



National Ground-Water Monitoring Network

Advisory Committee on Water Information—Subcommittee on Ground Water

NGWMN Data Portal Status and Plans for Fiscal Year 2017

Jessica Lucido

Office of Water Information

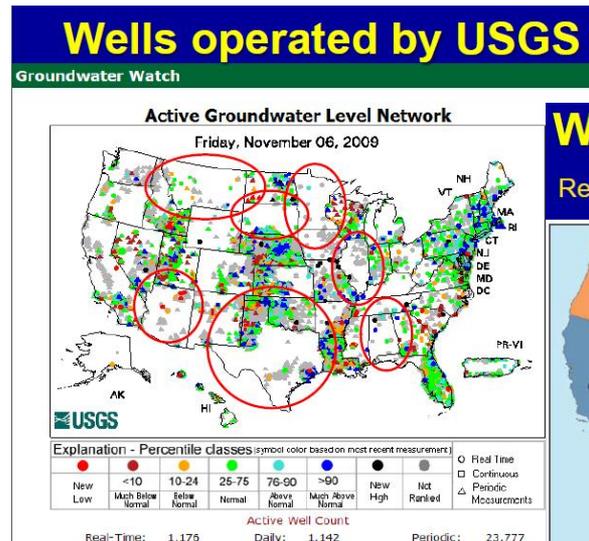
U.S Geological Survey

SOGW NGWMN Data Providers Meeting

December 6, 2016

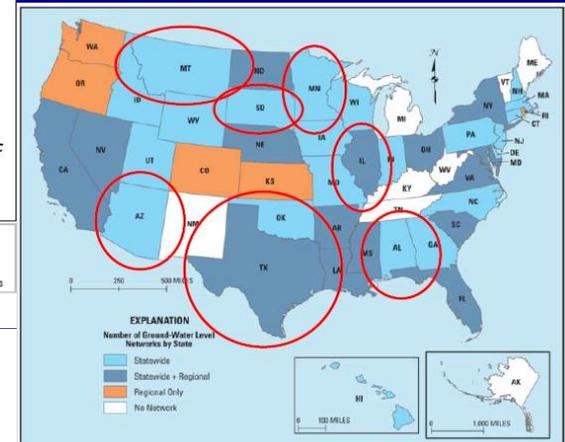
Portal Objectives:

- Integrate National, State and Local GW data
- Make all data available through a single web portal
- Automated data transfer from data providers, through portal, to public user
- Dynamically access data from original source
- Real-time or near real-time data available
- Data Available
 - Water levels
 - Water-quality
 - Lithology
 - Construction



Wells operated by States

Results from survey of State networks



New Features, New Data Providers, & What's Next

NETWORK STATUS

Network Growth

National Ground-Water Monitoring Network

The National Ground-Water Monitoring Network (NGWMN) is a product of the [Subcommittee on Ground Water](#) of the Federal Advisory Committee on Water Information (ACWI). The NGWMN is a compilation of selected groundwater monitoring wells from Federal, State, and local groundwater monitoring networks across the nation.

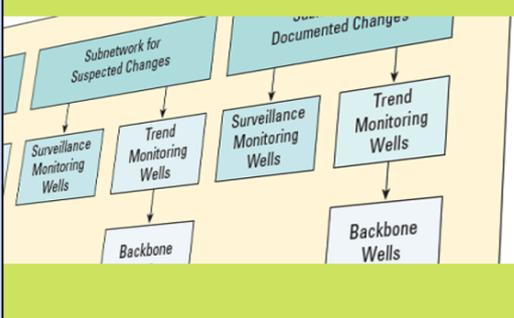
The [NGWMN Data Portal](#) provides access to groundwater data from multiple, dispersed databases in a web-based mapping application. The portal contains current and historical data including water levels, water quality, lithology, and well construction. The NGWMN is currently in the process of adding new data providers to the Network. Agencies or organizations collecting groundwater data can [find out more about becoming a data provider for the Network](#).

Funding to support data providers to the National Ground-Water Monitoring Network is provided through USGS Cooperative Agreements. Agencies can also find information about the status of the [USGS cooperative agreements](#).

NETWORK STATUS:

- 6,589 sites (+84%)
- 52 states (+12)
- 60 Principal Aquifers (+7)
- 7.9 M Water Levels (+49%)
- 754 K Water Quality Samples (+63%)

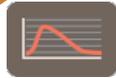
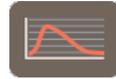
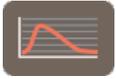
LEARN about the Network



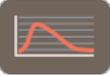
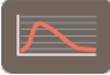
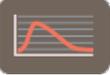
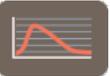
EXPLORE the Network



Updated Service Parsers

- TX Water Development Board     
- MT Bureau of Mines and Geology   
- IL State Water Survey  
- MN Pollution Control Agency 

New Data Providers Added

- UT Geological Survey  
- SC Department of Natural Resources  
- NC Department of Environmental and Natural Resources   
- OR Water Resources Department  
- KS Geological Survey  

New Features

- Put content management in place
- Enhanced web analytics
- Improved Handling of Significant Figures
- Water Level Statistics
- Water Level Status Map
- Attribution of Agencies with USGS Cooperative Matching Funds

National Ground-Water Monitoring Network Cooperative Agreements

The USGS is working with the Federal Advisory Committee on Water Information's (ACWI) Subcommittee on Ground Water (SOGW) to develop and administer the NGWMN. The NGWMN is designed as a cooperative groundwater data collection, management, and reporting system that will be based on data from selected wells and springs in existing Federal, State, Tribal, and local groundwater monitoring networks. The Network is envisioned as a long-term collaborative partnership among Federal and non-Federal data providers that will help address present and future groundwater management questions facing the Nation.

The USGS National Ground-Water Monitoring Network (NGWMN) offered funding to agencies in 2015 to support the NGWMN. Work on these projects included completion of tasks started during the NGWMN Pilot projects. The work also provided support to several agencies to start the process of becoming a new data provider. Projects initiated in 2015 are described in [this document](#).

The USGS National Ground-Water Monitoring Network (NGWMN) offered two competitive funding opportunities for the NGWMN in FY 2016. Funds were available to new data providers to select and classify sites within existing monitoring programs, to set up web services that will link the data to the [NGWMN Portal](#), and to produce a report describing this process. Funds were available to existing data providers to maintain web services and keep site information current. Existing data providers could also receive funding to collect data to improve site information, to maintain wells, and to drill new or replacement Network wells. The projects awarded in both rounds of funding in 2016 are described in [this document](#).

The USGS National Ground-Water Monitoring Network (NGWMN) Cooperative Funding Opportunity for 2017 to support the NGWMN is currently open on [grants.gov](#). The funding will be for a 2-year period in 2017-2018. Cooperative agreements will provide support for both new and existing data providers in the NGWMN. The USGS will fund new data providers to select and classify sites within existing monitoring programs, to set up web services that will link the data to the [NGWMN Portal](#), and to produce a report describing this process. Existing data providers can apply for funding to maintain web services and keep site information current. Data providers may also apply for funding to collect data to improve site information, to maintain wells, and to drill new or replacement Network wells.

Statistics & Map Service

WATER LEVEL STATISTICS

Water Level Statistics

National Ground-Water Monitoring Network

Site Number USGS-414315091252002	Site Name 080N05W22CBCB2 1941Elmira Depot 5 IACRN-4	
National Aquifer Name N400SLRDVN	Local Aquifer Name 350SLRN	State & County Iowa, Johnson County
Well Depth 82.5 feet	Aquifer Type Confined	

For information on the methods behind the statistics see [this page](#).

All available continuous and periodic data are used in calculating these statistics. For water level data that comes from the USGS National Water Information System, only approved values are used.

Overall Water Level Statistics (Depth to water, feet below land surface)

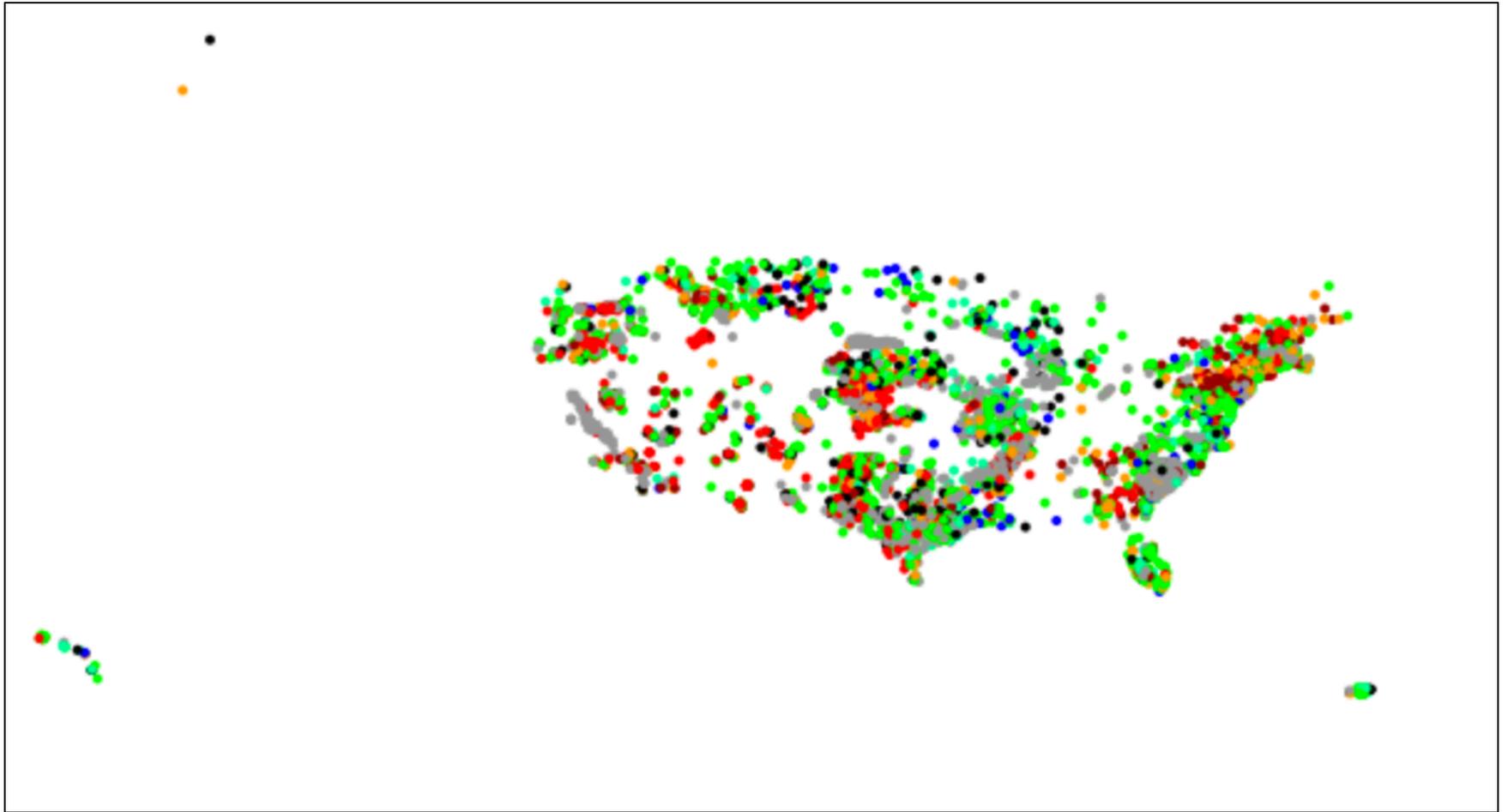
Highest Water Level	Median Water Level	Lowest Water Level	First Measurement Date	Last Measurement Date
102	120	160	1/12/12	5/12/16

Monthly Water Level Statistics (Depth to water, feet below land surface)

Month	Lowest Median	10th %ile	25th %ile	50th %ile	75th %ile	90th %ile	Highest Median	Number of Years
Jan	20.99	19.36	18.04	16.84	15.32	14.46	13.12	58
Feb	20.80	18.43	17.65	16.12	15.38	14.13	13.35	59
Mar	20.60	18.08	16.97	15.59	14.83	14.00	12.40	57
Apr	19.61	17.80	16.06	15.30	13.90	12.19	6.08	57

Statistics calculated on 11/15/2016

Map Display

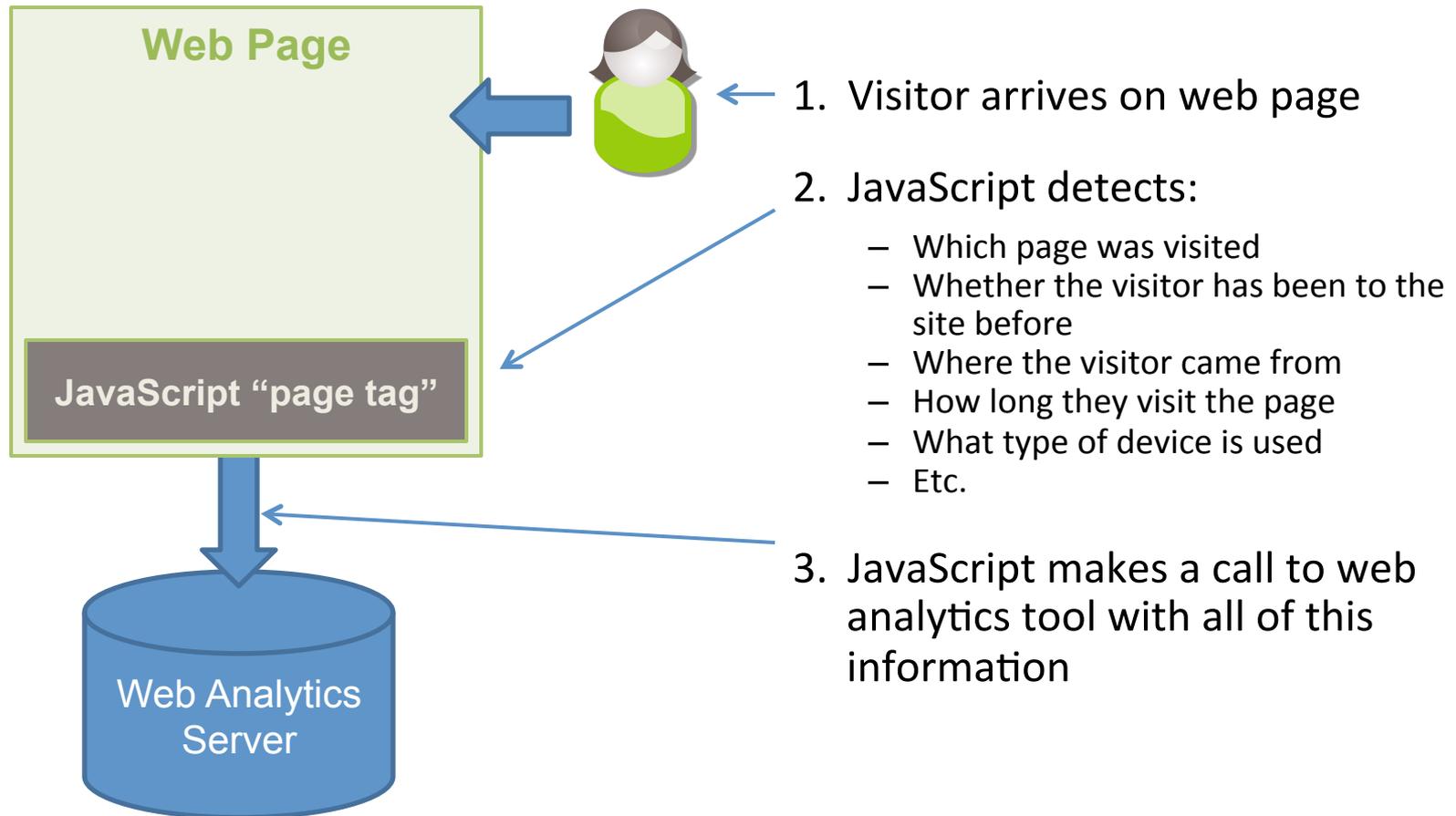


Introduction, Methods & Basic User Information

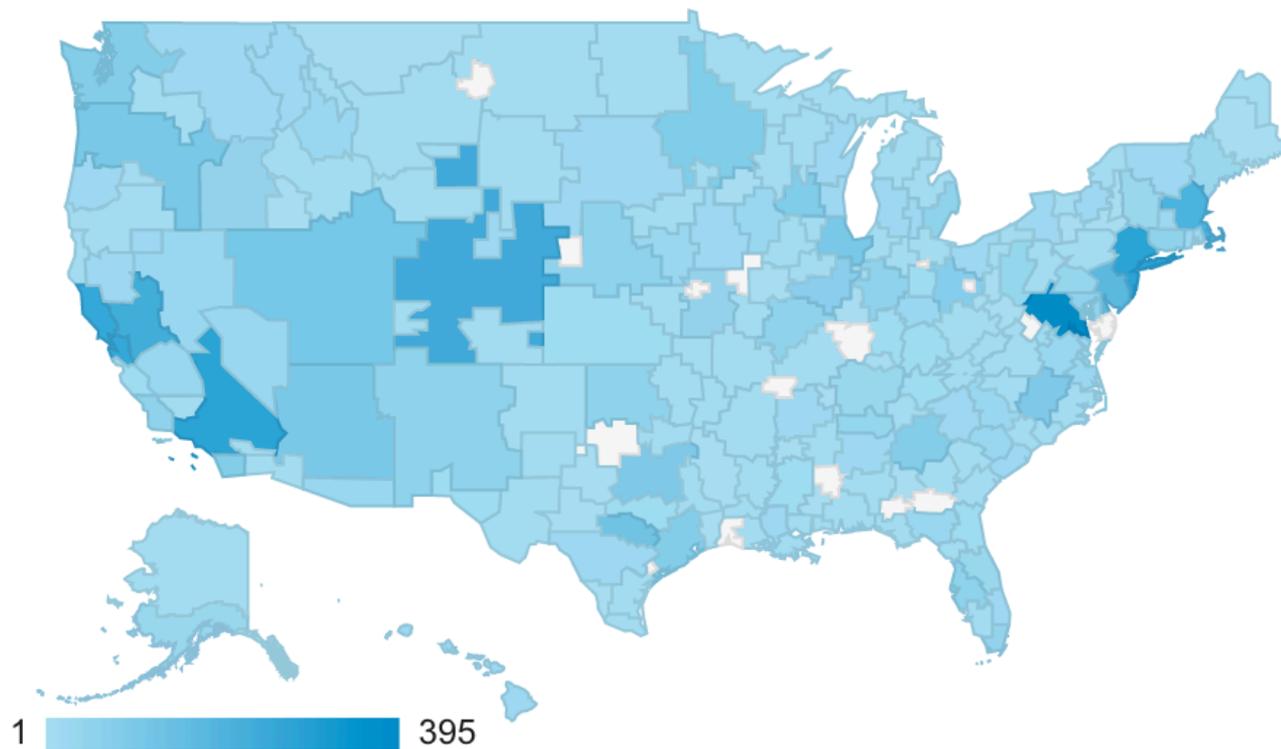
WEB ANALYTICS



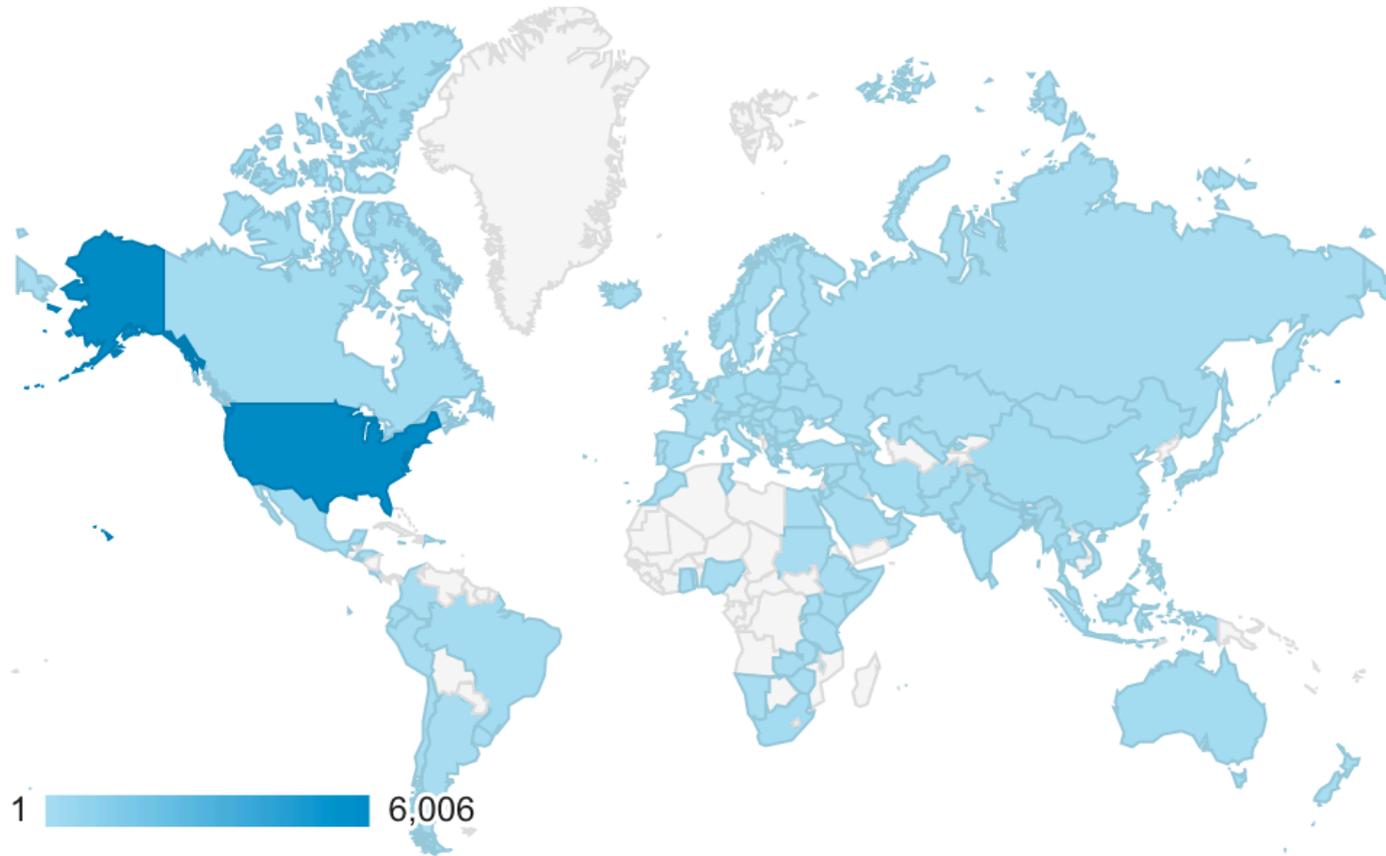
How Web Analytics Work: Tracking



Users



Users



Sessions and Users by Keyword

Keyword	Sessions	Users
(not set)	5,631	3,560
(not provided)	2,390	1,238
national groundwater monitoring network	42	27
ngwmn	28	16
groundwater monitoring	11	10
ground water monitoring	7	7
usgs groundwater monitoring	7	6
national ground water monitoring network	4	3
usgs ngwmn		
national ground-water monitoring network		

Sessions and Users by Full Referrer

Full Referrer	Sessions	Users
(direct)	2,426	1,196
google	2,301	1,215
water.usgs.gov/ogw/data.html	2,063	1,758
water.usgs.gov/ogw/networks.html	270	205
water.usgs.gov/usgs/ogw/NGWMN/	270	79
bing	190	121
usgs.gov/newsroom/article.asp	180	123
yahoo	74	29
portal_links/	71	53
	57	38

1.	u.s. geological survey	1,392 (16.98%)
2.	(not set)	592 (7.22%)
3.	united states geological survey	241 (2.94%)
4.	time warner cable internet llc	221 (2.70%)
5.	us department of the interior	213 (2.60%)
6.	charter communications	147 (1.79%)
7.	comcast cable communications holdings inc	125 (1.52%)
8.	texas department of information resources	117 (1.43%)
9.	state of oregon	113 (1.38%)
10.	state of nc - state telecommunications services	100 (1.22%)

Starting pages

7.4K sessions, 4.1K drop-offs

 /ngwmn/
6.5K



3.3K drop-offs
43.9% of total traffic

 /ngwmn/index.jsp
842

 /ngwmn/splash.jsp
71

 /ngwmn/doc
3

 /ngwmn/source/twdb
1

 (7 more pages)
7

1st Interaction

3.3K sessions, 2.3K drop-offs

 index.jsp
3.2K



 splash.jsp
50

 /ngwmn/
44

 documents
1

 tipsheets
1

2nd Interaction

1K sessions, 725 drop-offs

 /ngwmn/
896

 splash.jsp
77

 index.jsp
38

 cocoon
1

3rd Interaction

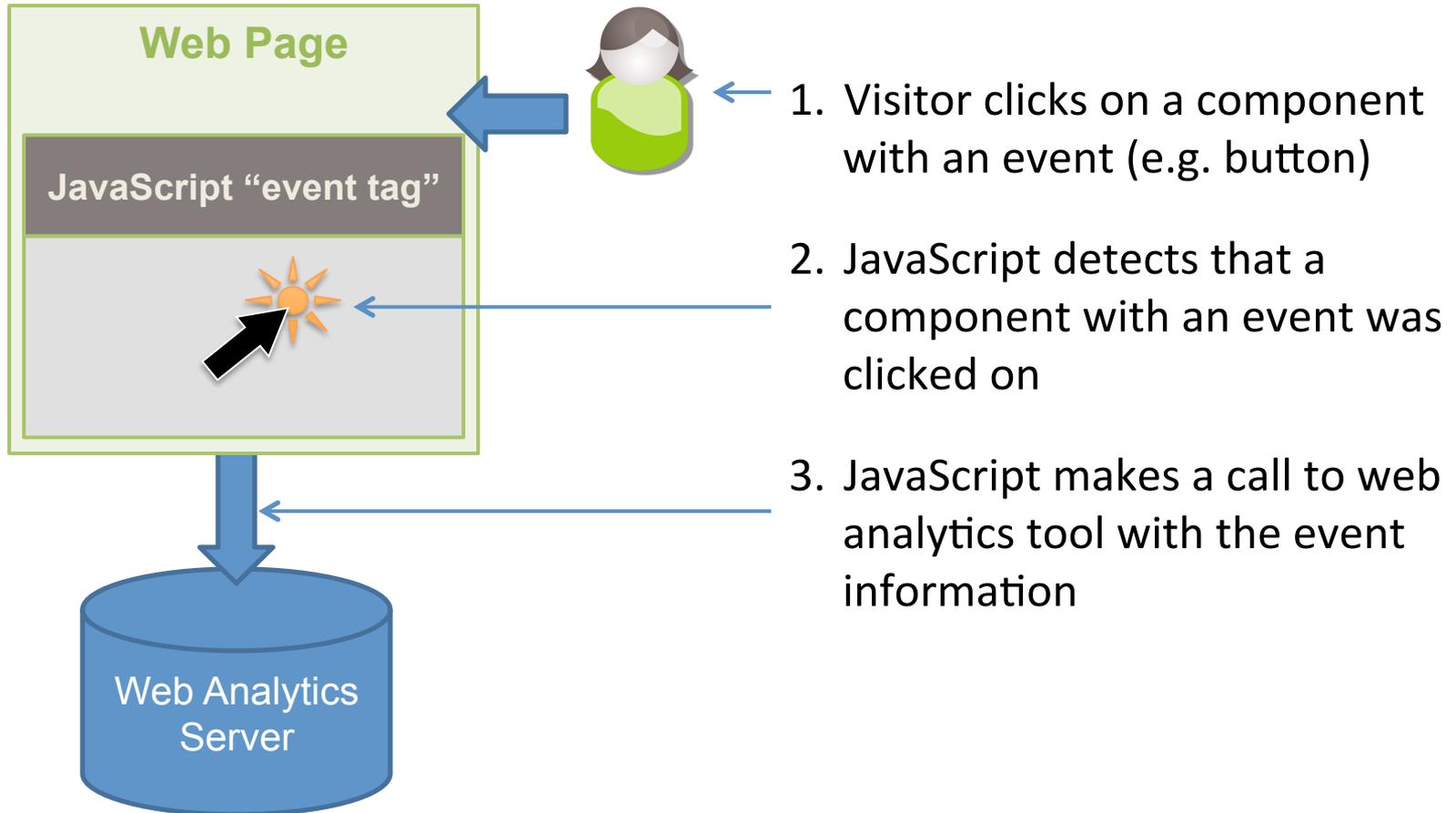
287 sessions, 183 drop-offs

 index.jsp
268

 /ngwmn/
10

 splash.jsp
9

How Web Analytics Work: Events

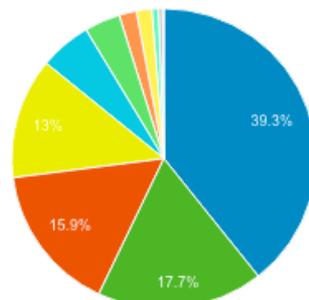


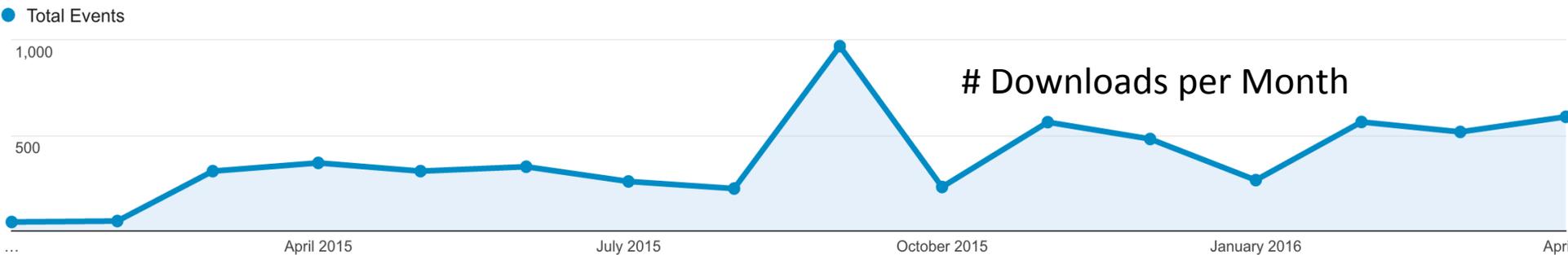
Using analytics to inform investment in product development

UNLEASHING THE POWER



1 Using Stats to Evaluate Feature Use

Event Category	Total Events	Total Events	Contribution to total: Total Events
	41,359 % of Total: 100.00% (41,359)	41,359 % of Total: 100.00% (41,359)	
1. Identify	16,274	39.35%	
2. panel filter	7,316	17.69%	
3. panel filter option	6,582	15.91%	
4. Download	5,372	12.99%	
5. panel	2,275	5.50%	
6. Data Type	1,572	3.80%	
7. filters	760	1.84%	
8. ExternalLink	679	1.64%	
9. download options	286	0.69%	
10. save filters accessed	57	0.14%	
11. map layers	44	0.11%	
12. save filters	37	0.09%	
13. help button	22	0.05%	



NGWMN NETWORKS

Water level: ?

Subnetwork: ?

- Background
- Suspected Changes
- Documented Changes

Monitoring Category: ?

- Surveillance
- Trend
- Special

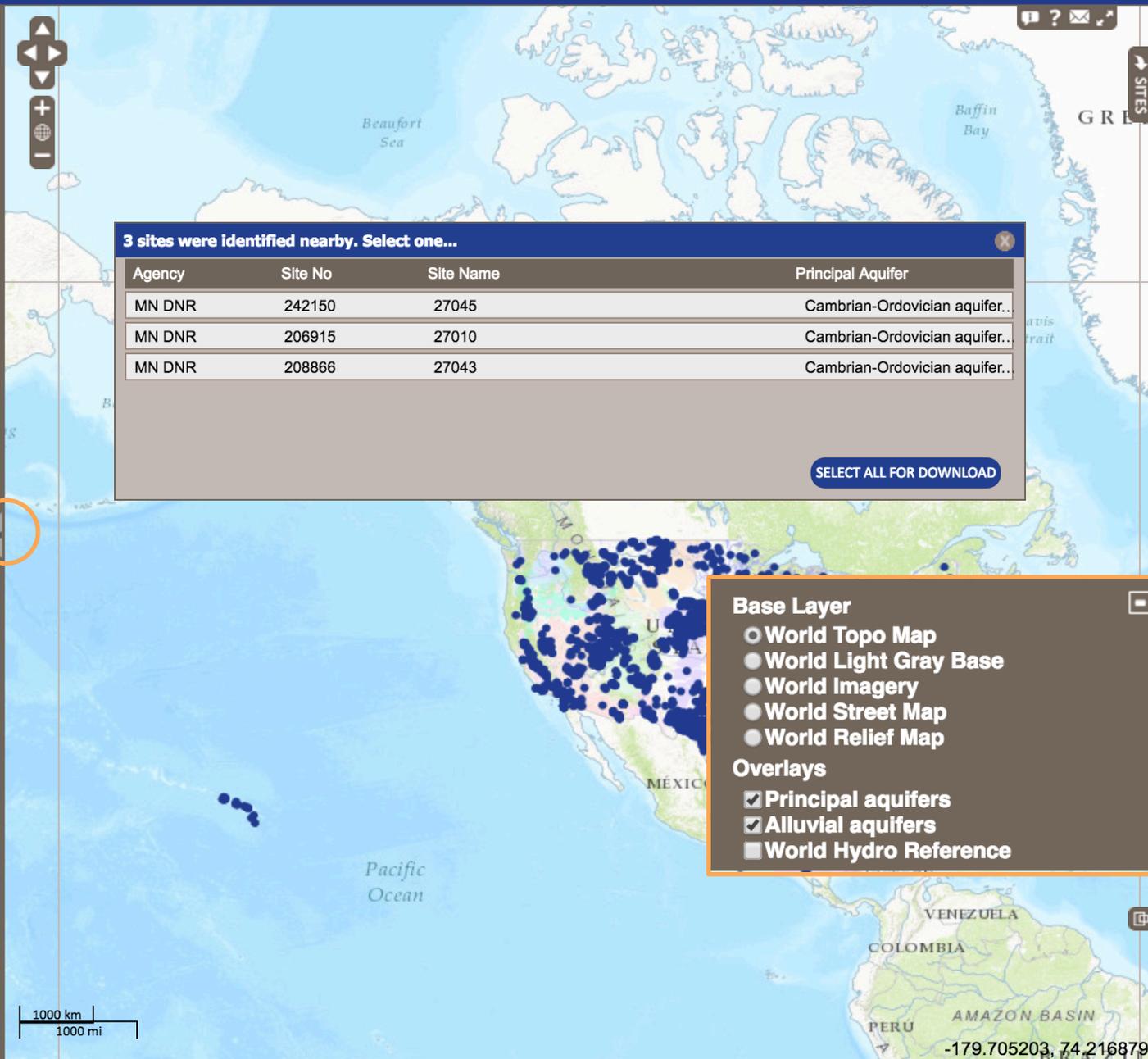
Water quality: ?

Subnetwork: ?

- Background
- Suspected Changes
- Documented Changes

Monitoring Category: ?

- Surveillance
- Trend
- Special



3 sites were identified nearby. Select one...

Agency	Site No	Site Name	Principal Aquifer
MN DNR	242150	27045	Cambrian-Ordovician aquifer..
MN DNR	206915	27010	Cambrian-Ordovician aquifer..
MN DNR	208866	27043	Cambrian-Ordovician aquifer..

SELECT ALL FOR DOWNLOAD

Base Layer

- World Topo Map
- World Light Gray Base
- World Imagery
- World Street Map
- World Relief Map

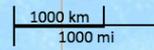
Overlays

- Principal aquifers
- Alluvial aquifers
- World Hydro Reference

FILTER MAP DATA

CURRENT STATUS

4801 Sites mapped
4801 Sites matching filter
3967 Water-level network wells
1231 Water-quality network wells



1 Using Stats to Evaluate Feature Use

Event Category	Total Events	Total Events	Contribution to total: Total Events
	41,359 % of Total: 100.00% (41,359)	41,359 % of Total: 100.00% (41,359)	
1. Identify	16,274	39.35%	
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11. map layers	44	0.11%	
12. save filters	37	0.09%	
13. help button	22	0.05%	

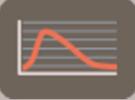


>> NGWMN NETWORKS

>> FILTER MAP DATA 

>> Principal Aquifer

>> Available Data

 Water Level

 Water Quality

 Well Log

>> Site Type

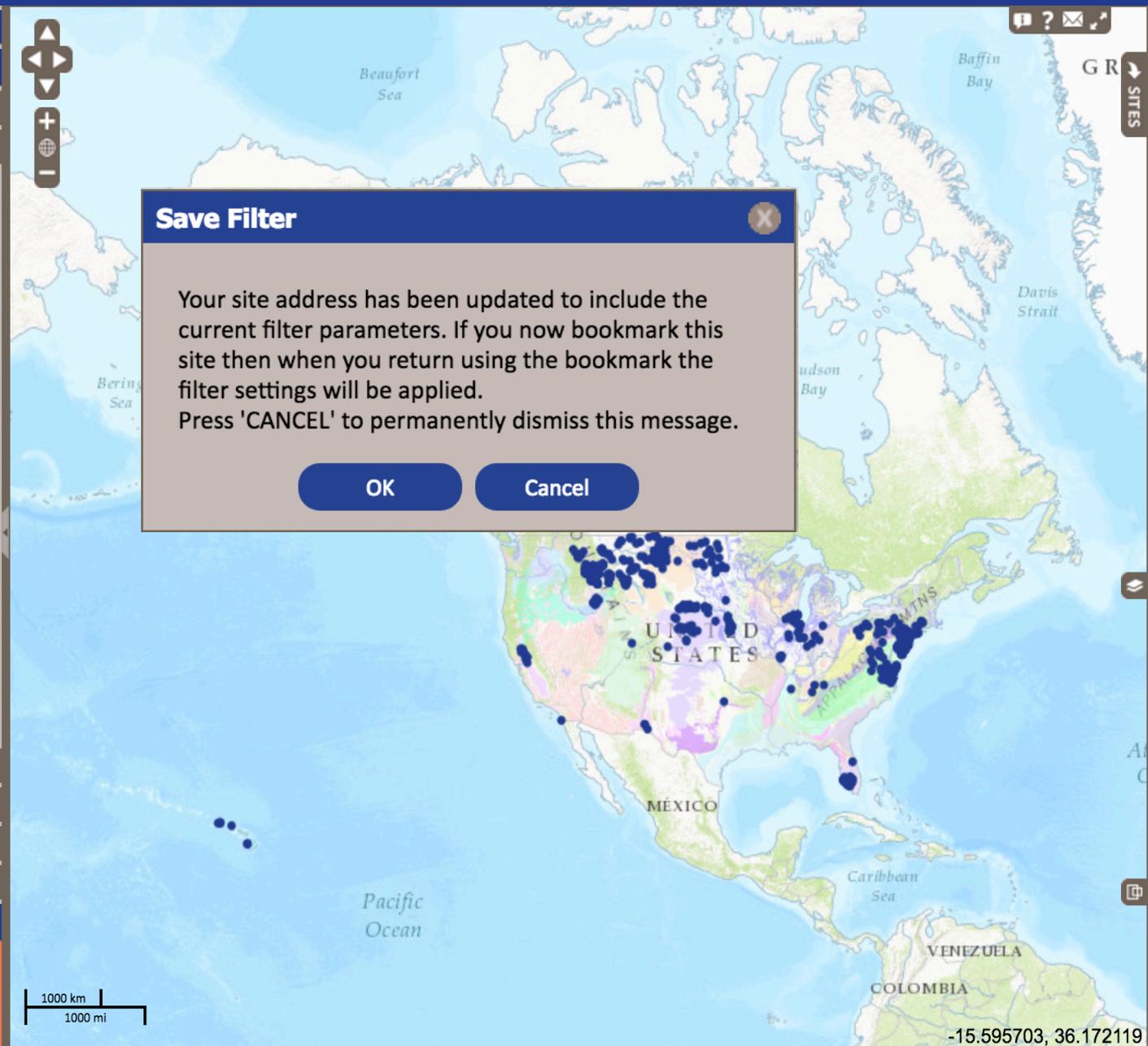
>> State and County

>> Contributing Agency

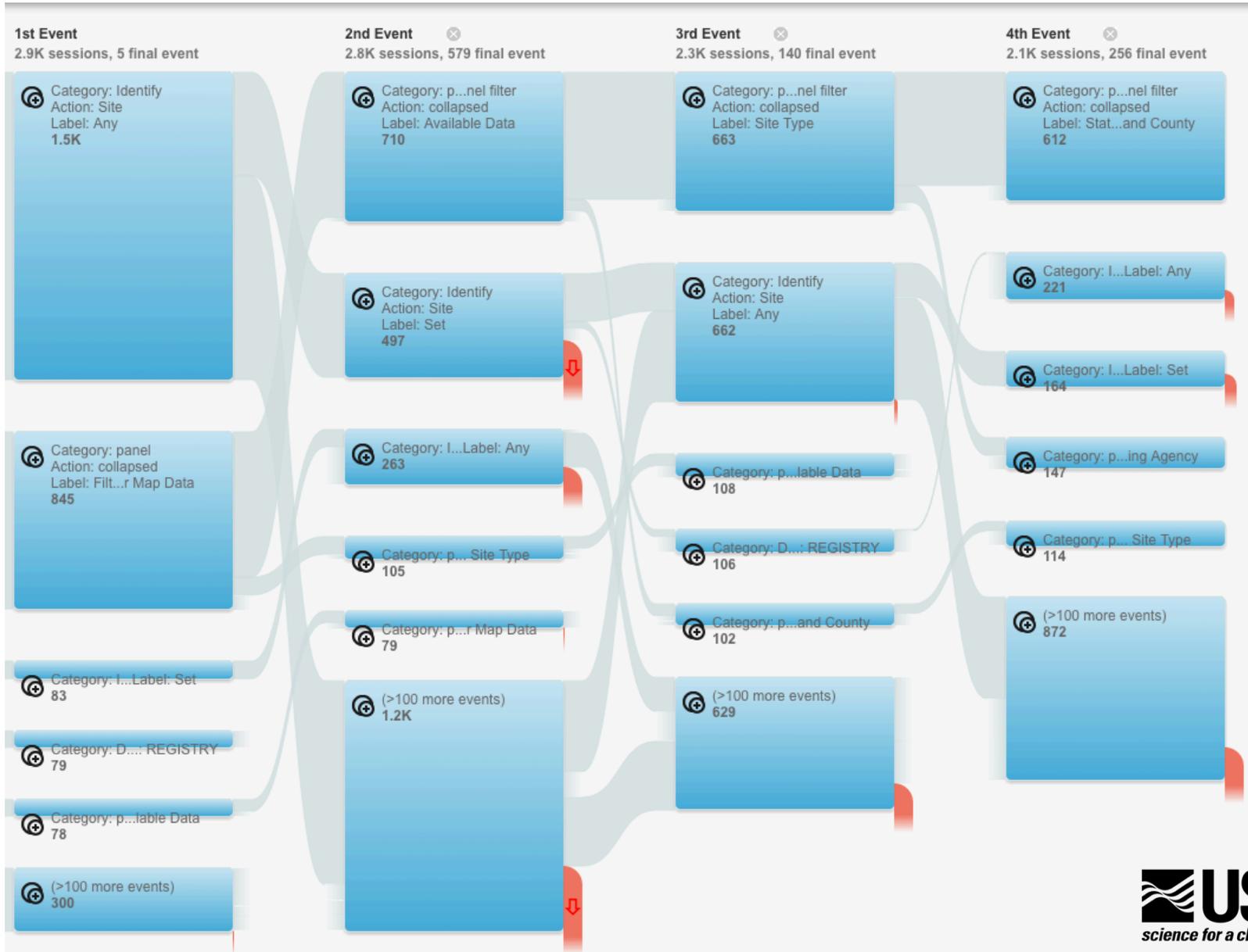
>> Aquifer Characteristics

CURRENT STATUS

985 Sites mapped
985 Sites matching filter
818 Water-level network wells
545 Water-quality network wells



2 Analyzing Workflows



2 Analyzing Workflows

2nd Event 2.8K sessions, 579 final event

3rd Event 2.3K sessions, 140 final event

4th Event 2.1K sessions, 256 final event

5th Event 1.9K sessions, 85 final event

6th Event 1.8K sessions, 139 final event

7th Event 1.7K sessions, 63 final event

Category: p...nel filter
Action: collapsed
Label: Available Data
695 / 710

Category: p...nel filter
Action: collapsed
Label: Site Type
619 / 663

Category: p...nel filter
Action: collapsed
Label: Stat...and County
567 / 612

Category: p...nel filter
Action: collapsed
Label: Cont...ing Agency
564 / 613

Category: p...nel filter
Action: collapsed
Label: Aquil...cteristics
644 / 723

Category: p...ter option
Action: checked
Label: Avail...ater Level
691 / 782

>> NGWMN NETWORKS

>> FILTER MAP DATA

>> Principal Aquifer

>> Available Data

Site Type

Water Level

Water Quality

Well Log

Water Level

Water Quality

Well Log

All

WELL

SPRING

Multiple states

One state, multiple counties

States:

All

Alabama

Alaska

Arizona

Arkansas

California

Colorado

Connecticut

Delaware

Florida

Georgia

Hawaii

Idaho

Illinois

Indiana

Iowa

Kansas

Kentucky

Louisiana

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

U.S. Geological Survey

Utah Geological Survey

Lithology:

All

Carbonate-rock aquifers

Igneous and metamorphic-rock

Other rock

Sandstone and carbonate-rock

Sandstone aquifers

Semiconsolidated sand aquifer

Unconsolidated sand and grav

Aquifer Type:

All

CONFINED

UNCONFINED

>> Site Type

>> State and County

>> Contributing Agency

>> Aquifer Characteristics

>> Site Type

>> State and County

>> Contributing Agency

>> Aquifer Characteristics

>> Site Type

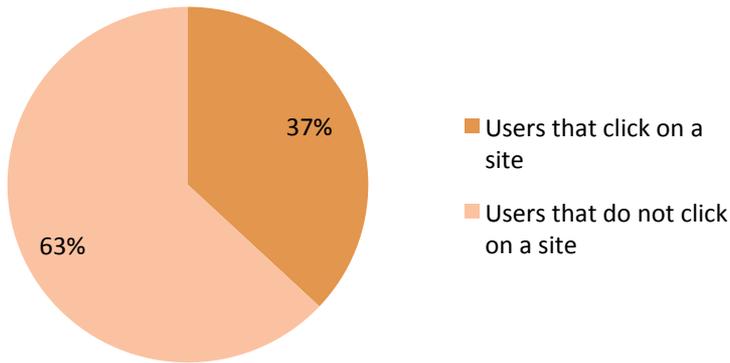
>> State and County

>> Contributing Agency

>> Aquifer Characteristics

3 Using Goals to Focus Development

% Users that Click on Sites

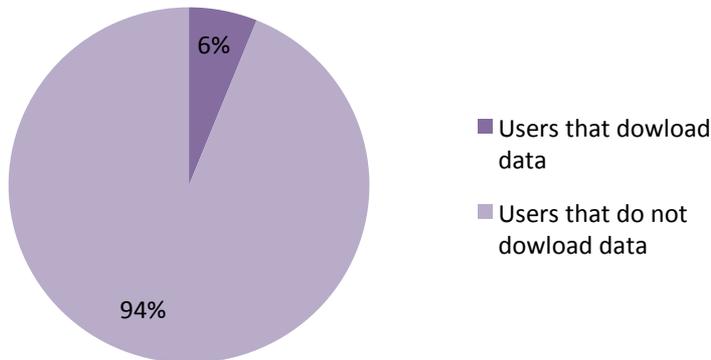


Goal Conversion Rate

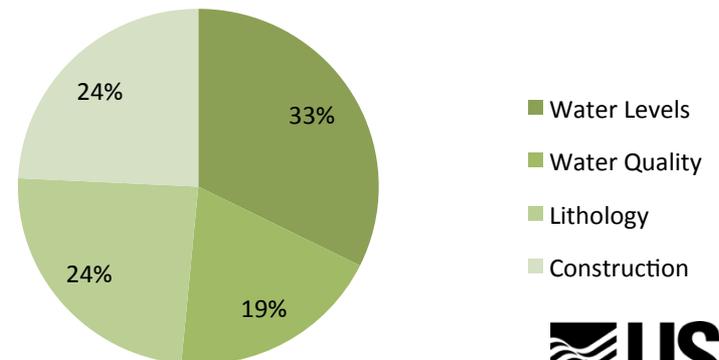
59.75%



% Users that Download Data



Data Download Types



Attribution of Agencies with USGS Cooperative Matching Funds

National Ground-Water Monitoring Network

The **National Ground-Water Monitoring Network (NGWMN)** is a compilation of selected wells monitoring groundwater aquifers all around the nation. The **NGWMN Data Portal** brings groundwater data together in one place to provide users with current and reliable information for the planning, management, and development of groundwater resources.

ABOUT THE NETWORK | THE DATA PORTAL | DATA PROVIDERS | GET INVOLVED

Data Providers

Current Data Providers | Resources for New Data Providers
| Pending Data Providers

Current Data Providers

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 following agencies are currently contributing to the NGWMN.

The agencies listed below participated in the pilot phase of the NGWMN. More data providers will be added to the network when full implementation occurs.

Arkansas Natural Resources Commission



USDA NRCS
U.S. Department of Agriculture
Natural Resources Conservation Service

EPA
United States Environmental Protection Agency



MISSOURI DEPARTMENT OF NATURAL RESOURCES
Missouri Geological Survey

Wofford Farm

SUMMARY | WELL LOG | WATER LEVELS

Agency	U.S. Geological Survey
Site Name	Wofford Farm
Site #	373653091330101
Site Type	WELL
Lat/Long(NAD83)	37.6147, -91.5504
Well Depth	355 ft
Local Aquifer Name	Gasconade Dolomite
National Aquifer Name	Ozark Plateaus aquifer system
Aquifer Type	UNCONFINED
Water Level Network	Trend - Documented Changes
Water Quality Network	-
Additional info	link



051389-- New Lisbon 1 Obs

SUMMARY | WELL LOG | WATER LEVELS | WATER QUALITY

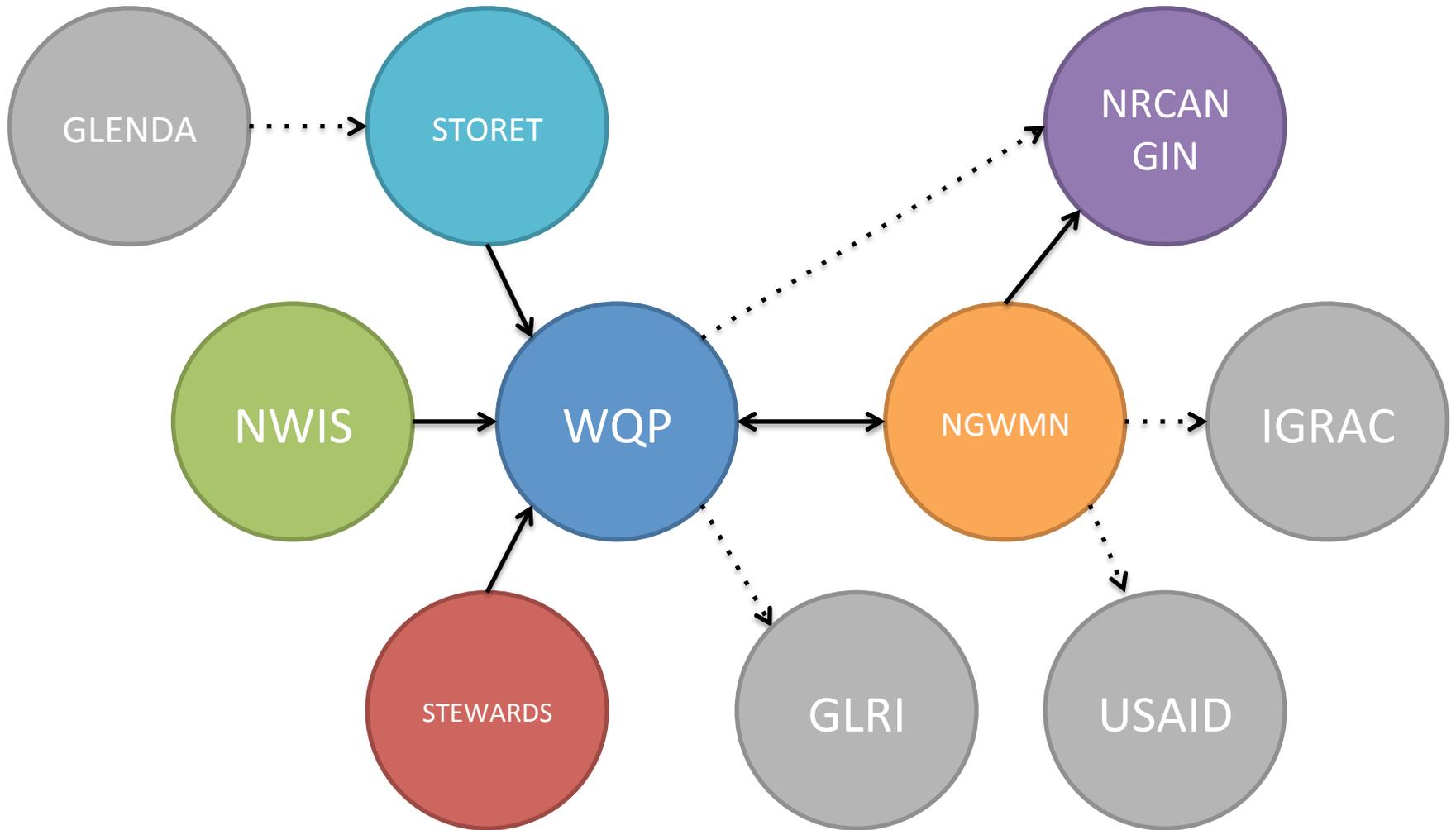
Agency	U.S. Geological Survey
Site Name	051389-- New Lisbon 1 Obs
Site #	395309074352101
Site Type	WELL
Lat/Long(NAD83)	39.8859, -74.5888
Well Depth	920 ft
Local Aquifer Name	Magothy-Raritan-Potomac Aquifer System, Upper Aquifer
National Aquifer Name	Northern Atlantic Coastal Plain aquifer system
Aquifer Type	CONFINED
Water Level Network	Trend - Documented Changes
Water Quality Network	Surveillance - Background
Additional info	link



SELECT FOR DOWNLOAD

WEB SERVICES & STANDARDS

Why are Web Services Important?



National Ground-Water Monitoring Network

Web Services Guide

IMPORTANT NOTICE: Changes are coming to this web service in the next couple of weeks. This service is being transitioned to HTTPS. The deadline has been moved up to **Dec. 12th, 2016**. Check back for further information.

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. In addition to providing access to these groundwater data from multiple, dispersed databases through a web-based mapping application, the data is accessible via web services. Web service requests may be submitted to obtain data directly and to bypass the **NGWMN** map interface. Currently only basic site information and water levels are available through web service requests. For full site information, lithology, construction information or water quality data visit the **NGWMN Data Portal**. For more information on the [NGWMN Data Portal](#), see the [User Guide](#).

Submitting a Web Service Request

The NGWMN web service follows the [OGC Sensor Observation Service \(SOS\)](#) specification and may be queried using a REST (REpresentational State Transfer) technique. This method may be used to retrieve water levels or basic site data. The basic building blocks for querying the services are outlined in the following series of tables. Most non-alphanumeric characters (such as punctuation) must be "[url-encoded](#)", (for example: space is "%20").

The request type and parameters must be appended to the base Uniform Resource Locator (URL) for the REST NGWMN web service (http://cida.usgs.gov/ngwmn_cache/sos?). There are three request options, which each offer a different type of data and have different options for query parameters.

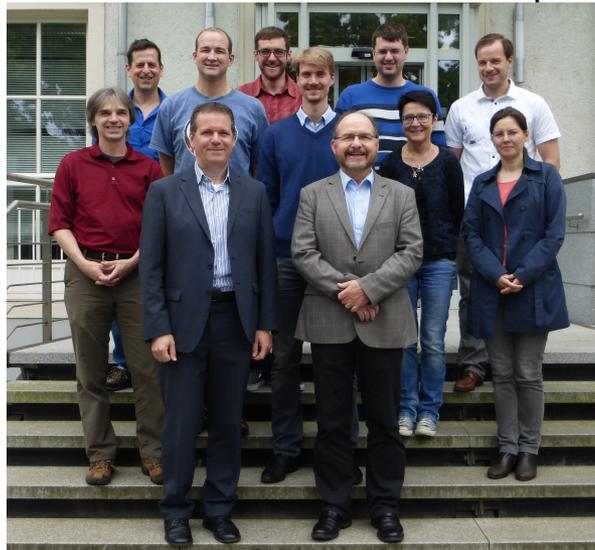
Table 1. URL-encoded request and offering, descriptions for NGWMN web service

Request	Offering	Description
GetCapabilities	Service Metadata	Operation for obtaining a description of the service's capabilities
GetObservation	Water Levels	Operation for obtaining water level observation time-series data
GetFeatureofInterest	Site Metadata	Operation for obtaining information about sites (wells or springs)

Groundwater Data Standards

- **GWML2 Approved as OGC Standard (5 packages)**
 - main, groundwater flow, groundwater well, groundwater constituents, well construction
 - Journal article in press
- **GW Interoperability Experiment 2 Engineering Report Published**
- **5 Use Cases:**
 - Commercial
 - Policy
 - Environmental
 - Scientific
 - Technologic

OGC HDWG Meeting
June 13-17, 2016



Attendees: Irina Dornblut (Federal Inst. of Hydrology (BfG) GRDC), Uli Looser (Federal Inst. of Hydrology (BfG) GRDC), Simon Jirka (52°North), Michael Utech (KISTERS AG), Martin Seul (CUAHSI), Erik de Rooij (Deltares), Silvano Pecora (ARPAE SIMC - AREA IDROLOGIA), Rob Atkinson (Metalinkage), David Blodgett (USGS), Diana Achim (National Institute of Hydrology and Water Management, Romania), Sylvain Grellet (BRGM)

Open Geospatial Consortium

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Approval Date: 2015-11-06

Publication Date: 2016-04-27

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Category: OGC[®] Engineering Report

Editor: Boyan Brodaric

OGC GroundWaterML 2 – GW2IE FINAL REPORT

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Access Data in 3 Ways

- Data Portal
 - Water Quality Portal: <http://www.waterqualitydata.us/>
 - National Ground-Water Monitoring Network: <https://cida.usgs.gov/ngwmn/>
- Web Service
 - WQP: http://www.waterqualitydata.us/webservices_documentation/
 - NGWMN: <https://cida.usgs.gov/ngwmn/web-services.jsp>
- R Client
 - <https://github.com/USGS-R/dataRetrieval>



Publications

Blodgett, D., Read, E., Lucido, J., Slawewski, T., and Young, D., 2016, An Analysis of Water Data Systems to Inform the Open Water Data Initiative: JAWRA Journal of the American Water Resources Association, v. 52, no. 4, p. 845-858. DOI: 10.1111/1752-1688.12417

Larsen, S., Hamilton, S., Lucido, J., Garner, B., and Young, D., 2016, Supporting Diverse Data Providers in the Open Water Data Initiative: Communicating Water Data Quality and Fitness of Use: JAWRA Journal of the American Water Resources Association, v. 52, no. 4, p. 859-872. DOI:10.1111/1752-1688.12406

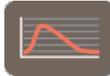
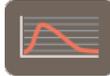
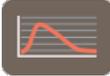
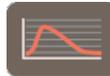
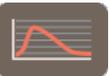
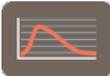
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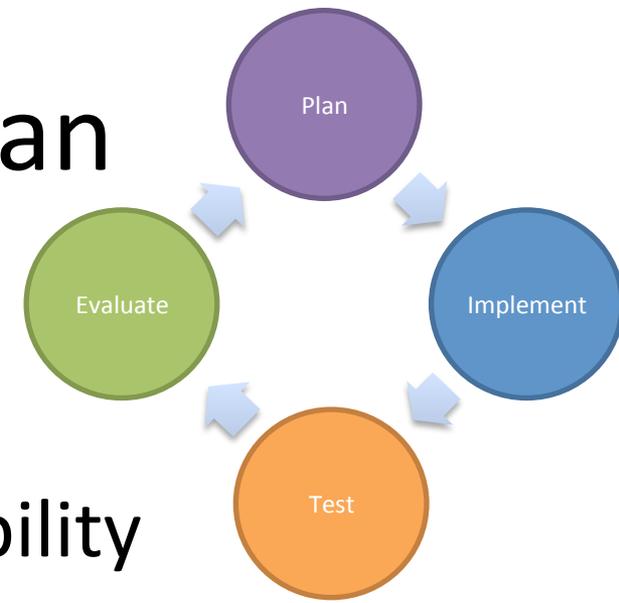
Fiscal Year 2017 Plans

WHAT'S NEXT?

Data Providers

- DE Geological Survey   
- MS Department of Environmental Quality  
- OK Water Resources Board 
- AK Department of Natural Resources   
- NH Geological Survey  
- ME Geological Survey  

FY17 Feature Plan



- Data Provider Pages
- Well Registry Bulk Loading Capability
- Support Deleting Sites through Well Registry Management System
- Provider capability for NGWMN to be used for the High Planes Aquifer studies
- Systems Operation & Maintenance