

A Collaborative National Ground Water Monitoring Network



Ohio Water Resources Council

March 21, 2014

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Co-Chair, Advisory Committee on Water Information Subcommittee on Ground Water

Acknowledgements:

Bob Schreiber, SOGW Co-Chair

Subcommittee on Ground Water Volunteers

Summary Messages

- Collaborative NGWMN “framework” was created in 2009. It was piloted and improved. New “framework” version completed in 2013.
- A Pilot NGWMN “information portal” was released in 2011 and continues to operate as the SOGW awaits funds for full NGWMN Implementation.
- The NGWMN collaborative approach has been embraced by many NGO’s and State/Federal agencies.
- Water quality pilots are underway in Utah and New England
- Pending available funds, the SOGW expects to begin implementation of the NGWMN in federal FY15.
- The NGWMN may be a useful tool for Ohio groundwater agencies.

Presentation Outline

- Background
- NGWMN Design
- Pilot Results
- NGWMN Portal
- Current Status and Future Plans

A National Framework for Ground-Water Monitoring in the United States

Prepared by The Subcommittee on Ground Water of The Advisory Committee
on Water Information

Approved by The Advisory Committee on Water Information

First Release – June 2009

Revised – July 2013

P.L. 111-11 SECURE Water Act 2009

(B) in coordination with the **Advisory Committee and State and local water resource agencies**—

- (i) assess the current scope of groundwater monitoring based on the access availability and capability of each monitoring well in existence as of the date of enactment of this Act; and
- (ii) develop and carry out a monitoring plan that maximizes coverage for each major aquifer system that is located in the United States; and

(C) prior to initiating any specific monitoring activities within a State after the date of enactment of this Act, **consult and coordinate with the applicable State water resource agency** with jurisdiction over the aquifer that is the subject of the monitoring activities, and comply with all applicable laws (including regulations) of the State.

What is ACWI?

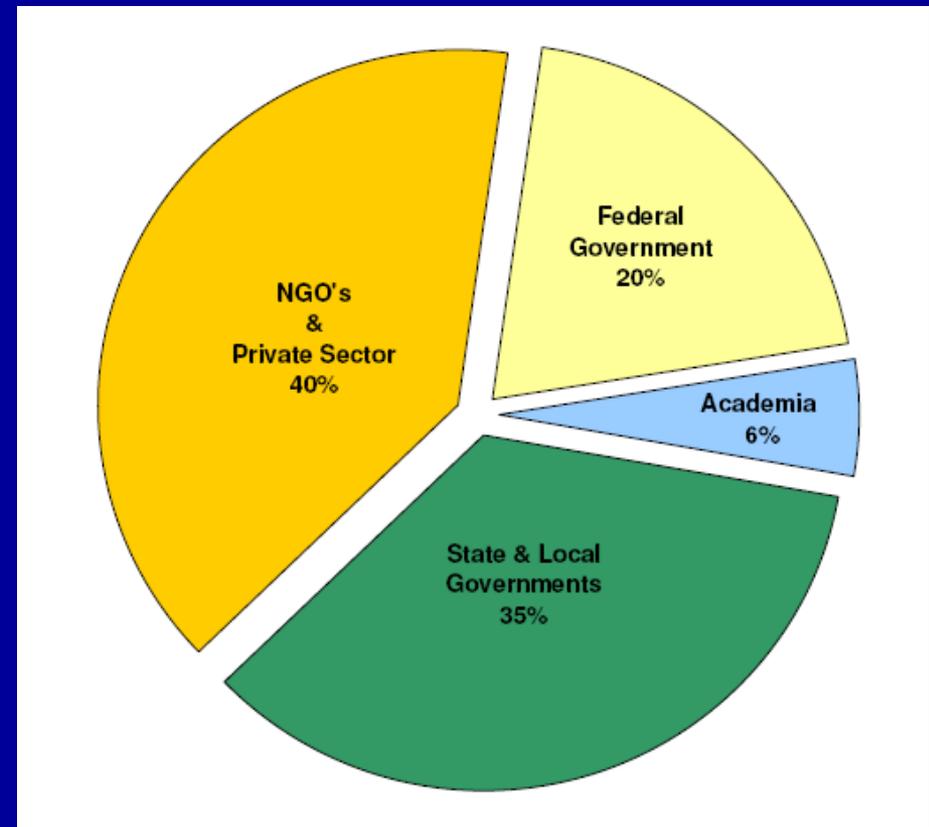
- Federal Advisory Committee on Water Information (<http://acwi.gov>)
 - The ACWI represents the interests of water-information users and professionals in advising the Federal Government on Federal water-information programs and their effectiveness in meeting the Nation's water-information needs.
 - Purpose is to improve water information for decision making about natural resources management and environmental protection.
 - USGS is the lead agency. Other Federal agencies that fund, collect, or use water resources information work together to implement program recommendations.
 - The Committee is chartered under the Federal Advisory Committee Act.

What is the Subcommittee on Ground Water?

- *American Society of Civil Engineers*
- *Ground Water Protection Council*
- *Interstate Council on Water Policy*
- *Association of American State Geologists*
- *National Ground Water Association*
- *Texas Commission on Environmental Quality*
- *US Geological Survey*
- *USEPA Headquarters and Region 8*
- *Association of State Drinking Water Administrators*
- *Water Environment Federation*
- *USDA Forest Service*
- *Association of State and Interstate Water Pollution Control Administrators*
- *ASTM*

Support for the NGWMN

70+ individuals
from private industry and 54 organizations



Subcommittee on Ground Water

(Established 2007)

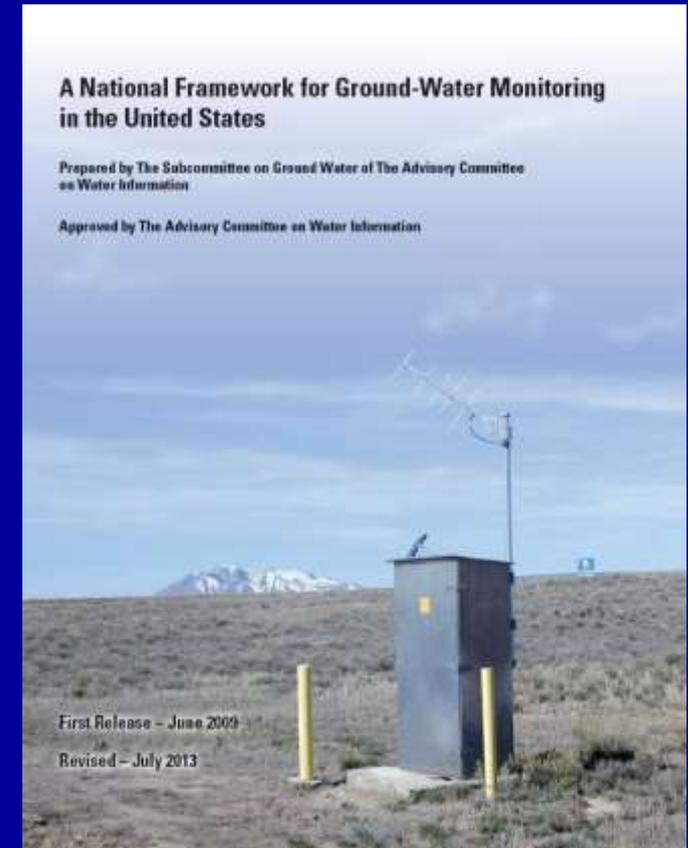
The overall goal of the SOGW is to develop and encourage implementation of a nationwide, long-term ground-water quantity and quality monitoring framework that would provide information necessary for the planning, management, and development of ground-water supplies to meet current and future water needs, and ecosystem requirements.

Scope: This national framework for ground-water monitoring and collaboration will be developed to assist in assessments of the quantity of U.S. ground-water reserves, as constrained by ground-water quality.

National GW Monitoring Network

“Framework Document”

- Design for a collaborative National GW Monitoring Network
- Inventoried Federal and State monitoring programs
- Guidance for Field Methods
- Guidance for Minimum Data Elements, Standards, & Mgmt
- Implementation Plan and Recommendations
- 2009 and 2013



Inventory Results

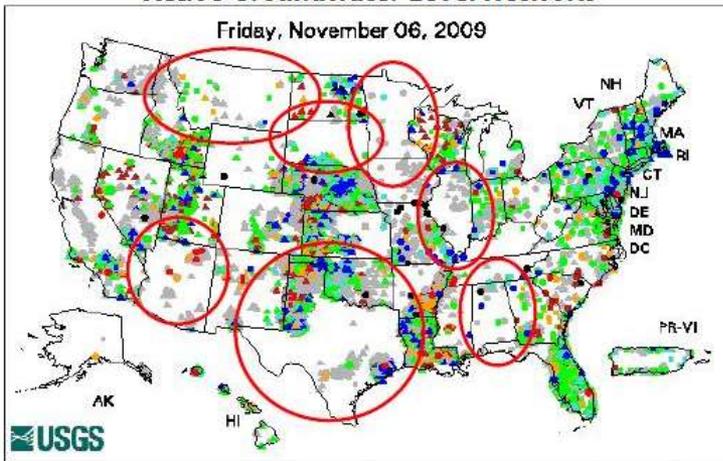
Lack of Nationwide Coverage

Wells operated by USGS

Groundwater Watch

Active Groundwater Level Network

Friday, November 06, 2009



Explanation - Percentile classes (symbol color based on most recent measurement)							Measurement Type		
● New	● <10	● 10-24	● 25-75	● 76-90	● >90	● New High	○ Real Time	□ Continuous	△ Periodic Measurements
● New Low	● Much Below Normal	● Below Normal	● Normal	● Above Normal	● Much Above Normal	● Not Ranked			

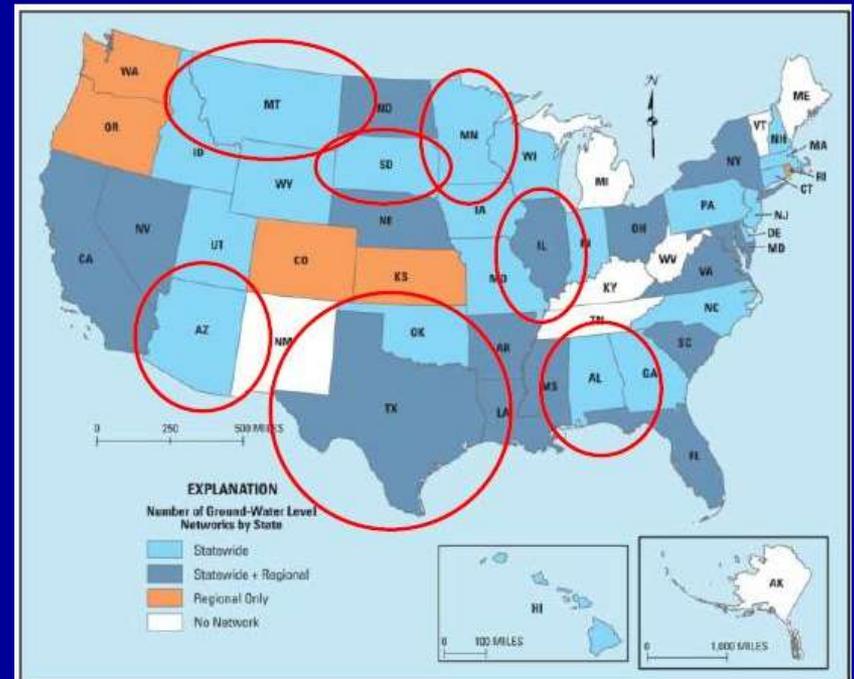
Active Well Count

Real-Time: 1,176 Daily: 1,142 Periodic: 23,777

Water Level example.....

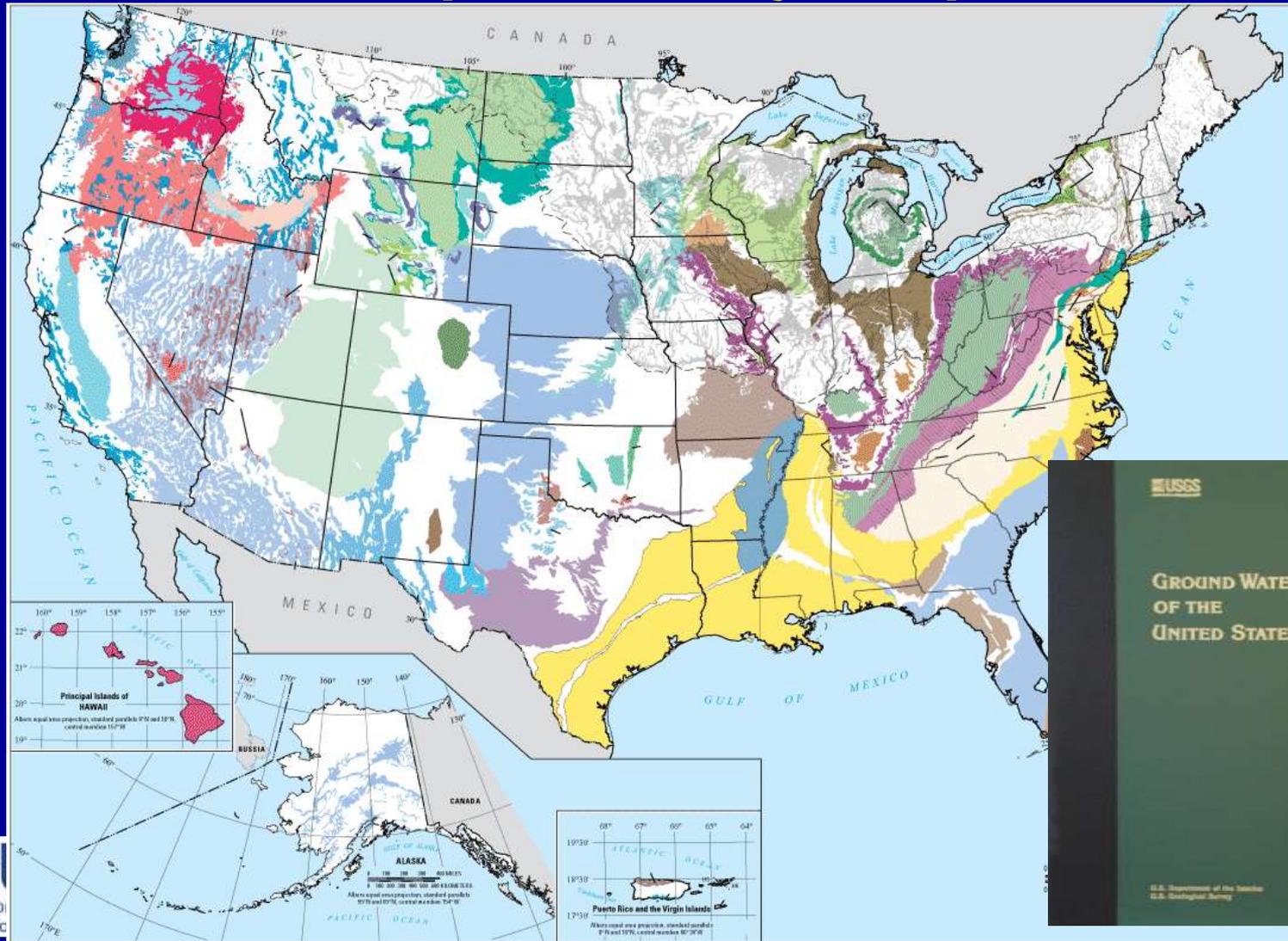
Wells operated by States

Results from survey of State networks



Network Design

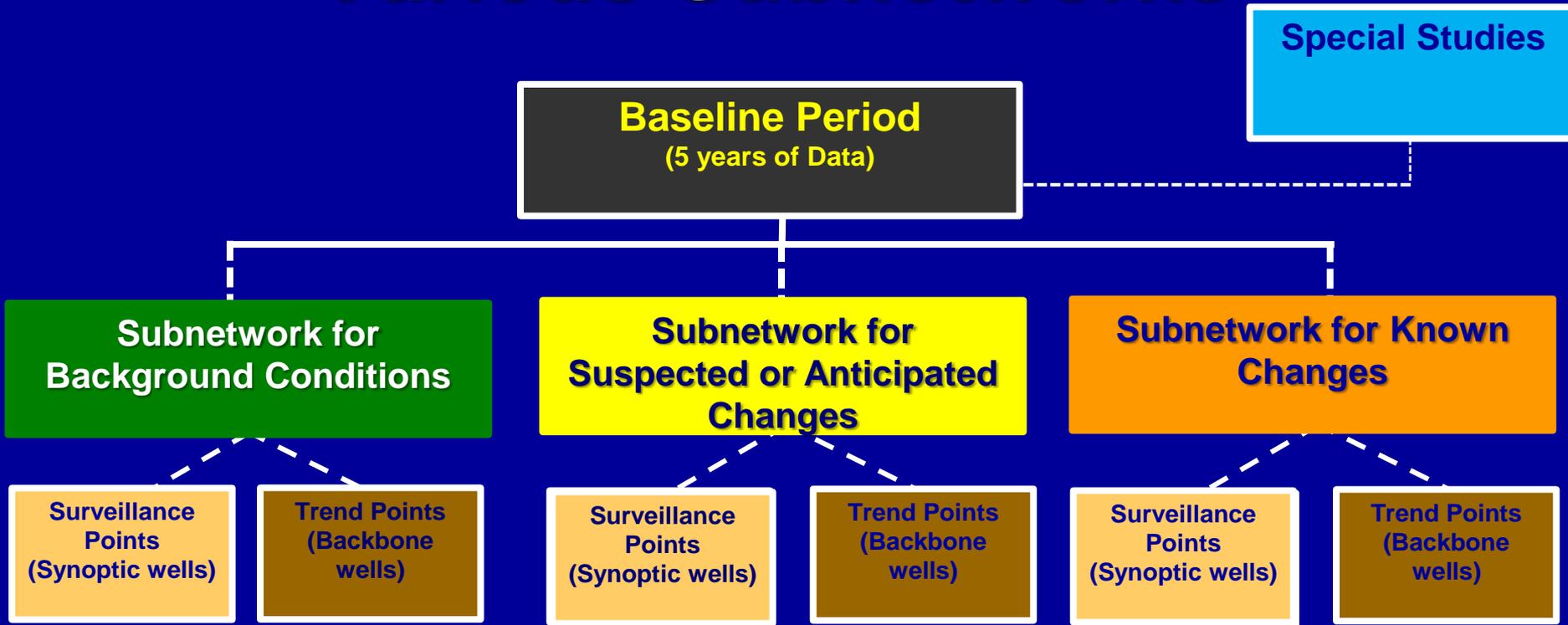
→ Principal and Major Aquifers



NGWMN Design Elements

- Groundwater Monitoring Network for the Principal and major aquifers
- Groundwater levels and quality, but focus is availability
- Priority on wells/springs with long-term data. **NGWMN is a network, not a warehouse**
- NGWMN is not designed around a specific science question
- Composed of data from willing data providers: State, Federal, Tribes and others
- Sites classified by local experts
- Data available to all without restriction or cost via an Internet portal
- Data provider is the authoritative data source. The NGWMN is not a “master database”

Network Design: Various Subnetworks

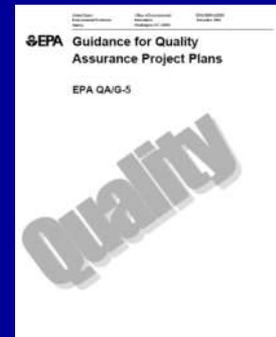


“Classified” based on water level or water quality change and on frequency of data collection

What about data quality? Field Practices



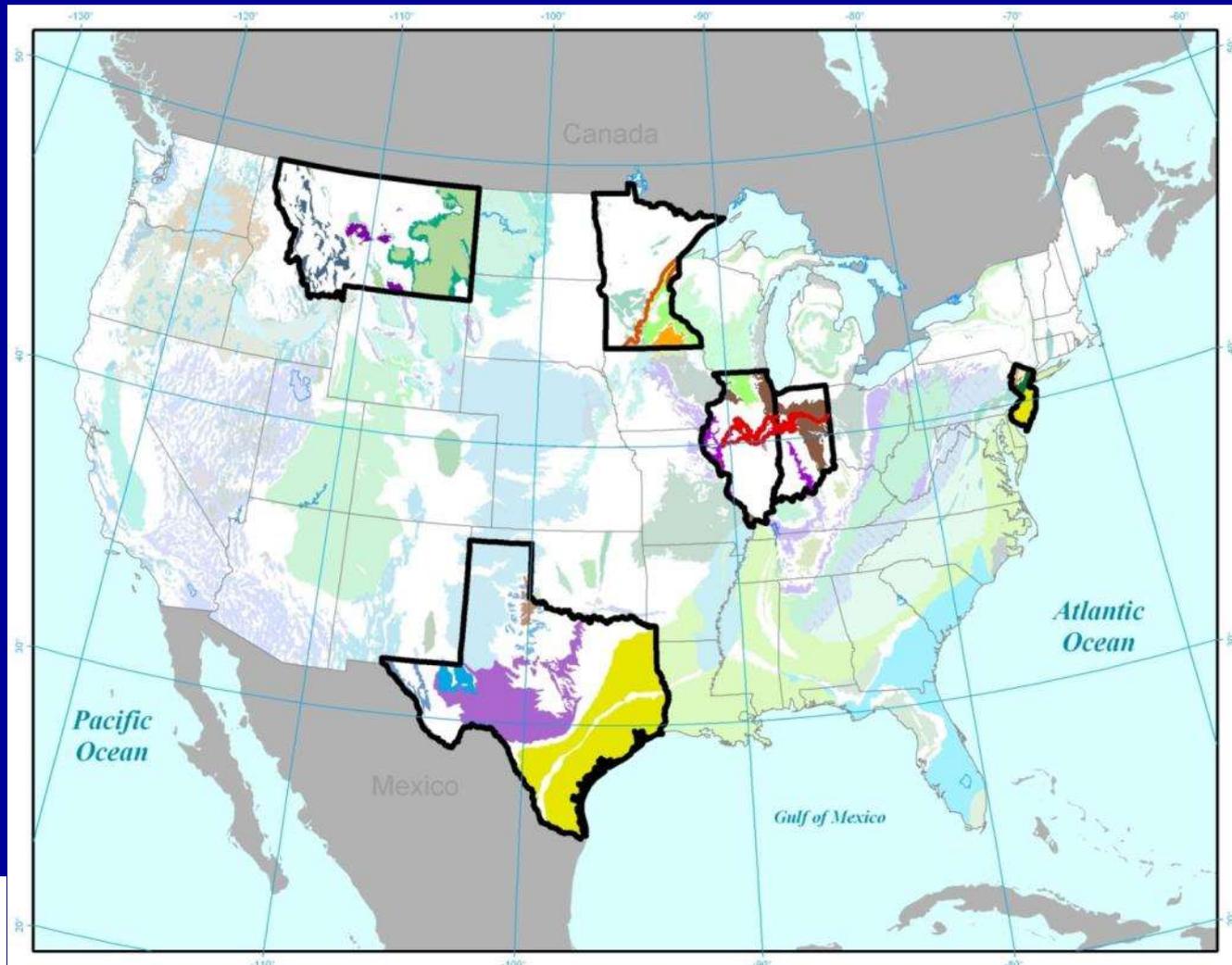
- Few absolute requirements--flexible and adaptable.
- Requires documentation of techniques to ensure comparability and assure quality in ground-water measurement and sampling activities.
- Documentation must be available to the user—known provenance



Data Standards & Management

- **Minimum Data Elements** for wells, measurements, and water quality results are established: source agency, location, depth, aquifer, analytical method.....
- NGWMN data must be freely available without restriction
- Data are available via the NGWMN Data Portal immediately, once available from the data provider

National Ground Water Monitoring Network Pilot Projects



NGWMN Pilot Studies

- Pilots (5) evaluated the design, selected and classified wells, and tested the data exchange approach
- Volunteer effort with 1-year timeline
- Reported on design changes, costs, and benefits
- All supported future Network implementation
- Network Portal is key product

The Subcommittee on Ground Water of The Advisory Committee on Water Information

National Ground-Water Monitoring Network— Results of Pilot Studies



September 2011

Pilot Benefits

Pilots benefited from:

- a single, consistent dataset for shared interstate GW resources
- an opportunity to share data among state agencies
- a critical review of internal field procedures and data management procedures
- the opportunity to raise awareness for GW monitoring
- the NGWMN Internet data portal

NGWMN User Interface

Search results - wcuri x DEPARTMENT OF TH x Google Contacts x National Ground-Wat x

cida.usgs.gov/ngwmn/

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on Water Information

National Ground-Water Monitoring Network

The **National Ground-Water Monitoring Network (NGWMN)** is a compilation of selected groundwater monitoring wells from Federal, State, and local groundwater monitoring networks across the nation.

The **NGWMN** is a product of the [Subcommittee on Groundwater](#) of the Federal Advisory Committee on Water Information ([ACWI](#)).

The **NGWMN Data Portal** provides access to groundwater data from multiple, dispersed databases in a web-based mapping application. The portal contains current and historical data including water levels, water quality, lithology, and well construction. The NGWMN is transitioning from a pilot phase into full implementation. In the future we will be adding additional data providers to the network.

CURRENT NETWORK:

- 2806 water-level wells
- x water-quality wells

10 subnetworks

7 contributing agencies

29 states

48 principal aquifers

LEARN about the Network

```
graph TD; A[Subnetwork for Suspected Changes] --> B[Surveillance Monitoring Wells]; A --> C[Trend Monitoring Wells]; D[Documented Changes] --> B; D --> C; B --> E[Backbone]; B --> F[Backbone Wells]; C --> F;
```

EXPLORE the Network

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Network Portal Requirements

- Map-based interface
- Acceptable data download performance
- Translates heterogeneous state data formats to a common formats (OGC WaterML 2.0)
- Data provider maintains data ownership. Data User can track data provenance
- Display real-time or nearly real-time data
 - Well characteristics (lithology, construction, aquifer)
 - Spring information
 - Water levels
 - Water quality

NGWMN Pilot Portal

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National Ground-Water Monitoring Network

NGWMN NETWORKS

Water level: ⓘ

Subnetwork: ⓘ

- All
- Background
- Suspected Changes
- Documented Changes

Monitoring Category: ⓘ

- All
- Surveillance
- Trend
- Special

Water quality: ⓘ

Subnetwork: ⓘ

- All
- Background
- Suspected Changes
- Documented Changes

Monitoring Category: ⓘ

- All
- Surveillance
- Trend
- Special

>> FILTER MAP DATA

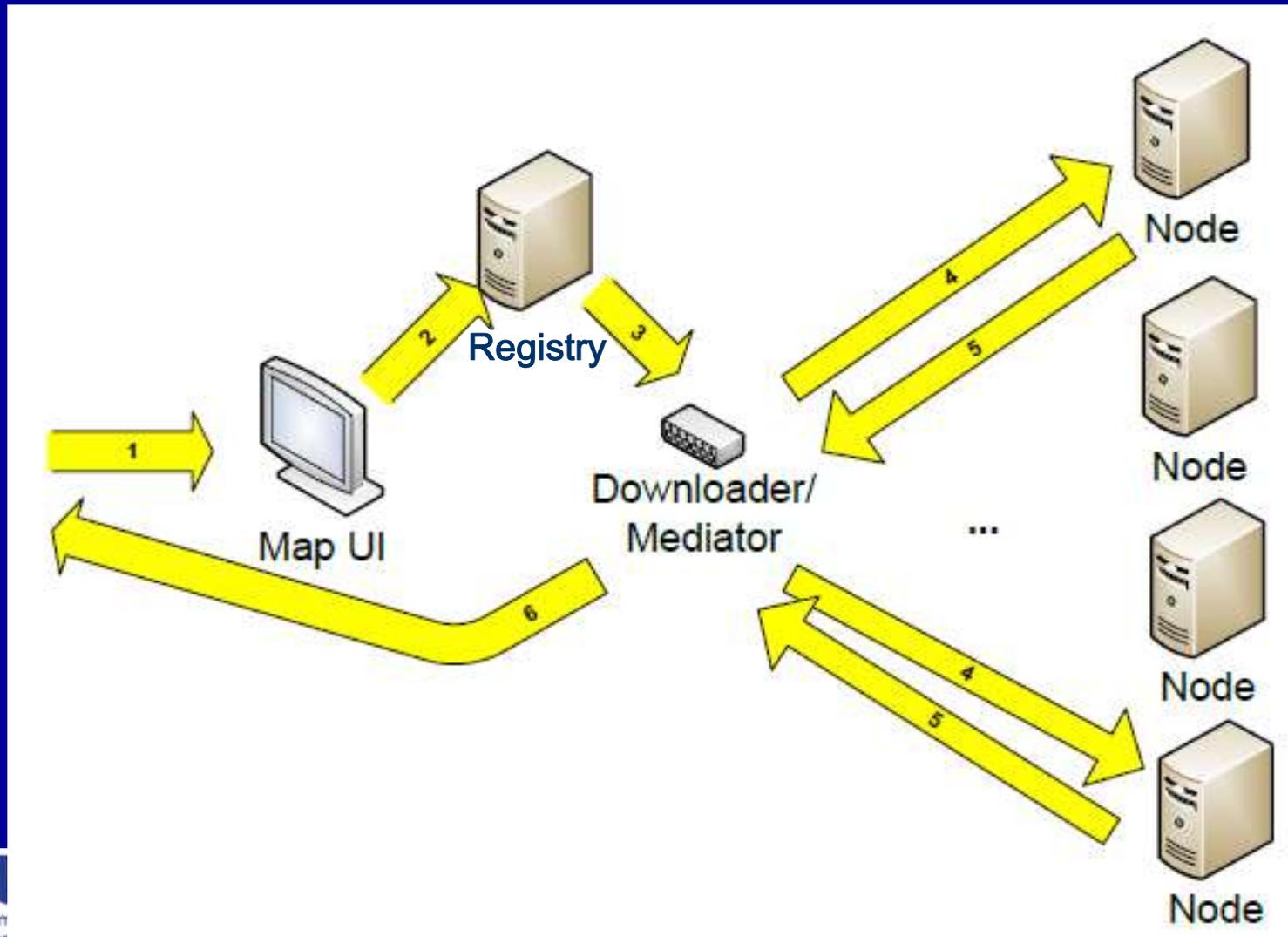
CURRENT STATUS

- 3022 Sites mapped
- 3022 Sites matching filter
- 2806 Water-level network wells

<http://cida.usgs.gov/ngwmn/>

Map labels: GREENLAND (KALAALLIT NUNAAT), East Siberian Sea, Chukchi Sea, Beaufort Sea, Baffin Bay, Hudson Bay, Labrador Sea, Sea of Okhotsk, Bering Sea, Gulf of Alaska, PACIFIC OCEAN, CANADA, ROCKY MOUNTAINS, UNITED STATES, GULF OF MEXICO, MEXICO, ATLANTIC OCEAN, CARIBBEAN SEA, AMAZON BASIN, BRAZIL.

Network Portal Data Model



Illinois-Indiana Example

NGWMN NETWORKS

Water level: ?

Subnetwork: All ?
 Background
 Suspected Changes
 Documented Changes

Monitoring Category: All ?
 Surveillance
 Trend
 Special

Water quality: ?

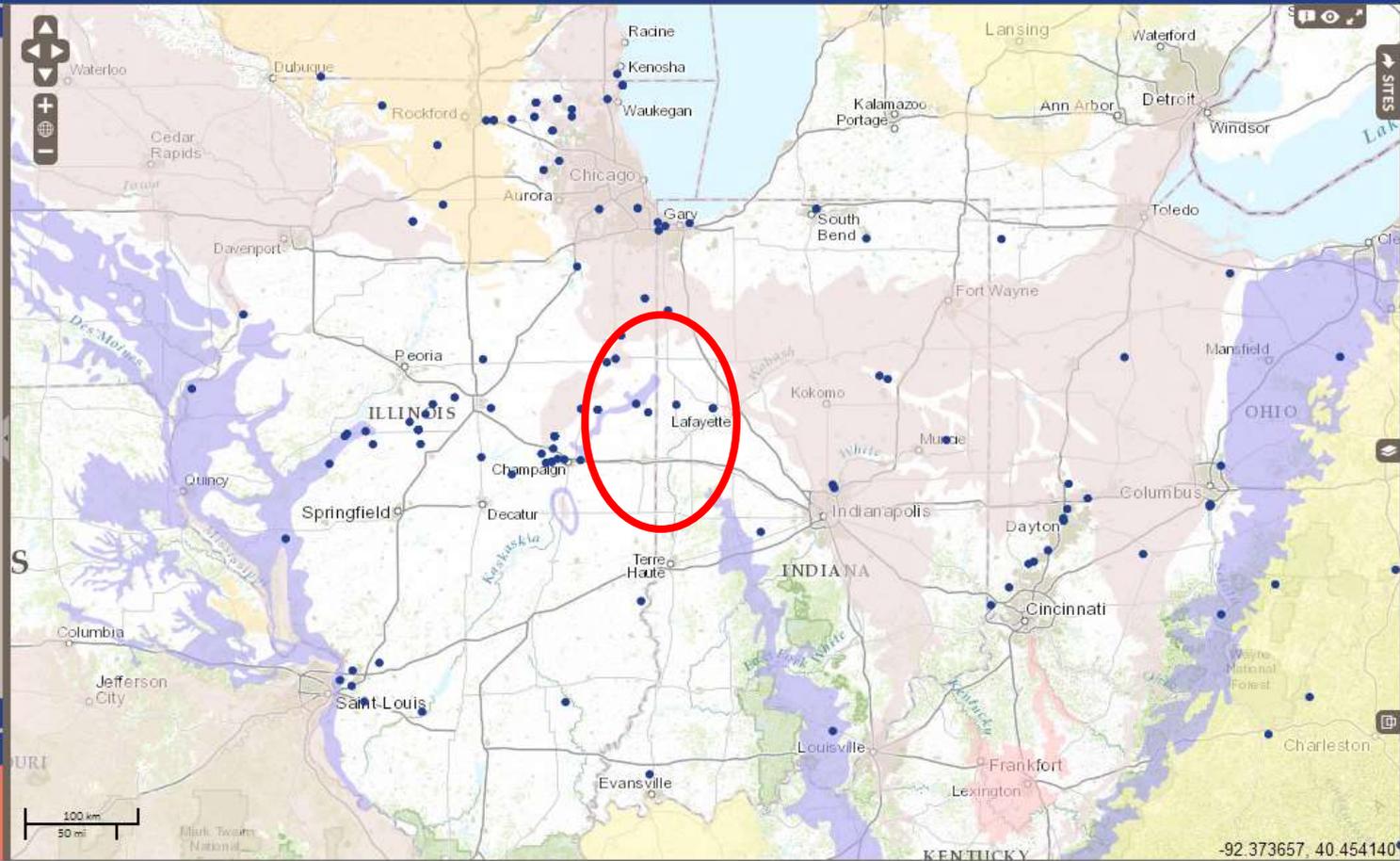
Subnetwork: All ?
 Background
 Suspected Changes
 Documented Changes

Monitoring Category: All ?
 Surveillance
 Trend
 Special

>> FILTER MAP DATA

CURRENT STATUS

159 Sites mapped
3022 Sites matching filter
149 Water-level network wells
15 Water-quality network wells



CRESCENT CITY #2 (MTBV 2)

SUMMARY	WELL LOG	WATER QUALITY
Agency	Illinois Environmental Protection Agency	
Site Name	CRESCENT CITY #2 (MTBV 2)	
Site #	P406197	
Lat/Long(WGS84)	40.7708, -87.8588	
Well Depth	132 ft	
Local Aquifer Name	Mahomet Aquifer	
National Aquifer Name	Sand and gravel aquifers (glaciated regions)	
Water Level Network	Unknown - Unknown	
Water Quality Network	Surveillance - Background	
Additional Info	Link	



SELECT FOR DOWNLOAD




BENTON 4 (BE 4)

SUMMARY	WELL LOG	WATER LEVELS
Agency	U.S. Geological Survey	
Site Name	BENTON 4 (BE 4)	
Site #	402851087113501	
Lat/Long(WGS84)	40.4808, -87.3597	
Well Depth	320 ft	
Local Aquifer Name	Pleistocene Series	
National Aquifer Name	Sand and gravel aquifers (glaciated regions)	
Water Level Network	Surveillance - Background	
Water Quality Network	Unknown - Unknown	
Additional Info	Link	



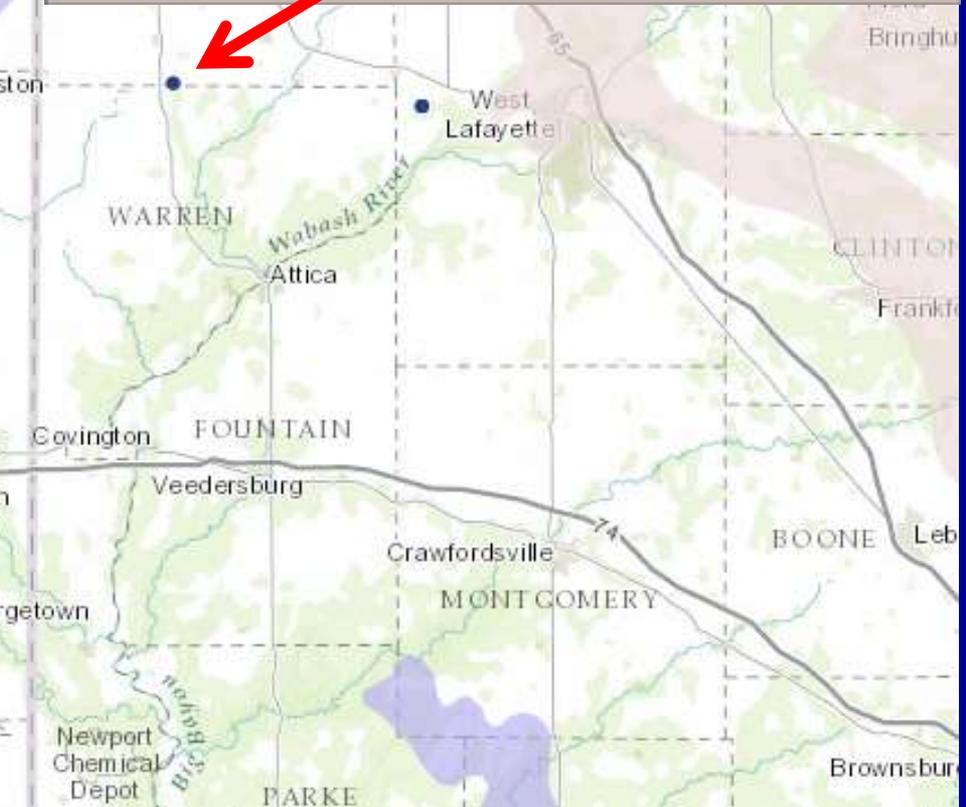
SELECT FOR DOWNLOAD

23R11W-22.8a1 (Hoopston)

SUMMARY	WELL LOG	WATER LEVELS	WATER QUALITY
Agency	U.S. Geological Survey		
Site Name	23R11W-22.8a1 (Hoopston)		
Site #	402568087361601		
Lat/Long(WGS84)	40.4822, -87.5907		
Well Depth	146 ft		
Local Aquifer Name	Quaternary System		
National Aquifer Name	Sand and gravel aquifers (glaciated regions)		
Water Level Network	Trend - Background		
Water Quality Network	-		
Additional Info	Link		



SELECT FOR DOWNLOAD




Methods of Site Selection

The screenshot displays the NGWMN website interface with several filtering menus highlighted by red circles. The 'NGWMN NETWORKS' menu is on the left. The 'State and County' menu is at the top, with options for 'Multiple states' and 'One state, multiple counties', and a list of states including ALABAMA, ARKANSAS, CALIFORNIA, CONNECTICUT, FLORIDA, and GEORGIA. The 'Contributing Agency' menu lists agencies such as the Illinois Environmental Protection Agency, Illinois State Water Survey, Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, Montana Bureau of Mines and Geology, Texas Water Development Board, and U.S. Geological Survey. The 'Principal Aquifer' menu lists various aquifer types like Ada-Vamoosa, Alluvial, and Arbuckle-Simpson. An 'Available Data' menu at the bottom offers 'Water Level', 'Water Quality', and 'Well Log' options. The background features a map of the United States with numerous monitoring sites marked as blue dots. A status bar at the bottom left indicates '3022 Sites mapped', '3022 Sites matching filter', and '2806 Water-level network wells'.

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Advisory Committee
on Water Quality

NGWMN NETWORKS

Water Level

Subnetwork: All, Background, Suspected Changes, Documented Changes

Monitoring Category: All, Surveillance, Trend, Special

Water quality: [checked] All, Background, Suspected Changes, Documented Changes

Monitoring Category: All, Surveillance, Trend, Special

State and County

Multiple states
One state, multiple counties

States: All, ALABAMA, ARKANSAS, CALIFORNIA, CONNECTICUT, FLORIDA, GEORGIA

Contributing Agency

Illinois Environmental Protection Agency
Illinois State Water Survey
Minnesota Department of National Resources
Minnesota Pollution Control Agency
Montana Bureau of Mines and Geology
Texas Water Development Board
U.S. Geological Survey

Principal Aquifer

Ada-Vamoosa aquifer
Alluvial aquifers
Arbuckle-Simpson aquifer
Basin and Range basin-fill aquifers
Biscayne aquifer
California Coastal Basin aquifers
Cambrian-Ordovician aquifer system
Castle Hayne aquifer
Central Oklahoma aquifer
Central Valley aquifer system
Coastal lowlands aquifer system
Columbia Plateau basaltic-rock aquifers

Available Data

Water Level
Water Quality
Well Log

National Ground-Water Monitoring Network

3022 Sites mapped
3022 Sites matching filter
2806 Water-level network wells

Output Options

NGWMN NETWORKS

Water level: ?

Subnetwork:

- All
- Background
- Suspected Changes
- Documented Changes

Monitoring Category:

- All
- Surveillance
- Trend
- Special

Water quality: ?

Subnetwork:

- All
- Background
- Suspected Changes
- Documented Changes

Monitoring Category:

- All
- Surveillance
- Trend
- Special

>> FILTER MAP DATA

CURRENT STATUS

3022 Sites mapped
3022 Sites matching filter
2806 Water-level network wells

BIG SPIRIT FISH HATCHERY - WELL FWY-08

SUMMARY WELL LOG WATER LEVELS

Monthly/Year

Date	Time	Value	Unit	Comment
03-13-2013	15:47:00.00	28.4300	FEET	
12-08-2012	08:34:00.00	28.4700	FEET	
06-21-2012	15:45:00.00	28.5100	FEET	

[SELECT FOR DOWNLOAD](#)

SHETHAL

SUMMARY WELL LOG WATER LEVELS

Well information

Well Depth	145.00 ft.	Latitude	-306.9349
Elevation	2638.00 ft.	Longitude	47.3257

Depth from (ft)	Depth to (ft)	Screen/Casing Material
0.00 ft.	145.00 ft.	PVC-SCHED 40

Detailed Lithology

Depth From (ft)	Depth To (ft)	Lithology	Description
0.00	12.00	SAND	SAND
12.00	15.00	ROCK	ROCK
15.00	20.00	COAL	COAL
20.00	110.00	SHALE	SHALE
110.00	140.00	SAND	SAND
140.00	145.00	CLAY	CLAY

[SELECT FOR DOWNLOAD](#)

TIPPECANOE 17 (TC 17)

SUMMARY WELL LOG WATER LEVELS WATER QUALITY

Agency	U.S. Geological Survey (National Water Information System)
Site Name	TIPPECANOE 17 (TC 17)
Site #	402734087033401
Lat/Long[WGS84]	40.4595,-87.0595
Well Depth	212.54 ft
Local Aquifer Name	Outwash
National Aquifer Name	Sand and gravel aquifers (glaciated regions)
Water Level Network	Surveillance - Background
Water Quality Network	Unknown - Unknown
Additional info	link

[SELECT FOR DOWNLOAD](#)

Site Selection

Site Name	Agency	WL	WQ	Log
GREAT NORTHERN RAILWAY COMPA...	MBMG	●	●	●
PIA-2000A Cisco	ISWS	●	●	●
TWDB-7764401	TWDB	●	●	●
250790-- lmlaystown MW1	USGS	●	●	●
GRANT 10 (GT 10)	USGS	●	●	●
66018	MN DNR	●	●	●
MPCA Ambient Network Site 1152	MPCA	●	●	●

7 sites selected.

[REMOVE SELECTED](#) [DOWNLOAD](#)

Water Quality Data

NGWMI NETWORKS

Water level: All

Subnetwork: All

Monitoring Category: All

Water quality: All

Subnetwork: All

Monitoring Category: All

PAXTON #7 (MTBV 1)

SUMMARY	WELL LOG	WATER QUALITY				
2008-08-26Z	00:00:00	CST	NITROGEN-AMMONIA AS (N)	1.47	MG/L	
2008-08-26Z	00:00:00	CST	ARSENIC	1.34	UG/L	
2008-08-26Z	00:00:00	CST	BARIUM	146	UG/L	
2008-08-26Z	00:00:00	CST	CADIUM	0		< 3 UG/L detection limit
2008-08-26Z	00:00:00	CST	CHLORIDE	1.08	MG/L	
2008-08-26Z	00:00:00	CST	CALCIUM	83100	UG/L	
2008-08-26Z	00:00:00	CST	CHROMIUM	0		< 5 UG/L detection limit
2008-08-26Z	00:00:00	CST	COPPER, FREE	0		< 100 UG/L detection limit
2008-08-26Z	00:00:00	CST	CYANIDE	0		< 0.01 MG/L detection limit
2008-08-26Z	00:00:00	CST	FLUORIDE	0.268	MG/L	
2008-08-26Z	00:00:00	CST	IRON	2010	UG/L	
2008-08-26Z	00:00:00	CST	LEAD	0		< 5 UG/L detection limit
2008-08-26Z	00:00:00	CST	MAGNESIUM	32600	UG/L	
2008-08-26Z	00:00:00	CST	MANGANESE	26.4	UG/L	
2008-08-26Z	00:00:00	CST	MERCURY	0		< 0.1 UG/L detection limit
2008-08-26Z	00:00:00	CST	NICKEL	0		< 25 UG/L detection limit
2008-08-26Z	00:00:00	CST	NITRATE-NITRITE	0		< 0.1 MG/L detection limit
2008-08-26Z	00:00:00	CST	POTASSIUM	1780	UG/L	
2008-08-26Z	00:00:00	CST	SELENIUM	0		< 2 UG/L detection limit
2008-08-26Z	00:00:00	CST	SILICA	19000	UG/L	
2008-08-26Z	00:00:00	CST	SILVER	0		< 10 UG/L detection limit
2008-08-26Z	00:00:00	CST	STRONTIUM	710	UG/L	
2008-08-26Z	00:00:00	CST	SODIUM	25300	UG/L	

>> FILTER MAP DATA

SELECT FOR DOWNLOAD

3022 Sites mapped
3022 Sites matching filter
2806 Water-level network wells

FY14 NGWMN Status

- Limited NGWMN activity, pending Congressional budget support
- Maintain NGWMN portal
- **Begin EPA Water Quality Pilot**
 - USEPA Regional Labs providing Analytical Services at no cost
 - Massachusetts/New England Pilot
 - USGS lead with state agencies
 - Utah Pilot
 - Utah GS lead with USGS and other UT State agencies

Implementation: NGWMN Next Steps

Funds for NGWMN are in the President's Budget in FY15.

Pending available resources

- SOGW will solicit new data providers and initiate a “**National Program Board**”, as recommended by the Framework Document. Board will begin set priorities.
- USGS will begin extramural grant program to assist data providers
- USGS will expand NGWMN portal capabilities
- Pilot program for EPA analytical services will expand



National Ground-Water Monitoring Network

Advisory Committee on Water Information—Subcommittee on Ground Water

Questions?

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<http://acwi.gov/sogw>



Establishing a Collaborative National Ground-Water Monitoring Network Program for the United States

Ground water monitoring networks are operated by many Federal, State, Tribal, and local agencies. Even though ground-water monitoring is done in many places and at many scales, there is no ready access to these data at the national level and there are no standards that address common data structure and quality. It is apparent, however, that data being collected by these many entities will provide a rich and comprehensive picture of the Nation's ground-water resources.

The Federal Advisory Committee on Water Information (ACWI; <http://acwi.gov>), as directed by the U.S. Office of Management and Budget, State collaboration related to water information collection and sharing. In recognition of the dispersed nature of ground-water data networks, the ACWI directed its Subcommittee on Ground Water (SOGW) to develop a collaborative ground-water monitoring framework that could provide information necessary for the planning, management, and development of ground-water resources in their current and future water needs and in current regulations. To this end, a process to develop a National Ground-Water Monitoring Network (NGW-MN) was begun. The SOGW developed an initial network framework in 2009 and conducted public hearings on the feasibility of a NGW-MN and to develop a final sharing plan in 2011. A national framework incorporating the lessons learned during the pilot phase was completed in 2013 (reauthorized on October 2009, revised 2013, available at <http://www.gpo.gov/sopdocs/13oct09/>).

The NGW-MN is established as a voluntary, cooperative, integrated system of data collection, management, and reporting that will provide the data needed to help address current and future ground-water management questions. Thus, the NGW-MN may be thought of as an aggregation of well-aligned data-sharing, Federal, State, Tribal, and local ground-water monitoring networks (completed to address regulations across the Nation) to share information of the data needed to address the existing monitoring efforts. The NGW-MN will provide data that can be used to assess baseline conditions and help assess trends in water levels and water quality to improve quality on a national, watershed, and regional scale.

Design and testing of the National Ground-Water Monitoring Network will be a multi-step process. One of the first steps will be to identify and test the data structure and the data quality needed by the NGW-MN. This process is a significant step toward the effective delivery of groundwater data. The success of every endeavor to have a national network that will effectively fill important data gaps and provide the data for significantly improved management of groundwater health on a national basis.

—Bob Schreiber
Vice President, CDM Smith
Co-Chair, Subcommittee on Ground Water



Major Goals of the NGWMN

- (1) Compile the water-resources data that can be used to define the status and trends of ground-water availability at the national scale;*
- (2) Identify areas where additional monitoring is needed;*
- (3) Provide data to support regional, interstate, and national management actions; and*
- (4) Provide a data-management framework to receive, manage, and distribute data.*

All of the data and information in the NGWMN will be available to all interested parties at no cost and with no restrictions.