



# ***The U.S. National Ground Water Monitoring Network History, Development, and Progress 2007-2017***

***Bill Cunningham***

*U.S. Geological Survey*

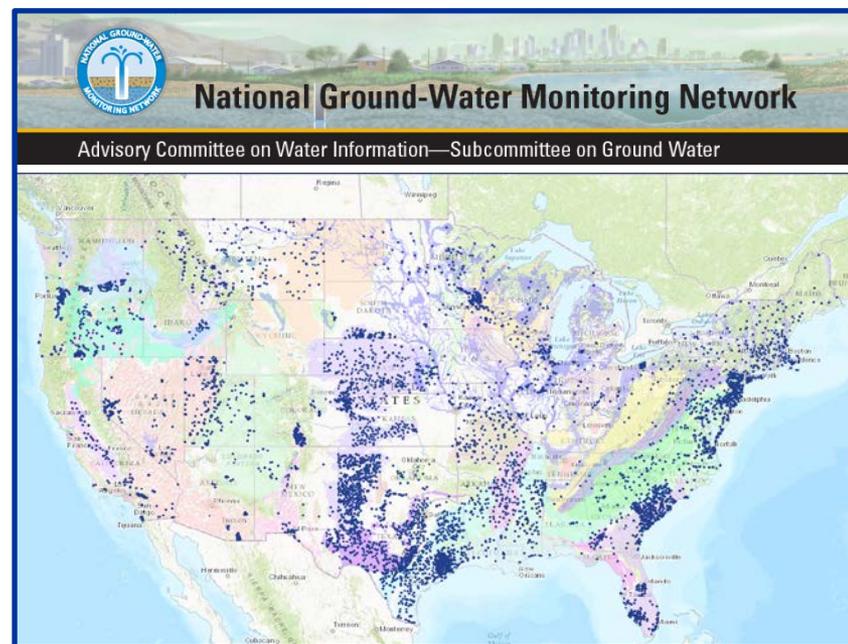
*Co-Chair, Subcommittee on Ground Water*

*ACWI-SOH*

*Streamflow Information Collaborative*

*May 1, 2017*

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



**NGWMN NETWORKS**

**Water level:**  ?

Subnetwork: **All** ?

- Background
- Suspected Changes
- Known Changes

Monitoring Category: **All** ?

- Surveillance
- Trend
- Special

**Water quality:**  ?

Subnetwork: **All** ?

- Background
- Suspected Changes
- Known Changes

Monitoring Category: **All** ?

- Surveillance
- Trend
- Special

**FILTER MAP DATA**

- Principal Aquifer
- Available Data

**Water Level** **Water Quality** **Well Log**

**Tipton**

**SUMMARY** WELL LOG WATER LEVELS

Agency	U.S. Geological Survey
Site Name	Tipton
Site #	383929092464901
Site Type	WELL
Lat/Long(NAD83)	38.6580, -92.7801
Well Depth	750 ft
Local Aquifer Name	Canadian Series
National Aquifer Name	Ozark Plateaus aquifer system
Aquifer Type	UNCONFINED
Water Level Network	Trend - Suspected / Anticipated Changes

MISSOURI DEPARTMENT OF NATURAL RESOURCES  
Missouri Geological Survey

Number of Measurements: 258  
Period of Record: 1980-10-06 - 2016-12-19  
Highest Water Level: 0.56  
Lowest Water Level: 10.0

**SMITH AL**

**SUMMARY** WELL LOG WATER LEVELS

Longitude: 47.3237  
Latitude: -106.9149  
Elevation: 2636.00 ft.  
Well Depth: 145.00 ft.

CLAY	CLAY
SAND	SAND
SHALE	SHALE
COAL	COAL
ROCK	ROCK
SAND	SAND

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

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**Bear Grass School**

**SUMMARY** WELL LOG WATER LEVELS WATER QUALITY

Activity Start Da...	Activity Start Time	Characteristic Name	Measure Value	Units	Detection Condition	Value Type	Sample Fraction	USGS
2015-09-23	00:00:00 EST	Specific Conductance	275.9	uS	unknown		dissolved	
2015-09-23	00:00:00 EST	Salinity	0.1	ppt	unknown		dissolved	
2015-09-23	00:00:00 EST	chloride	not detected	mg/l	31		dissolved	
2015-09-23	00:00:00 EST	pH	7.42	pH	unknown		dissolved	
2012-09-06	00:00:00 EST	chloride	not detected	mg/l	28		dissolved	
2012-09-06	00:00:00 EST	pH	7.22	pH	unknown		dissolved	
2012-09-06	00:00:00 EST	Specific Conductance	526	uS	unknown		dissolved	
2012-09-06	00:00:00 EST	Salinity	0.3	ppt	unknown		dissolved	
2010-09-22	00:00:00 EST	Specific Conductance	260.1	uS	unknown		dissolved	
2010-09-22	00:00:00 EST	Salinity	0.1	ppt	unknown		dissolved	
2010-09-22	00:00:00 EST	chloride	not detected	mg/l	33		dissolved	
2010-09-22	00:00:00 EST	pH	7.31	pH	unknown		dissolved	
2007-04-18	00:00:00 EST	chloride	not detected	mg/l	28		dissolved	
2007-04-18	00:00:00 EST	pH	6.1	pH	unknown		dissolved	
2007-04-18	00:00:00 EST	Specific Conductance	120	uS	unknown		dissolved	
2007-04-18	00:00:00 EST	Salinity	0.1	ppt	unknown		dissolved	

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**Site Selection**

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

**CURRENT STATUS**

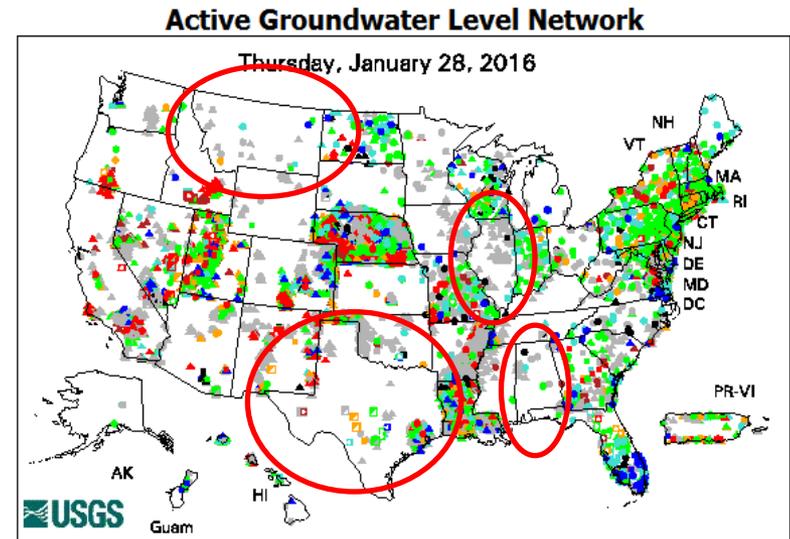
3022 Sites mapped  
2806 Water-level network wells



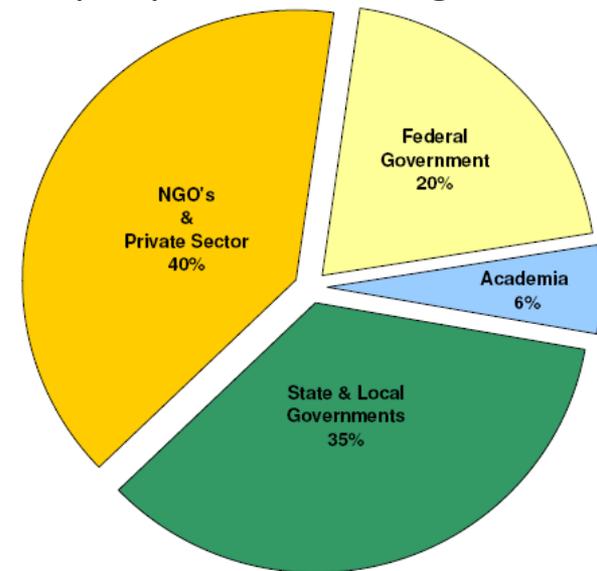
<http://cida.usgs.gov/ngwmn/>

# Background

- Why?
  - USGS Network “not adequate for national reporting” (Heinz Center, 2006)
  - Legal requirement (SECURE Act)
- How?
  - Leadership (Federal, in this case)
  - Advocacy (NGO’s, “Data Providers”)
  - Participation; Value Proposition
- Timeline
  - 2006 Idea “re-hatched”
  - 2007 SOGW formed
  - 2009 SECURE Act; “Framework”
  - 2010 Pilots begin
  - 2013 “Framework” re-issued
  - 2015 \$\$; Implementation begins
  - 2016 23 States via 3 PA’s
  - 2017 4<sup>th</sup> PA. Awards in progress



Subcommittee and Work Groups:  
70 people from 54 organizations



# Purpose

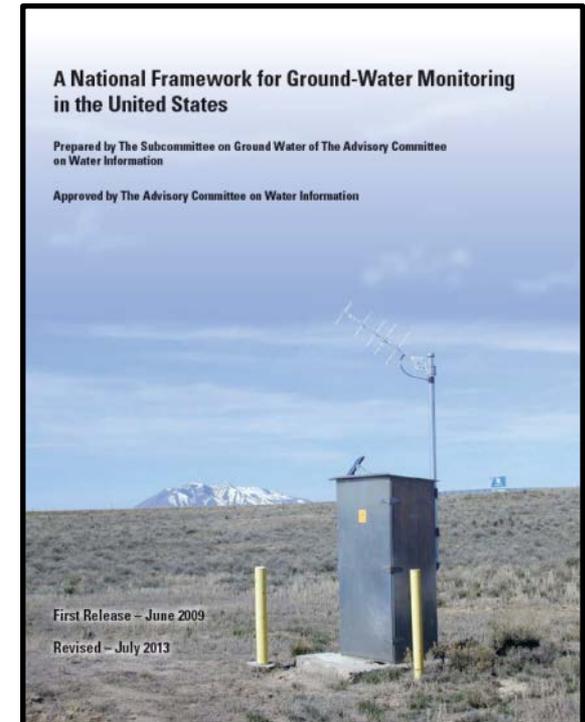
- Develop and encourage implementation of a nationwide, **long-term ground-water quantity and quality monitoring framework** that would provide information necessary for the planning, management, and development of ground-water supplies to meet current and future water needs, and ecosystem requirements.

NGWMN purpose framed by questions (manage expectations):

- *“Questions that can be addressed using NGWMN data”*
  - What is baseline? Status and trends of water levels/quality?
- Questions that can be addressed using NGWMN data, plus supplemental data
  - What are the impacts of land use change?
- Questions that can be addressed using NGWMN data, supplemental data, and additional resources
  - What are impacts to GW and SW due to pumping?

# Scope

- 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.
  - Levels + quality, focus is levels
  - Selected wells (versus “warehouse”)
  - Defined by “Framework” plus “tip sheets”
  - Framework contains (a) network designs, (b) limitations (questions), (c) standards, (d) minimum data elements.

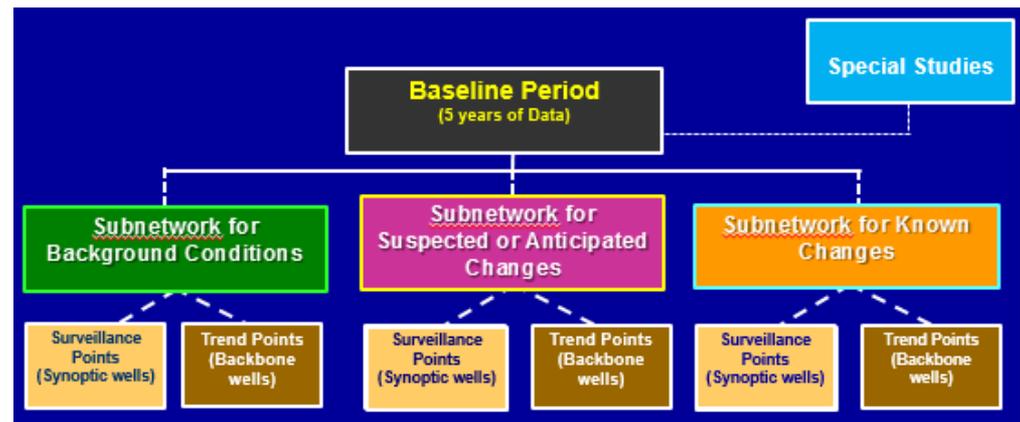


# Approach – Key Concepts and Lessons

- Leadership needed at many levels
- Consensus building is critical to buy-in
- Roll local expertise into National design

## Key tripping points

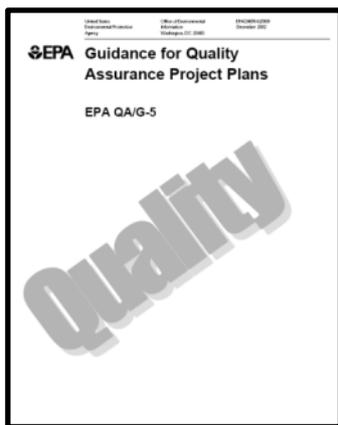
- Data ownership vs master database
- Regulatory concerns
- Security issues
  - Data available without restriction



# Key Concepts:

## Field/Lab Standards; Minimum Data Elements

- Consensus approach
- Fundamental principle – data provider must have documented standards.
- Result = data consumer obtains data of known quality, but not uniform quality.
- Enough information to locate the site (well/spring) in 3 dimensions, and provide basic information.
- Basic standards, but typically not so strict as to preclude participation.



# Known Quality

- The NGWMN portal will provide a series of pages for each Data Provider
  - Site Selection/Classification
  - Data Collection Techniques
  - Data Management
  - Other Agency Information

Link to: [South Carolina Department of Natural Resources Groundwater Information](#)

#### NGWMN Contact:

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The South Carolina Department of Natural Resources (SCDNR) maintains a network of wells to monitoring groundwater levels in major aquifer in South Carolina. This network is referred to as the DNR Groundwater Monitoring Network. Water levels in most wells have been measured since the mid 1990s. Most wells are equipped with automated data recorders. The remainder of wells are measured manually during bimonthly site visits. The SCDNR also maintains a Potentiometric Mapping Network. These wells are typically measured on a three-year interval and are used to produce potentiometric surface maps of major aquifers in South Carolina. Data from the network are used to assess groundwater availability, monitor drought conditions and calibrate hydrologic models. Water levels in most network wells have been measured since the mid 1990s. The SCDNR began participating in the NGWMN as a water level data provider in October 2015.

Principal aquifers monitored in South Carolina are the Surficial aquifer system, the Southeastern Coastal Plain aquifer system, and the Piedmont and Blue Ridge crystalline rock aquifers

#### NGWMN progress reports:

[Final report from initial NGWMN project, October 2015 to September 2016](#)

#### Current NGWMN Projects

2016 Round 2: October 1, 2016 to September 30, 2017

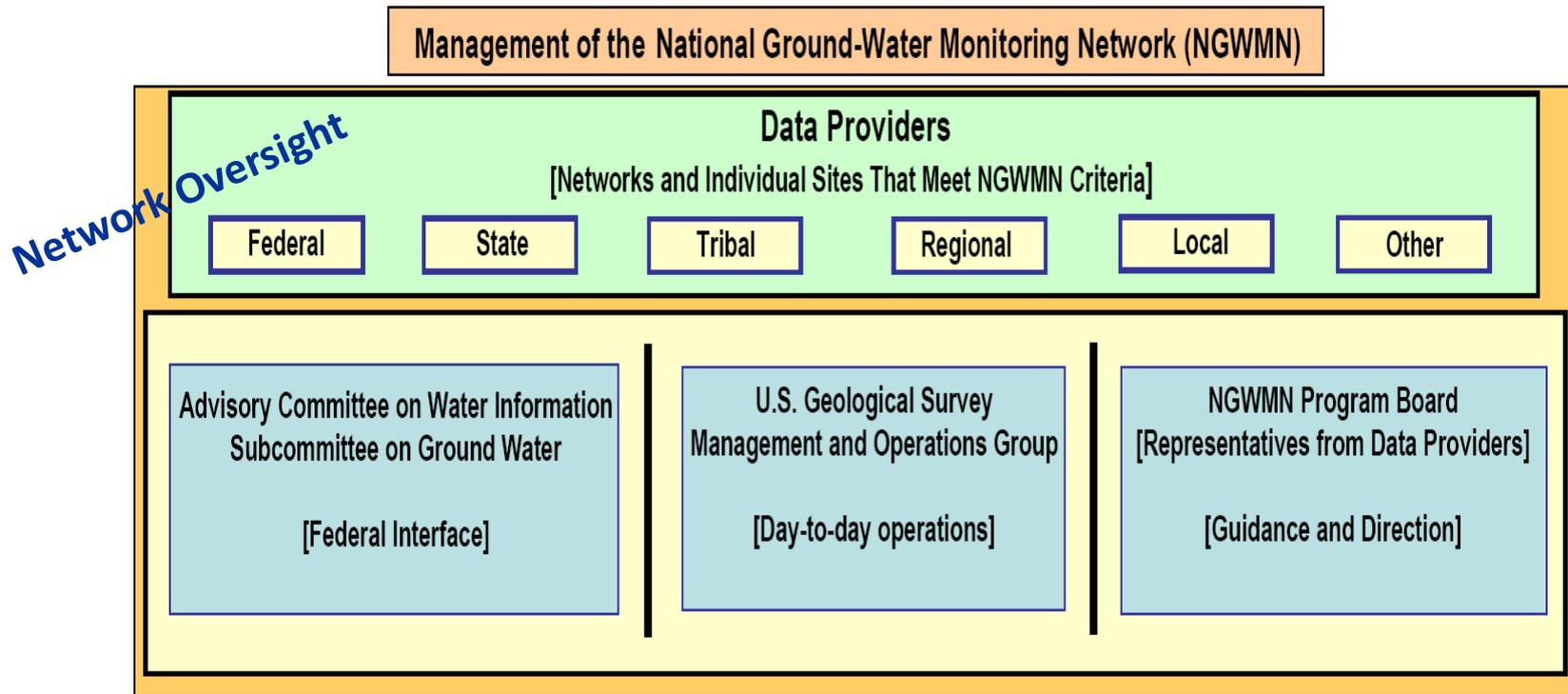
Project is to fill site information data gaps. The first part of the work involves entering lithologic data, well construction data, and historic water level data at NGWMN sites. The second part of the work is to determine tidal corrections for thirty network surveillance monitoring wells completed in the Upper Floridan aquifer. Five pressure transducers will be installed on rotating short term deployments to collect the water level data needed for the corrections.

#### NGWMN presentations

[December 2016 presentation to SOGW](#)

Site Selection and Classification	Data Collection Techniques	Data Management	Other Agency Information	
<b>Site Selection and Classification</b>				
<b>South Carolina Department of Natural Resources</b>				
<b>Site Selection</b>				
Based on the Guidance provided by the NGWMN sites were selected from both the DNR Groundwater Monitoring Network and the Potentiometric Mapping Well Networks. Sites were selected based on their period of record, anticipated future monitoring, spatial distribution and value to answering trans boundary issues. After sorting sites based on period of record and anticipated future availability of the monitoring sites, wells were evaluated for inclusion or exclusion in the NGWMN by a committee of hydrologist from DNR. Sites from the Groundwater Monitoring Network are considered Trend Sites for the frequency of data collection. Surveillance Sites were selected from wells in the Potentiometric Mapping Well Networks. The resulting selection identified 137 Trend and 301 Surveillance wells for inclusion into the NGWMN.				
<b>Site Classification</b>				
Using the guidance provided from the NGWMN, the wells selected for inclusion in the National network were classified into Subcategories. A committee of hydrologists from DNR examined the data available for each well. Hydrographs were created and examined to identify wells that had documented				

# Implementation Responsibilities



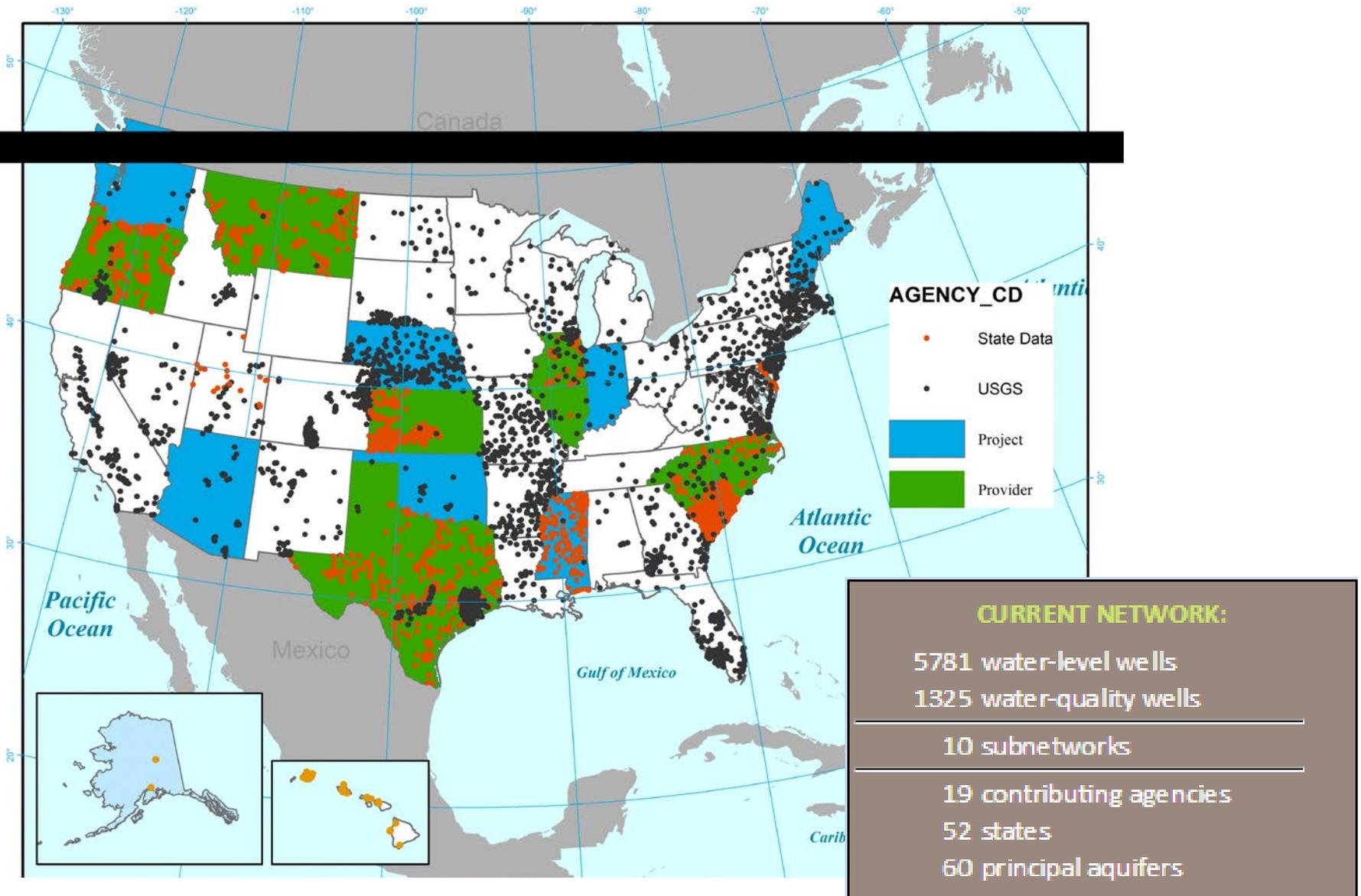
- Data Providers: Potentially, anyone with a database connected to the internet
  - Monitoring at a relevant scale or key site(s)
  - Respond to the annual Program Announcement (RFP)
  - Select sites (Framework/Tip Sheets)
  - Set up data sharing with portal
  - Maintain portal connection (and do normal work)

*Constructing the Network*

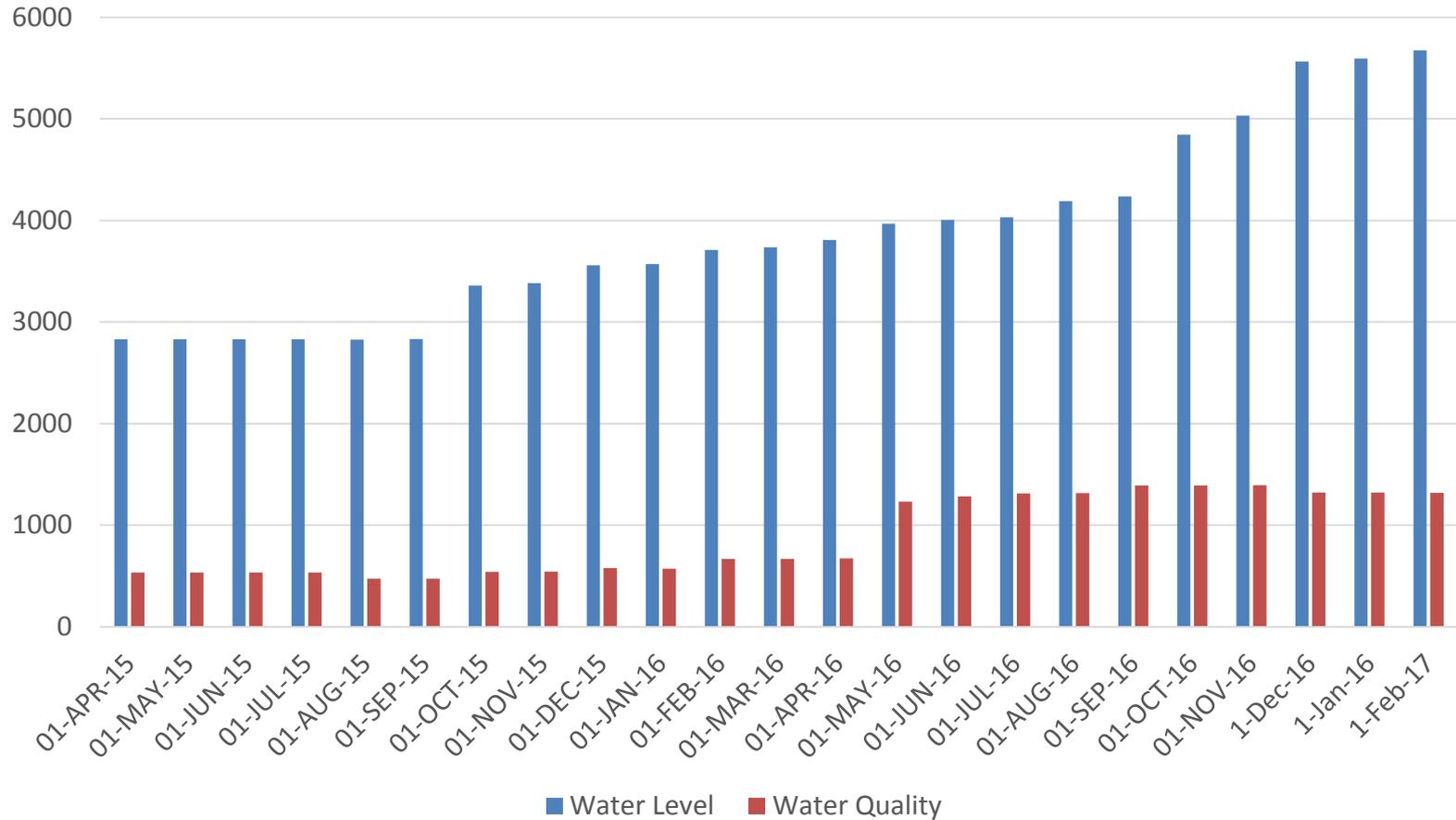
# *Funds for Data Providers*

- Annual “Program Announcement” – solicitation for NGWMN proposals
- Provides support for:
  - New data providers:
    - Select wells/springs
    - Classify wells/springs
    - Establish database connection to NGWMN portal using web services
    - Document Field Techniques
  - Ongoing support to existing data providers
    - Maintain portal connection and site list
    - Fill site information gaps
    - Maintain sites
    - Drill wells

# 2016 NGWMN Collaboration Status: Water Levels



# NGWMN Status: Growth of Network



In past year

- 51 states (+12)
- 60 Principal Aquifers (+7)





# National Ground-Water Monitoring Network

Advisory Committee on Water Information—Subcommittee on Ground Water

## *Acknowledgements*

Advisory Committee on Water Information, Subcommittee on Ground Water

Co-Chair: Bob Schreiber, CDM-Smith

Executive Secretary: Lauren Schapker, National Ground Water Association

Members and Collaborators

NGWMN Data Providers

U.S. Geological Survey

Doug Yeskis, GWSIP Coordinator

Daryll Pope, NGWMN Manager

