  - Climate
- Policy and Planning
  - Conservation and Reuse
  - Infrastructure investments and maintenance
  - Prioritizing Uses
  - Growth Estimates (Future Use; Smart Growth)
- Funding

Sources of Water

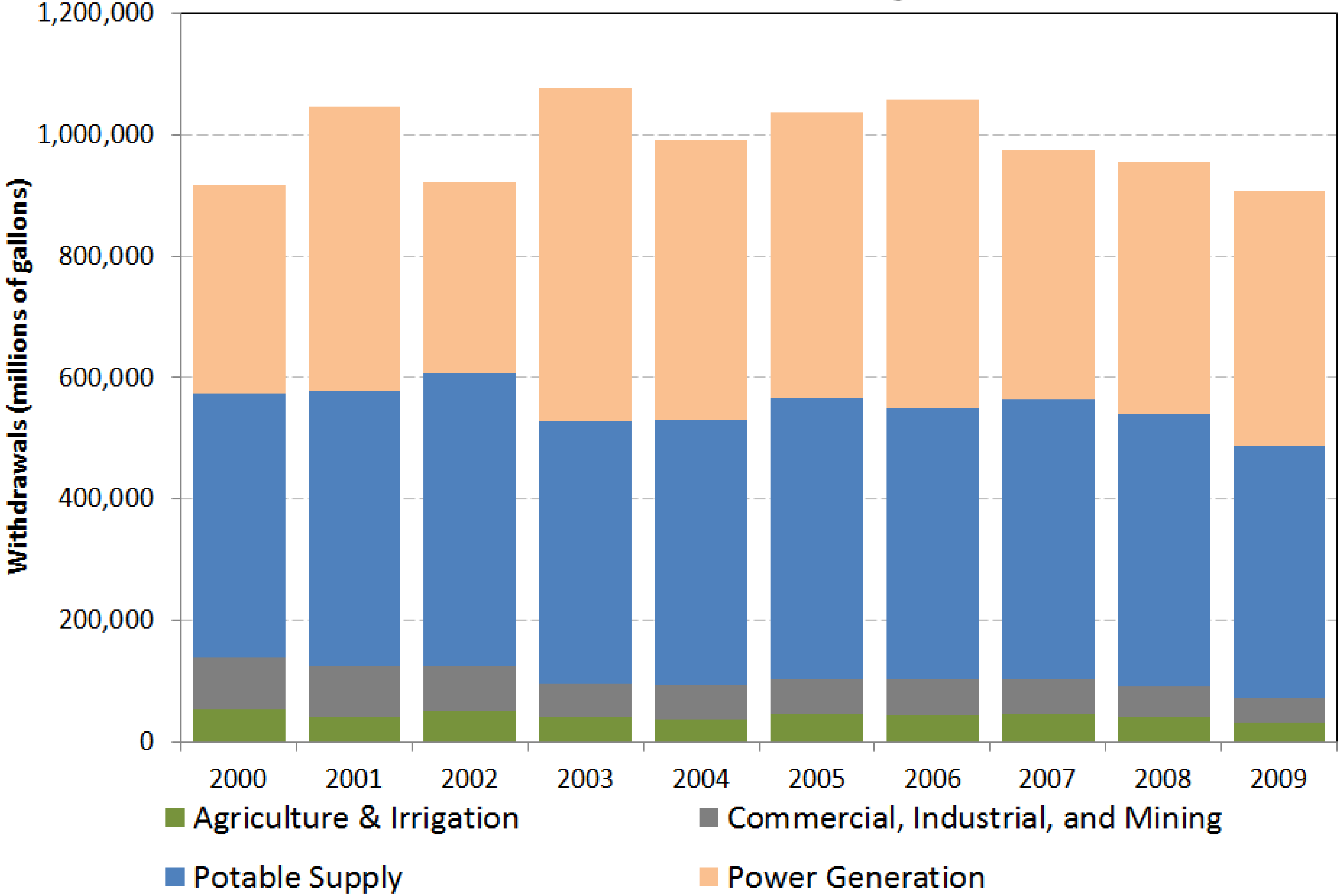
Three distinct but related water resources



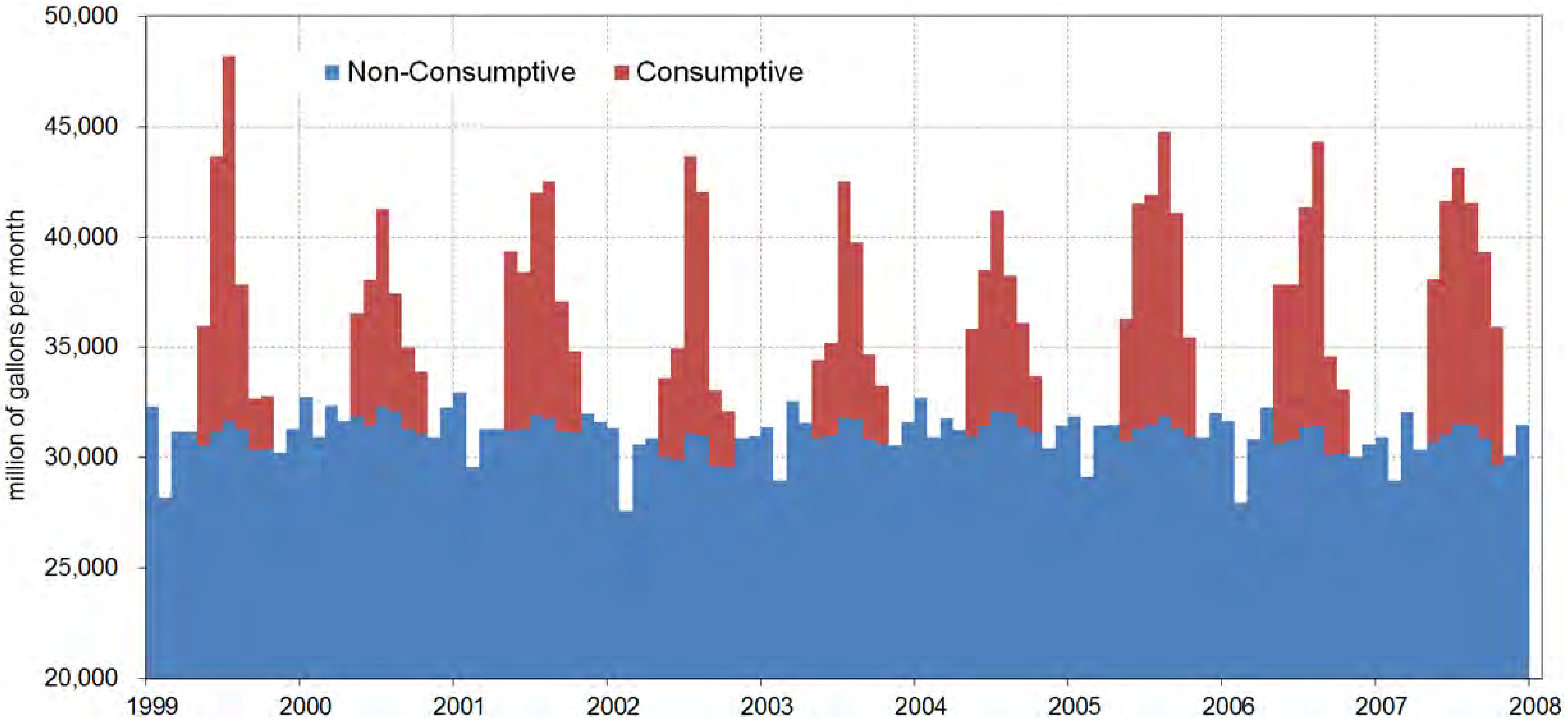
Withdrawals by Source



Withdrawals by Use



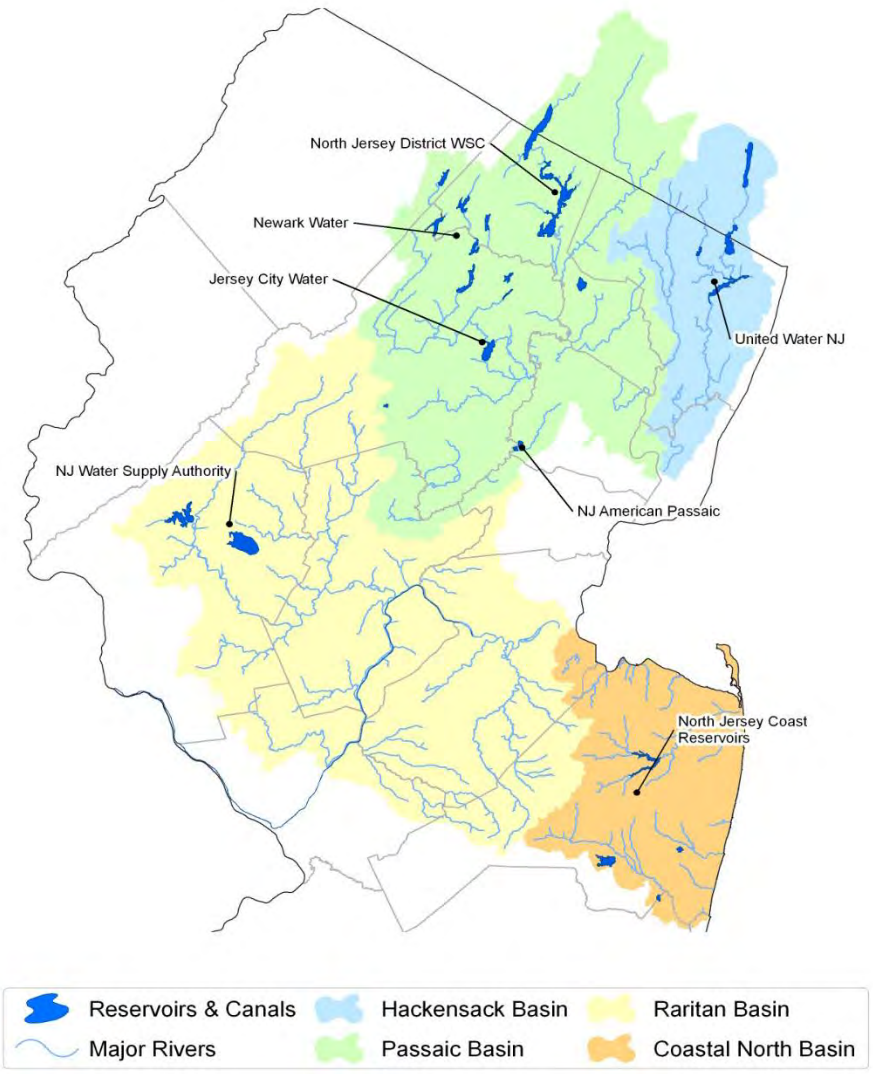
Monthly Potable Use – Consumptive & Nonconsumptive



Total Availability

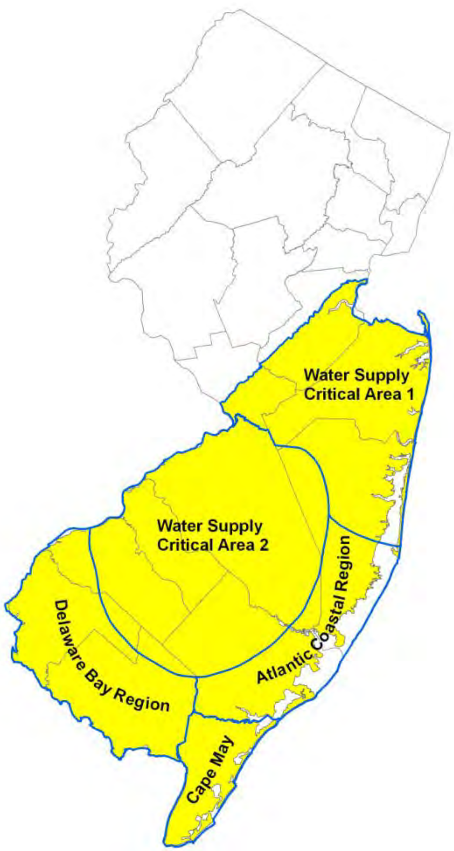
- How much water is available?
  - From safe yield, unconfined aquifer and surface water, and confined ground water sources
- How much of the available water is currently being used and how much remains available for the future?

Reservoirs defined by Safe Yield



- 772 mgd of safe yield from 7 major reservoir systems
- Serving 4 million people in 8 counties
- Interconnected water systems; some improvement needed
- Upstream hydrologic modifications can reduce yield
- Dynamic tension between use of reservoirs as flood control vs. use as water supply source

Critical Areas - Confined Aquifers



Characteristics

- Relatively pristine sources of water
- Not easily recharged
- Subject to saltwater intrusion along coast
- Historically, were over-allocated (Critical Areas 1 and 2)

Key Points

- Recovering…amount of additional supply currently unknown
- Detailed USGS modeling studies
- Should be reserved for potable use

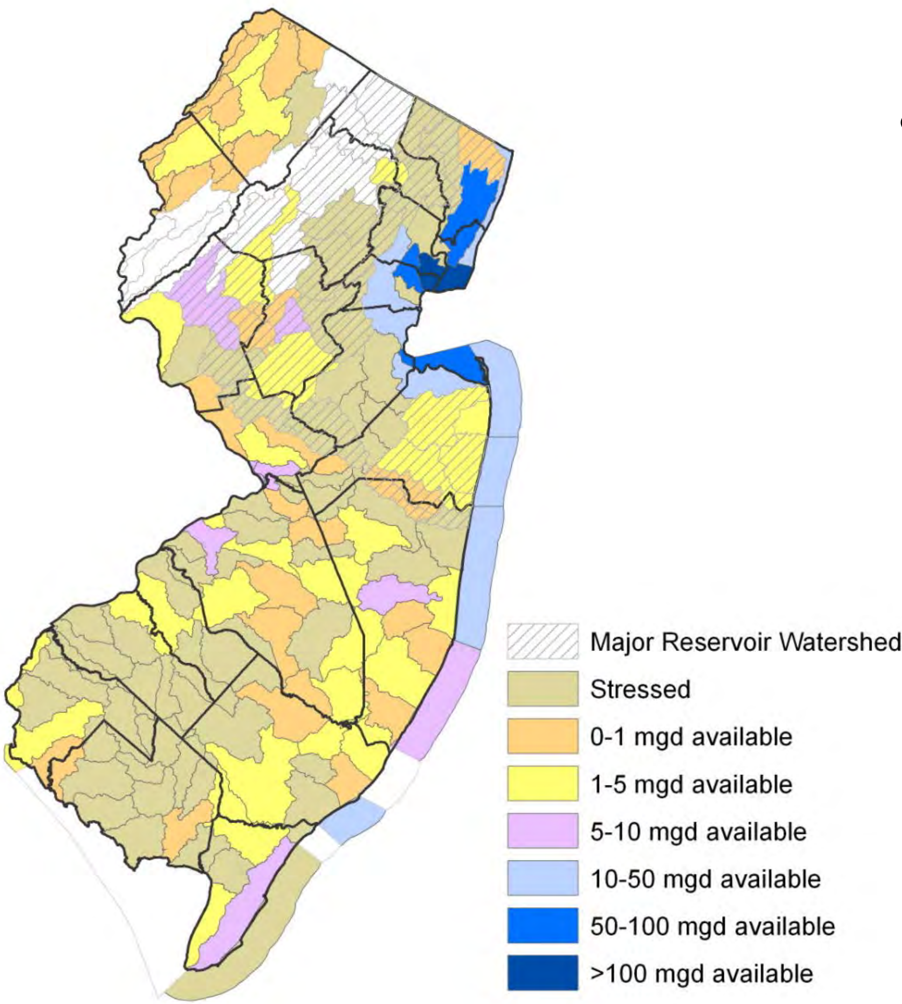
Options to Evaluate

- Conservation
- Conjunctive use - using unconfined sources when supply is plentiful and confined sources during more ‘stressful’ periods)
- Advanced technologies (e.g. desalination, wastewater injection)

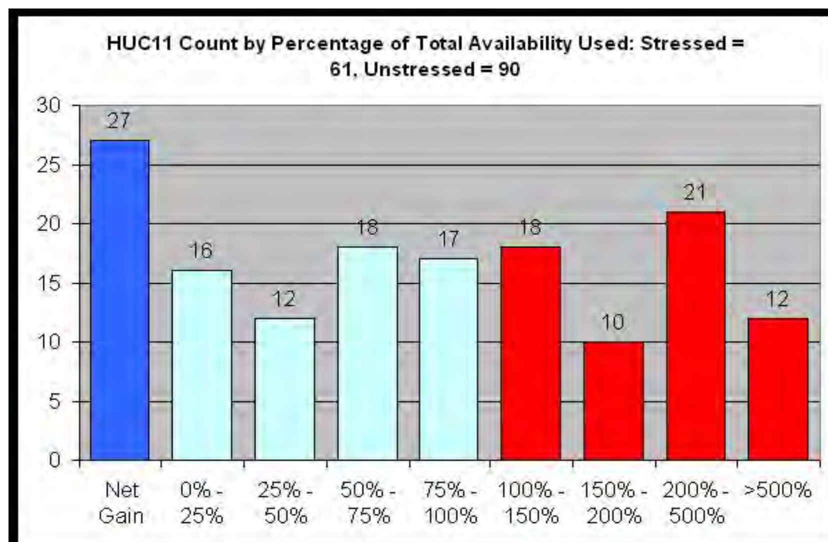
Confined Aquifer Availability

- Approximately 360 mgd available
- Current unused availability approximately 80 mgd: Cape May, Great Egg, and Mullica WMAs are at or close to availability limits
- Limited availability statewide at full allocation, but case-by-case evaluations need to be made

Unconfined Ground Water and Surface Water Availability



- Stream Low Flow Margin Method
- HUC11 water budget
  - Sept med flow minus 7Q10
  - 25% of margin available
  - 1990 to 2007 peak water use
  - 385 mgd total available for depletive and consumptive loss (not total use)



Availability Summary

- Total availability is a function of:
  - Resource availability: safe yield, unconfined gw and sw, and confined gw
  - Allocations, contracts, firm capacity
  - Interconnections, imports, new projects, conservation, and reuse
  - Reserves ‘needed’ for protection of sensitive ecology (Pinelands/Highlands)

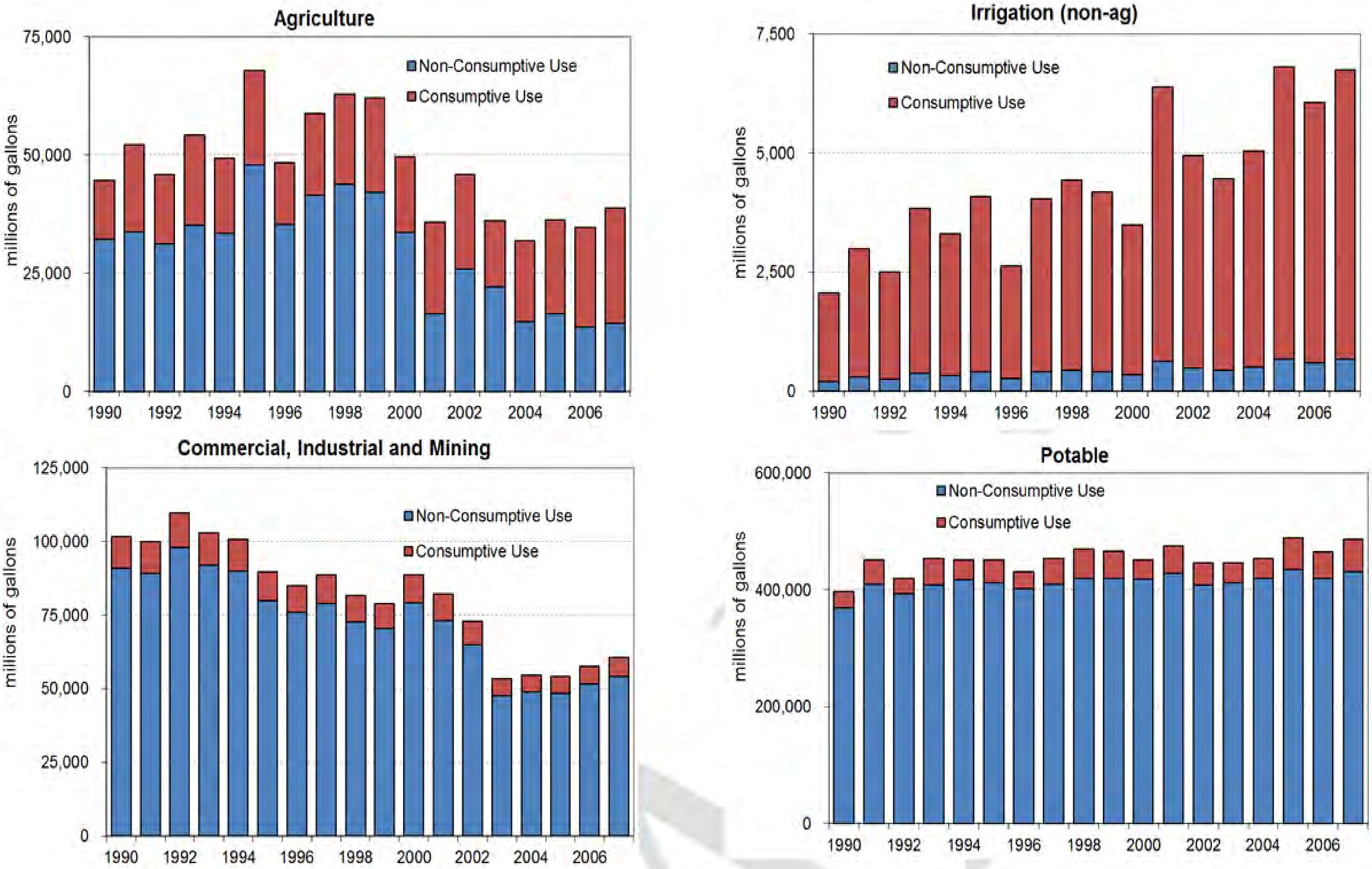
Global Warming/Climate Change

Uncertainty over future weather patterns complicates future water supply planning/management and begs for adaptive strategies

Increasing loss of highly treated drinking water for "non-potable" purposes

(watering of lawns and landscapes)

Consumptive & Nonconsumptive by Use



Nearly 800 MGD is currently lost through wastewater discharges to the ocean and water losses tied to excessive lawn irrigation

– Represents opportunity for wastewater reuse

Reuse

- Advancing wastewater reuse for non-potable uses
  - 750 mgd wastewater ‘lost’ to the ocean…potential source of supply, mitigate drought effects
  - Providing tax credits, low-interest loans, and demonstration project funding
  - Coordinated regulatory changes made to streamline permitting and require assessments
- Roadblocks to Implementation
  - Public perception of health risks
  - Costs of treatment vs. pumping water
  - Lack of common interests between wastewater and water utilities
  - Liability for operation/maintenance
  - Reuse ‘works’ when other sources are unavailable (e.g. CA, FL and AZ)
- Recommendations
  - Limit use of fresh water for non-potable purposes….start with limiting confined aquifer use in next rulemaking
  - Public outreach and education
  - Pursue options to offset costs and address liability

Existing Approved Supply & Projected Demands

- *Water Surplus/Deficit by Water Service Area - DEP website* http://www.state.nj.us/dep/watersupply/pws.htm

- Current Demands/Projected to 2025

Future Demands and Approved Supplies

- NJ's 2000 Census Population = 1996 NJSWSP Projected 2020 Population
- Projected 2020 Population = 9.53 Million*

So, in just 10 Years –

- – An additional 1.12 Million People
- – Added Demand = ~100+ MGD Avg.
  - Significantly Higher Peak Summer Demands

*Based on Metropolitan Planning Organization (MPO) estimates being used in support of NJ Water Supply Plan

Good News… Bad News… Better News…

Good news… *we have ample supply statewide to meet needs until 2020.*

Bad news... *the supply is not always the quantity needed for the area or available when it is needed.*

Better news… *with **smart & efficient** use of water we can meet New Jersey's water needs.*

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  - (609) 292 7219

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SPEAKER BIO

JASON MICKEL

Jason Mickel is the Water Supply section manager for the Southwest Florida Water Management District. He has a MS in Environmental Science & Management from the University of South Florida. He has 15 years experience working in water supply project development and planning, lake and pond restoration, stormwater improvement projects, and regulation. Jason's section manages large regional projects, reclaimed water and other alternative water supply projects, conservation, and water supply planning, demands and projections for the District.

Creative Partnerships for Sustainable Groundwater Management

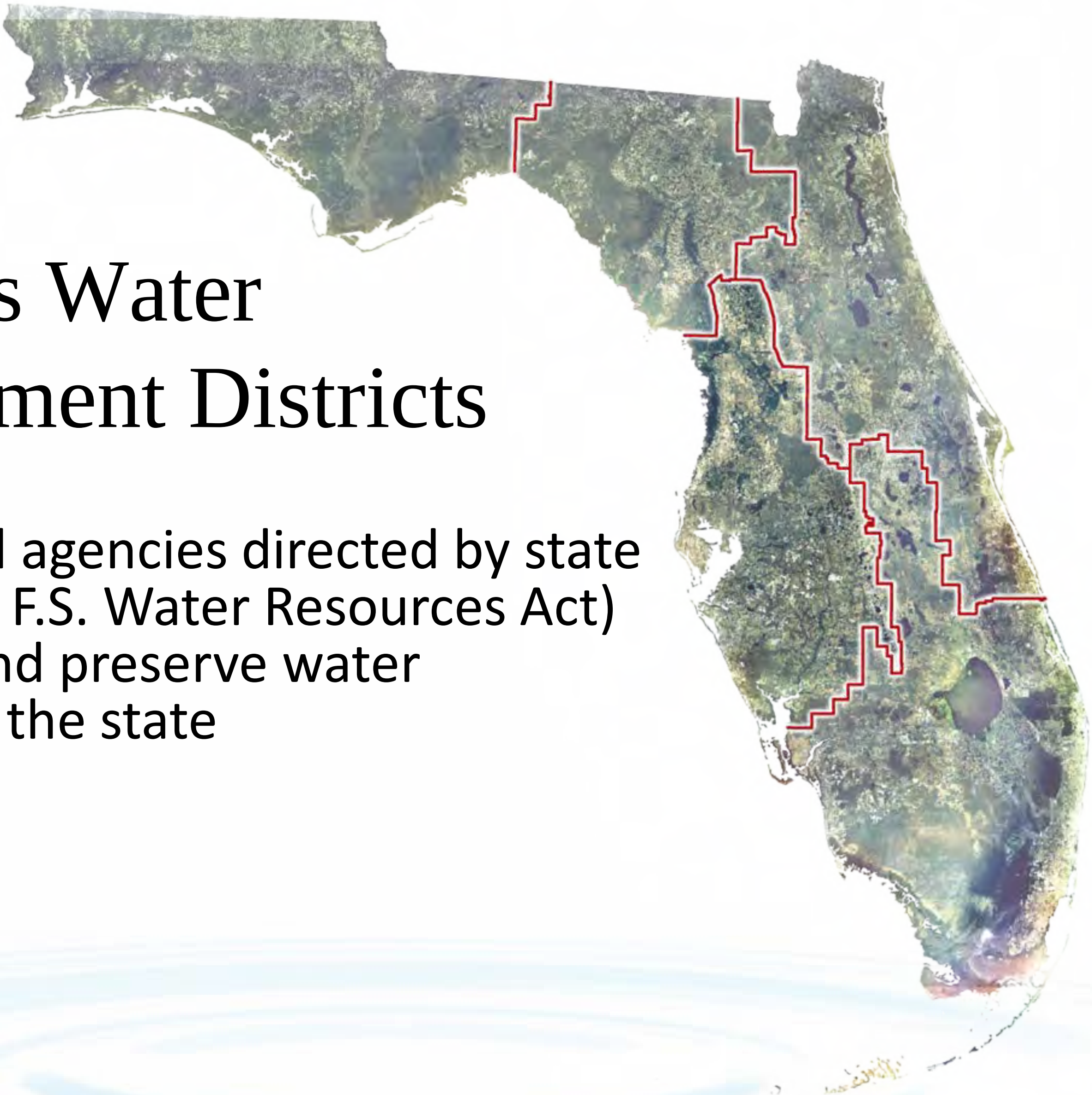
Jason Mickel
Water Supply Manager
10/16/13

Southwest Florida
Water Management District

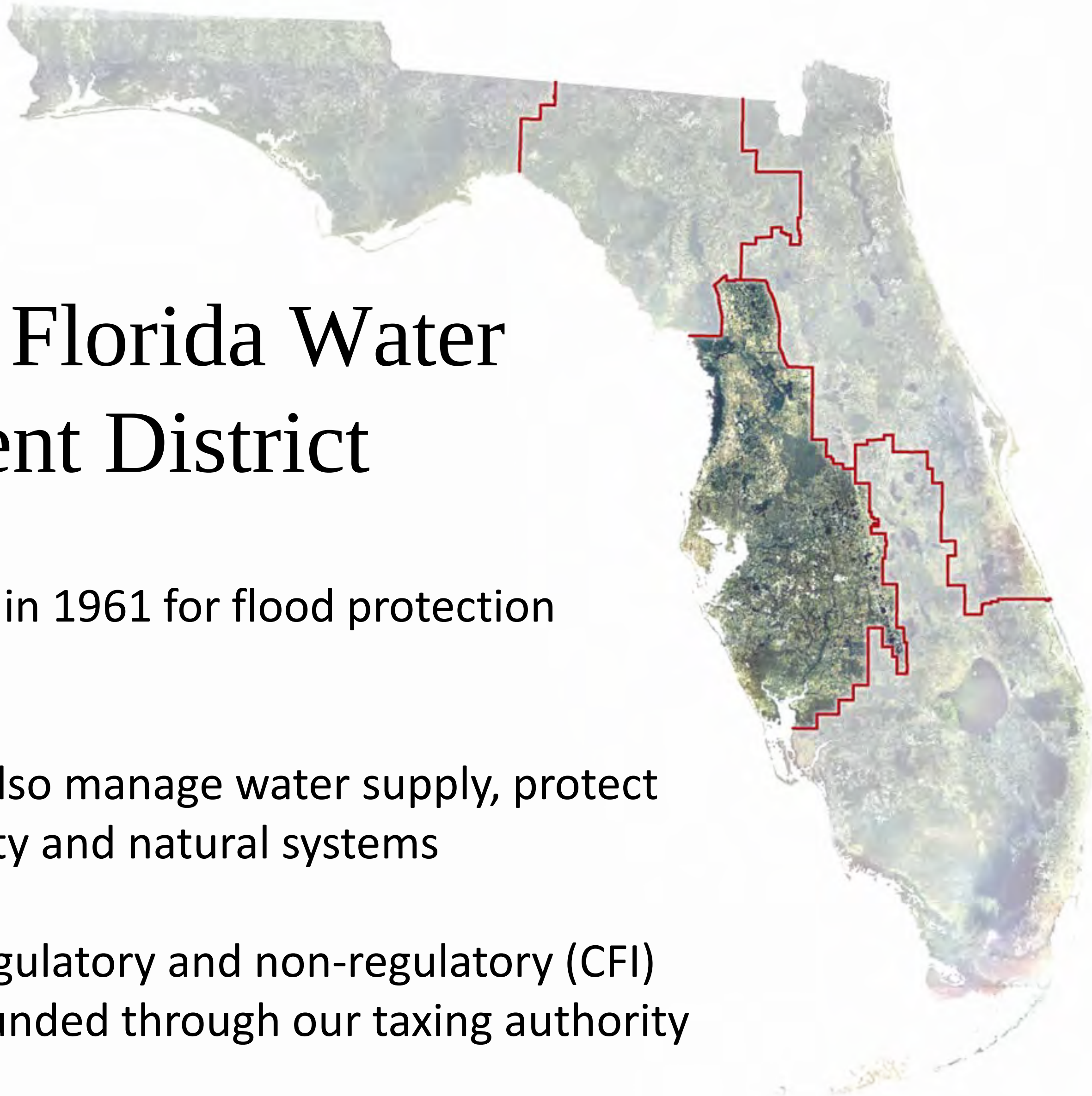
Presentation Topics

- About the District
- Managing Water Resources
- Alternative Water Supply
- Project Example - Creative Partnerships for Sustainable Groundwater Management

Florida's Water Management Districts



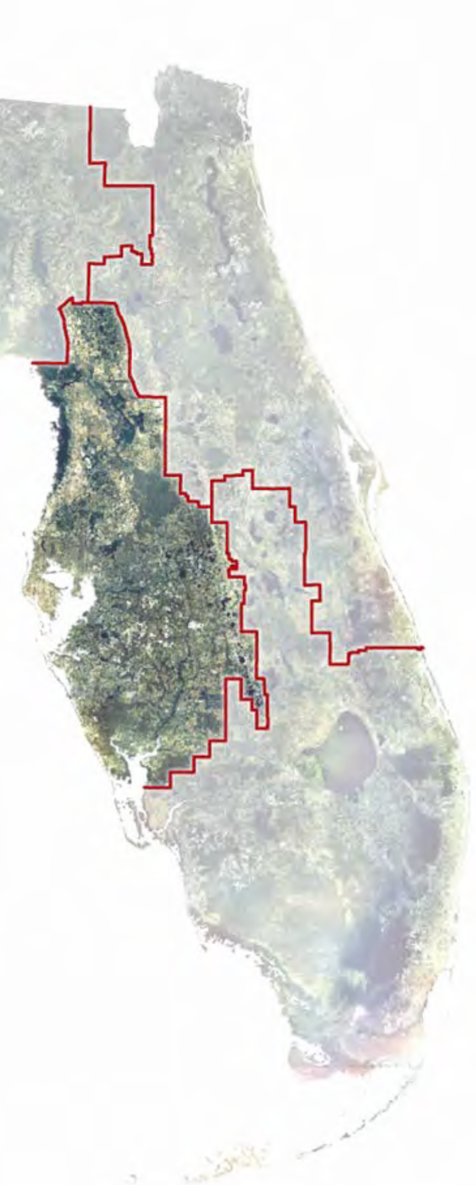
Five regional agencies directed by state law (Ch. 373 F.S. Water Resources Act) to protect and preserve water resources in the state



Southwest Florida Water Management District

- Established in 1961 for flood protection projects
- Today, we also manage water supply, protect water quality and natural systems
- We have regulatory and non-regulatory (CFI) programs funded through our taxing authority

Southwest Florida Water Management District



- Encompasses 16 counties, 10,000 sq. miles
- Abundance of water resources - 1,800 lakes, 13 major rivers, 3 estuaries of national recognition and thousands of acres of wetlands

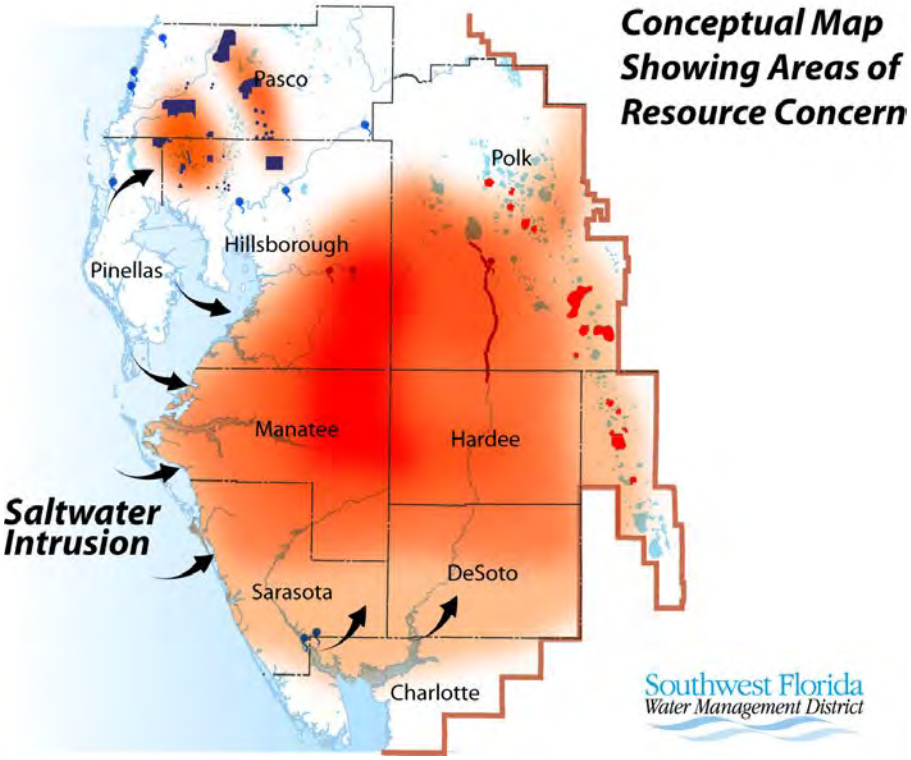
Managing Water Resources

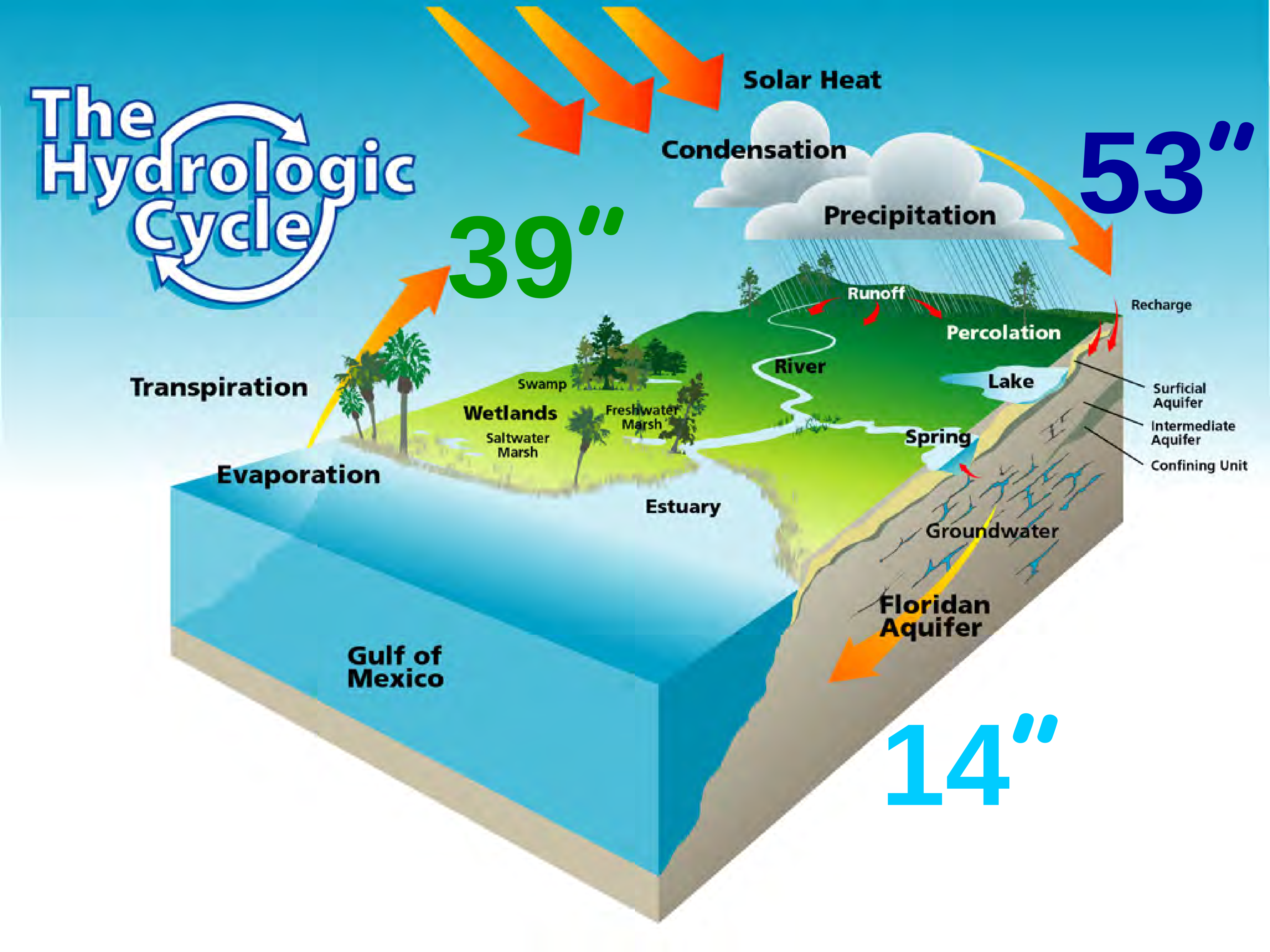
- 4.7 million people live within District boundary - expected to increase to 5.2 million by 2020

- Not just people need the water
  - Agriculture
  - Wildlife
  - Natural Systems
  - Business and Industry
  - Recreational Activities

Existing Water Management Concerns

- Excessive groundwater pumping has:
  - Lowered lake, wetland and aquifer levels
  - Reduced river flows
  - Increased saltwater intrusion in the aquifer along the coast
  - Imposed limits on groundwater
- Climate variations and uncertainty




The Hydrologic Cycle
Solar Heat
Condensation
53”
Precipitation
39”
Runoff
Recharge
Percolation
River
Lake
Transpiration
Swamp
Wetlands
Freshwater Marsh
Saltwater Marsh
Surficial Aquifer
Intermediate Aquifer
Spring
Confining Unit
Evaporation
Estuary
Groundwater
Floridan Aquifer
Gulf of Mexico
14”

Water Supply - SWFWMD

- Over 1.1 billion gpd in 2011
  - ➢ Groundwater – 823 million gallons per day
  - ➢ Other Sources– 223 million gallons per day
  - ➢ Increase by 430 MGD by 2030

Where Does The Water Come From?

Groundwater – avg 65%

Where Does The Water Come From?

Surface Water – avg 20%

Where Does The Water Come From?

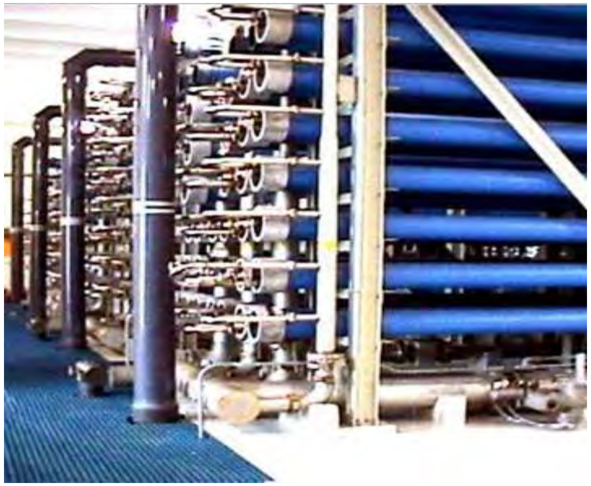
- Seawater Desalination
- Brackish Groundwater
- Reclaimed Water

Water Supply Programs

- Water Use Permitting
- Watering Restrictions
- Regional Planning & Partnerships
- Water Conservation
  - Toilet Rebate Program
  - Smart Irrigation Controllers
  - Education
- Alternative Water Supply

Alternative Water Supply

- Surface water
- Agricultural research & conservation
- Brackish groundwater
- Seawater desalination
- Aquifer storage
- Education
- Reclaimed Water



Reclaimed water is critical to the mission of managing water and related natural resources.

Florida Legislature Recognized…

"Reuse is a critical component of meeting the State's existing and future water supply needs while sustaining natural systems"

403.064(1), F.S.

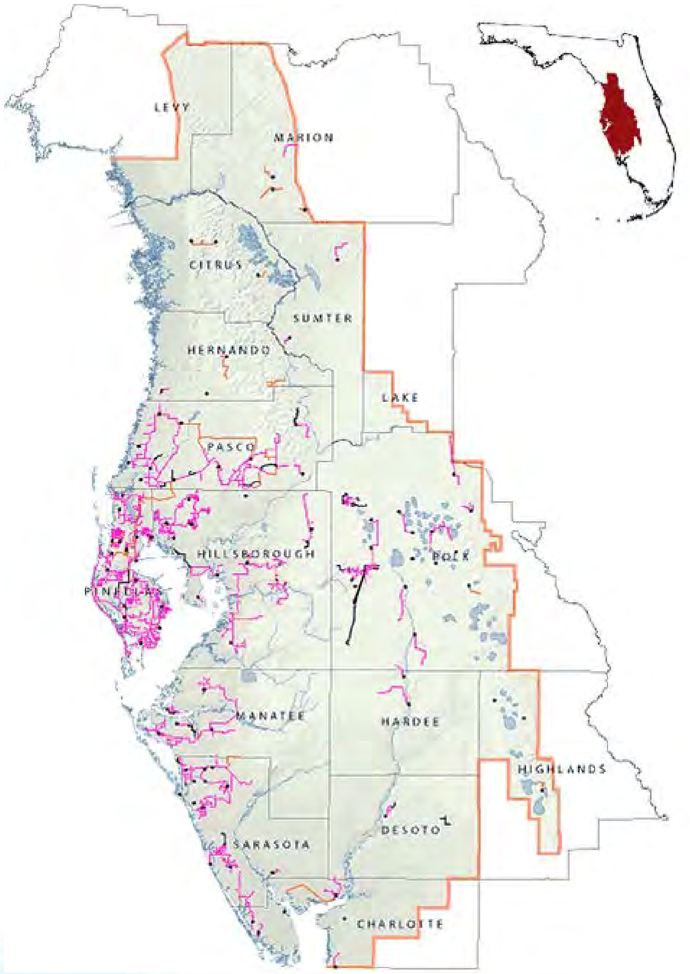
"To encourage and promote water conservation and reuse of reclaimed water"

373.250, F.S.

Reclaimed Water Accomplishments

SWFWMD Totals:

- 323 Projects Funded Since 1987
- $363M Leveraged $870M
- 913 Miles of Pipelines
- 234 MGD Reuse Made Available
- 162 MGD of New Water
- 10% of District-wide Water Use
- $5.37 per GPD Developed



Beneficial Use of Reclaimed Water to Reduce Groundwater Use and Improve Water Quality to the Crystal River Spring System

Creative Partnership

- Duke Energy – use reclaimed water/onsite infrastructure
- City of Crystal River - project partner/available reclaimed water/ funding
- SWFWMD - contract management/funding
- FDEP - funding for spring protection/restoration

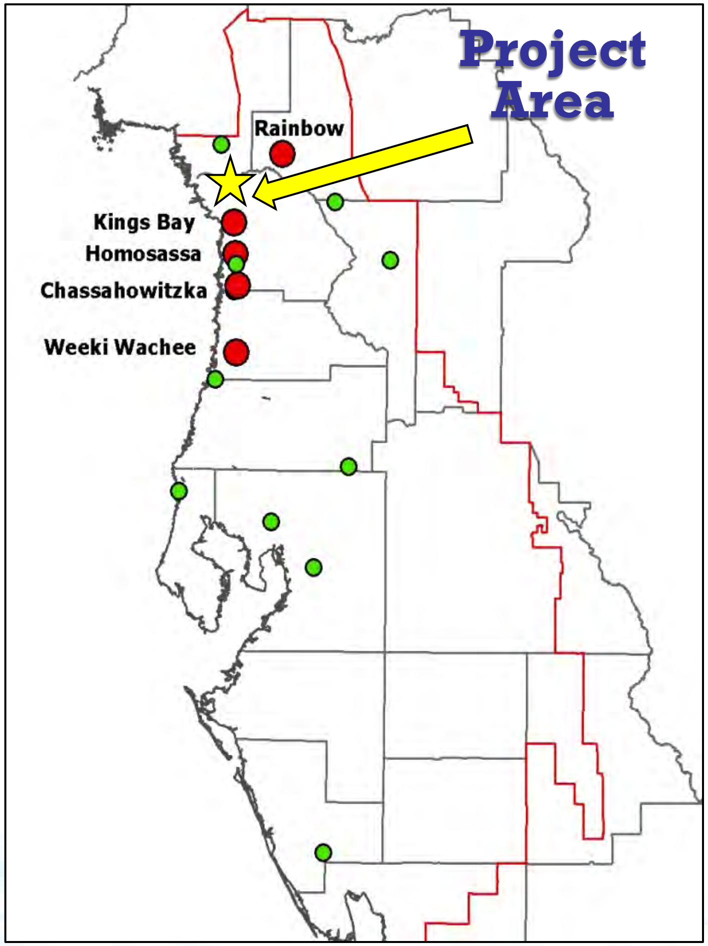
Project Details

Duke Energy in Citrus County

- $6.2 million project
- Use 0.75 MGD of reclaimed water
- Flue gas desulfurization
- Reduce groundwater use
- Improve water quality in springshed

SWFWMD Springs

- 150 springs Districtwide
- 16 spring groups
- 5 first-magnitude groups
  - More than one billion gallons per day
  - Springs Coast – 2nd largest seagrass area in the nation

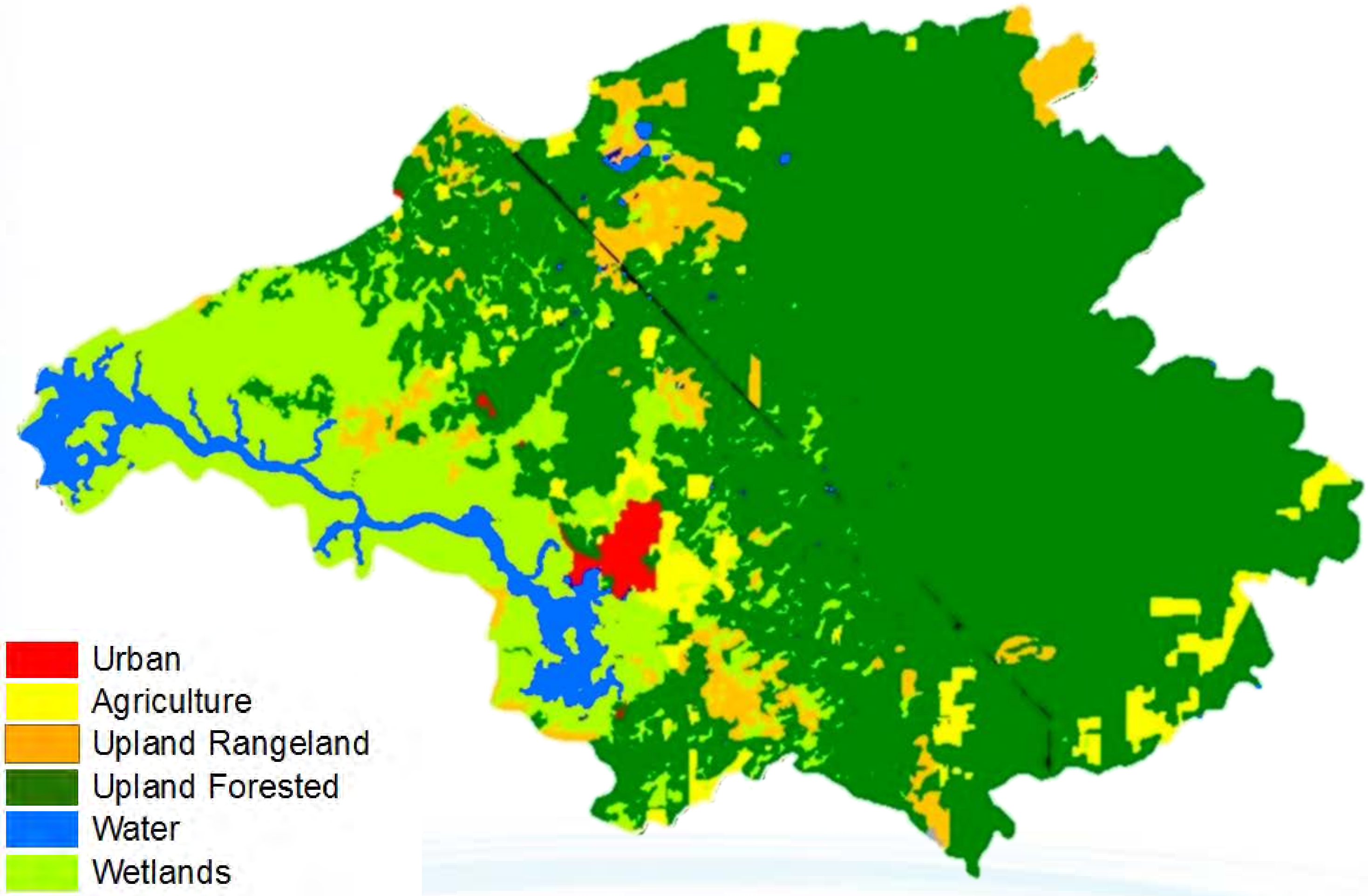


A World Class Resource

- Important manatee refuge
- Valuable estuaries and fisheries
- Large economic impact on small communities
- Significantly impacted by disturbance

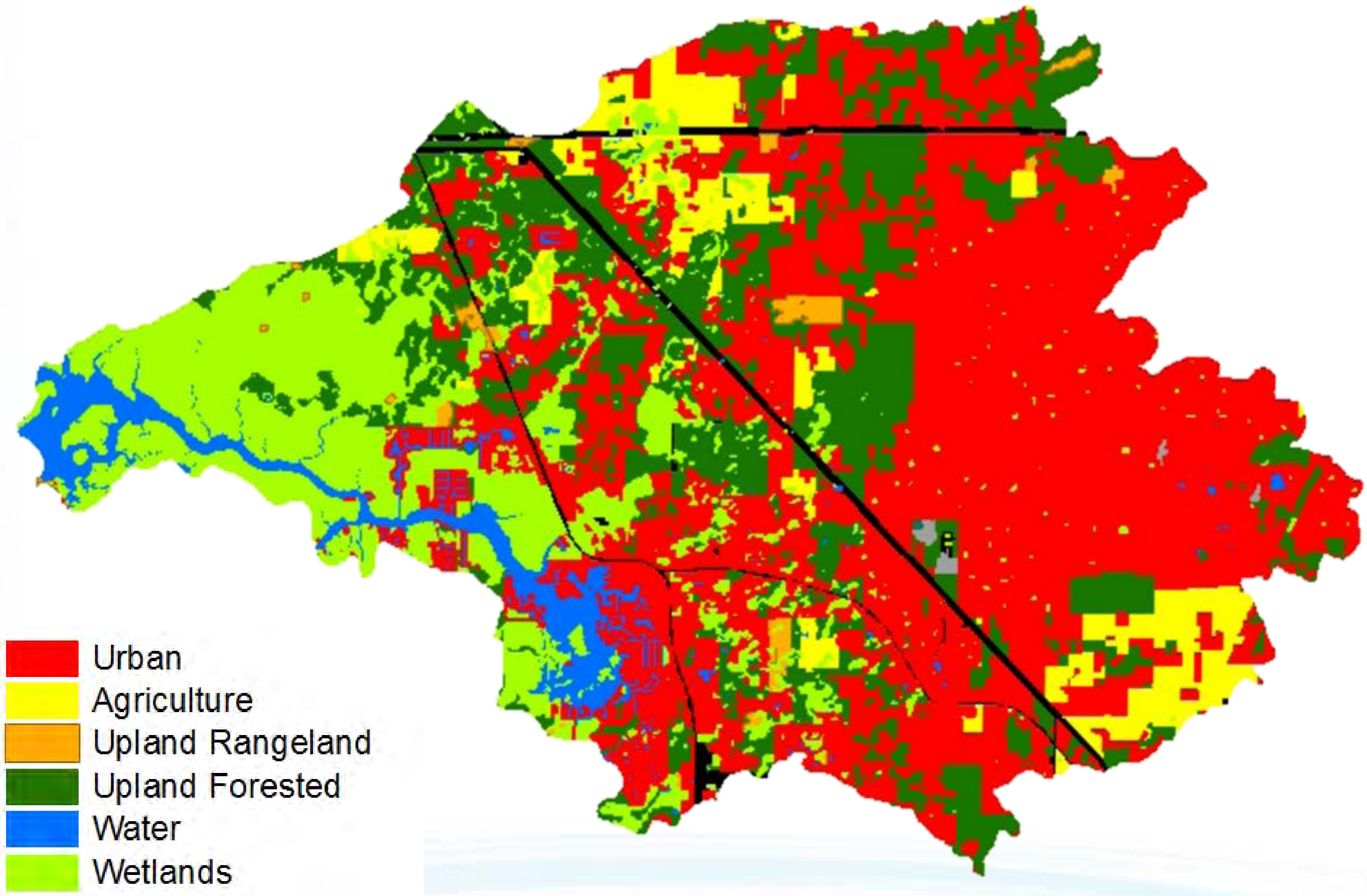
Land-Use Change

1944 Crystal River Watershed Landuse



Land-Use Change

2010 Crystal River Watershed Landuse



Project Site Map

Range of Nutrients in Reclaimed

WWTP Class	Range mg/l	Average mg/l
Secondary	0.1-29.1 for N 0.1-16.0 for P	7.9 for N 2.0 for P
AWT	0.1 -3.0* for N 0.02-1.0* for P	1.6 for N 0.2 for P

*Maximum per Regulations

FDEP 2009 Survey

Water Quality Benefits

WWTP Nitrogen Load to Groundwater In the Crystal River Springshed

WWTP	WW Discharge (mgd)	Effluent N load (lb N/yr)	Discharge Fate	% Removal	N load to Groundwater (lb N/yr)	
Beverly Hills	0.47	11,313	RIBs	57.5	4,808	
Brentwood	0.34	8,184	RIBs	57.5	3,478	
Meadowcrest	0.47	11,313	RIBs	57.5	4,808	
Crystal River	0.75	19,016	Sprayfield	70	5,705	
Totals	2.03				18,800	lb N/yr

Water Quality Benefits

Reduced wastewater load to groundwater

- Crystal River WWTP effluent N load
  - 0.75 mgd
  - 8 mg/l N (FDEP 2009)
- N reduction to surficial aquifer
  - 5705 lbs N/yr
- Reduction in WWTP N load to aquifer
  - 30%

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Questions

Photo by: Curt Bower,© 2009

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SPEAKER BIO

GEORGE EDWARDS

George Edwards was born and reared in Kansas City, and earned his professional degree in Geology at the University of Kansas. After jobs in mineral exploration and mapping in Argentina, a stint as Mine Geologist for a copper mine in Michigan, and several years doing research for the Federal Government, he joined Corning Glass Works, retiring after nearly 30 years as Chief Geologist. He now serves as President of G.H. Edwards & Associates, Inc., a consulting group providing technical and marketing services in glass technology and glass raw materials. He and his wife Lee moved to Gainesville from Upstate New York in 1998.

George has served on the Boards of a number of not-for-profit corporations ranging from yacht clubs to National scholarship funds, including the National Soaring Museum, where he served two terms as President. Currently he is the Investment Trustee of the Robert L. Bates Memorial Scholarship Fund, Inc., a member of the ASTM International, Inc. Standards Committee on Hydraulic Fracturing, member of the Board of AquiferWatch, a member of the scholarship committee for the Society of Mining Engineers, and the VP of the Southeastern Geological Society.

AQUIFERWATCH – A NEW EDUCATIONAL AND AQUIFER DATA-GATHERING PROGRAM IN FLORIDA

George H. Edwards, CPG

Rick Copeland, PhD, PG

Gary Maddox, PG

October, 2013

FLORIDA'S AQUIFERS

- Geological History of Florida
- Long period of a warm Earth with high sea levels
- Produced a thick sequence of porous limestones
- Now the host rocks for a large aquifer
- Mantle of sand hosts overlying aquifers

First Came
Florida **LAKEWATCH**

- Univ. FL. – Institute of Food & Agricultural Sciences (IFAS)
- Monitoring of Lakes by Volunteers (1986)

AquiferWatch

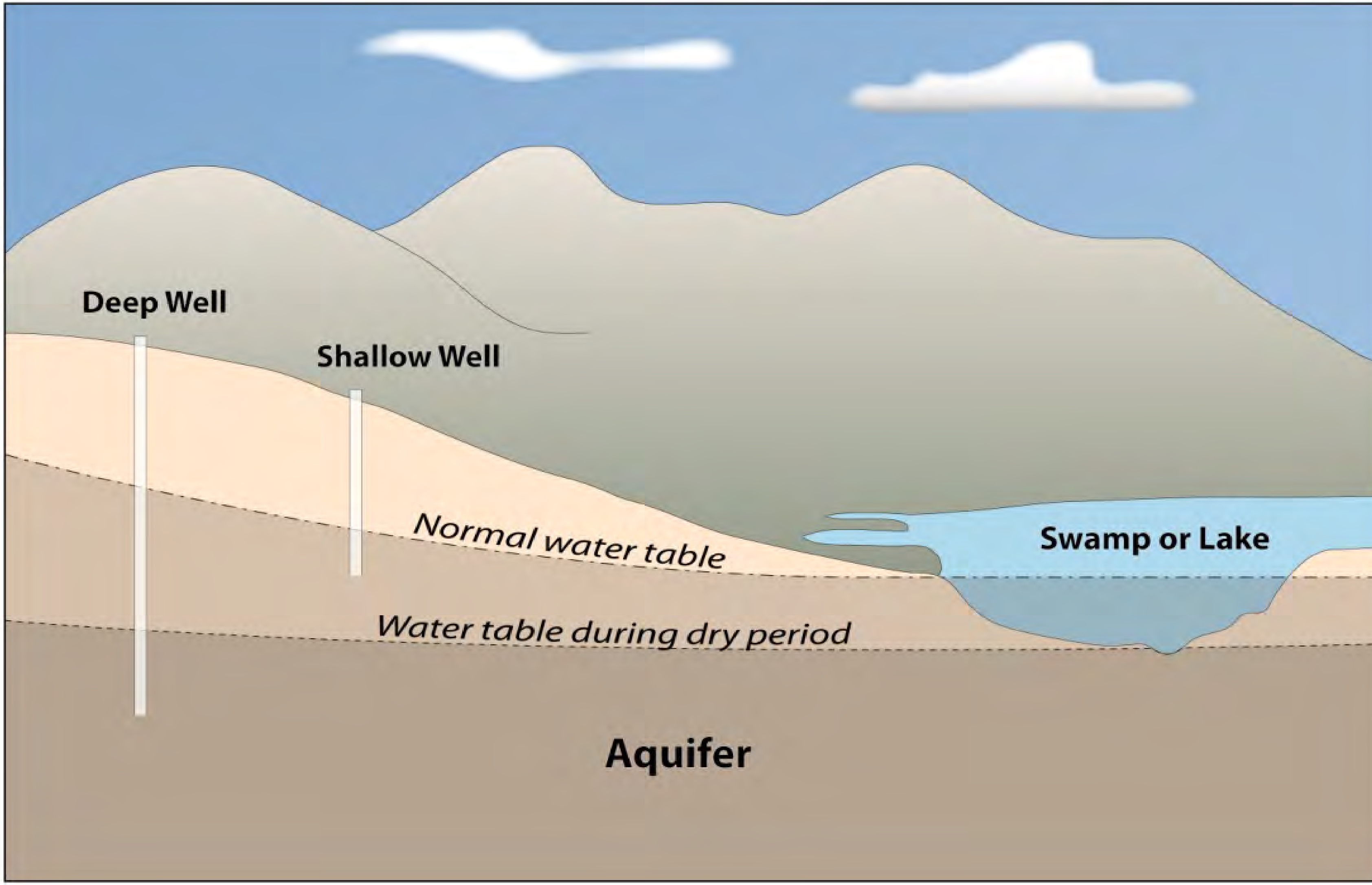
On suggestion of IFAS, AquiferWatch founded in Fall of 2012

Operational in early 2013

Surface Water Concerns

Concerns

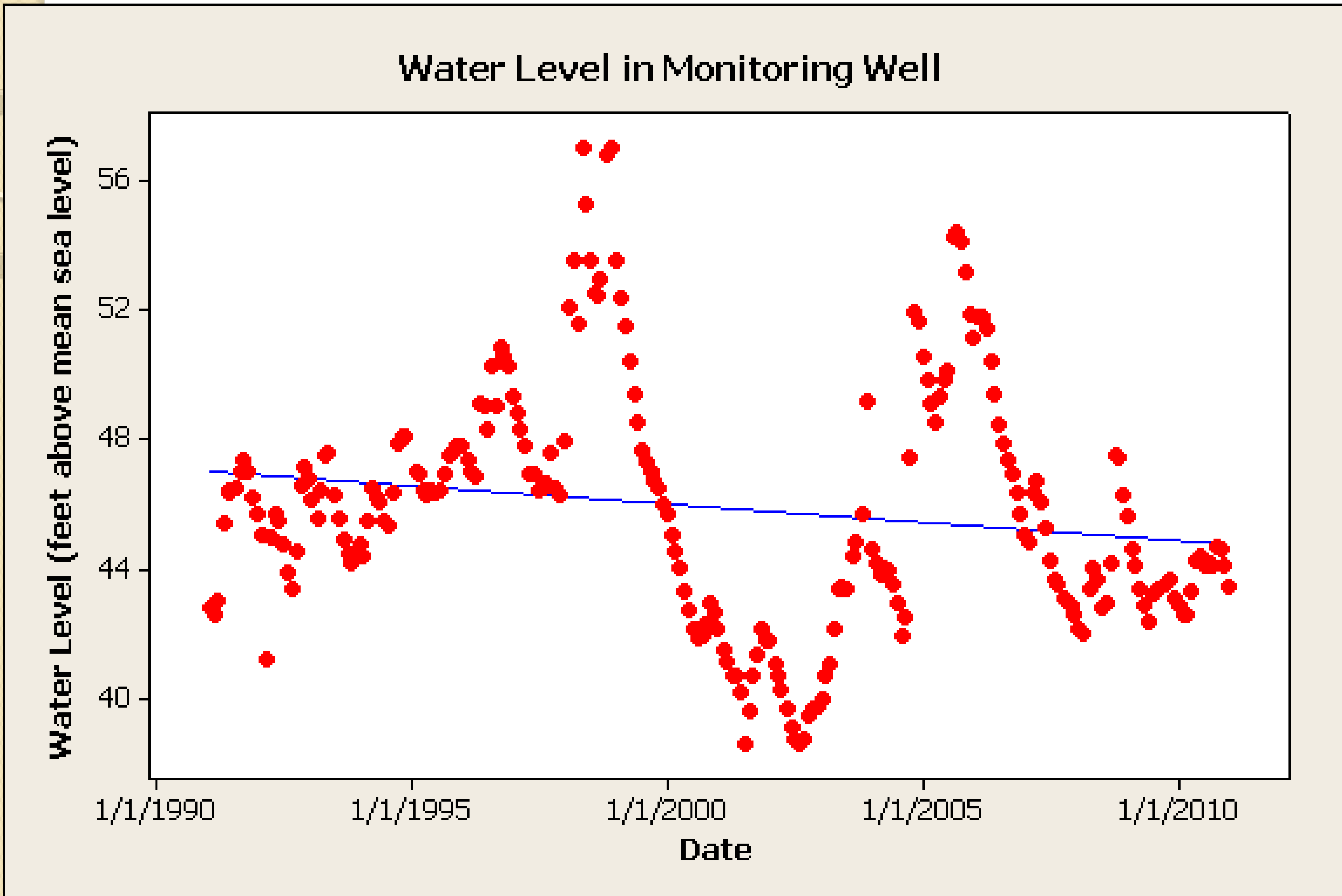
Lake going dry



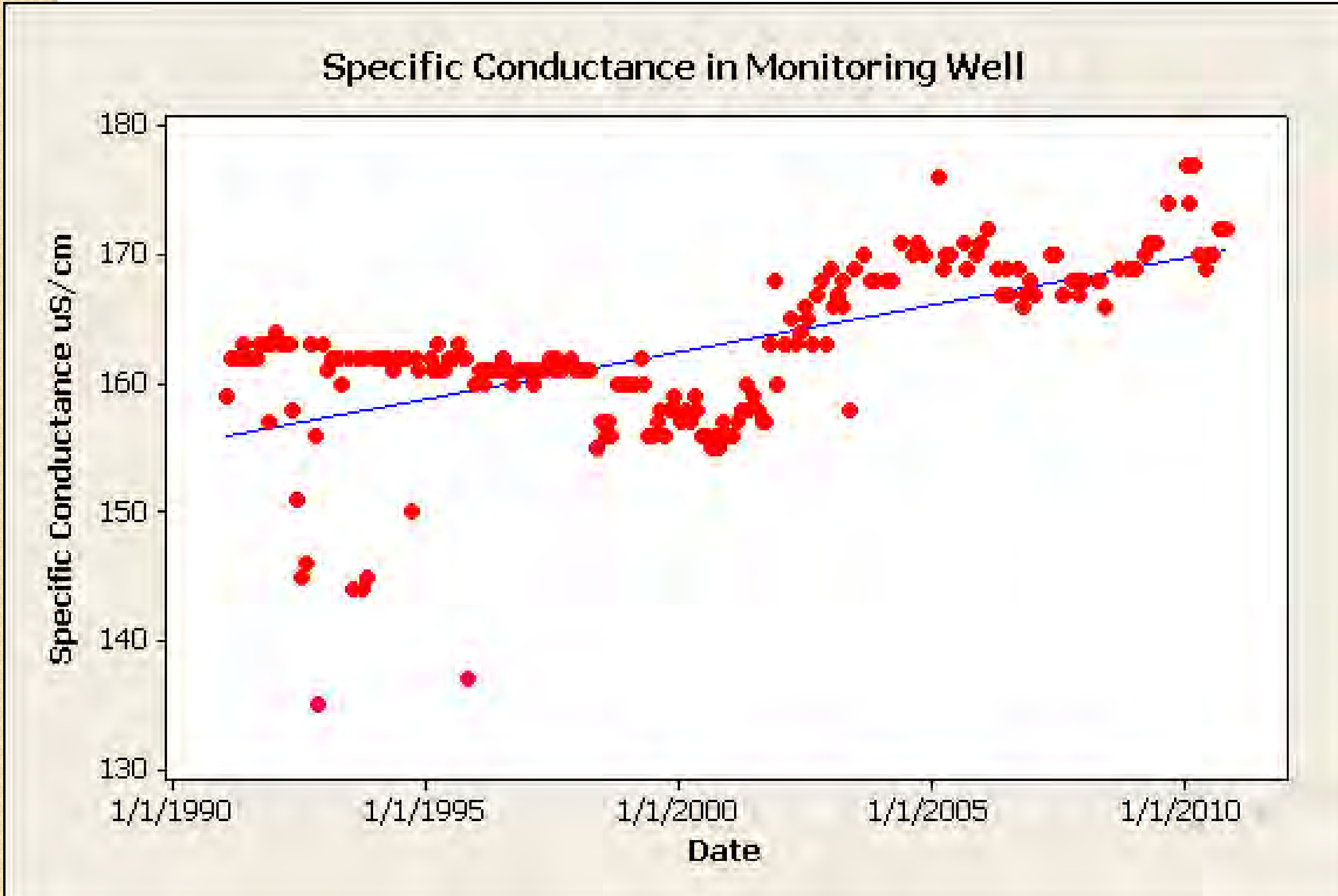
Deep Well
Shallow Well
Normal water table
Swamp or Lake
Water table during dry period
Aquifer

Groundwater Concerns

- Since 1998
  - ENSO Cycle has been subdued
  - Groundwater levels have generally decreased
  - Indicators such as Na, Cl, SO4 and TDS have generally increased

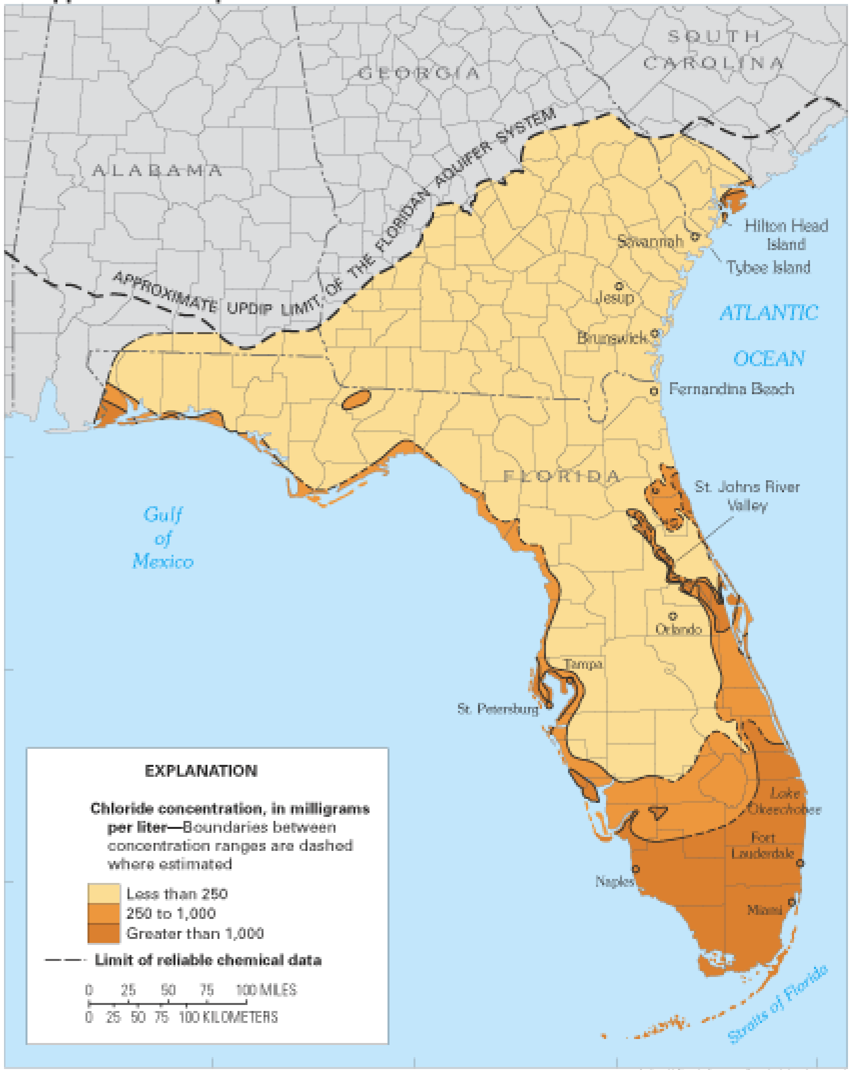


Water level in a monitoring well (1991-2010)



Specific Conductance in a Monitoring well (1991-2010)

A. Upper Floridan Aquifer



Modified from Sprinkle (1989)

Chloride Concentrations in Floridan Aquifer System

AquiferWatch Inc

- A 501(c)(3) nonprofit corporation
- Objectives:
  - **1. Public Education**
  - 2. Facilitate “hands-on” education through GW monitoring
    - **Easier to educate if participants are actively involved**
  - 3. Well Monitoring – Data Gathering

AquiferWatch Program within LAKEWATCH

- AW working in cooperation with LW
- Mission
  - 1. **<u>Educate public</u>** about groundwater (GW)
  - 2. Facilitate "hands-on" education through GW monitoring
  - 3. Produce long-term GW monitoring data
- Same Missions but two separate orgs.
  - Paths to success may be different

AW and the Public

- AW recruits volunteers
  - Volunteers do not need to own water well
    - Volunteer receive training and educational material
- If Volunteer has a well,
  - Well must be checked and surveyed
  - Volunteer must be trained (≈ one hour)
    - Learn about aquifers and groundwater
    - Techniques for obtaining <u>**water level**</u> and <u>specific conductance (SC)</u>

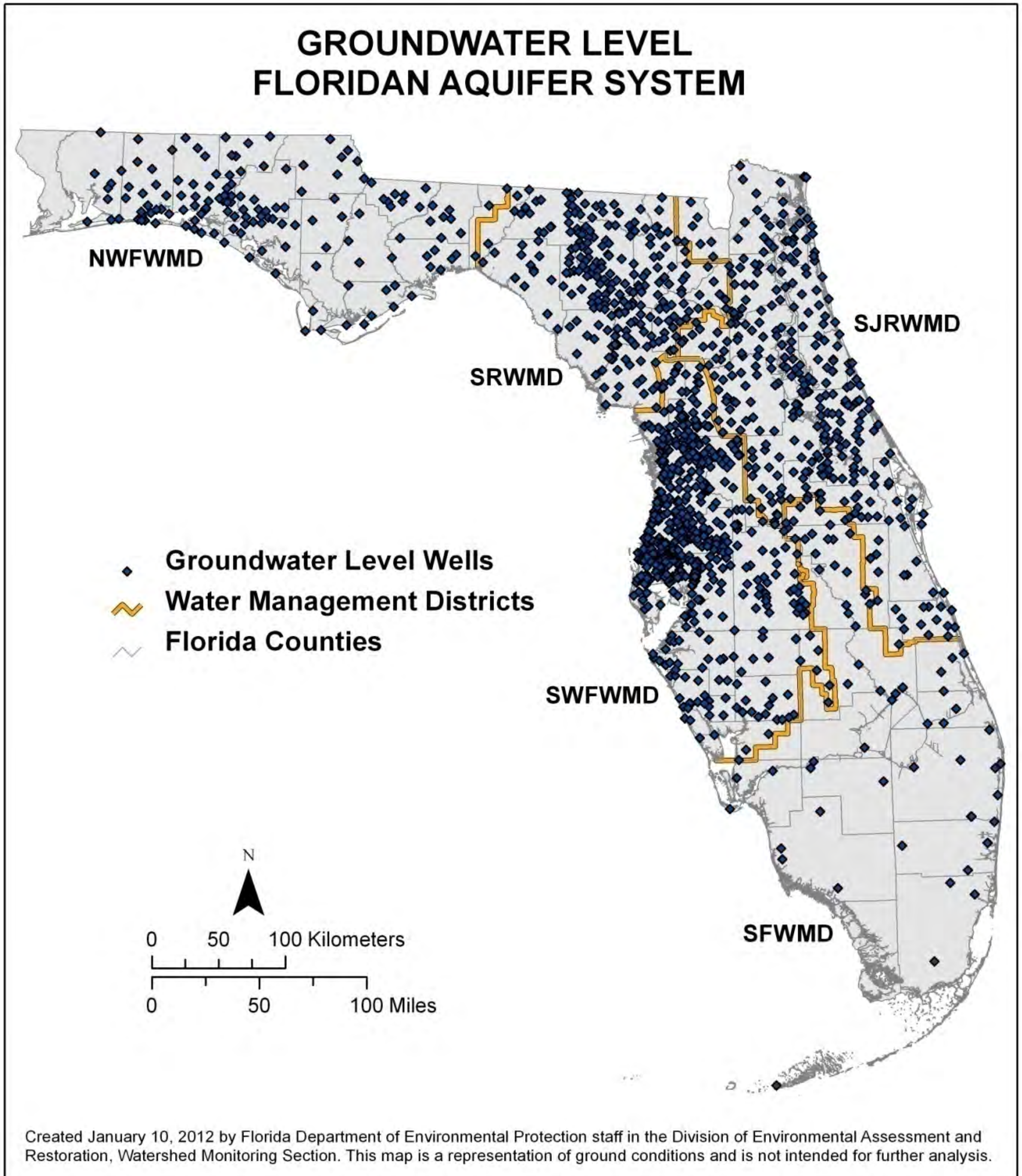
VOLUNTEERS

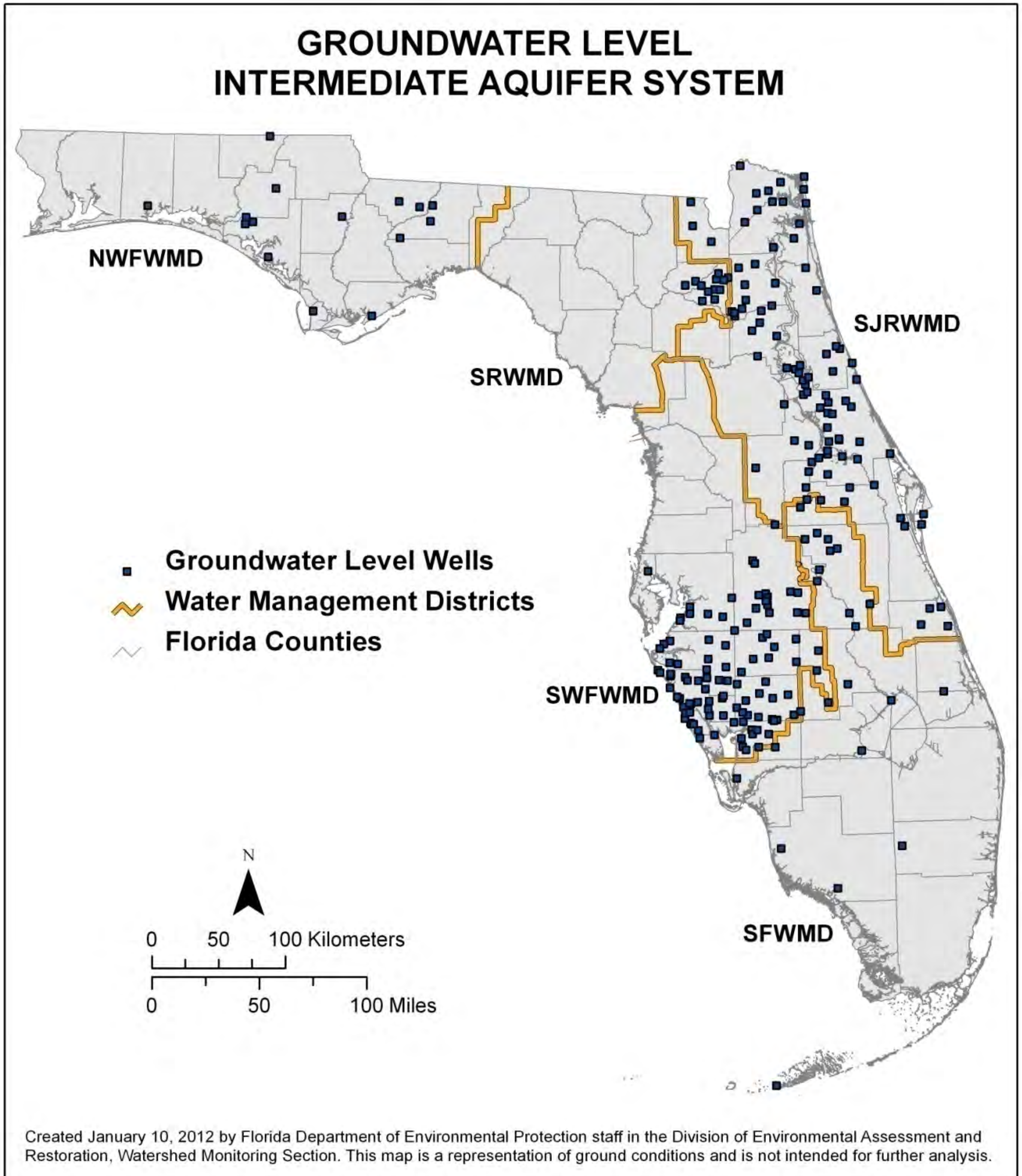
- Volunteers Receive:
  - Training
  - Literature
  - Well monitoring equipment

Data

- Volunteers obtain data at least 1/month
- Quarterly send data to LW
- Data entered into LW database
- Data available to the public

Monitoring Wells of Governmental Agencies in Florida (GWL)


GROUNDWATER LEVEL
FLORIDAN AQUIFER SYSTEM
NWFWMD
SRWMD
SJRWMD
SWFWMD
SFWMD
Groundwater Level Wells
Water Management Districts
Florida Counties
N
0 50 100 Kilometers
0 50 100 Miles
Created January 10, 2012 by Florida Department of Environmental Protection staff in the Division of Environmental Assessment and Restoration, Watershed Monitoring Section. This map is a representation of ground conditions and is not intended for further analysis.


GROUNDWATER LEVEL
INTERMEDIATE AQUIFER SYSTEM
NWFWMD
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SJRWMD
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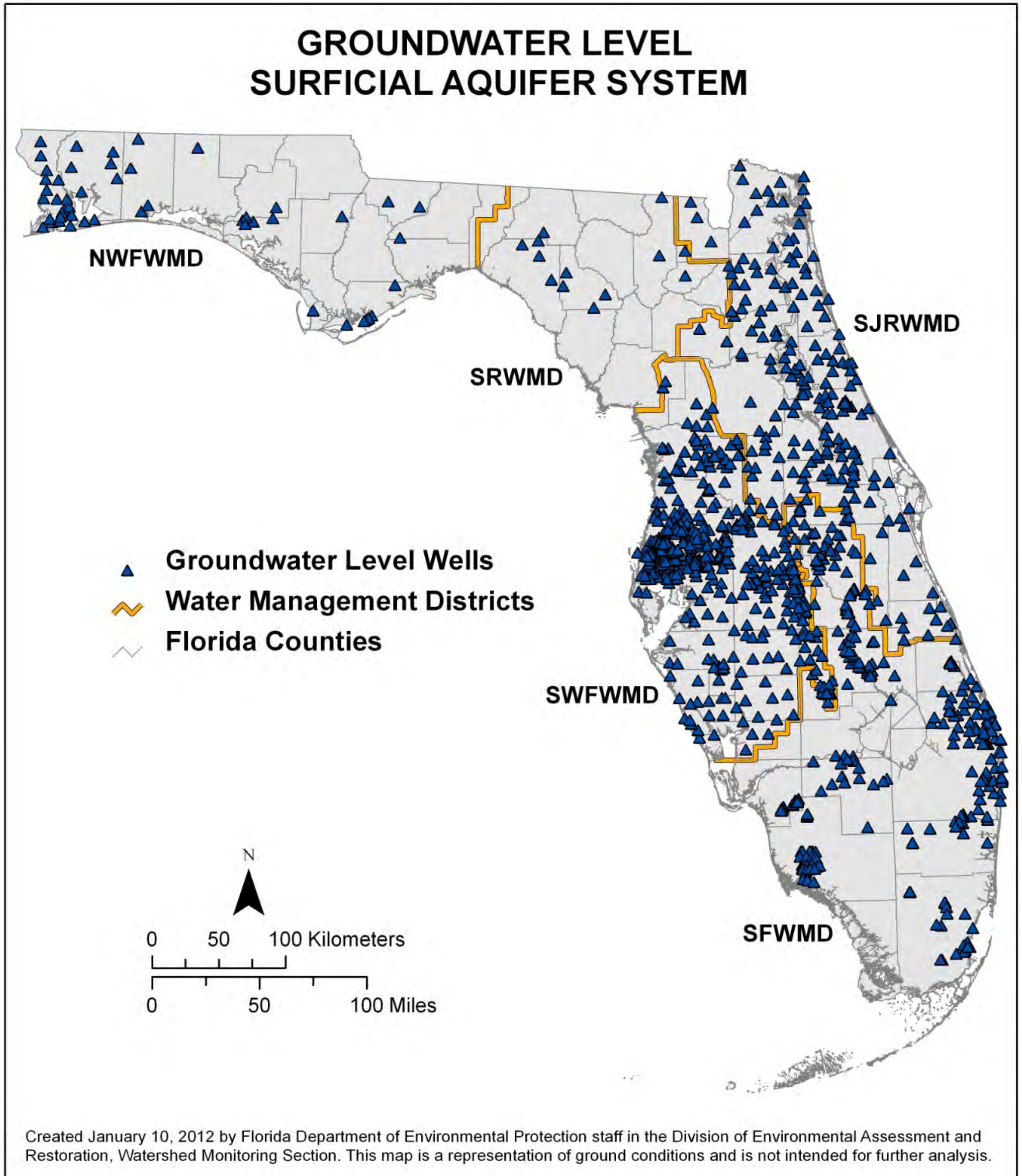
GROUNDWATER LEVEL
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N
0 50 100 Kilometers
0 50 100 Miles
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Advantages of Volunteer Monitoring

- All volunteers ↑ their awareness of water issues
- Well Volunteer data
  - Time and cost efficient
- Without volunteers, many areas of aquifers would not be monitored

Field Situations

Obtaining GWL measurements


Solinst
Water Level Meter


OLD GUYS RULE

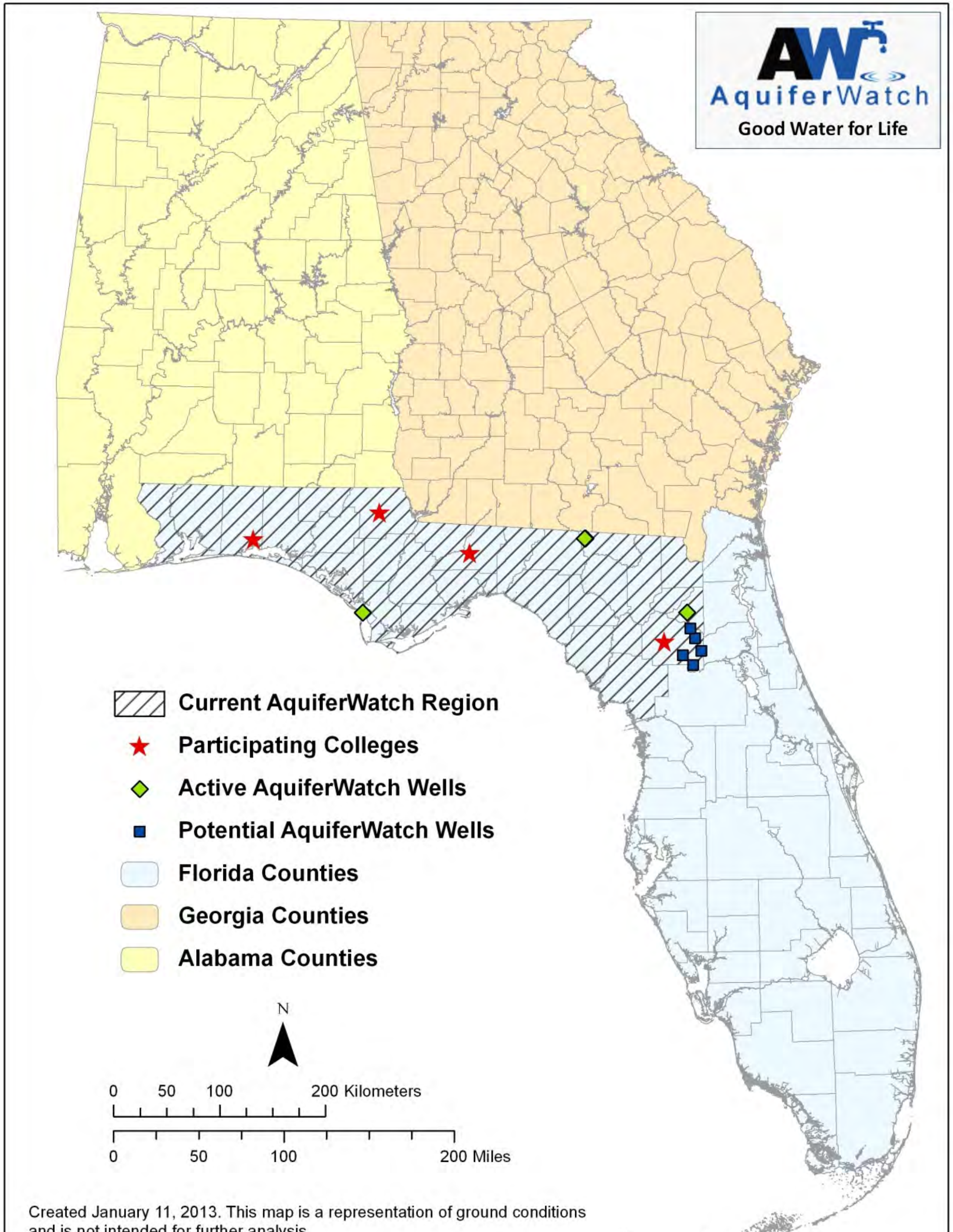
Well Sampling Field Sheet

- **LAKEWATCH**)/County:____
- Florida Unique Well Identifier (FLUWID) (Assigned by **LAKEWATCH**):________
- Well Name: ____
- Sampler:____
- Address (including City, State, and Zip Code):___________________________
- Stickup (**SU**: ft/0.01 ft)_____Measuring Point Elevation (**MPE**: ft/0/0.01)_________

- Date/Time:_________________
- (Please take a minimum of two measurements to within 0.01 ft)

- 1. Depth to Water (**DTW**: ft/0.01 ft) (Distance from MPE to water): ___________

- 2. Depth to Water (**DTW**: ft/0.01 ft) (Distance from MPE to water):___________


AW
AquiferWatch
Good Water for Life
Current AquiferWatch Region
Participating Colleges
Active AquiferWatch Wells
Potential AquiferWatch Wells
Florida Counties
Georgia Counties
Alabama Counties
N
0 50 100 200 Kilometers
0 50 100 200 Miles
Created January 11, 2013. This map is a representation of ground conditions
and is not intended for further analysis.

BACK TO AGENDA

NEXT STEPS

Expand Volunteer Base

We need more volunteers!

Secure Funding

We need help locating and winning grants

Interested?

Contact George Edwards – 352.373.2502 or

Rick Copeland – 850.559.7199

BACK TO AGENDA

AquiferWatch – A New Educational and Groundwater Data-Gathering Program in Florida

George H. Edwards, CPG; Rick Copeland, PG, PhD; and Gary Maddox, PG
AquiferWatch Inc.
P.O. Box 11185
Tallahassee, FL 32302
850.559.7199

Abstract

The importance of groundwater in Florida to the lives and commerce of citizens is difficult to overstate. Most domestic, industrial, and agricultural water used in Florida is derived from groundwater. Detailed scientific information is expensive to collect; thus data are not always obtained is sufficient quantities by the responsible governmental agencies.

Supplemental data, obtained by an educated public, enhance the ability of government agencies to better manage Florida's groundwater resources. In cooperation with the Florida LAKEWATCH program at the University of Florida, we have started AquiferWatch, a 501(c) (3) not-for-profit corporation composed of citizen scientists who undertake the tasks of public education about groundwater, and the monitoring of water levels and water quality

Groundwater levels are recorded as feet below a well's measuring point, and later converted to feet above mean seal level. Future plans are to obtain water quality as specific conductance, measured as microseimens per centimeter (µS/cm). Measurements are tabulated and forwarded to a central office, where they are integrated into the Florida LAKEWATCH database. The information generated by the program is made available to all, including the volunteers themselves, interested citizens, schools, researchers, and governmental agencies. Initial comparison of monitoring results indicated that volunteers, if trained and supervised, can generate data having precision equal to those gathered by professionals.

The task of AquiferWatch is large and, as yet, the number of volunteers is small. AquiferWatch has room for more volunteers. The program thus far has been entirely self-funded by the volunteers themselves.

AquiferWatch – A New Educational and Groundwater Data-Gathering Program in Florida

Introduction

As many Floridians know, since the 1990s water levels in many lakes throughout state have declined. Unfortunately, many of those same Floridians are unaware of the inter-relationships among lake and groundwater levels (Figure 1) and, thus, are also unaware that groundwater levels in wells have also declined. For example, Figure 1 demonstrates that during dry time periods, the lowering of the water table declines forces the lake levels to recede.

Because the majority of water use in Florida is from groundwater, and because greater than 90% of drinking water is from groundwater (Fla. Department of Environmental Protection, 2013), it is important that the citizens of Florida understand the relationship between groundwater and surface water.

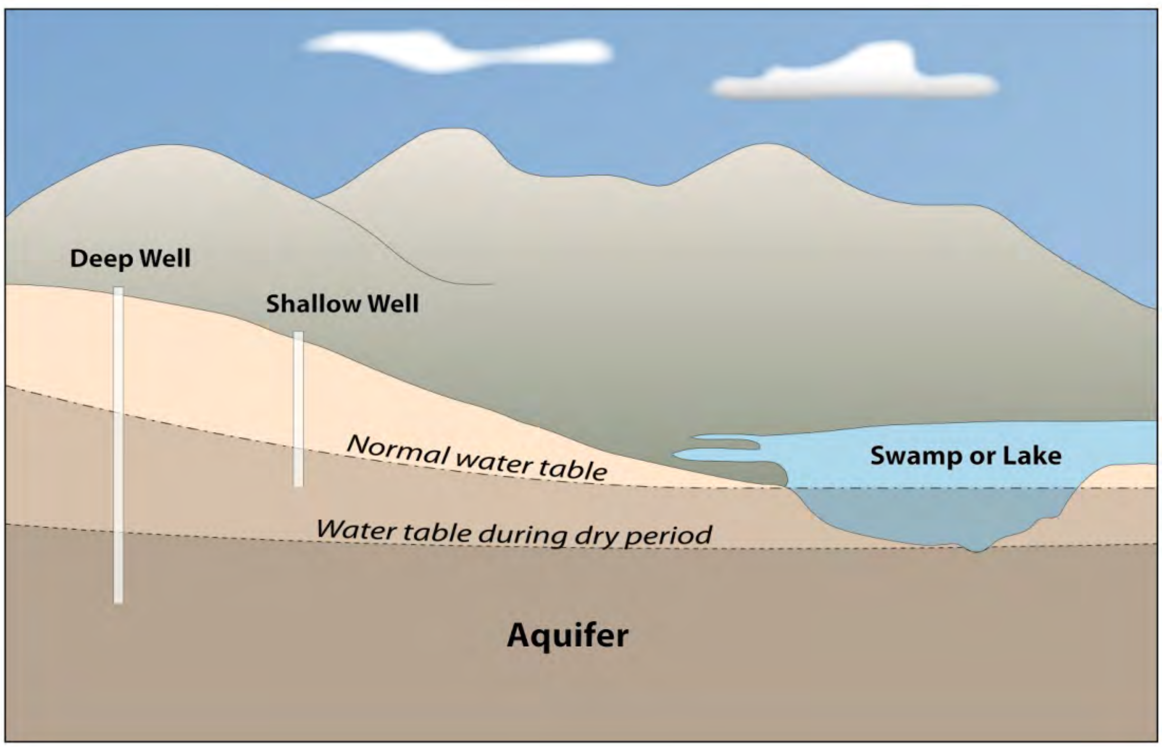


Figure 1. Relationship of water in wells, an aquifer, and a lake (Figure by J. Berke: Fla. Dept., of Environ. Protection)

Florida expends a great deal of money and time monitoring its groundwater resources. Unfortunately, the public tends to forget the critical importance of groundwater to their well-being, unless the state is experiencing periods of droughts of floods. Publicly voiced expressions of concern are often limited to periods of low rainfall and subsequent declines in lake levels. Persons living on these ephemeral lakes become concerned when the lake levels recede from their docks. Clearly, improved public education with regard to our groundwater resources is needed.

Miller (1990) pointed out that, prior to 1990, groundwater levels in portions of Florida have declined for decades. Copeland (2011) noted that since 1990 there have been continued declines throughout the state. Figure 2 displays groundwater level measurement of a "typical" well in Florida since 1990. This short period indicate a general decline in groundwater levels, interrupted by two peaks which probably correspond to El Nino episodes in the El Nino-Southern Oscillation (Verdi, et al., 2006). The blue trend line in Figure 2 may or may not be an artifact of the short time line of the diagram.

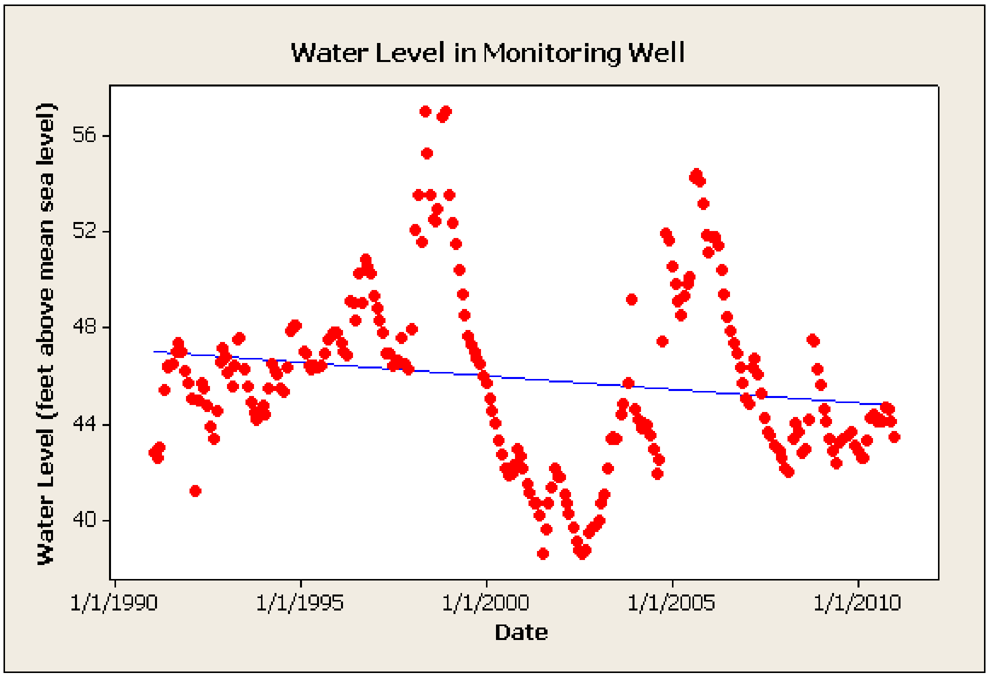


Figure 2. Water level in a typical well over the past 20+ years (Florida LAKEWATCH, 2012).

Copeland (2011) also observed that groundwater quality has slowly become more saline. These changes can be seen in the long term as potential threats to continued quality of life for Floridians. Figure 3 shows an increase in specific conductance (SC) of the time span of the data from the same "typical" monitoring well. Note that SC taken as a proxy of salinity, and is easily measured in the field with portable equipment

Florida has three fresh water aquifer systems; in ascending order, the Floridan aquifer system (FAS), the intermediate aquifer system (IAS), and the surficial aquifer system (SAS) (Southeastern Geological Society, 1986). The FAS is a vast reservoir of fresh water. It underlies all of Florida and portions of four additional southeastern states. In terms of water use, the Upper Floridan aquifer is the major aquifer of both the FAS and the state of Florida. Aquifers of the IAS are only locally important. However, two major aquifers lie within the SAS. In the extreme western and southeastern portions of the state, the majority of groundwater originates from the Sand and Gravel and the Biscayne aquifers respectively. It should be noted that most lakes and springs in Florida are fed by groundwater from the SAS, and the FAS where is at, or close to, land surface.

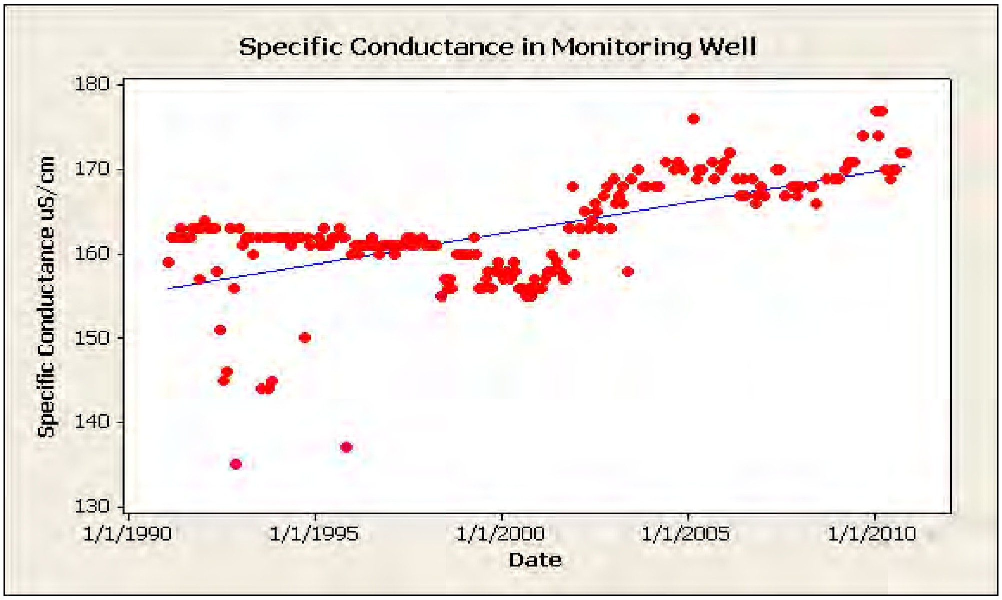


Figure 3. Specific conductance data 1990 to 2010 (Florida LAKEWATCH, 2012)

Most metropolitan areas, with relatively high population densities, place heavy burdens on Florida's groundwater resources. The FAS is especially important. The system is a result of the unusual geologic history of the Florida peninsula, which consists of a basement complex of hared igneous and metamorphic rocks of pre-Mesozoic age overlain by approximately one kilometer of porous and permeable Mesozoic and Cenozoic limestones and dolostones (Scott, 2001). Had the geological history of Florida been different, were the bedrocks of the peninsula of a different and less permeable nature, it is not likely that the fresh water supply of the state would be sufficient to support the present population.

AquiferWatch and LAKEWATCH

The declines in groundwater levels and increases in salinity, measured as SC, and depicted in Figures 2 and 3 were instrumental in establishing the AquiferWatch program. We work closely with Florida LAKEWATCH program which is run out of the University of Florida's Institute of Agricultural Sciences (IFAS). LAKEWATCH has operated a volunteer program to monitor the water quality and depths of lakes, springs, and coastal water in Florida for many years. The program has met with notable success by engaging volunteers to gather data and report them to a centrally managed database, making them useful to both professionals in the field, and the interested citizens. The key elements of the program are the voluntary gathering of critically important data, and the involvement and education of the public. For a given time frame, many citizen scientists can obtain the same amount of data as a few professional scientists. This truism about citizen scientist participation has been well established in the LAKEWATCH program.

The citizen scientists of LAKEWATCH have demonstrated that volunteers can collect technically valid and reliable data over the long term for only a fraction of the cost of professional monitoring. Because of the success of this program with lakes, springs, and coastal water, we have established AquiferWatch cooperatively with Florida LAKEWATCH to develop a similar program, with similar standards of scientific accuracy, for monitoring groundwater in wells throughout Florida.

AquiferWatch is an independent non-profit corporation, established as a 501 (c) (3) public charity under the Internal Revenue Service regulations, devoted to publication and the gathering of data. Our objectives include involving citizens in the data collection process in order to further their education about groundwater. We do this, in part, by soliciting individuals to open their wells for measurement. We train them in the use of measuring instrumentation and supply instruments to volunteers for monitoring. AquiferWatch volunteers currently monitor groundwater levels. Inexpensive, hand-held field SC meters have been shown to produce reliable measurements. For this reason, as funds become available, we plan to expand the program in this important areas as funding permits the acquisition of these meters.

Wells to Be Monitored: Most wells in the AquiferWatch program are domestic water wells, owned by the volunteers themselves, or monitoring wells owned by the various monitoring agencies. However, all types of wells can potentially be included. Well locations are surveyed by latitude and longitude using commercial-grade, hand-held, Global Positioning System (GPS) receiver units. Elevations are determined by overlaying the GPS latitude/longitudes onto the corresponding U.S. Geological Survey topographic maps. Elevations are relative to the national geodetic vertical datum, informally referred to as mean sea level. Each well head is provided with a fiduciary mark so that all measurements are made from a recoverable reference point.

Monitoring wells are preferred, because they are open casings with few or no constrictions. Domestic production wells present more difficulties because they contain additional pipes and electrical conduits within the casing. These additional elements offer potential constrictions which can trap the probe during extraction following water level measurement. Special emphasis is placed on domestic wells of private landowners, because the involvement of these landowners is a key element of our purpose and practice of public education.

Data Collection: Wells are measured on a monthly basis. Data collected by the method described herein are delivered to an IFAS county extension office for compilation into the Florida LAKEWATCH general database. Groundwater levels are obtained using water level meters. The program uses both commercial-grade, and meters built by AquiferWatch staff. Figure 4 displays a commercial-grade meter (left) and one made by AquiferWatch staff (right) next to a monitoring well. The commercial-grade meter has a 200-foot laser-graduated cable, measured every hundredth of a foot, and fitted with a stainless steel water-sensing probe. The cable for the meter produced by AquiferWatch is marked every foot. The ruler is then used to obtain a groundwater level to within one-quarter of an inch and then mathematically converted to the nearest hundredth of a foot. The commercial meter is more durable and precise, but it can cost up to seven times that of the AquiferWatch meter.

Figure 4. Water level meters and monitoring well.

To obtain a groundwater-level measurement, the meter probe, located at the end of the cable, is rinsed with clean water. The probe and cable line are then lowered into the well. The cable is hand-fed into the well. The volunteer takes care to control the speed, because as greater depths are reached, the weight of the cable tends to pull addition cable off the reel with increasing velocity. When the probe reaches water, the electrical circuit is completed, the meter flashes a light and emits and audible signal. The volunteer then adjusts the cable up and down to determine the precise level of the water below a standard reference measuring point, the fiduciary mark at the top of the well casing. He or she records the level on a standardized data form to the hundredth of a foot. The cable is then withdrawn a few feet, and again lowered once more to repeat he measurement. Standards require that both measurements are within 0.01 foot, or the process must be repeated.

At the current time water quality is not obtained. However, in the future, as funding becomes available, AquiferWatch will obtain hand-held commercial grade SC meters. Once meters have been obtained and volunteers are trained, AquiferWatch will commence monitoring SC. Volunteers will suitably purge the well for a minimum of 15 minutes. The LAKEWATCH chemistry laboratory will supply volunteers with two reference solutions; one at a concentration of less than the expected SC of the groundwater within the well, and one above it. After calibrating the SC meter by bracketing the expected SC in the well water with the two reference solutions, the volunteer will obtain a water sample into a special cup. The volunteer will place the probe into the water sample and read the SC measurement, in µS/cm, directly from the meter. A second sample is then obtained by the volunteer for a repeat the measurement. Standards require that both measurements are within 0.5%, or the process must be repeated.

Education

The three primary objectives of AquiferWatch are to:

1. Educate the public about groundwater,
2. Facilitate "hands-on" education through groundwater monitoring, and
3. Produce long-term groundwater monitoring data

Since education is our highest priority, a major effort is to periodically produce newsletter articles, brochures, and pamphlets regarding a variety of groundwater issues that pertain to the citizens of Florida. We produce these short publications at a minimum of twice per year. In addition, a time-honored technique of pedagogy is engagement. It is much easier to teach a student at any level if the teacher first engages the personal interest of the student. So it is with AquiferWatch. We seek to engage the citizen by seeking active volunteering, which includes a commitment of time and effort. We avoid making the process overly simple for fear of making it seem trivial and unimportant. But, at the same time, we expend effort in training the volunteer citizen scientist so that he or she have a demonstrable level of technical expertise, and can produce accurate, repeatable measurements.

Our approach to training is a traditional one-on-one system, in which an experienced person travels with the volunteer to each well that he or she may monitor. The experienced person demonstrates the techniques of handling the meter, the proper quality assurance techniques, obtaining a measurement, and recording the data. The volunteers are then asked to carry out the measurements under the supervision of the experienced person. After a session or two, the volunteers are authorized to carry out the procedures without further immediate supervision.

Repeated contacts by the trainer at later dates help maintain quality control. The Board of Directors maintains a quality control program an on-going basis to ensure that technical standards are maintained.

Future Plans and Needs

Aquifer watch is still in its start-up phase as of this writing. Our numbers are few and our resources are limited. Most of our equipment has been self-funded by the Board of Directors. We need additional volunteers, not only those interested in performing monitoring activities, but also those show are skilled and experienced in the identification of and application for grants, that could be used to assist in funding AquiferWatch. With an expanded volunteer citizen scientist group, and with additional funding, we expect to be able to cover the entire state of Florida with frequent and monitoring of the aquifer systems of Florida. If you are interested in participating in AquiferWatch, let any of the authors know. The contact information is:

George Edwards
Gedwards@atlantic.net
352.514.243

Rick Copeland
Rick@aquiferatch.org
850.559.7190

Gary Maddox
Gary.Maddox@dep.state.fl.us
850.245.8511

References Cited

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SPEAKER BIO

JANE GRIFFIN

Jane Griffin serves as president of The Groundwater Foundation, a national nonprofit organization whose mission is to educate people and inspire action to ensure sustainable, clean groundwater for future generations. The Groundwater Foundation is based in Lincoln, Nebraska and is a well-respected voice for groundwater education and citizen involvement. Griffin's background includes a B.A. from Smith College in Northampton, MA and a diploma from the Universita' Internazionale dell'Arte in Florence, Italy. Griffin's professional experiences reflect her awareness of the need to educate people to create knowledge of the world around us. She has accomplished this goal through her work with the Make-A-Wish Foundation of Nebraska, the Nebraska Art Association Board, and by co-founding an Italian language school for both adults and children.

Growing Groundwater Awareness in Your Community

Jane Griffin

The Groundwater Foundation

What is in the headlines

Conserve Water or Perish, Warns U.N. Chief
Thursday, October 10, 2013
UNITED NATIONS, Oct 10 (IPS) - Just 17 years from now, nearly half the global population could be facing water scarcity, with demand outstripping supply by 40 percent.

In Trinidad, Sports Complex Targets a Key Watershed

Monday, October 07, 2013

PORT OF SPAIN, Oct 07 (IPS) - Trinidad's Orange Grove Savannah sits at the foothills of the Northern Range, whose watersheds provide copious volumes of fresh water into the aquifers - natural underground water storage areas - lying below these green spaces.

Fracking Water: It's Just So Hard to Clean

Bill Chameides of Duke University on October 4, 2013

As the term implies, "hydraulic fracturing" involves water -- and, as it turns out, lots of it. A new study reveals yet another crack in the technique called fracking that needs fixing: radioactive radium, chloride and bromide found near a water treatment facility in Pennsylvania.

- **“In the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught.” Baba Dioum**

We rely on groundwater

It relies on us to protect and conserve it

Tools for Groundwater Protection

GGAN (Growing Groundwater Awareness in Nebraska) Project

- Generate **interest**
- Deeper **understanding**
- **Engage** communities

How it works:

- Determine **needs** of the community
- Develop a **campaign** designed around those needs

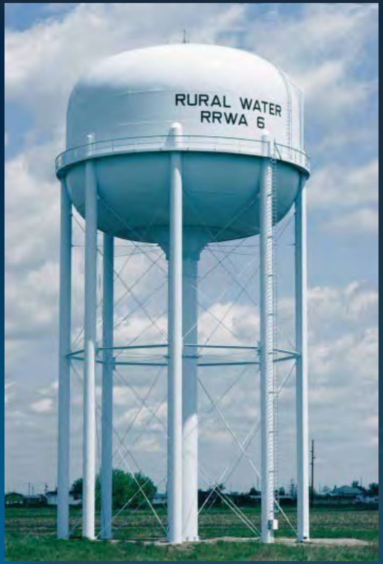
Ultimate Goal

- **Long-term** protection efforts in the community
  - Groundwater Guardian Program
  - Green Sites Program
  - Wellhead Protection Plans

Success Stories

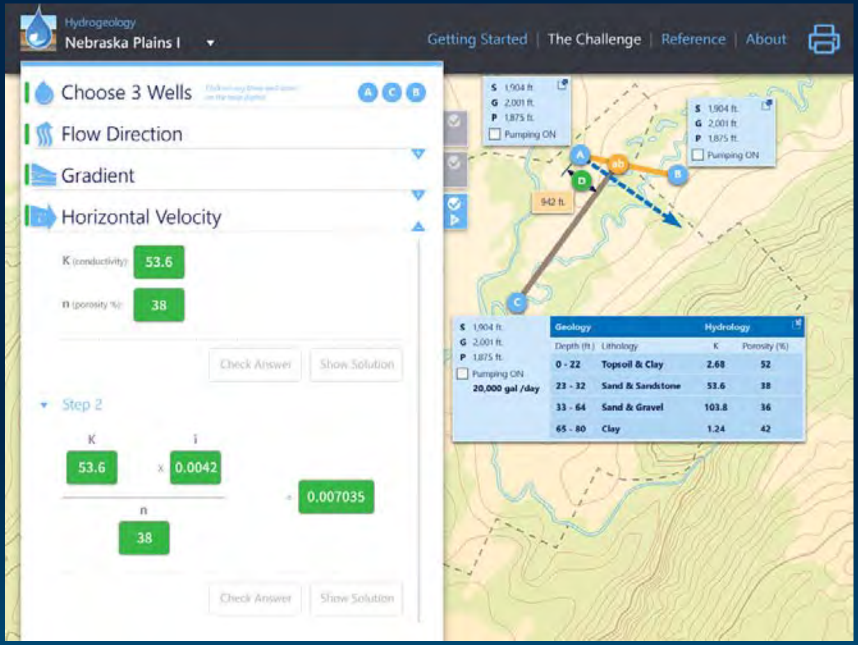
- 32 new Groundwater Guardian Green Sites
- Test your Well event
- Rain gauge program
- Inspired Students
- Wellhead Protection Plans
- Groundwater Guardians

Thinking About the Bigger Picture



- Be **proactive**!
- Make drinking water protection a **priority**

Fostering a Generation of Environmentally Informed Citizens



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Questions?

The Groundwater Foundation

5561 S. 48th St. Suite 215

Lincoln, NE 68516

Phone: 402-434-2740

Jane Griffin

jgriffin@groundwater.org

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SPEAKER BIO

ROBERT SWANSON

Bob Swanson is the Director of the U.S. Geological Survey (USGS) Nebraska Water Science Center (NEWSC). The NEWSC has about 45 dedicated water science professionals located in Lincoln and North Platte and a budget of about $5.5 million. He joined the United States Geological Survey as a hydrologic technician working for the Lincoln Subdistrict Office in 1978. Bob gained a wide range of experience in the Data Section as a hydrologic technician and hydrologist in the Cambridge, Ord, and North Platte Field Offices. He served as field hydrologist for the National Water Quality Assessment Program's Central Nebraska River (CNBR) Basins Study Unit research team and later as CNBR Study Unit Chief. Bob moved on to the USGS Wyoming Water Science Center as the Chief of Hydrologic Surveillance in 1999 and returned to Nebraska as Director in 2004. He is responsible for developing and overseeing USGS hydrologic investigations and data collection for ground-water, surface-water and water-quality programs in Nebraska. Bob is a native Nebraskan and graduated from Doane College with a major in biology and minors in geology and environmental studies. He has had the privilege to both train and study with some of the finest water scientists in the world for the past 30 years.

Custom Networks from USGS Groundwater Watch Provide Information for Multiple Missions

2013 Groundwater Foundation National Conference

Ocotber 15, 2013

Robert B. Swanson
Director, USGS Nebraska Water Science Center

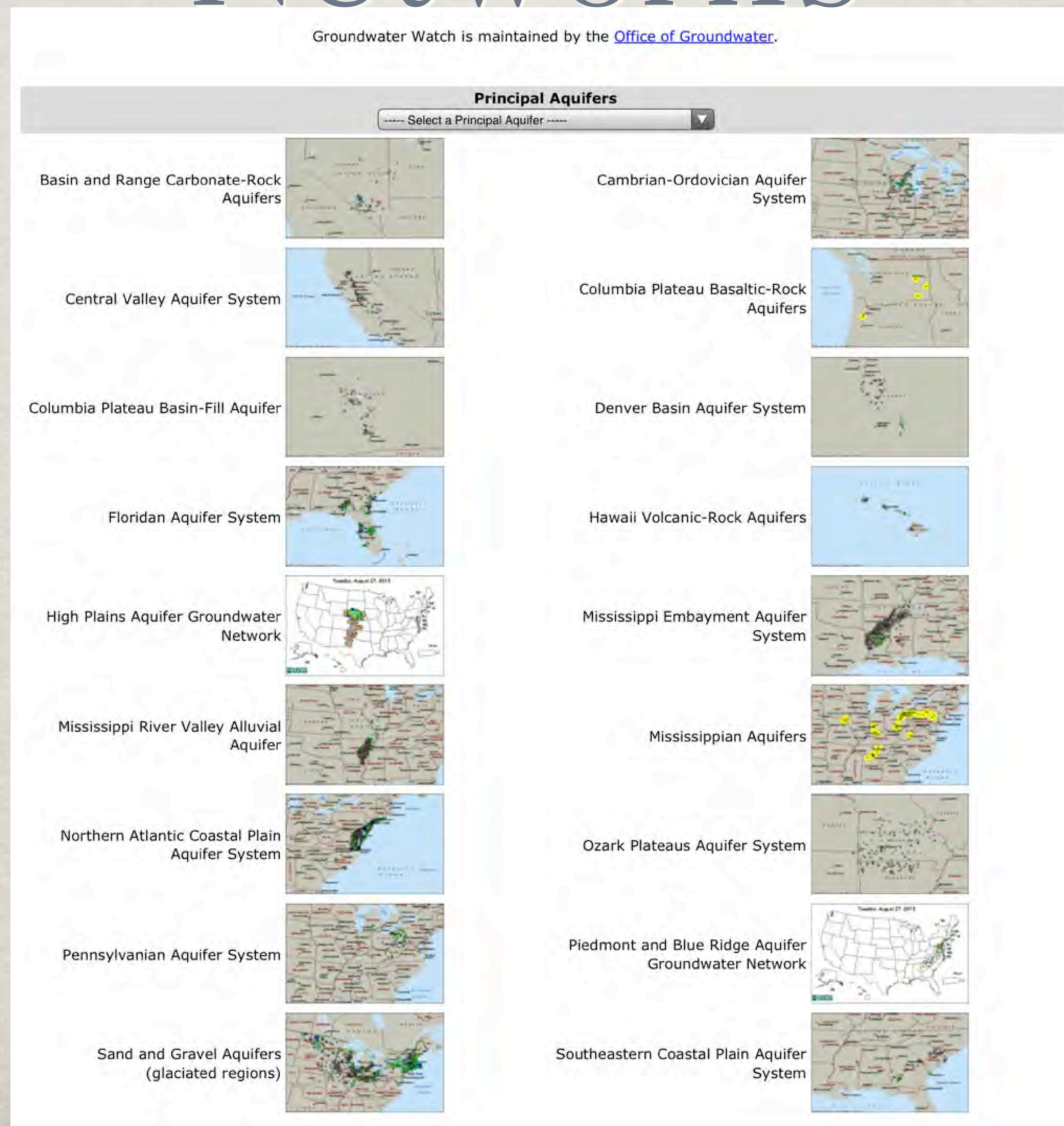
U.S. Department of the Interior
U.S. Geological Survey

U.S. GEOLOGICAL SURVEY GROUNDWATER WATCH NETWORKS

- >20,000 wells across the U.S.
  - Measured within the last 12 months
  - Statistics for those with >10 years record
  - Same wells, many networks

USGS
science for a changing world

Principle Aquifer Networks



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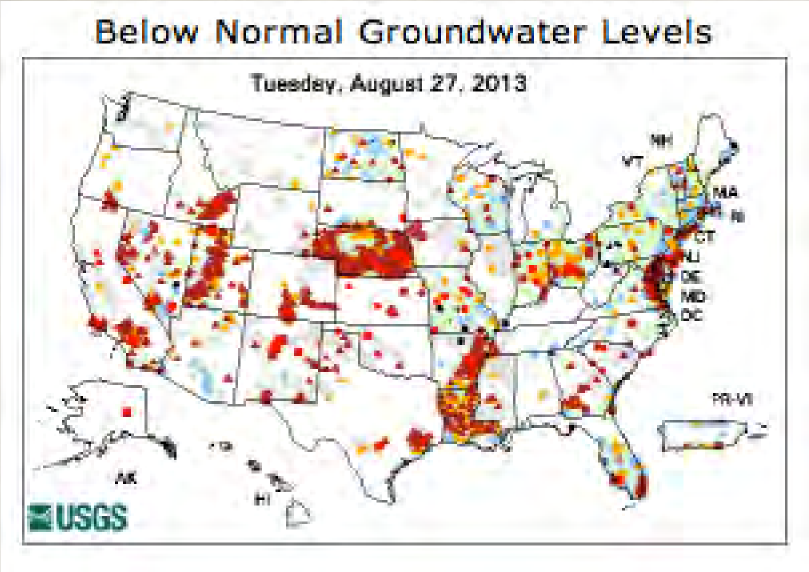
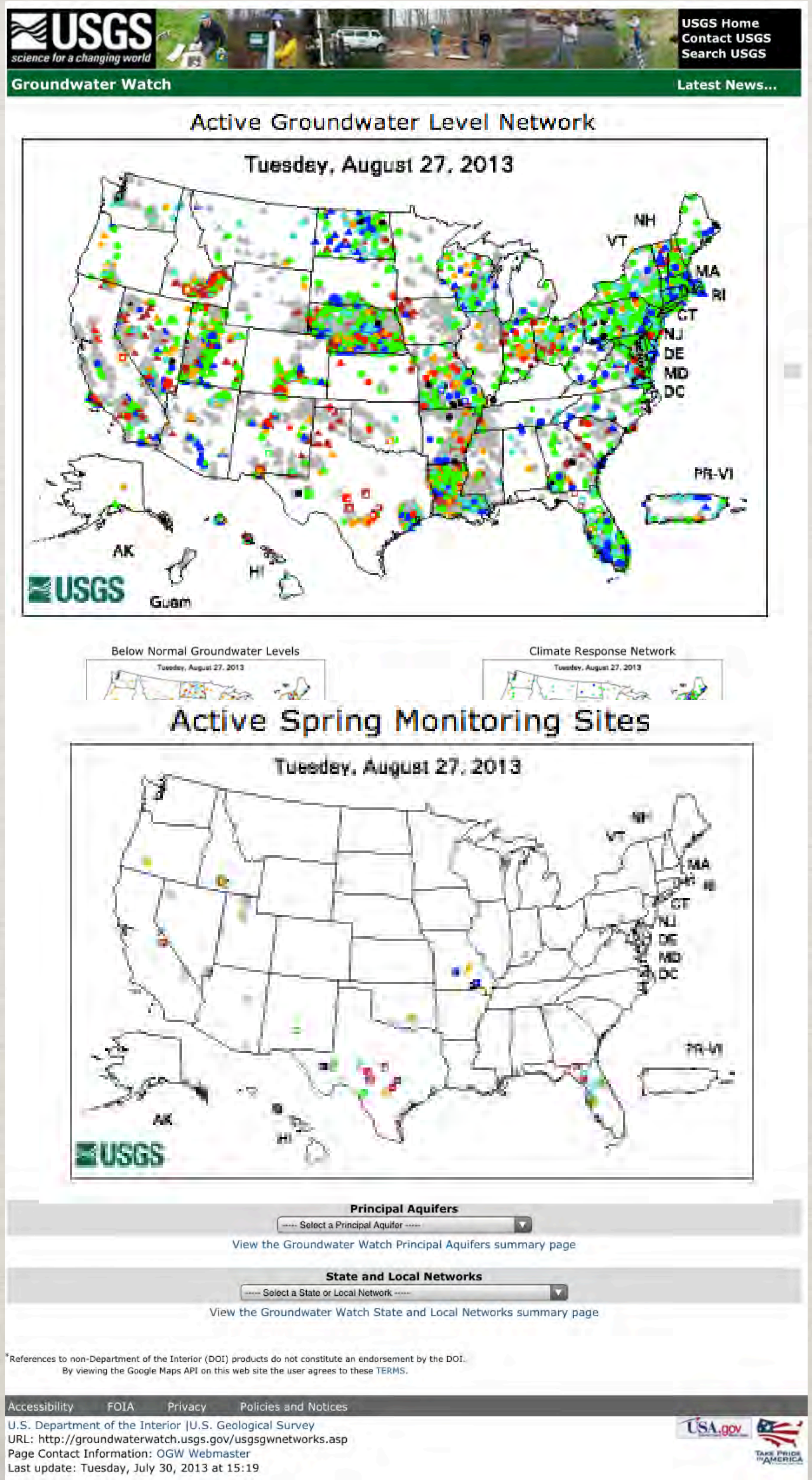
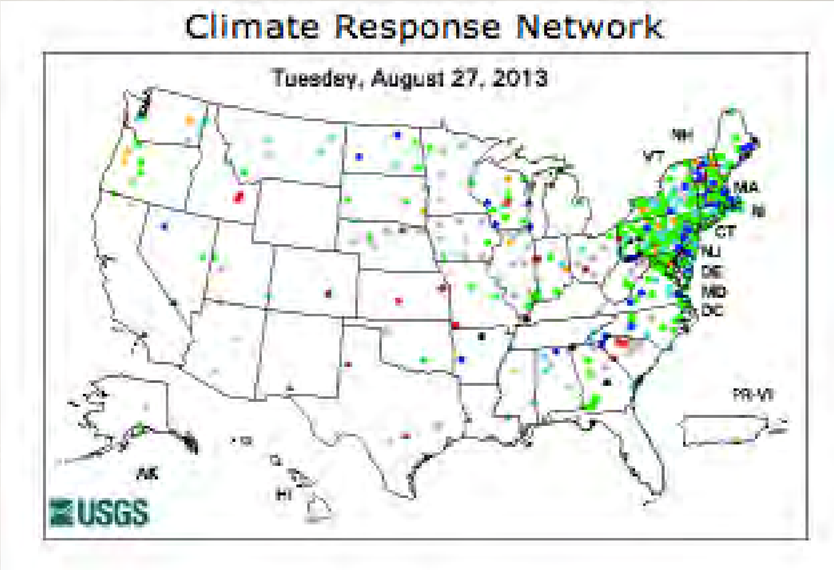
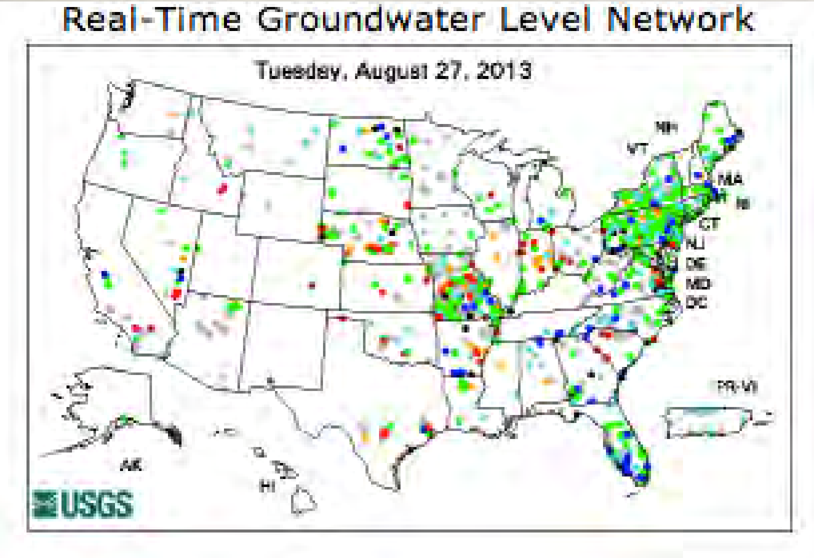
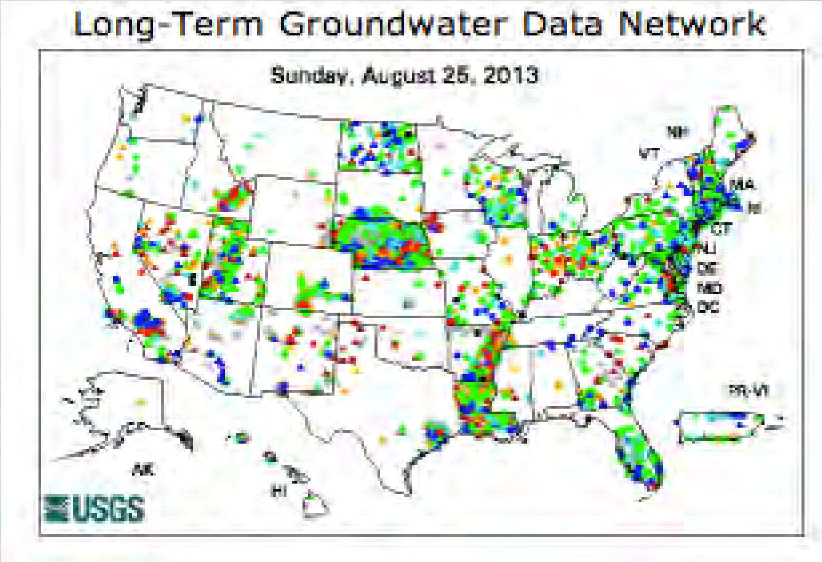
http://groundwaterwatch.usgs.gov



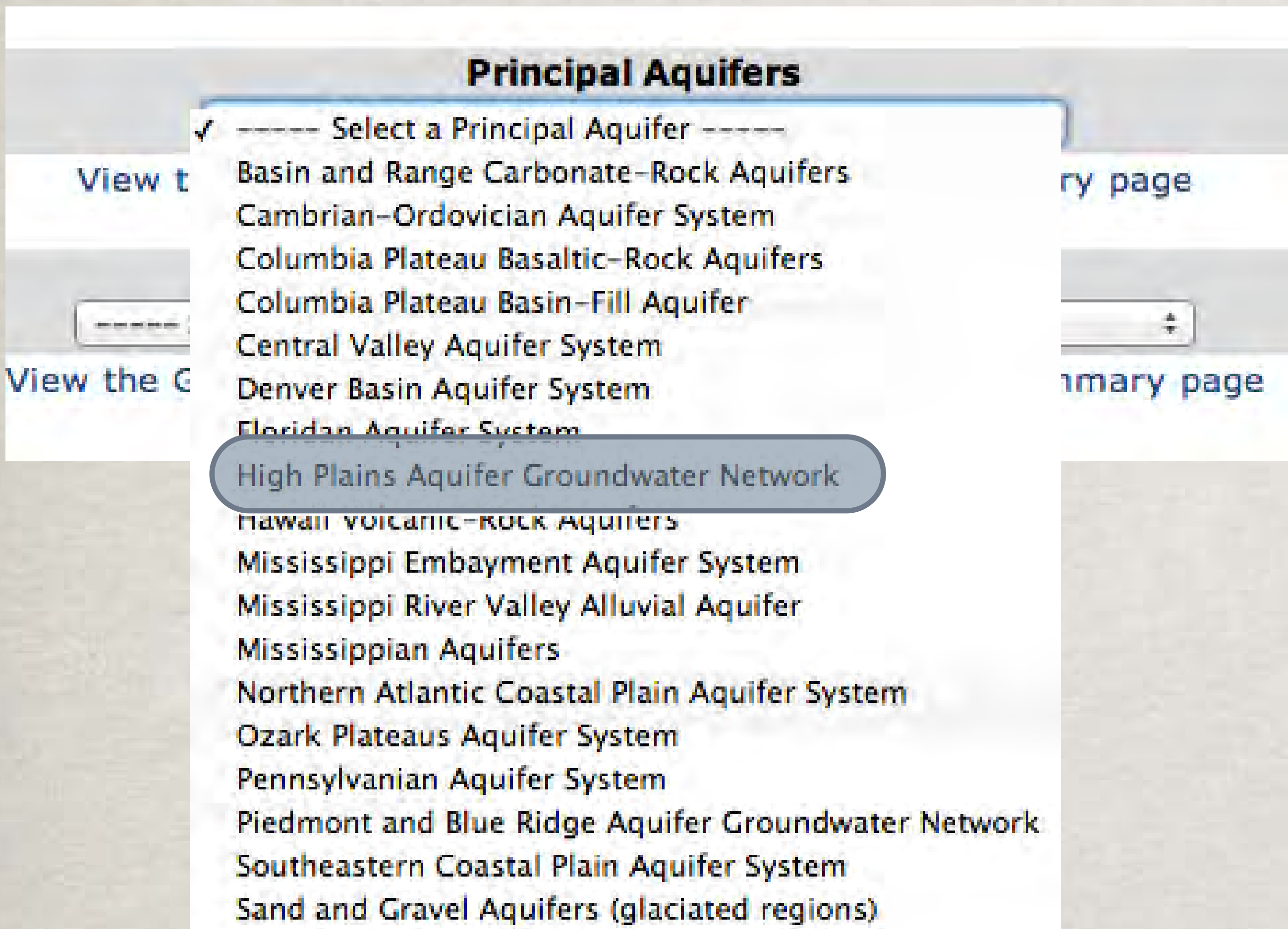


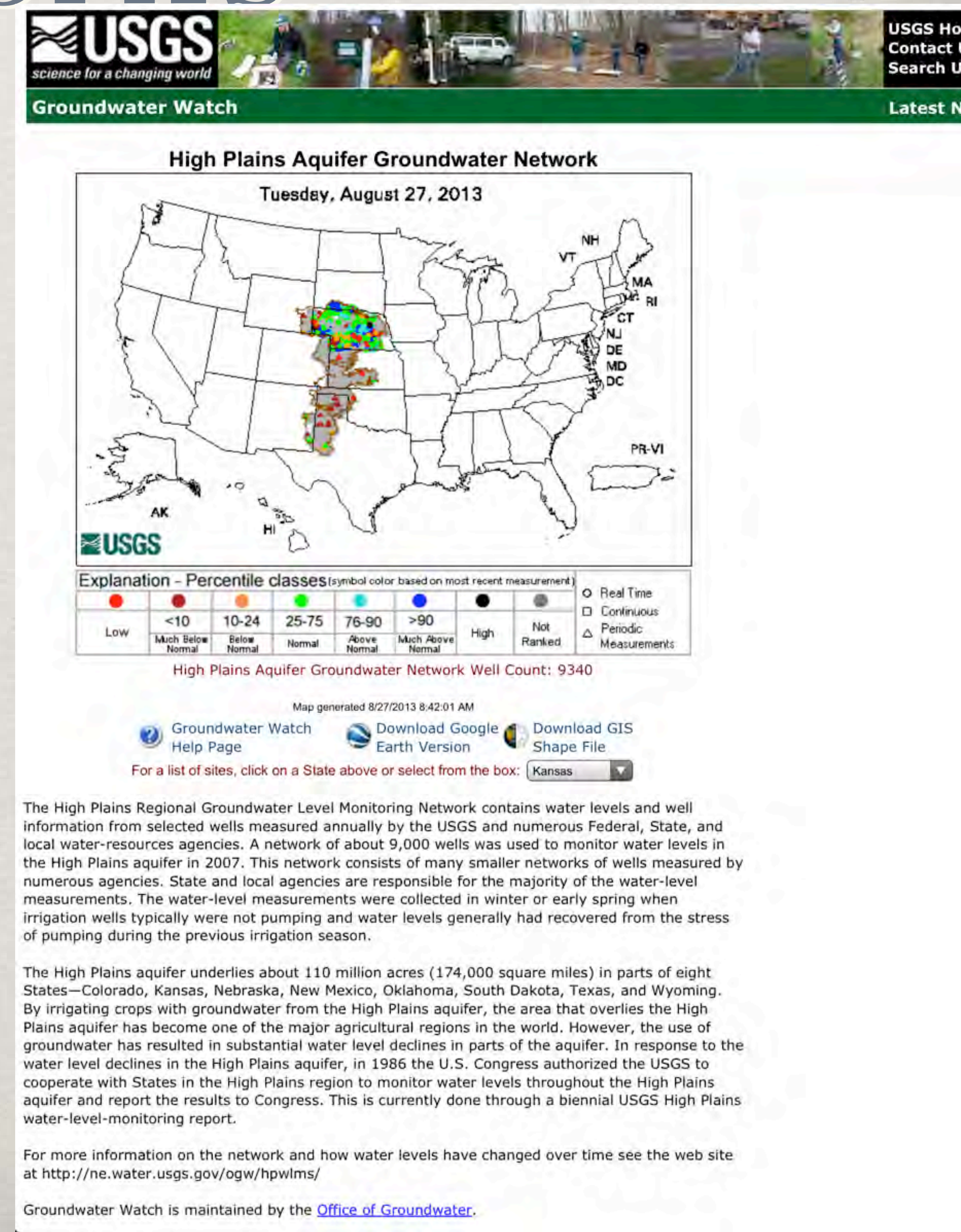




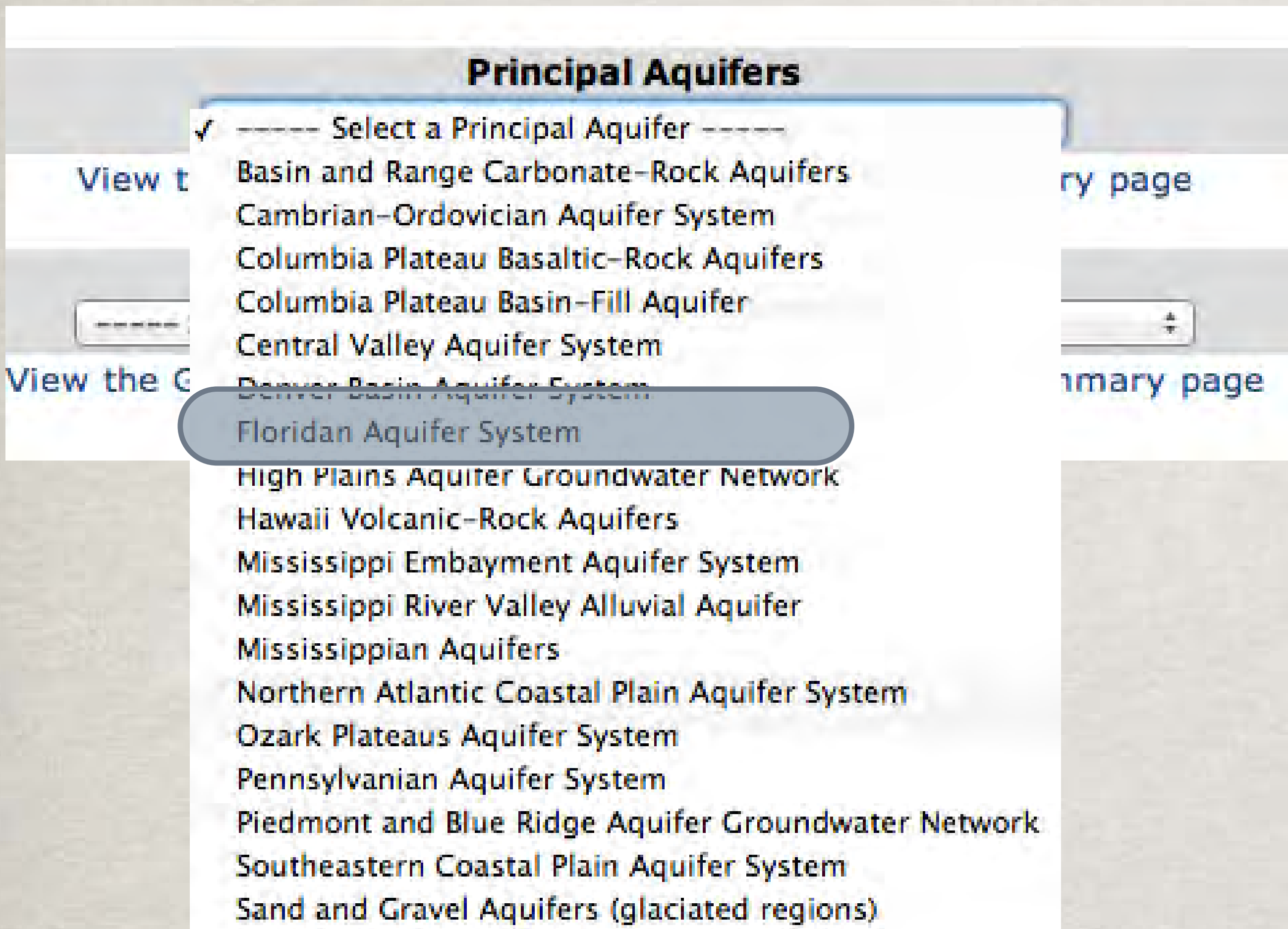


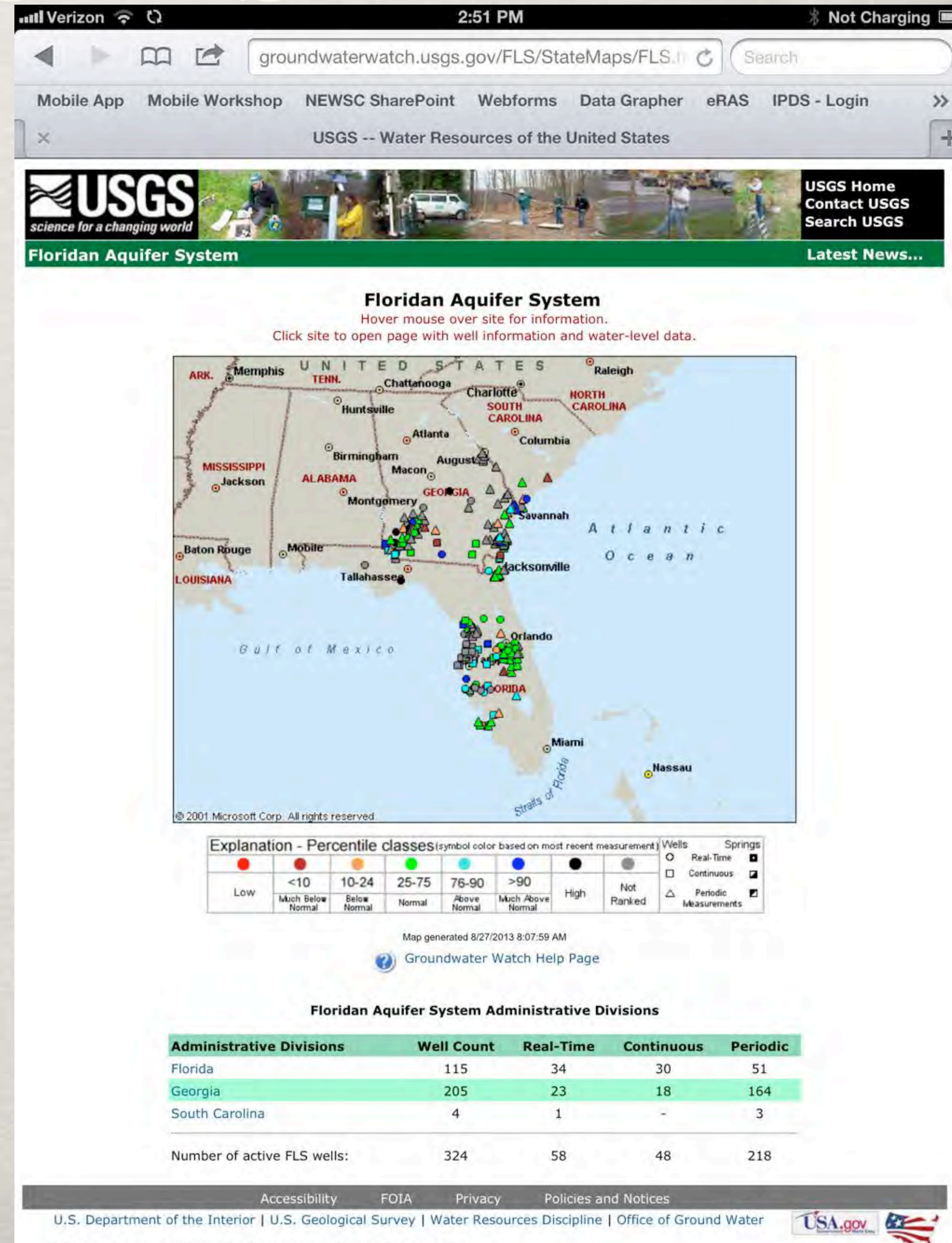
Principle Aquifer Networks





Principle Aquifer Networks





Administrative Divisions	Well Count	Real-Time	Continuous	Periodic
Florida	115	34	30	51
Georgia	205	23	18	164
South Carolina	4	1	-	3
Number of active FLS wells:	324	58	48	218

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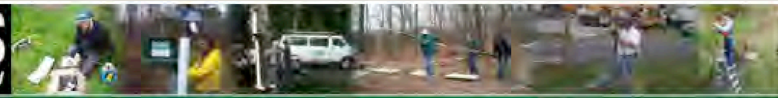
Well data page

Lake Sawyer well near Windermere



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Groundwater Watch Latest News ...

Site Number: - LAKE SAWYER WELL NEAR WINDERMERE, FL

Groundwater Watch Help Page

DESCRIPTION:
Latitude 28°27'38", Longitude 81°34'14" NAD27
Orange County, Florida, Hydrologic Unit 03090101
Well depth: 178 feet
Hole depth: 178 feet
Land surface altitude: 119.64feet above NGVD29.
Well completed in "Floridan aquifer system" (S400FLORDN) national aquifer.
Well completed in "Floridan Aquifer System" (120FLRD) local aquifer

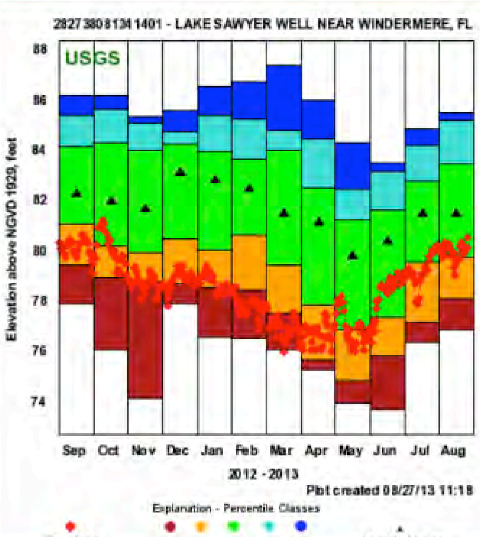
AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Current / Historical Observations	2007-10-01	2013-08-24	
Daily Data			
Elevation above NGVD 1929, feet	1980-10-03	2013-08-23	10824
Field groundwater-level measurements			
Field/Lab water-quality samples			

Additional Data Sources	Begin Date	End Date	Count
Annual Water-Data Report (pdf) **offsite**	2006	2012	7
Groundwater Watch **offsite**	1979	2013	11082

OPERATION:
Record for this site is maintained by the USGS Florida Water Science Center - Orlando
Email questions about this site to Florida Water-Data Inquiries

Site Statistics



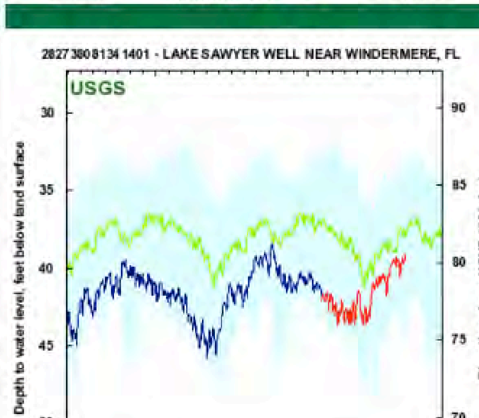
Most recent data value: 80.51 on 8/26/2013
Period of Record Monthly Statistics for 282738081341401
Elevation above NGVD 1929, feet
All Approved Continuous & Periodic Data Used In Analysis
Note: Highlighted values in the table indicate closest statistic to the most recent data value.

Month	Lowest Median	10th %ile	25th %ile	50th %ile	75th %ile	90th %ile	Highest Median	Number of Years
Jan	76.54	78.55	80.02	82.83	83.96	85.37	86.54	30
Feb	76.53	78.44	80.61	82.48	83.66	85.24	86.72	32
Mar	76.08	77.49	79.42	81.48	83.98	84.81	87.36	31
Apr	75.26	75.66	77.87	81.10	82.49	84.46	85.97	31
May	73.91	74.81	76.88	79.79	81.21	82.44	84.30	33
Jun	73.69	75.81	77.33	80.37	81.64	83.15	83.51	32
Jul	76.36	77.17	79.54	81.47	82.74	84.19	84.83	32
Aug	76.85	78.10	79.73	81.47	83.44	85.17	85.50	33
Sep	77.89	79.41	81.05	82.26	84.13	85.37	86.18	33
Oct	76.07	78.93	80.20	81.95	84.27	85.64	86.17	33
Nov	74.11	78.78	79.93	81.68	84.00	85.10	85.35	32
Dec	77.88	78.69	80.48	83.08	84.24	84.75	85.60	30

Statistics Options

View month/year statistics

Daily Groundwater Data



Most recent Provisional daily data value: 80.51 on 08/26/13

Summary for Period of Continuous Record
Elevation above NGVD 1929, feet
Approved Daily Maximum Values Data Used in Analysis

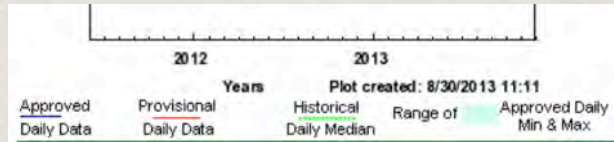
Begin Date	End Date	Days	% Complete
10/03/80	02/05/13	10,625	89

Lowest Level	5th %ile	10th %ile	25th %ile	50th %ile	75th %ile	90th %ile	95th %ile	Highest Level
70.36	76.20	77.54	79.36	81.51	83.50	84.73	85.46	87.98

Daily Data Options

View latest data on NWISWeb

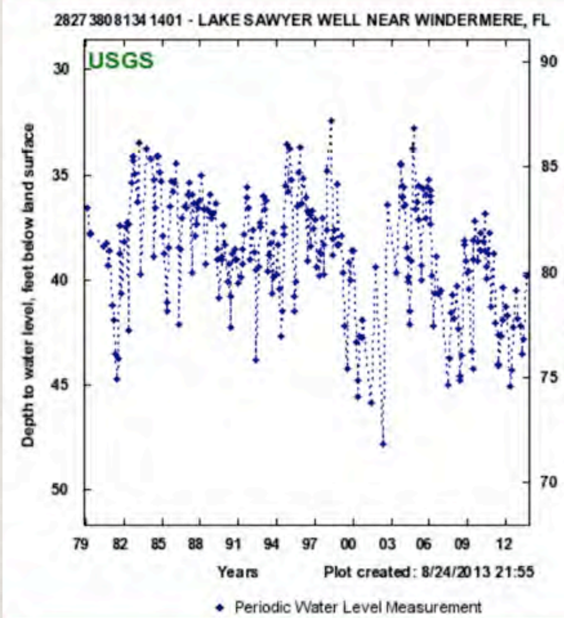
View data in calendar format



Download data in text format

View daily medians

Periodic Groundwater Data



Summary for Period of Record Periodic Water Levels
Elevation above NGVD 1929, feet
Approved Periodic Water Level Values

Begin Date	End Date	Number of Values
02/22/79	08/05/13	267

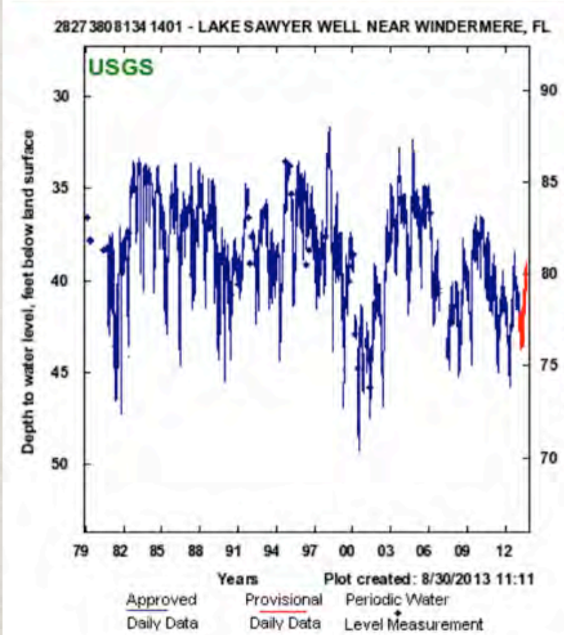
Lowest WL	Date of Lowest WL	Highest WL	Date of Highest WL
71.82	05/14/02	87.22	03/26/98

Groundwater Levels Options

View latest data on NWISWeb

Download Groundwater levels in text format

Period of Record - All Data Types



Summary for Period of Record - All Data Types
Elevation above NGVD 1929, feet

Begin Date	End Date	Number of Values
02/22/79	08/29/13	11,828

Lowest WL	Date of Lowest WL	Highest WL	Date of Highest WL
70.36	06/22/00	87.98	03/20/98

Period of Record Options

View latest data on NWISWeb for all data types

View annual monthly statistics for all data types

Download Groundwater levels in text format of all data types

Custom Groundwater Networks

- Aquifer networks
- Geographic area networks
  - State
  - County
  - Municipality
  - Water management districts
- Temporal needs networks
  - Discrete records
  - Continuous records
  - Real-time records

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Custom Groundwater Networks

Principal Aquifers

----- Select a Principal Aquifer -----

View the Groundwater Watch Principal Aquifers summary page

State and Local Networks

- ✓ ----- Select a State or Local Network -----
- Arkansas Hot Springs National Park Network
- Arkansas Natural Resources Commission Groundwater Network
- Arkansas northern Lonoke County Groundwater Network
- Arkansas Sparta Recovery Groundwater Network
- Catawba-Wateree Groundwater Network
- Georgia Albany Dougherty County Groundwater Level Network
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- New Hampshire and Vermont Groundwater Level Network
- New Jersey Groundwater Level Network
- Philadelphia Area Groundwater Level Network
- Southern California Basin Network
- St. Joseph County, Indiana Groundwater Network

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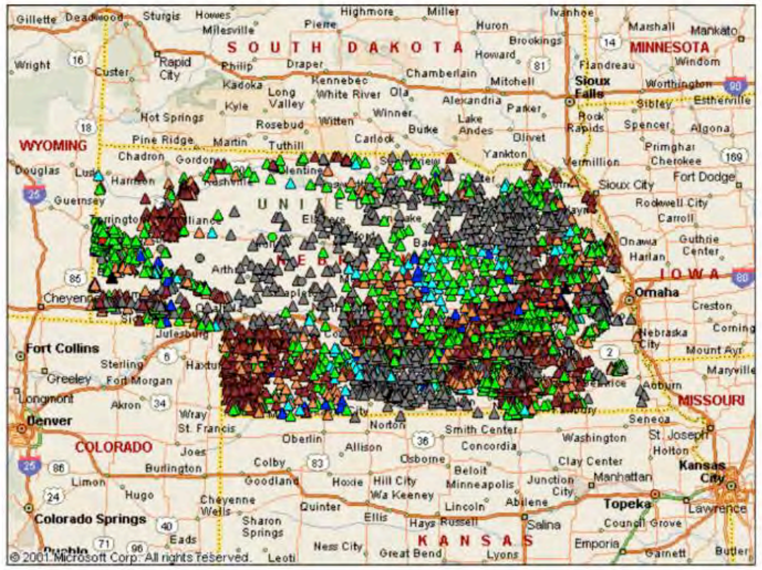
Nebraska's Natural Resource Districts — Latest News...

Nebraska's Natural Resource Districts

Hover mouse over site for information.
Click site to open page with well information and water-level data.



Explanation - Percentile classes (symbol color based on most recent measurement)

Low	<10 Much Below Normal	10-24 Below Normal	25-75 Normal	76-90 Above Normal	>90 Much Above Normal	High	Not Ranked

Wells / Springs: Real-Time, Continuous, Periodic Measurements

Map generated 8/27/2013 8:19:36 AM

Groundwater Watch Help Page

Nebraska's Natural Resource Districts Wells

Wells	Well Count	Real-Time	Continuous	Periodic
Central Platte NRD	394	20	3	371
Lewis & Clark NRD	30	-	-	30
Little Blue NRD	227	-	-	227
Lower Big Blue NRD	56	-	-	56
Lower Elkhorn NRD	230	1	-	229
Lower Loup NRD	188	-	-	188
Lower Niobrara NRD	47	1	-	46
Lower Platte North NRD	111	1	-	110
Lower Platte South NRD	58	-	-	58
Lower Republican NRD	93	-	-	93
Middle Niobrara NRD	56	1	-	55
Middle Republican NRD	106	-	-	106
Nemaha NRD	20	-	-	20
North Platte NRD	408	16	1	391
Papio-Missouri River	34	-	-	34
South Platte NRD	148	-	-	148
Tri-Basin NRD	195	-	-	195
Twin Platte NRD	73	-	-	73
Upper Big Blue NRD	373	-	1	372
Upper Elkhorn NRD	85	-	-	85
Upper Loup NRD	75	2	-	73
Upper Niobrara-White NRD	98	-	-	98
Upper Republican NRD	219	3	6	210
Number of active NNR wells:	3324	45	11	3268

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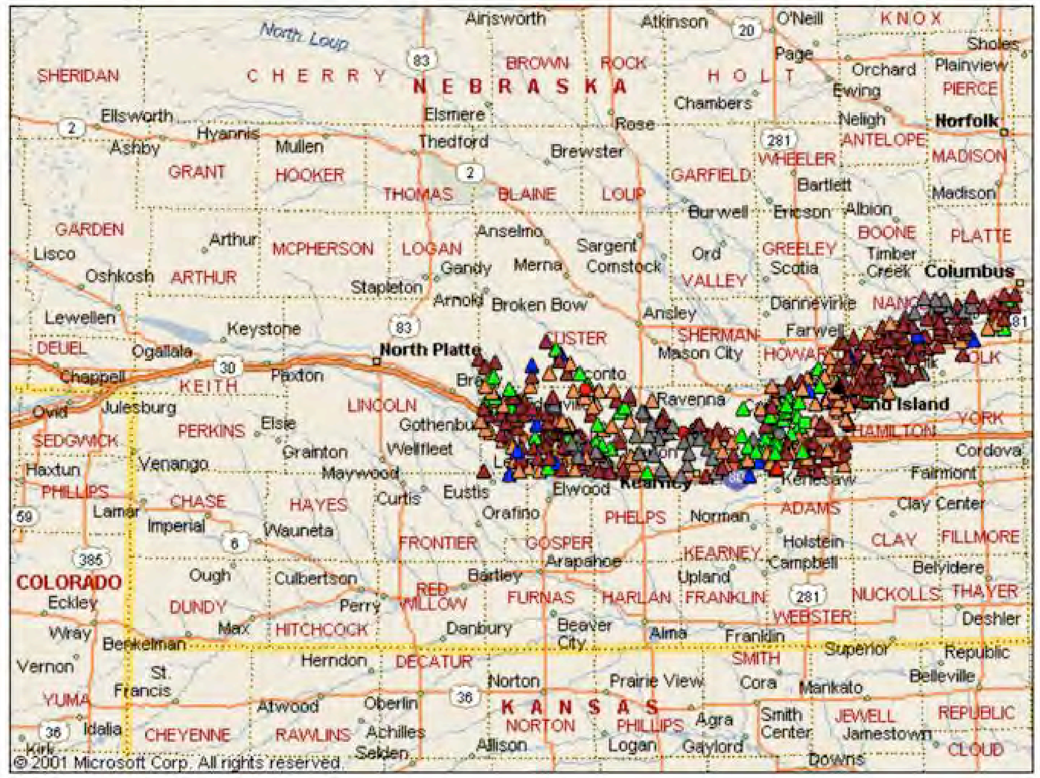
Custom Groundwater Networks

Nebraska's Natural Resource Districts **Latest News...**

Central Platte NRD

Hover mouse over site for information. Click site to open page with well information and data.



Explanation - Percentile classes (symbol color based on most recent measurement)								
Low	<10 Much Below Normal	10-24 Below Normal	25-75 Normal	76-90 Above Normal	>90 Much Above Normal	High	Not Ranked	Wells / Springs: Real-Time; Continuous; Periodic Measurements

Map generated 8/27/2013 8:20:36 AM

Groundwater Watch Help Page

Network wells depicted on the Central Platte NRD location map

Note: Color shading in the table below indicates multiple wells that plot as a single point on the state location map above.

Note: BLS = Water Level in Feet Below Land Surface, RVD = Water Level referenced to a vertical datum

Map Index	Site ID	Site Name	Most Recent Measurement	Date	Well Depth	Local Aquifer
1	404051099023101	8N 15W 8BA 1	**16.44** BLS	5/6/2013	48.0	
2	404057098482501	8N 13W 8AB 1	**4.92** BLS	4/24/2013	60.0	
3	404122099102301	8N 16W 6CAC 1	**8.15** BLS	5/6/2013	285.0	
4	404138099150901	8N 17W 4BC 1	**11.98** BLS	5/8/2013	30.0	
5	404146099205001	8N 18W 3AB 1	**12.84** BLS	5/8/2013	33.0	
6	404150100040401	8N 24W 5BA 1	**220.56** BLS	5/21/2013	380.0	
7	404201098264901	9N 10W33CD 1	**115.78** BLS	4/23/2013	201.0	
8	404205098590901	9N 15W35CDC 1	**17.90** BLS	5/6/2013	66.	
9	404206099321301	9N 19W31CC 1	**9.65** BLS	5/9/2013	32.0	
10	404209098313301	9N 11W35C 1	**78.60** BLS	4/23/2013	155.0	
11	404210099545501	9N 23W35C 1	**111.50** BLS	5/21/2013	280.0	
12	404219099353801	9N 20W34CB 1	**8.35** BLS	5/9/2013	90.0	
13	404219100011801	9N 24W35DB 1	**220.72** BLS	5/21/2013	426.0	

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Groundwater Watch — Latest News...

Site Number: - 9N 12W33AADD2

Groundwater Watch Help Page

DESCRIPTION:
Latitude 40°42'36.71", Longitude 98°39'54.60" NAD83
Hall County, Nebraska, Hydrologic Unit 10200101
Well depth: 12.5 feet
Land surface altitude: 1,994.25feet above NAVD88.
Well completed in "Alluvial aquifers" (N100ALLUVL) national aquifer.
Well completed in "Sand and Gravel Deposits" (112SDGVD) local aquifer

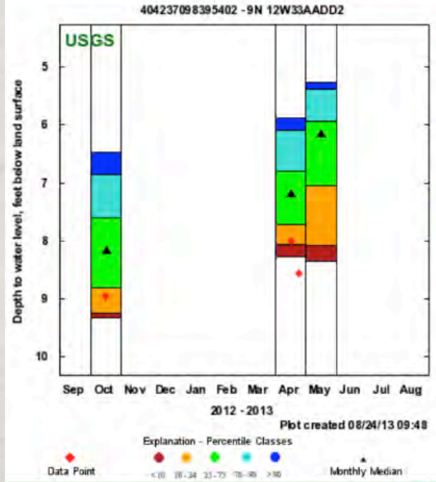
AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Field groundwater-level measurements			

Additional Data Sources	Begin Date	End Date	Count
Groundwater Watch **offsite**	1987	2013	86

OPERATION:
Record for this site is maintained by the USGS Nebraska Water Science Center
Email questions about this site to Nebraska Water Science Center Water-Data Inquiries

Site Statistics



Most recent data value: 8.56 on 4/23/2013
Period of Record Monthly Statistics for 404237098395402
Depth to water level, feet below land surface
All Approved Continuous & Periodic Data Used In Analysis
Note: Highlighted values in the table indicate closest statistic to the most recent data value.

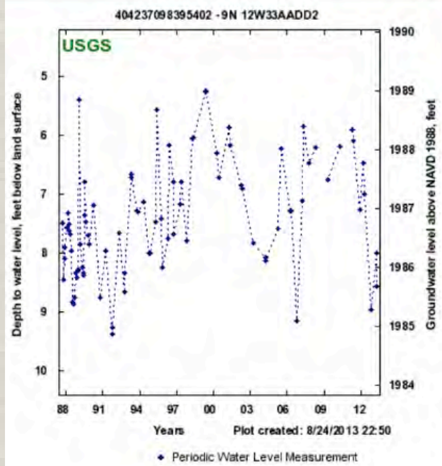
Month	Lowest Median	10th %ile	25th %ile	50th %ile	75th %ile	90th %ile	Highest Median	Number of Years
Apr	8.28	8.07	7.71	7.20	6.79	6.09	5.87	21
May	8.34	8.08	7.04	6.17	5.93	5.39	5.27	13
Oct	9.32	9.24	8.81	8.18	7.61	6.86	6.48	14

As of 8/23/2013 16:45-2

Statistics Options

View month/year statistics

Periodic Groundwater Data



Summary for Period of Record Periodic Water Levels		
Depth to water level, feet below land surface		
Approved Periodic Water Level Values		
Begin Date	**End Date**	**Number of Values**
09/09/87	04/23/13	86

Highest WL	Date of Highest WL	Lowest WL	Date of Lowest WL
5.25	05/26/99	9.38	10/09/91

Groundwater Levels Options

View latest data on NWISWeb

Download Groundwater levels in text format

Return to Groundwater Watch | Return to Previous Page | Return to Network Home Page

*References to non-Department of the Interior (DOI) products do not constitute an endorsement by the DOI.
By viewing the Google Maps API on this web site the user agrees to these TERMS.

Custom Groundwater Networks

Principal Aquifers

----- Select a Principal Aquifer -----

View the Groundwater Watch Principal Aquifers summary page

State and Local Networks

- ✓ ----- Select a State or Local Network -----
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- St. Joseph County, Indiana Groundwater Network

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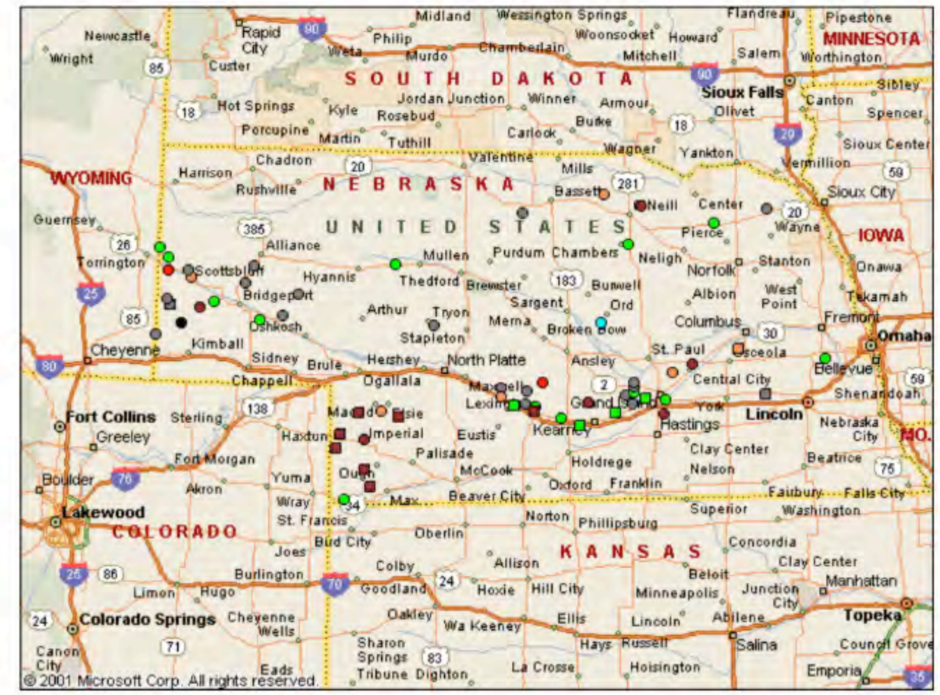
Nebraska Continuous Groundwater Level Network

Nebraska Continuous Groundwater Level Network

Hover mouse over site for information.
Click site to open page with well information and water-level data.



Explanation - Percentile classes (symbol color based on most recent measurement)

Low	<10 Much Below Normal	10-24 Below Normal	25-75 Normal	76-90 Above Normal	>90 Much Above Normal	High	Not Ranked

Wells / Springs: Real-Time, Continuous, Periodic Measurements

Map generated 8/27/2013 8:16:15 AM

Groundwater Watch Help Page

Nebraska Continuous Groundwater Level Network Hydrologic Units

Hydrologic Units	Well Count	Real-Time	Continuous	Periodic
Banner County	7	6	1	-
Brown County	1	1	-	-
Buffalo County	5	4	1	-
Cedar County	1	1	-	-
Chase County	3	1	2	-
Dawson County	10	8	2	-
Dundy County	3	1	2	-
Garden County	2	2	-	-
Hall County	7	6	1	-
Holt County	3	3	-	-
Hooker County	1	1	-	-
McPherson County	1	1	-	-
Merrick County	3	3	-	-
Morrill County	3	3	-	-
Perkins County	3	1	2	-
Phelps County	1	-	1	-

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Custom Groundwater Networks

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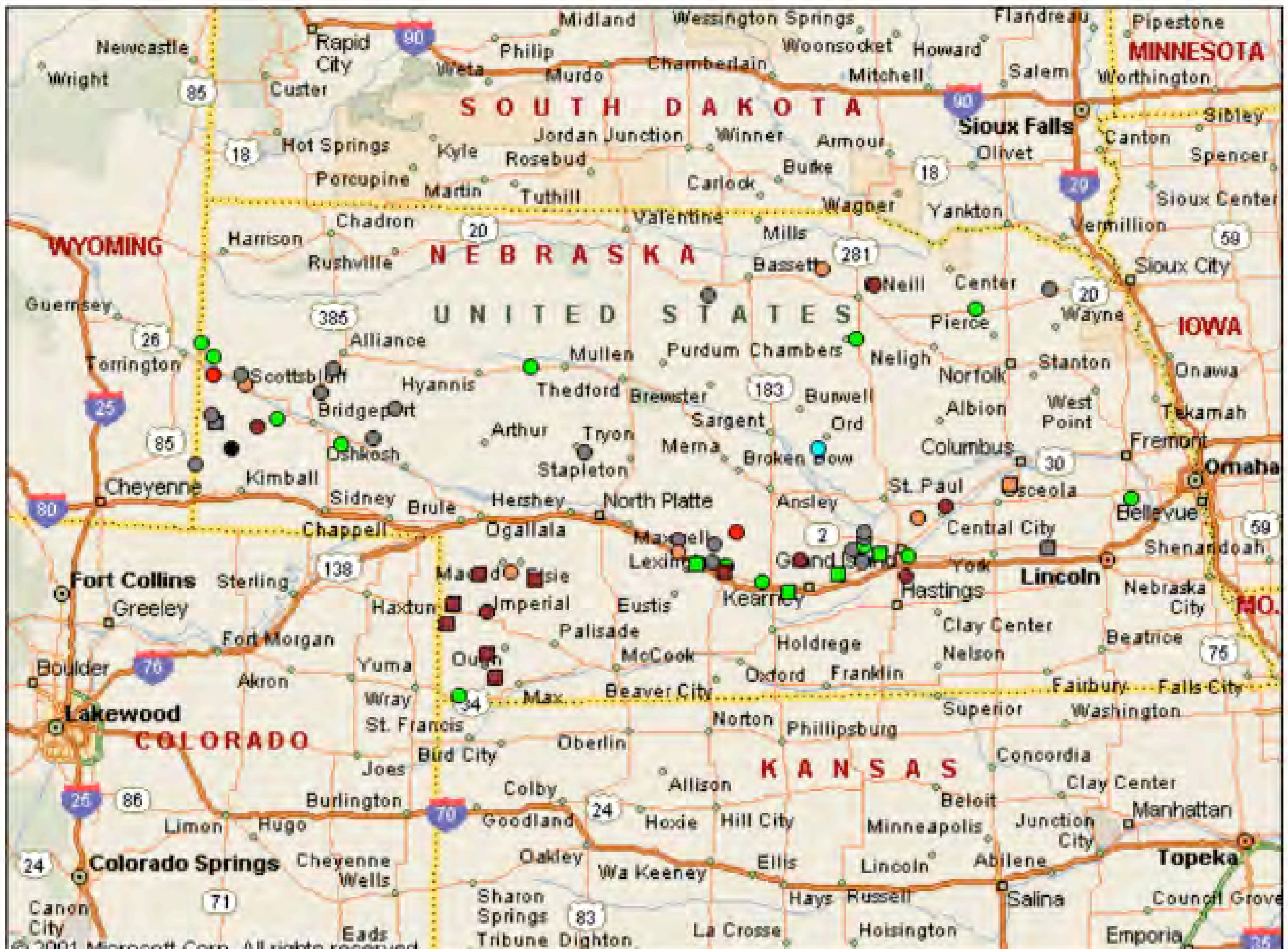
Nebraska Continuous Groundwater Level Network | **Latest News...**

Nebraska Continuous Groundwater Level Network

Hover mouse over site for information.
Click site to open page with well information and water-level data.



Explanation - Percentile classes (symbol color based on most recent measurement)								Wells	Springs
Low	<10 Much Below	10-24 Below	25-75	76-90 Above	>90 Much Above	High	Not Ranked	Real-Time	
								Continuous	
								Periodic	

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Groundwater Watch

- http:groundwaterwatch.usgs.gov

BACK TO AGENDA

Contacts

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5231 South 19th St.
Lincoln, NE 68512-1271
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http://ne.water.usgs.gov

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jmlambre@usgs.gov

Richard C. Wilson
Associate Director of Hydrologic Studies
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wilson@usgs.gov

Ronald B. Zelt
Chief, Watershed and Riverine Integrated Studies Team
(402) 328-4140
rbzelt@usgs.gov

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BACK TO AGENDA

SPEAKER BIO

JAMES BURKS

James has been in the irrigation industry for nearly 30 years, more than half of those spent at Senninger Irrigation in Clermont, Florida where he has served as President for the past 6 years. He holds a BS degree in Agriculture from the University of Nebraska. And, most importantly, James Burks serves as Chair of the Groundwater Foundation Board of Directors.

BACK TO AGENDA

SPEAKER BIO

CINDY KREIFELS

Cindy Kreifels is the executive vice president for the Groundwater Foundation. As executive vice president, Kreifels oversees the development and implementation of all of the Foundation's programs and projects which educate people and inspire action to ensure clean, sustainable groundwater for future generations. Through her work at the Foundation over the past 20 years, Cindy has gained practical experience in program design and implementation, evaluation methodology, community partnerships, volunteerism, facilitation, fundraising, youth programs, and community-based environmental education.

PANEL DISCUSSION
Community Education and Engagement

PANELISTS

Jay Beaumont, Orange County, NY

Alys Brockway, Hernando County Utilities, Brooksville, FL

Jane Griffin, The Groundwater Foundation, Lincoln, NE

Cathy Lotzer, Marshfield Utilities, Marshfield, WI

MODERATOR

Cindy Kreifels, The Groundwater Foundation, Lincoln, NE

BACK TO AGENDA

SPEAKER BIO

JAY BEAUMONT

Jay Beaumont is a consulting civil engineer with 43 years of experience. He began his association with the Groundwater Guardian program in 1995, when he enrolled the Orange County Water Authority as a Groundwater Guardian Community. In the following years he enlisted 37 other communities in New York, because the program offers an excellent vehicle for educating the public about the importance of protecting our groundwater. In recognition of his recruitment efforts, he was the recipient of the James Beaumont Groundwater Guardian Recruitment Prize. Jay has served on the Groundwater Guardian Council and presently serves on the Board of Directors of the Groundwater Foundation.

BACK TO AGENDA

SPEAKER BIO

ALYS BROCKWAY

Alys Brockway has managed the water conservation program in Hernando County for the past 11 years. Prior to her work with Hernando County Utilities Department, she was with St. Johns Water Management District, as a water conservation planner. Water conservation in Hernando County is accomplished through specifically designed programs. This includes, incentive based conservation, education, strong community support and media outreach. She has lead a very successful Groundwater Guardian Committee in Hernando County for over a decade. Brockway holds a Bachelor of Science degree from Kansas State University.

BACK TO AGENDA

SPEAKER BIO

JANE GRIFFIN

Jane Griffin serves as president of The Groundwater Foundation, a national nonprofit organization whose mission is to educate people and inspire action to ensure sustainable, clean groundwater for future generations. The Groundwater Foundation is based in Lincoln, Nebraska and is a well-respected voice for groundwater education and citizen involvement. Griffin's background includes a B.A. from Smith College in Northampton, MA and a diploma from the Universita' Internazionale dell'Arte in Florence, Italy. Griffin's professional experiences reflect her awareness of the need to educate people to create knowledge of the world around us. She has accomplished this goal through her work with the Make-A-Wish Foundation of Nebraska, the Nebraska Art Association Board, and by co-founding an Italian language school for both adults and children.

BACK TO AGENDA

SPEAKER BIO

CATHY LOTZER

Cathy works at Marshfield Utilities in Marshfield, Wisconsin as their Technical Services Manager. As part of Marshfield Utilities commitment to energy and water conservation, Cathy coordinates the efforts of the Marshfield Groundwater Guardian team, which has been active since 1996. Cathy has been married for 28+ years and has two boys ages 26 and 24 and soon to be a new Grandma in March.

QUESTION 1:

How important is community education and engagement to long-term groundwater sustainability?

QUESTION 2:

What are the most effective ways your community has educated people and engaged them in groundwater protection and conservation?

QUESTION 3:

What outcomes have you seen from education and engagement efforts in your community?

QUESTION 4:

What other elements are necessary to move a community towards groundwater sustainability?

QUESTION/ANSWER

BACK TO AGENDA

SPEAKER BIO

CHRISTINE OWEN

Christine Owen is the Regulatory Compliance Senior Manager for Tampa Bay Water, a wholesale water utility in southwest Florida. Chris has participated in and/or directed more than 100 research efforts over the past twenty years covering a range of topics including analytical method development to membrane integrity investigations and desalination. She has presented more than 75 papers at national meetings, is a contributing author to several Water Research Foundation reports and has been an invited presenter on several state and national teleconferences on research, water treatment and regulations. She was featured in the 125th Anniversary edition of Journal of the American Water Works Association in the article titled "Women in Water: Making Waves". Chris is currently the chair of the Journal AWWA Editorial Advisory Board.

In the Tampa area, Chris serves as a technical advisor to the water agency as well as local governments and utilities for water treatment issues, rule making efforts, research and regulatory compliance. Her responsibilities include supporting the operations and optimization of thirteen groundwater supplies, a large surface water treatment plant and a desalination facility. As the Senior Manager of Regulatory Compliance, she is responsible for all Agency regulatory matters which include compliance with all federal, state and local rules.

Her activities include several American Water Works Association rule making efforts: the Technical Work Groups focused on Microbial Contaminants, Public Health and Policy, and Disinfection Byproducts. She worked on the Stage 2 Disinfection/Disinfection By-Product Rule, the revisions to the Total Coliform Rule and was a representative on the Technical Work Group for the ICR Public Database Development. She is currently a member of the Standards Committee and the Climate Change and Sustainability Committee. She previously served as the national chair of the Emerging Issues Committee, its liaison to the Security Committee, and as a member of the Laboratory Committee and the Desalting Committee.

Chris has been active at the national level having served on the Research Advisory Council for Water Research Foundation for High Quality Water from 2002 to 2008. She was a two term appointee to the USEPA Science Advisory Board (SAB) Drinking Water Committee and served as contributing expert to the USEPA SAB Homeland Security Committee. She served two terms on the USEPA National Advisory Council Subcommittee for Environmental Policy and Technology and is currently on the board of directors for the American Membrane Technology Association.

What Do We Know Now?
Where Do We Go From Here?

Groundwater Foundation National Conference

Christine Owen

October 17, 2013

Till taught by pain, men really know not what good water's worth

- Lord Byron

During this conference……

- Sustainability
- Water supply plans
- Conservation
- Regulatory environment
- Political environment
- Education

Sustainability

- What does it mean?
  - It means different things to different people
  - Depends on your perspective
  - Depends on your time frame
- How to achieve it?
  - Multiple examples
  - Try more than one thing; think outside of the box!

Aquifers

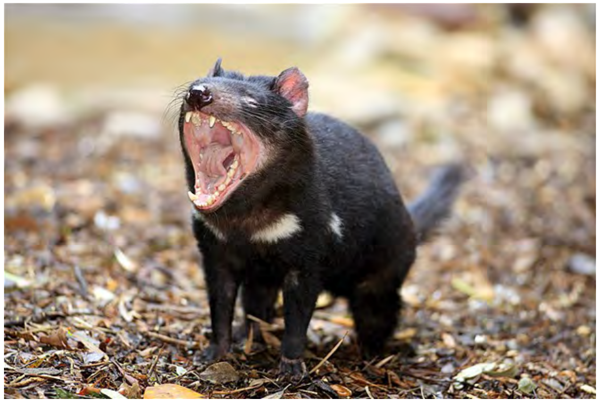
- How do we communicate what an aquifer is?
  - Out of sight, out of mind
  - Geographic scale
  - Time frames
- Pristine groundwater

Water Supply Plans

- Plans are made for important commodities
- Engage the community, local utility and regulators; planning horizons have changed
- More utilities understand the need to plan for more than the next ten years; they need to plan for 30 to 50 years!
- Conservation is a part of a complete supply portfolio

Politics and Regulation

- Engage policy makers
- Engage the public and the elected officials will follow
- Engage regulatory agencies
- "Carrots and Sticks"
- Georgia Desal Initiative



Value of Water

- Affordability is important
  - Water is essential
  - Does that mean it should be free?
- Cost does not always necessarily dictate how we value a commodity
  - Think about air

– Education is key

The Value of Water

- We have to change how we think about water
- We have to educate people about the value of water
  - For the vast majority of the US, we really only charge people what it takes to deliver water (pumping costs)

Education Matters!

- Water is water is water
- It really does not matter if it is groundwater, storm water, su
water or wastewater
  - New AWWA tag line is “One Water”
- We need to value it and conserve it
  - Not too many meteors bringing new water

Power of One (or Two……)

- Individuals do make a difference
- Lots of individuals can make a lot of a difference!
- Consider how you can your effectiveness multiplying forces
  - Local schools
  - Local utility
  - Regional and national organizations

The next steps.....

- Continue what you are doing
  - Each child, parent, elected official
- Develop one new local collaboration
- Think about regional and national collaborations
- Educate!

“What can be counted, does not always matter………and what matters cannot always be counted.”

– Albert Einstein

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NATIONAL CONFERENCE PARTNER

Senninger Irrigation, Inc.

SUPPORTING SPONSORS

Southern Nevada Water Authority

Valmont Irrigation

ADDITIONAL CONFERENCE SUPPORT

Marshfield Utilities

Lake County Board of County Commissioners, Lake County, Florida

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BACK TO AGENDA

GROUNDWATER FOUNDATION STAFF

Jane Griffin, President

Cindy Kreifels, Executive Vice President

Lori Davison, Database Manager

Amy Kessner, Program Manager

Doug Sams, Accountant

Heather Voorman, Community Outreach Specialist

Jennifer Wemhoff, Program Manager

CONFERENCE ADVISORY COMMITTEE

Alys Brockway, Hernando County Utilities Department, Brooksville, FL

Thomas Davis, Department of Environment, Agriculture, Parks and Recreation, Hillsborough, NC

Jane Griffin, The Groundwater Foundation, Lincoln, NE

Cindy Kreifels, The Groundwater Foundation, Lincoln, NE

Christine Owen, Tampa Bay Water, Tampa, FL

Chris Rayburn, Water Research Foundation, Denver, CO

Pat Mangan, National Parks Service, Denver, CO

Jennifer Wemhoff, The Groundwater Foundation, Lincoln, NE

GROUNDWATER FOUNDATION BOARD OF DIRECTORS

James Burks, Chair, Senninger Irrigation, Inc., Clermont, FL

Jay Beaumont, Vice Chair, Energy Curtailment Specialists, Inc., Walden, NY

Cathy Lotzer, Secretary, Marshfield Utilities, Marshfield, WI

Ann Bleed, Treasurer, Ann Bleed and Associates, Lincoln, NE

Warren Arganbright, Arganbright Law Office, Valentine, NE

Andy Belanger, Southern Nevada Water Authority, Las Vegas, NV

Jane Griffin, Ex-Officio, Groundwater Foundation President, Lincoln, NE

Cindy Kreifels, Ex-Officio, Groundwater Foundation Executive Vice President, Lincoln, NE

Dave Johnson, Tucson, AZ

Chandler Mazour, Monsanto, Gothenburg, NE

E. Robert Meaney, Valmont Industries, Omaha, NE

Stephen Mossman, Mattson, Ricketts, Davies, Stewart, Lincoln, NE

Lee Orton, Orton Law Office, Lincoln, NE

Steve Seglin, Ex-Officio, Legan Counsel, Crosby, Guenzel LLP, Lincoln, NE