Alabama Surveillance Wells for the U.S. Geological Survey National Groundwater Monitoring Network

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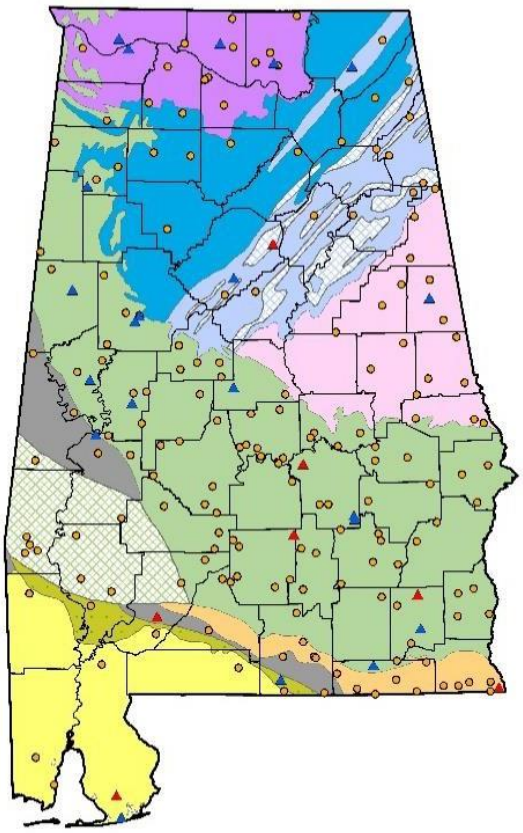

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November 3, 2022

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Open-File Report 2209

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BACKGROUND INFORMATION

DESCRIPTION OF AGENCY AND PURPOSE OF MONITORING

The Geological Survey of Alabama (GSA) has provided services and information to Alabama and its citizens as a natural resource data gathering and research agency since its establishment in 1848 by the Alabama legislature. As part of its mission, the GSA explores and evaluates the mineral, water, energy, biological, and other natural resources of the State of Alabama and conducts basic and applied research in these fields. Natural resource investigations of both groundwater and surface water began in 1898 when the GSA, in cooperation with the U.S. Geological Survey (USGS), began a systematic evaluation of the state's water resources (Johnston, 1933). For the past several decades, the GSA has published many reports related to both the groundwater and the surface water resources of the state.

The GSA Groundwater Assessment Program (GSA-GAP) has two ongoing monitoring programs: real-time and periodic. Collected data from the networks are made available to the public and to other state agencies such as the Drought Monitoring and Impact Group (MIG) of the Alabama Drought Assessment and Planning Team (ADAPT) through online portals https://gsa.state.al.us/gsa/groundwater/realtime and https://gsa.state.al.us/gsa/groundwater/periodic. Semi-annual water levels collected for the periodic monitoring program are used to create snapshots of specific aquifers that have been impacted by pumping, land use, and/or drought stressors. These programs are detailed in a publication entitled *An Assessment of Groundwater Resources in Alabama, 2010-2016* (GSA, 2018), which contains a detailed compilation of aquifer characteristics and groundwater wells monitored across the state. Alabama utilizes the major regional aquifer physiography to delineate groundwater flow regimes across the state as described in the program design section of Appendix 2 of a report by the Advisory Committee on Water Information Subcommittee on Ground Water (SOGW, 2013).

The GSA began systematically installing real-time monitoring equipment in wells throughout the state in 2010 to monitor and assess groundwater levels and to provide data on groundwater responses to water use, land use changes, and natural stressors.

Beginning in 2020, this data was made available to the National Groundwater Monitoring Network (NGWMN) operated by the U.S. Geological Survey. The NGWMN is a national database of vetted groundwater quality data presented in the same format to facilitate scientific research and the discernment of large-scale groundwater patterns. Providing the GSA-GAP groundwater monitoring network data through the NGWMN portal to view readily alongside adjacent states can reveal regional aquifer conditions within the southeastern region of the United States. This knowledge has the potential to lead to a better understanding of groundwater conditions, support water management decisions, and provide insight about groundwater responses to climatic changes in the region.

PROJECTS WITH THE NGWMN

This report summarizes the second phase of water-level data served to the NGWMN, under a previous USGS Award #G18AC00066, which identified and selected 172 wells as potential surveillance wells. The Objective 2 task for the current project, which is to classify and serve water-level data for the 172 Alabama surveillance wells to the NGWMN has been performed. This final technical report documents the services performed for Objective 2, in fulfillment of the current USGS NGWMN award (#G21AC10422).

OVERVIEW OF WORK

EXISTING MONITORING NETWORKS REPORTING TO THE NGWMN

The GSA-GAP has been actively monitoring groundwater conditions in the state since the early 1950s through a network of observation wells. Initially, this network was operated in conjunction with the USGS; however, currently the GSA-GAP has full responsibility for maintenance and operation of the network. Real-time data collection began in 2010, with the installation of the first equipment in some of the observation wells used for periodic monitoring. Since 2010, the GSA-GAP has focused on expanding the network, which now includes 30 well sites to monitor daily water-level changes across the state. The current real-time network incorporates wells in which water levels are recorded every two hours and reported twice daily to the GSA-GAP server. Updates are available daily via an online portal https://gsa.state.al.us/gsa/groundwater/realtime. Eight real-time wells are currently used to report groundwater level responses to climatic

variation to the MIG during the drought season, as well as other interested stakeholders throughout the state.

The GSA-GAP real-time monitoring network includes wells in eight of the principal aquifer systems established by the USGS (USGS, 2013). Hydrogeologic attributes of the principal aquifers in the State are described from north to south in the following sections.

MISSISSIPPIAN AQUIFERS

The Mississippian aquifer system in Alabama is comprised of karstic carbonate strata that have complex flow characteristics. The five wells with dedicated real-time equipment, located in this part of the state provide important water-level monitoring data trends in an area of active groundwater withdrawal from the Alabama portion of the Tennessee River (ATR) basin. Currently, this northern region of Alabama is experiencing unprecedented population growth expanding outward from the city of Huntsville, causing increasing competition for water resources, between municipal, agricultural, and residential land development sectors. Accurate water-level data provides useful information for water-supply planning purposes.

PENNSYLVANIAN AQUIFERS

The well-indurated clastic sandstone formations forming the Pennsylvanian aquifers are not prolific water-bearing units in Alabama. The aquifers consist of interbedded sandstone, shale, and coal, with limited primary permeability and low hydraulic conductivity. The entire hydrologic sequence is fractured, and the fracture-dominated flow patterns create inconsistent water availability issues. Most productive wells are deep and not directly connected to the surface. Surface reservoirs serve as the primary sources of public water in regions of the state underlain by these aquifers.

VALLEY AND RIDGE AQUIFERS

The Valley and Ridge aquifer system is a complex assemblage of sedimentary rocks overprinted by structural features developed during Paleozoic deformation. Limestones, dolomites, and sandstones serve as the primary aquifers, with thick shale units forming aquitards. The fractured character of the sequence has resulted in the development of preferential flow paths along strike, typically northeast to southwest, and vertical flow between the shale layers. As a result, this aquifer system is susceptible to vertical and

horizontal transport of contaminants released from surface sources. Valley and Ridge aquifers serve as an important source for public water, agricultural, and domestic water supplies.

PIEDMONT AND BLUE RIDGE AQUIFERS

The Piedmont and Blue Ridge aquifers in Alabama comprise metasedimentary, metaigneous, and igneous rocks arranged in a complex pattern, with rocks of distinct metamorphic grade separated by major regional fault systems. Metamorphic grade and mineral recrystallization and fabric development increases from low grade in the northeast to high grade in the southeast. Pre-, syn-, and post-metamorphic intrusive rocks occur throughout the central and southeastern areas of this aquifer system. Metamorphic overprinting has resulted in a loss of primary porosity, permeability, and groundwater storage. Water flow patterns are primarily controlled by fractures and other structural features. Surface water reservoirs are the primary sources for water supply in this region of the state.

MISSISSIPPI EMBAYMENT AQUIFER SYSTEM

The Mississippi embayment aquifer system comprises sedimentary confined and semi-confined aquifers. These aquifers consist of coarse sand layers interbedded with clay, which forms effective confining units. Groundwater storage and flow are controlled by the primary porosity and permeability characteristics of these layers. Groundwater provides a major source of water in this area of the state.

SOUTHEASTERN COASTAL PLAIN AQUIFER SYSTEM

The Southeastern Coastal Plain aquifer system is a regionally extensive and productive aquifer complex comprised of clastic sedimentary strata interbedded with thin layers of carbonate. This thick hydrogeologic unit of Cretaceous to upper Miocene sediments underlies more than half of the state of Alabama. Groundwater produced from this aquifer system provides essential water resources for public, domestic, and agricultural use. Wells in this system provide important real-time monitoring data useful for evaluating potential transboundary groundwater issues along Alabama’s western boundary with Mississippi through both surface and subsurface connections with the Tombigbee River.

FLORIDAN AQUIFER SYSTEM

The small portion of the regionally extensive Floridan aquifer system located in southern Alabama consists of clastic sedimentary strata interlayered with thin-bedded carbonates. Wells in this aquifer system provide valuable continuous water-level data to the NGWMN in an area of active groundwater withdrawals within the Apalachicola-Chattahoochee-Flint (ACF) River basin.

COASTAL LOWLANDS AND SURFICIAL AQUIFER SYSTEM

The Coastal lowlands and surficial aquifer system in Alabama comprises a complex assemblage of interbedded clays and sands in southern Alabama and along major waterways throughout the state. Wells in this aquifer system in the southern part of the state are susceptible to storm surge impacts from hurricanes and large storm systems. Data from these wells are useful to evaluate saltwater encroachment and climate change issues along the coast.

WELL SITE SELECTION FOR THE NGWMN

The purpose of the NGWMN is to provide a national overview of long-term trends across regional aquifer systems. As such, wells are selected to differentiate between the effects of short-term and long-term hydrologic stressors to the aquifers. As a data provider to the NGWMN, the GSA-GAP staff selected wells from the current water-level monitoring programs to meet the requirements of the NGWMN after reviewing the criteria for inclusion into the USGS catalog.

TREND WELL NETWORK

Trend monitoring, as described in Section 4.5.1 of the SOGW (2013) report, is designed to look at long-term and seasonal water-level variations at frequent measuring intervals for a limited number of wells across the state. The GSA-GAP staff selected trend wells from the state's real-time network, which derives water-level elevation data from the principal aquifer systems identified in Alabama. The trend well locations are shown in figure 1.

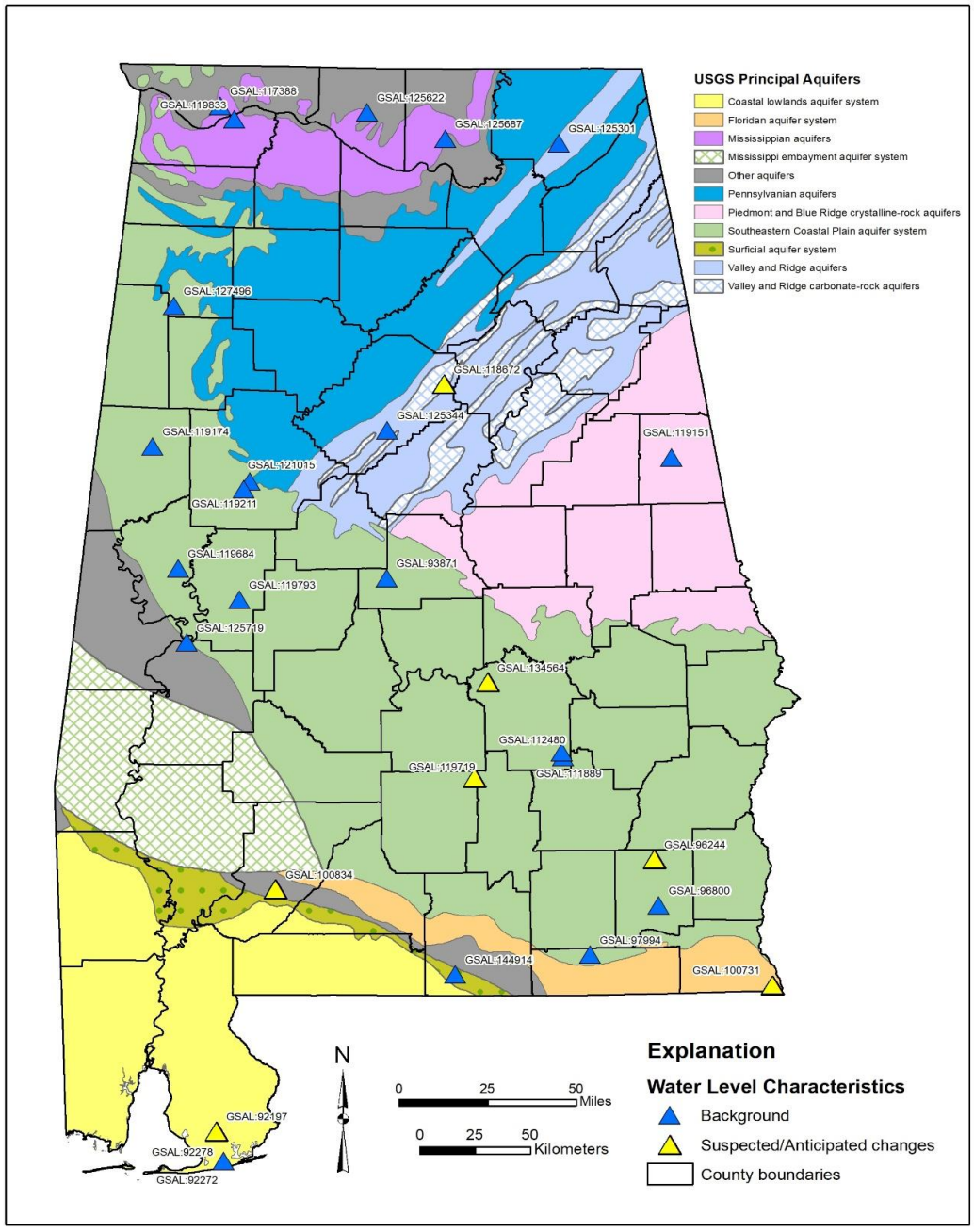

Figure 1. Location of NGWMN trend monitoring wells in Alabama.

Twenty-nine wells in Alabama's real-time network were established as trend-monitoring wells in appendix table A-1, and the daily data are currently being served to the NGWMN program online at cida.usgs.gov/ngwmn. Water-level elevations are measured by pressure transducers and recorded on a data logger every two hours. These data are transmitted to a GSA-GAP dedicated computer each day, and the daily average for each trend monitoring well is served to the NGWMN portal every evening.

SURVEILLANCE WELL NETWORK

Surveillance monitoring, as described in Section 4.5.1 of the SOGW (2013) report, is designed to periodically "tie together" the trend monitoring well data, providing greater spatial coverage to fill in spatial gaps between trend wells that are monitored on a more frequent basis. The frequency of measurements made in Alabama's surveillance wells is semi-annual, which provides an extensive snapshot of overall aquifer conditions in the state when combined with trend well data.

The selection of periodic wells to be included in the NGWMN surveillance network was a three-step process. In the first step, ineligible wells were eliminated from further consideration. In general, these eliminated wells either had access problems or did not have detailed lithologic or well construction data on record.

As clearly stated in section 4.5.1 of the SOGW (2013) report, the monitoring wells selected for the network are most representative of *static* water levels. The GSA-GAP staff eliminated the public supply wells and periodic monitoring wells within a 1-mile radius of a public supply well from further consideration as potential surveillance wells, due the possible drawdown effects of high-capacity pumping.

The second step was a process to evaluate the remaining wells in relation to the NGWMN goals, whereby the five factors listed below were quantified and weighted:

- years of data,
- distance from public supply wells,
- proximity to other monitoring wells,
- distance from real-time wells, and

- proximity to a stream gage.

The third and final step of the process was to rank the periodic program wells as potential candidates for the NGWMN surveillance subnetwork. Listed below in order of consideration, are the weighted factors that *improved* the priority ranking for inclusion into the USGS NGWMN as a surveillance site:

1. greater number of years of water-level elevation data,
2. further distance from public supply well,
3. number and proximity of monitoring wells within a 5-mile radius,
4. further distance from an existing real-time well, and
5. close proximity to a monitored stream gage.

A more detailed breakdown of each step in this well selection process is included in the final contract report submitted to USGS for Grant #G18AC00066 entitled *Establishing Alabama as a Data Provider to the USGS National Groundwater Monitoring Network* (Arnold, 2020).

Based on the technical analyses of the periodic program wells, as outlined above and described in the previous report (Arnold, 2020), 172 monitoring wells were selected from Alabama's periodic network to be included in the USGS NGWMN surveillance well network (appendix table A-2). Wells were selected in order of usefulness and suitability of the water-level measurements as data points for inclusion in the national network. The majority of the surveillance wells, 114, are in unconfined aquifers, and the remaining 58 wells are in confined aquifers.

Water-level data collected from the periodic and real-time wells are stored in two separate databases on the GSA servers; therefore, additional web services had to be established between the GSA and USGS servers in order to serve the data to the NGWMN.

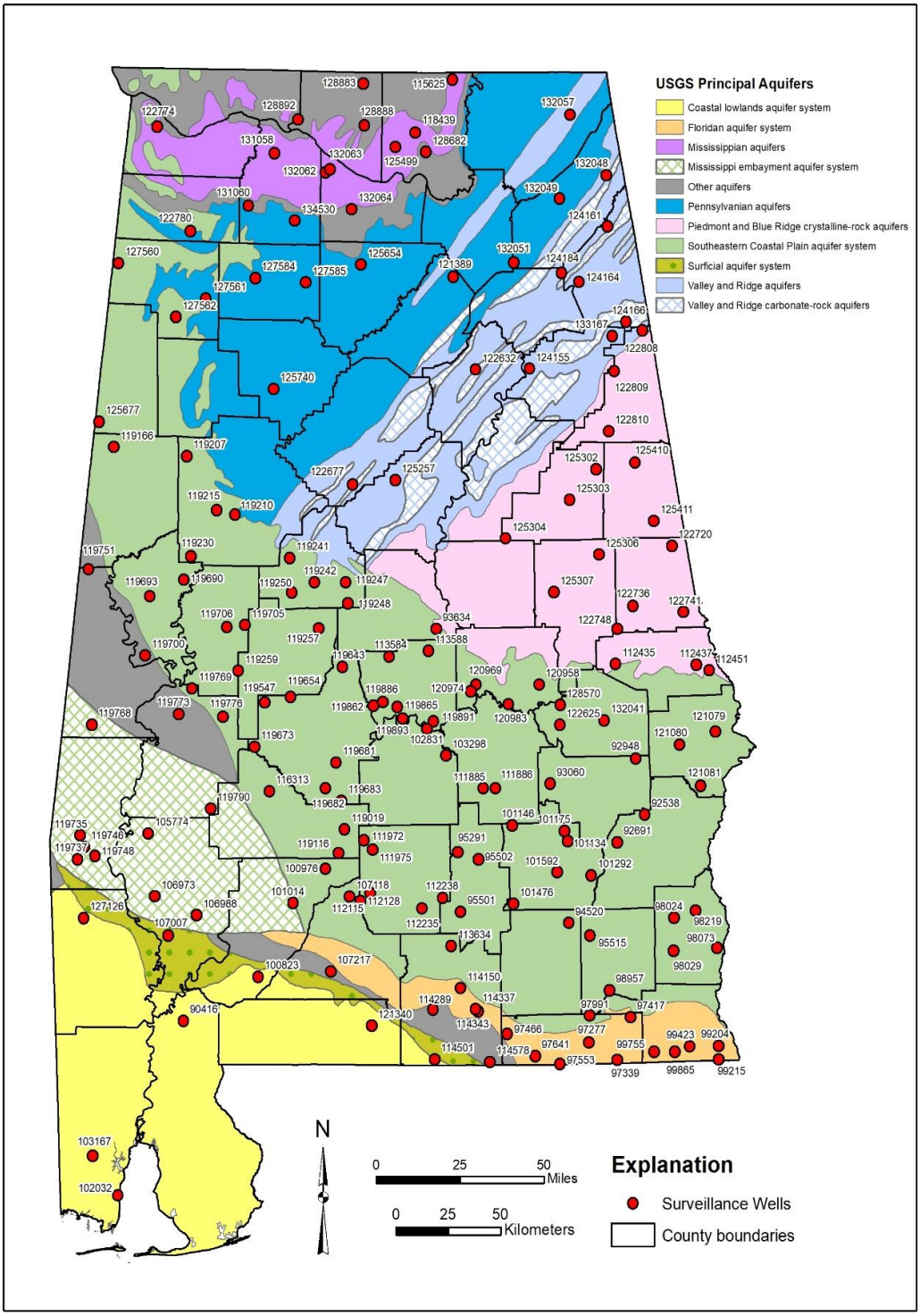

Figure 2. Location of NGWMN surveillance monitoring wells in Alabama.

ASSIGNING SUBNETWORKS AND MONITORING CATEGORIES

Groundwater monitoring wells from both the surveillance and trend network were evaluated for placement into the appropriate subnetwork classification defined as *background*, *suspected changes*, and *documented changes* in section 1.4.3 of the SOGW report (2013). The inclusion of wells into these subnetworks is based upon the identification of anthropogenic effects on water levels due to land use and development and withdrawal due to pumping. GSA geologists used the historic hydrographs to visually interpret the water-level drawdown for each well and further classify the surveillance wells into subnetwork categories established by the NGWMN. To fulfill the current scope of work, the subclassified surveillance wells were assigned to these subnetworks, and the well data were uploaded to the NGWMN portal.

BACKGROUND SUBNETWORK

As defined by the USGS NGWMN, the *background* subnetwork includes monitoring sites that show minimal anthropogenic effects as measured from water-level elevations. Of the 172 surveillance monitoring wells in Alabama added to the NGWMN for this project, 116 are classified as background. Moreover, 22 of the 29 GSA-GAP trend network wells were classified as background in the NGWMN water level database (see GSA Open-File Report 2011, November 2020). Background wells are spatially distributed throughout all of the principal aquifers located in Alabama (figure 3).

SUSPECTED OR ANTICIPATED CHANGES SUBNETWORK

The *suspected changes* subnetwork includes monitoring wells in principal aquifer systems that have water level variations due to observed or anticipated anthropogenic influence. The *suspected or anticipated changes* subnetwork may be in areas where land-use changes or pumping effects are known or anticipated based on population growth and property development. At this time, 37 of the surveillance wells and 7 of the GSA-GAP trend network wells are listed in the *suspected or anticipated changes* subnetwork (see figure 3 and appendix table A-1). Most of these wells are in the southern half of the state in the Southeastern Coastal Plain and confining units, the Floridan, and the Coastal Lowland aquifer systems. A limited number of wells (6) within principal aquifers in the northern half of the state are classified in this subnetwork.

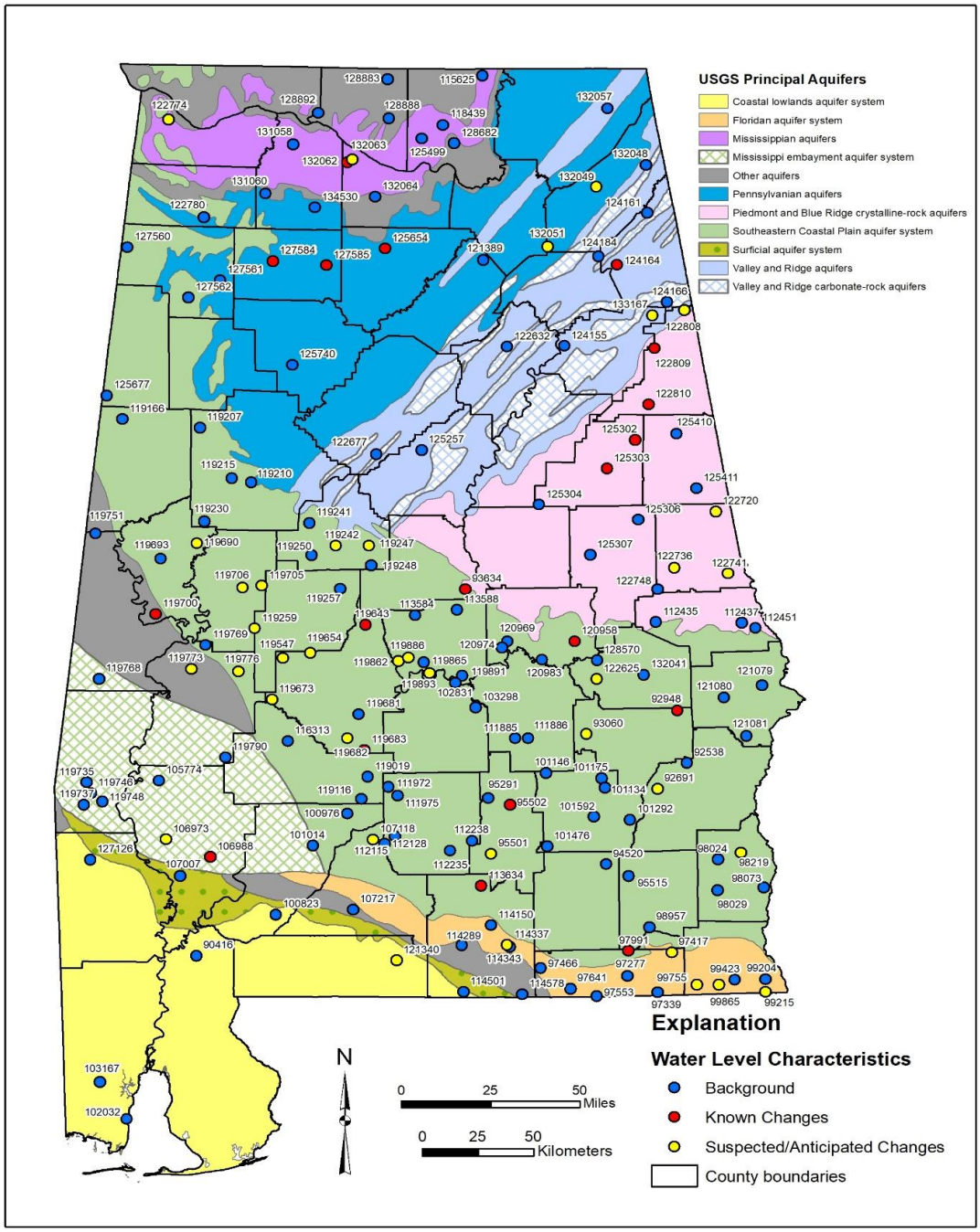

Figure 3. NGWMN surveillance wells classified by water-level characteristics.

KNOWN CHANGES SUBNETWORK

The *known changes* subnetwork includes monitoring wells that provide data from principal aquifer systems that have documented anthropogenic effects. At this time, 19 of the 172 surveillance wells were placed into the subnetwork of *known changes* as defined by the USGS NGWMN. Most of these wells are in the southern part of the state (see figure 3). As more data becomes available and reviewed, this determination could change. The complex geologic diversity in the state combined with shared state boundaries, demonstrates the need for careful assessment and water resource planning.

FIELD TECHNIQUES

Water levels in the periodic program wells are measured manually by GSA staff using a steel tape and chalk or an electronic metering tape. Field sampling methods are described in detail in the groundwater assessment report (GSA, 2018), and a graphic overview of the sampling methodology is included on the GSA website, https://www.ogb.state.al.us/gsa/groundwater/periodic.

DATA MANAGEMENT PROCEDURES

Periodic water-level data is manually entered and stored in Excel spreadsheets on the GSA-GAP data server and uploaded to the Risk Based Data Management System (RBDMS) database. The data is copied and stored on a separate data back-up storage device each evening. The updated data is served once per day to the USGS portal.

MINIMUM DATA ELEMENTS

Criteria entered for wells selected for upload to the NGWMN registry include:

- Agency name.
- Unique site number and name.
- Location information including state, county, latitude and longitude with the horizontal datum and method used, and accuracy.
- Altitude in specified units with the vertical reference datum and method used and accuracy.

- Well depth in specified units.
- The national aquifer designation and local aquifer name.
- The type of groundwater well and aquifer type.
- Whether the site is in a water level (WL) subnetwork and the WL subnetwork name from which the data is uploaded.
- Whether the well meets the criteria for WL baseline (five years of data), well type, well characteristics, well purpose, and well purpose notes.
- Whether the well is part of the water quality (QW) subnetwork.
- The URL to the specified data on the data provider's website.

SITES THAT DO NOT MEET NGWMN REQUIREMENTS

As discussed in section 4.5.1, of the SOGW report (2013), public supply wells do not meet NGWMN requirements because water levels from these actively pumped wells are within the cone of depression influenced by nearby active groundwater withdrawal.

WEB SERVICES FOR THE NGWMN SURVEILLANCE WELLS

The GSA web services were developed using an existing ArcGIS Server. Pertinent well data was aggregated and extracted from the agency's two water databases via SQL queries. These SQL results were loaded into three empty tables in a new NGWMN geodatabase where each table represents a web service (water levels, construction data, and lithology). A new map was created from each of the tables using ArcGIS Pro, and published to the ArcGIS Server as a new REST WFS web service. Each web service returns XML formatted data by passing a unique well identifier as a parameter in the URL. Data from these web services will be maintained from scheduled tasks that execute Python scripts to update the source data for each web service. At the time of this report, the tasks execute on a monthly schedule but have the flexibility to be executed upon any query.

WATER-LEVEL SERVICE

Water levels for a well can be retrieved by accessing the water-level service and passing the unique site number as a URL parameter. As an example, in the web service

URL below, the USGS NGWMN Site Number 92278 is queried. When the matching record is accessed, an XML formatted document returning required elements is returned. The query and response shown below depicts a water-level record. A complete water-level measurement includes the date of measurement, depth-to-water, units, method for measuring, and the accuracy.

https://map.gsa.state.al.us/arcgis/services/NGWMN/**Water_Levels**/MapServer/WFSServer?&service=WFS&request=GetFeature&typename=NGWMN:Water_Level&outputFormat=GML3&filter=<ogc:Filter><ogc:PropertyIsEqualTo><ogc:PropertyName>Site_Number</ogc:PropertyName><ogc:Literal>**92278**</ogc:Literal></ogc:PropertyIsEqualTo></ogc:Filter>.

```
▼<gml:featureMember>
 ▼<NGWMN:Water_Level gml:id="Water_Level.1461">
    <NGWMN:OBJECTID>1461</NGWMN:OBJECTID>
    <NGWMN:Agency_Code>GSAL</NGWMN:Agency_Code>
    <NGWMN:Site_Number>92278</NGWMN:Site_Number>
    <NGWMN:Source_Site_ID>BAL-2</NGWMN:Source_Site_ID>
    <NGWMN:Date_of_Measurement>2011-05-24T00:00:00-06:00</NGWMN:Date_of_Measurement>
    <NGWMN:Depth_to_Water>8.359999656677246</NGWMN:Depth_to_Water>
    <NGWMN:Depth_to_Water_Units>ft</NGWMN:Depth_to_Water_Units>
    <NGWMN:Depth_to_Water_Method>Pressure Tranducer</NGWMN:Depth_to_Water_Method>
    <NGWMN:Depth_to_Water_Accuracy>0.01</NGWMN:Depth_to_Water_Accuracy>
    <NGWMN:Depth_to_Water_Accuracy_Units>ft</NGWMN:Depth_to_Water_Accuracy_Units>
  </NGWMN:Water_Level>
 </gml:featureMember>
```

CONSTRUCTION SERVICE

The construction service, which contains casing and screen information, can also be accessed via passing a unique site number inside the URL, as follows:

https://map.gsa.state.al.us/arcgis/services/NGWMN/**Construction**/MapServer/WFSServer?&service=WFS&request=GetFeature&typename=NGWMN:Construction&outputFormat=GML3&filter=<ogc:Filter><ogc:PropertyIsEqualTo><ogc:PropertyName>Site_Number</ogc:PropertyName><ogc:Literal>**92278**</ogc:Literal></ogc:PropertyIsEqualTo></ogc:Filter>.

For both casing and screen information, the web service returns tops, bottoms, diameters, construction materials, and units for each casing and screen. The service also supplies well depth and well depth units. The features described by this query are illustrated as follows:

```
▼<gml:featureMember>
  ▼<NGWMN:Construction gml:id="Construction.7113">
      <NGWMN:OBJECTID>7113</NGWMN:OBJECTID>
      <NGWMN:Agency_Code>GSAL</NGWMN:Agency_Code>
      <NGWMN:Site_Number>92278</NGWMN:Site_Number>
      <NGWMN:Source_Site_ID>BAL-2</NGWMN:Source_Site_ID>
      <NGWMN:Well_Depth>130</NGWMN:Well_Depth>
      <NGWMN:Well_Depth_Units>ft</NGWMN:Well_Depth_Units>
      <NGWMN:Casing_Depth_Top>0</NGWMN:Casing_Depth_Top>
      <NGWMN:Casing_Depth_Top_Unit>ft</NGWMN:Casing_Depth_Top_Unit>
      <NGWMN:Casing_Depth_Bottom>100</NGWMN:Casing_Depth_Bottom>
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      <NGWMN:Casing_Material/>
      <NGWMN:Casing_Diameter>4</NGWMN:Casing_Diameter>
      <NGWMN:Casing_Diameter_Unit>in</NGWMN:Casing_Diameter_Unit>
      <NGWMN:Screen_Depth_Top>100</NGWMN:Screen_Depth_Top>
      <NGWMN:Screen_Depth_Top_Unit>ft</NGWMN:Screen_Depth_Top_Unit>
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      <NGWMN:Screen_Diameter_Unit>in</NGWMN:Screen_Diameter_Unit>
    </NGWMN:Construction>
</gml:featureMember>
```

LITHOLOGY SERVICE

Similar to the web services described in prior sections, lithologic information can be obtained by passing the same unique identifier from the previously mentioned services as a parameter to the web service URL, as follows:

https://map.gsa.state.al.us/arcgis/services/NGWMN/**Lithology**/MapServer/WFSServer?&service=WFS&request=GetFeature&typename=NGWMN:Lithology&outputFormat=GML3&filter=<ogc:Filter><ogc:PropertyIsEqualTo><ogc:PropertyName>Site_Number</ogc:PropertyName><ogc:Literal>**92278**</ogc:Literal></ogc:PropertyIsEqualTo></ogc:Filter>

The lithology web service provides the lithologic ID, description, top and bottom of the unit, and the observation method. All lithologic observations were determined from drilling records reviewed by geologists on staff in the GSA-GAP. Where necessary, these depths were correlated with available electrical logs. The features described by the lithologic query are illustrated as follows:

```
▼<gml:featureMember>
  ▼<NGWMN:Lithology gml:id="Lithology.7151">
      <NGWMN:OBJECTID>7151</NGWMN:OBJECTID>
      <NGWMN:Agency_Code>GSAL</NGWMN:Agency_Code>
      <NGWMN:Site_Number>92278</NGWMN:Site_Number>
      <NGWMN:Source_Site_ID>BAL-2</NGWMN:Source_Site_ID>
      <NGWMN:Lithology_ID>Tm</NGWMN:Lithology_ID>
      <NGWMN:Symbol_Lithology/>
      <NGWMN:Lithology_Description>Miocene Series undifferentiated</NGWMN:Lithology_Description>
      <NGWMN:Lithology_Depth_Top>80</NGWMN:Lithology_Depth_Top>
      <NGWMN:Lithology_Depth_Top_Unit>ft</NGWMN:Lithology_Depth_Top_Unit>
      <NGWMN:Lithology_Depth_Bottom>133</NGWMN:Lithology_Depth_Bottom>
      <NGWMN:Lithology_Depth_Bottom_Unit>ft</NGWMN:Lithology_Depth_Bottom_Unit>
      <NGWMN:Observation_Method/>
    </NGWMN:Lithology>
  </gml:featureMember>
```

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APPENDIX —
DATA TABLES FOR TREND WELLS AND SURVEILLANCE WELLS IN THE NGWMN REGISTRY

Table A-1. Geological Survey of Alabama trend wells in NGWMN registry

NGWMN Site ID	Site Name	County	Latitude	Longitude	Principal Aquifer	Local Aquifer Formation	Well Depth (ft.)	Aquifer Type	Well Classification subnetwork
GSAL:92278	BAL-2 003DDD11002	Baldwin	30.280253	-87.649846	Coastal lowlands aquifer system	Miocene	130	UNCONFINED	Background
GSAL:92272	BAL-3 003DDD11001	Baldwin	30.280249	-87.649863	Coastal lowlands aquifer system	Miocene	315	UNCONFINED	Background
GSAL:92197	BAL-5 003UU29001	Baldwin	30.407872	-87.684638	Coastal lowlands aquifer system	Miocene	137	UNCONFINED	Background
GSAL:93871	CHI-1 021O16004	Chilton	32.795811	-86.876908	Southeastern Coastal Plain aquifer system	Coker	253	UNCONFINED	Background
GSAL:119719	CHO-1 023Z11002	Choctaw	31.93294	-86.45764	Mississippi embayment aquifer system	Nanafalia	2,070	CONFINED	Background
GSAL:119833	COL-1 033H30001	Colbert	34.773148	-87.631206	Mississippian aquifers	Fort Payne	265	UNCONFINED	Background
GSAL:144914	COV-1 039AA04001	Covington	31.08529	-86.55266	Floridan aquifer system	Crystal River	420	UNCONFINED	Background
GSAL:96800	DLE-1 045J30005	Dale	31.377226	-85.580462	Southeastern Coastal Plain aquifer system	Clayton	453	CONFINED	Background
GSAL:96244	DLE-2 045C13001	Dale	31.5761	-85.59763	Southeastern Coastal Plain aquifer system	Nanafalia	240	UNCONFINED	Background
GSAL:97994	GEN-1 061J11001	Geneva	31.16697	-85.91009	Southeastern Coastal Plain aquifer system	Nanafalia	790	CONFINED	Background
GSAL:119684	GRE-3 063R33001	Greene	32.835589	-87.889155	Southeastern Coastal Plain aquifer system	Eutaw	407	CONFINED	Background
GSAL:119793	HAL-1 065P16005	Hale	32.701389	-87.591111	Southeastern Coastal Plain aquifer system	Eutaw	280	UNCONFINED	Suspected changes
GSAL:100731	HOU-1 069V28001	Houston	31.025555	-85.044444	Floridan aquifer system	Crystal River	118	UNCONFINED	Suspected changes
GSAL:125301	JAC-2 071GG29001	Jackson	34.667628	-86.022021	Mississippian aquifers	Fort Payne	40	UNCONFINED	Background
GSAL:125344	JEF-1 073CC29001	Jefferson	33.434966	-86.874071	Valley and Ridge aquifers	Bangor	140	UNCONFINED	Background
GSAL:118672	JEF-2 073L24004	Jefferson	33.632934	-86.594805	Valley and Ridge aquifers	Fort Payne	187	UNCONFINED	Background
GSAL:117388	LAU-1 077O33001	Lauderdale	34.831529	-87.700665	Mississippian aquifers	Fort Payne	227	UNCONFINED	Suspected changes
GSAL:125622	LIM-4 083J05001	Limestone	34.80528	-86.97111	Mississippian aquifers	Fort Payne	143	UNCONFINED	Background
GSAL:125687	MAD-2 089Q13001	Madison	34.690728	-86.583715	Mississippian aquifers	Fort Payne	168	UNCONFINED	Suspected changes
GSAL:125719	MAG-1 091B24002	Marengo	32.51552	-87.84453	Southeastern Coastal Plain aquifer system	Eutaw	900	CONFINED	Background
GSAL:127496	MAR-1 093T32001	Marion	33.967959	-87.920665	Pennsylvanian aquifers	Pottsville	444	UNCONFINED	Suspected changes
GSAL:100834	MON-1 099Z30001	Monroe	31.45344	-87.40981	Mississippi embayment aquifer system	Citronelle	140	UNCONFINED	Background
GSAL:134564	MTG-4 101K20013	Montgomery	32.34479	-86.3903	Southeastern Coastal Plain aquifer system	Gordo	446	CONFINED	Background
GSAL:111889	MTG-6 101AA14001	Montgomery	32.020654	-86.030427	Southeastern Coastal Plain aquifer system	Ripley	80	UNCONFINED	Background
GSAL:112480	MTG-7 101AA03001	Montgomery	32.041782	-86.036319	Southeastern Coastal Plain aquifer system	Eutaw	1,350	CONFINED	Background
GSAL:119174	PIC-5 107I32001	Pickens	33.359978	-88.018508	Southeastern Coastal Plain aquifer system	Gordo	235	UNCONFINED	Suspected changes
GSAL:119151	RAN-1 111K03002	Randolph	33.308262	-85.488146	Piedmont and Blue Ridge crystalline-rock aquifers	Wedowee Group	300	CONFINED	Background
GSAL:119211	TUS-4 125EE34001	Tuscaloosa	33.179167	-87.573611	Southeastern Coastal Plain aquifer system	Coker	71	UNCONFINED	Background
GSAL:121015	TUS-5 125EE23002	Tuscaloosa	33.211574	-87.543283	Pennsylvanian aquifers	Pottsville	302	UNCONFINED	Suspected changes

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
001E10006	Autauga	32.63968	-86.75374	Southeastern Coastal Plain aquifer system	Gordo Formation	170	CONFINED	Background
001G03006	Autauga	32.66278	-86.55185	Southeastern Coastal Plain aquifer system	Coker aquifer	460	CONFINED	Suspected/Anticipated Changes
001N23001	Autauga	32.443056	-86.83389	Southeastern Coastal Plain aquifer system	Eutaw Formation	260	UNCONFINED	Background
001O08001	Autauga	32.45777	-86.7875	Southeastern Coastal Plain aquifer system	Eutaw Formation	120	UNCONFINED	Background
001O13001	Autauga	32.438306	-86.71155	Southeastern Coastal Plain aquifer system	Eutaw aquifer	180	CONFINED	Suspected/Anticipated Changes
001T11001	Autauga	32.38001	-86.52944	Southeastern Coastal Plain aquifer system	Gordo Formation	400	CONFINED	Suspected/Anticipated Changes
001U05001	Autauga	32.389725	-86.68488	Southeastern Coastal Plain aquifer system	Eutaw Formation	200	UNCONFINED	Background
003G05002	Baldwin	31.17191	-87.79105	Southeastern Coastal Plain aquifer system	Miocene-Pliocene aquifer	250	UNCONFINED	Suspected/Anticipated Changes
005F29002	Barbour	31.995556	-85.45778	Southeastern Coastal Plain aquifer system	Gordo aquifer	1,423	CONFINED	Suspected/Anticipated Changes
005P36001	Barbour	31.885661	-85.60066	Southeastern Coastal Plain aquifer system	Ripley aquifer	181	UNCONFINED	Background
007L22001	Bibb	33.038223	-87.26284	Southeastern Coastal Plain aquifer system	Coker aquifer	176	UNCONFINED	Suspected/Anticipated Changes
007O25001	Bibb	32.93905	-87.13411	Southeastern Coastal Plain aquifer system	Valley and Ridge Aquifer System	404	UNCONFINED	Suspected/Anticipated Changes
007Q33001	Bibb	32.938909	-86.97563	Southeastern Coastal Plain aquifer system	Coker aquifer	100	UNCONFINED	Background
007T27001	Bibb	32.854701	-86.96371	Southeastern Coastal Plain aquifer system	Coker aquifer	143	UNCONFINED	Suspected/Anticipated Changes
007W11001	Bibb	32.89854	-87.25116	Southeastern Coastal Plain aquifer system	Coker aquifer	175	CONFINED	Suspected/Anticipated Changes

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
009E15001	Blount	34.169662	-86.4157	Pennsylvanian aquifers	Pottsville aquifer	38	UNCONFINED	Background
011G01001	Bullock	32.22041	-85.50058	Southeastern Coastal Plain aquifer system	Eutaw aquifer	540	CONFINED	Suspected/Anticipated Changes
011N10001	Bullock	32.125125	-85.93678	Southeastern Coastal Plain aquifer system	Eutaw Formation	925	CONFINED	Background
013E29001	Butler	31.901431	-86.88166	Southeastern Coastal Plain aquifer system	Clayton aquifer	165	CONFINED	Background
013F03001	Butler	31.862695	-86.83913	Southeastern Coastal Plain aquifer system	Clayton aquifer	110	CONFINED	Background
013P03003	Butler	31.687967	-86.85277	Southeastern Coastal Plain aquifer system	Nanafalia Formation	320	CONFINED	Background
013P18003	Butler	31.65551	-86.90018	Southeastern Coastal Plain aquifer system	Tuscahoma Sand	16	UNCONFINED	Background
013S31001	Butler	31.625232	-86.59003	Southeastern Coastal Plain aquifer system	Nanafalia aquifer	400	UNCONFINED	Suspected/Anticipated Changes
013T18001	Butler	31.667732	-86.48542	Southeastern Coastal Plain aquifer system	Clayton Formation	429	CONFINED	Background
015I04001	Calhoun	33.92432	-85.59234	Valley and Ridge aquifers	Valley and Ridge aquifer system	121	UNCONFINED	Background
015N20001	Calhoun	33.79648	-86.02401	Valley and Ridge aquifers	Parkwood; Floyd Shale undifferentiated	180	UNCONFINED	Background
017B14001	Chambers	33.07597	-85.30033	Piedmont and Blue Ridge crystalline-rock	Metagranite aquifer	36	UNCONFINED	Background
017N01001	Chambers	32.836609	-85.50506	Piedmont and Blue Ridge crystalline-rock	Overburden on top of metagranite	65	UNCONFINED	Background
017Q16001	Chambers	32.807971	-85.24731	Piedmont and Blue Ridge crystalline-rock	Metagranite aquifer	47	UNCONFINED	Background
017W06001	Chambers	32.743438	-85.58686	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	23	UNCONFINED	Background

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
019F05001	Cherokee	34.366666	-85.60972	Valley and Ridge aquifers	Monteagle aquifer	187	UNCONFINED	Background
019O26001	Cherokee	34.1425	-85.76167	Valley and Ridge aquifers	Conasauga Formation	318	UNCONFINED	Background
019V19001	Cherokee	33.98017	-85.51979	Valley and Ridge aquifers	Knox Group - undifferentiated	90	UNCONFINED	Background
021R36001	Chilton	32.751399	-86.51205	Southeastern Coastal Plain aquifer system	Metasedimentary and metavolcanic aquifer	48	UNCONFINED	Background
023BB24006	Choctaw	31.8183	-88.3327	Southeastern Coastal Plain aquifer system	Lisbon aquifer	40	UNCONFINED	Background
023CC04003	Choctaw	31.867733	-88.2989	Southeastern Coastal Plain aquifer system	Hatchetigbee Aquifer	270	UNCONFINED	Suspected/Anticipated Changes
023CC14004	Choctaw	31.833133	-88.2453	Southeastern Coastal Plain aquifer system	Hatchetigbee Formation	370	UNCONFINED	Background
023X20001	Choctaw	31.913267	-88.32094	Southeastern Coastal Plain aquifer system	Hatchetigbee Formation	200	UNCONFINED	Background
025EE11001	Clarke	31.671321	-87.9399	Southeastern Coastal Plain aquifer system	Lisbon Formation	200	UNCONFINED	Background
025H16001	Clarke	31.924744	-87.97593	Southeastern Coastal Plain aquifer system	Tuscahoma Sand	250	UNCONFINED	Background
025JJ12001	Clarke	31.597417	-87.72807	Mississippi embayment aquifer system	Crystal River Formation	140	UNCONFINED	Background
025PP04001	Clarke	31.514208	-87.87069	Southeastern Coastal Plain aquifer system	Lisbon aquifer	350	CONFINED	Background
027G10001	Clay	33.38795	-85.68517	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	191	UNCONFINED	Background
027I21001	Clay	33.26681	-85.82312	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	255	UNCONFINED	Background
027V17001	Clay	33.11314	-86.15292	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	68	UNCONFINED	Background

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
029B36001	Cleburne	33.944279	-85.43645	Valley and Ridge aquifers	Valley and Ridge aquifer system	200	UNCONFINED	Background
029H27001	Cleburne	33.7825	-85.58494	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	47	UNCONFINED	Background
029S17001	Cleburne	33.540877	-85.61856	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	45	UNCONFINED	Background
031A21002	Coffee	31.56312	-85.84837	Southeastern Coastal Plain aquifer system	Nanafalia aquifer	260	UNCONFINED	Background
033E25001	Colbert	34.771006	-87.96201	Mississippian aquifers	Tuscumbia	414	UNCONFINED	Background
035E10002	Conecuh	31.67381	-86.95628	Southeastern Coastal Plain aquifer system	Tuscahoma	193	UNCONFINED	Known Changes
035T27001	Conecuh	31.372387	-87.05164	Southeastern Coastal Plain aquifer system	Lisbon aquifer	259	UNCONFINED	Suspected/Anticipated Changes
039AA26002	Covington	31.017698	-86.52941	Southeastern Coastal Plain aquifer system	Crystal River aquifer	380	CONFINED	Suspected/Anticipated Changes
039C22001	Covington	31.473526	-86.44203	Southeastern Coastal Plain aquifer system	Nanafalia aquifer	672	UNCONFINED	Background
039DD33003	Covington	31.00569	-86.2513	Southeastern Coastal Plain aquifer system	Crystal River aquifer	275	Confined	Suspected/Anticipated Changes
039L19004	Covington	31.30379	-86.39622	Southeastern Coastal Plain aquifer system	Lisbon Formation	170	UNCONFINED	Background
039Q22001	Covington	31.218056	-86.53583	Southeastern Coastal Plain aquifer system	Crystal River aquifer	285	Confined	Suspected/Anticipated Changes
039S23001	Covington	31.218611	-86.32139	Southeastern Coastal Plain aquifer system	Lisbon aquifer	272	UNCONFINED	Suspected/Anticipated Changes
039S24003	Covington	31.210556	-86.30917	Southeastern Coastal Plain aquifer system	Crystal River Formation	220	CONFINED	Background
041H24001	Crenshaw	31.822603	-86.30386	Southeastern Coastal Plain aquifer system	Clayton Formation	182	CONFINED	Background

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
041I12001	Crenshaw	31.85064	-86.40687	Southeastern Coastal Plain aquifer system	Clayton Formation	170	CONFINED	Background
041S06001	Crenshaw	31.611111	-86.39444	Southeastern Coastal Plain aquifer system	Salt Mountain aquifer	291	CONFINED	Known Changes
043I31001	Cullman	34.219399	-86.89515	Pennsylvanian aquifers	Pottsville aquifer	111	UNCONFINED	Background
045E09006	Dale	31.512124	-85.74185	Southeastern Coastal Plain aquifer system	Salt Mountain aquifer	290	CONFINED	Known Changes
045N28001	Dale	31.290183	-85.64793	Southeastern Coastal Plain aquifer system	Tuscahoma Sand	355	CONFINED	Background
047AA01001	Dallas	32.214286	-87.0237	Southeastern Coastal Plain aquifer system	Eutaw aquifer	800	CONFINED	Suspected/Anticipated Changes
047C29001	Dallas	32.59902	-86.9911	Southeastern Coastal Plain aquifer system	Eutaw Formation	300	CONFINED	Background
047G09001	Dallas	32.454505	-87.3885	Southeastern Coastal Plain aquifer system	Eutaw Formation	450	UNCONFINED	Background
047GG09001	Dallas	32.110604	-87.07828	Southeastern Coastal Plain aquifer system	Eutaw Formation	1,260	CONFINED	Background
047H03001	Dallas	32.4791	-87.25674	Southeastern Coastal Plain aquifer system	Eutaw Formation	500	CONFINED	Background
047HH31001	Dallas	32.059527	-86.99653	Southeastern Coastal Plain aquifer system	Ripley Formation	60	UNCONFINED	Background
047S14001	Dallas	32.27674	-87.43958	Southeastern Coastal Plain aquifer system	Eutaw Formation	1,120	CONFINED	Background
049EE27001	DeKalb	34.225418	-86.10092	Pennsylvanian aquifers	Pottsville aquifer	170	UNCONFINED	Background
049J29001	DeKalb	34.571068	-85.61274	Valley and Ridge aquifers	Monteagle aquifer	136	UNCONFINED	Background
049P25001	DeKalb	34.47979	-85.858	Pennsylvanian aquifers	Pottsville aquifer	302	UNCONFINED	Background

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
051N19001	Elmore	32.523611	-85.98777	Southeastern Coastal Plain aquifer system	Coker aquifer	88	UNCONFINED	Background
051R24001	Elmore	32.525912	-86.31125	Southeastern Coastal Plain aquifer system	Coker Formation	137	UNCONFINED	Background
051R35001	Elmore	32.499167	-86.33806	Southeastern Coastal Plain aquifer system	Gordo aquifer	142	UNCONFINED	Background
051U15001	Elmore	32.446681	-86.14543	Southeastern Coastal Plain aquifer system	Coker Formation	135	UNCONFINED	Background
053Q10001	Escambia	31.154389	-86.84458	Southeastern Coastal Plain aquifer system	Miocene undifferentiated	203	CONFINED	Background
055B12001	Etowah	34.18083	-85.8515	Pennsylvanian aquifers	Pottsville aquifer	42	UNCONFINED	Background
059O22001	Franklin	34.351158	-87.78381	Southeastern Coastal Plain aquifer system	Gordo Formation	37	UNCONFINED	Background
061AA19002	Geneva	31.00805	-85.612	Southeastern Coastal Plain aquifer system	Crystal River aquifer	150	UNCONFINED	Background
061B03001	Geneva	31.1798	-85.54402	Southeastern Coastal Plain aquifer system	Tallahatta Formation	365	UNCONFINED	Background
061C33001	Geneva	31.188889	-85.74806	Southeastern Coastal Plain aquifer system	Tallahatta Formation	127	UNCONFINED	Known Changes
061H29001	Geneva	31.117778	-86.16361	Floridan aquifer system	Lisbon Formation	290	UNCONFINED	Suspected/Anticipated Changes
061Q04001	Geneva	31.079444	-85.75417	Southeastern Coastal Plain aquifer system	Lisbon aquifer	220	UNCONFINED	Suspected/Anticipated Changes
061T27001	Geneva	31.028611	-86.02417	Floridan aquifer system	Crystal River Formation	230	UNCONFINED	Known Changes
061X23001	Geneva	30.995833	-85.89972	Southeastern Coastal Plain aquifer system	Lisbon aquifer	260	UNCONFINED	Background
063EE09001	Greene	32.641419	-87.99997	Southeastern Coastal Plain aquifer system	Eutaw aquifer	700	CONFINED	Known Changes

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
063J29001	Greene	32.947744	-87.80444	Southeastern Coastal Plain aquifer system	Coker aquifer	560	UNCONFINED	Known Changes
063Q15001	Greene	32.880265	-87.97821	Southeastern Coastal Plain aquifer system	Gordo aquifer	550	UNCONFINED	Background
065I29001	Hale	32.766598	-87.49058	Southeastern Coastal Plain aquifer system	Eutaw Formation	130	UNCONFINED	Known Changes
065J28001	Hale	32.757972	-87.58255	Southeastern Coastal Plain aquifer system	Eutaw aquifer	100	UNCONFINED	Background
067J02001	Henry	31.605556	-85.20833	Southeastern Coastal Plain aquifer system	Nanafalia aquifer	302	CONFINED	Known Changes
067K15001	Henry	31.578611	-85.31694	Southeastern Coastal Plain aquifer system	Nanafalia Formation	280	UNCONFINED	Suspected/Anticipated Changes
067N34002	Henry	31.445232	-85.32155	Southeastern Coastal Plain aquifer system	Clayton aquifer	560	UNCONFINED	Suspected/Anticipated Changes
067P26002	Henry	31.455278	-85.10361	Southeastern Coastal Plain aquifer system	Tuscahoma sand	500	UNCONFINED	Suspected/Anticipated Changes
069R26002	Houston	31.039678	-85.42714	Crystal River aquifer	Southeastern Coastal Plain aquifer system	180	UNCONFINED	Background
069S27001	Houston	31.03834	-85.32419	Floridan aquifer system	Crystal River Formation	150	UNCONFINED	Background
069T16002	Houston	31.058056	-85.24833	Floridan aquifer system	Crystal River Formation	125	UNCONFINED	Background
069U14001	Houston	31.058611	-85.10222	Floridan aquifer system	Crystal River Formation	300	UNCONFINED	Background
069X14001	Houston	31.003889	-85.10361	Floridan aquifer system	Crystal River Formation	140	UNCONFINED	Background
071N33001	Jackson	34.815833	-85.79861	Mississippian aquifers	Fort Payne-Tuscumbia aquifer	72	UNCONFINED	Background
073LL34001	Jefferson	33.33333	-86.93861	Mississippian aquifers	Fort Payne-Tuscumbia aquifer	115	UNCONFINED	Background

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
075Q18001	Lamar	33.58054	-88.24761	Southeastern Coastal Plain aquifer system	Eutaw Formation	34	UNCONFINED	Background
079F26001	Lawrence	34.667777	-87.3475	Mississippian aquifers	Fort Payne-Tuscumbia aquifer	200	UNCONFINED	Background
079R35001	Lawrence	34.39567	-87.23959	Mississippian aquifers	Bangor aquifer	54	UNCONFINED	Background
079T09001	Lawrence	34.455	-87.48222	Mississippian aquifers	Bangor aquifer	120	UNCONFINED	Background
081G25001	Lee	32.603747	-85.5964	Southeastern Coastal Plain aquifer system	Tuscaloosa Group - Undifferentiated	30	UNCONFINED	Background
081K36001	Lee	32.59441	-85.18488	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	70	UNCONFINED	Background
081O10001	Lee	32.57129	-85.11943	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	190	UNCONFINED	Background
083A19001	Limestone	34.94843	-86.8829	Mississippian aquifers	Fort Payne-Tuscumbia aquifer	117	UNCONFINED	Background
083I17001	Limestone	34.780833	-86.87694	Mississippian aquifers	Fort Payne aquifer	220	UNCONFINED	Background
083M12001	Limestone	34.803333	-87.22583	Mississippian aquifers	Fort Payne aquifer	128	UNCONFINED	Background
085B21001	Lowndes	32.347939	-86.56165	Southeastern Coastal Plain aquifer system	Eutaw Formation	400	UNCONFINED	Suspected/Anticipated Changes
085J28001	Lowndes	32.242116	-86.46621	Southeastern Coastal Plain aquifer system	Eutaw aquifer	440	CONFINED	Known Changes
087I20001	Macon	32.441847	-85.88182	Southeastern Coastal Plain aquifer system	Eutaw Formation	240	CONFINED	Background
087N19002	Macon	32.361201	-85.88424	Southeastern Coastal Plain aquifer system	Eutaw aquifer	180	UNCONFINED	Background
087P16001	Macon	32.376766	-85.65811	Southeastern Coastal Plain aquifer system	Eutaw Formation	100	UNCONFINED	Known Changes

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
089B09002	Madison	34.963412	-86.41453	Mississippian aquifers	Fort Payne aquifer	136	UNCONFINED	Background
089N27015	Madison	34.749312	-86.61041	Mississippian aquifers	Fort Payne aquifer	195	UNCONFINED	Background
089P14002	Madison	34.692222	-86.71528	Mississippian aquifers	Fort Payne aquifer	227	UNCONFINED	Background
089R20006	Madison	34.672222	-86.55556	Mississippian aquifers	Fort Payne aquifer	145	UNCONFINED	Background
091A23002	Marengo	32.510353	-87.7588	Southeastern Coastal Plain aquifer system	Eutaw Formation	800	CONFINED	Known Changes
091G31005	Marengo	32.405789	-87.82721	Southeastern Coastal Plain aquifer system	Eutaw aquifer	1,000	CONFINED	Suspected/Anticipated Changes
091GG10001	Marengo	32.027032	-87.6606	Southeastern Coastal Plain aquifer system	Nanafalia aquifer	160	CONFINED	Known Changes
091I32001	Marengo	32.397301	-87.60096	Southeastern Coastal Plain aquifer system	Eutaw aquifer	1,000	CONFINED	Suspected/Anticipated Changes
093H06001	Marion	34.21996	-88.15553	Southeastern Coastal Plain aquifer system	Gordo Formation	98	CONFINED	Background
093M21001	Marion	34.080933	-87.70055	Pennsylvanian aquifers	Pottsville aquifer	101	UNCONFINED	Background
093T24001	Marion	34.00575	-87.85563	Southeastern Coastal Plain aquifer system	Coker Formation	69	UNCONFINED	Background
097GG12009	Mobile	30.623611	-88.24056	Southeastern Coastal Plain aquifer system	Miocene-Pliocene aquifer	139	CONFINED	Known Changes
097MM06004	Mobile	30.465633	-88.11247	Southeastern Coastal Plain aquifer system	Miocene-Pliocene aquifer	90	UNCONFINED	Background
099B32001	Monroe	31.785077	-87.07688	Southeastern Coastal Plain aquifer system	Nanafalia aquifer	380	CONFINED	Known Changes
099GG36001	Monroe	31.350456	-87.41608	Southeastern Coastal Plain aquifer system	Miocene-Pliocene aquifer	175	CONFINED	Background

Table A-2. Geological Survey of Alabama surveillance wells in NGWMN Registry								
GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
099O23001	Monroe	31.649709	-87.24204	Mississippi embayment aquifer system	Nanafalia Formation	800	UNCONFINED	Suspected/Anticipated Changes
101X13001	Montgomery	32.10824	-86.21382	Southeastern Coastal Plain aquifer system	Ripley aquifer	18	CONFINED	Background
101X17001	Montgomery	32.107761	-86.27657	Southeastern Coastal Plain aquifer system	Gordo aquifer	970	CONFINED	Known Changes
103B20001	Morgan	34.591667	-87.08111	Mississippian aquifers	Fort Payne-Tuscumbia aquifer	340	UNCONFINED	Background
103B21001	Morgan	34.604166	-87.05611	Mississippian aquifers	Fort Payne-Tuscumbia aquifer	56	UNCONFINED	Background
103O10001	Morgan	34.442865	-86.94397	Valley and Ridge aquifers	Hartselle aquifer	440	UNCONFINED	Background
105F31001	Perry	32.75312	-87.11389	Southeastern Coastal Plain aquifer system	Gordo aquifer	40	UNCONFINED	Background
105L31001	Perry	32.58221	-87.52332	Southeastern Coastal Plain aquifer system	Eutaw aquifer	200	UNCONFINED	Background
107D24001	Pickens	33.479434	-88.17045	Southeastern Coastal Plain aquifer system	Eutaw aquifer	65	UNCONFINED	Background
109D17001	Pike	31.93365	-85.86719	Southeastern Coastal Plain aquifer system	Ripley Formation	192	CONFINED	Suspected/Anticipated Changes
109D33001	Pike	31.89247	-85.85079	Southeastern Coastal Plain aquifer system	Ripley Formation	190	CONFINED	Suspected/Anticipated Changes
109G02001	Pike	31.959111	-86.13064	Southeastern Coastal Plain aquifer system	Ripley Formation	180	CONFINED	Background
109O15001	Pike	31.753409	-85.73294	Southeastern Coastal Plain aquifer system	Ripley Formation	565	CONFINED	Suspected/Anticipated Changes
109Q12001	Pike	31.768579	-85.90619	Southeastern Coastal Plain aquifer system	Ripley aquifer	565	CONFINED	Known Changes
109T26001	Pike	31.642437	-86.12905	Southeastern Coastal Plain aquifer system	Ripley aquifer	346	CONFINED	Suspected/Anticipated Changes

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GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
111C34001	Randolph	33.412795	-85.48384	Mississippian aquifers	Fort Payne-Tuscumbia aquifer	315	UNCONFINED	Suspected/Anticipated Changes
111O22001	Randolph	33.177207	-85.3915	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	22	UNCONFINED	Background
113L02001	Russell	32.324444	-85.09389	Southeastern Coastal Plain aquifer system	Gordo aquifer	350	CONFINED	Suspected/Anticipated Changes
113M19008	Russell	32.273333	-85.27722	Southeastern Coastal Plain aquifer system	Eutaw aquifer	465	CONFINED	Known Changes
113X13001	Russell	32.1075	-85.17278	Southeastern Coastal Plain aquifer system	Gordo aquifer	1,120	CONFINED	Suspected/Anticipated Changes
115L23001	Shelby	33.352222	-86.71944	Valley and Ridge aquifers	Parkwood Formation	120	UNCONFINED	Suspected/Anticipated Changes
117J26001	St. Clair	33.795	-86.30166	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	177	UNCONFINED	Background
119B10001	Sumter	32.9857	-88.29298	Southeastern Coastal Plain aquifer system	Gordo aquifer	693	CONFINED	Known Changes
119HH15001	Sumter	32.360433	-88.26833	Southeastern Coastal Plain aquifer system	Nanafalia aquifer	180	CONFINED	Background
123A29001	Tallapoosa	33.0446	-85.676	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	78	UNCONFINED	Background
123L13001	Tallapoosa	32.895792	-85.90828	Piedmont and Blue Ridge crystalline-rock	Metasedimentary and metavolcanic aquifer	54	UNCONFINED	Background
125E33001	Tuscaloosa	33.44603	-87.79504	Southeastern Coastal Plain aquifer system	Coker aquifer	195	UNCONFINED	Background
125EE23001	Tuscaloosa	33.212269	-87.54377	Southeastern Coastal Plain aquifer system	Coker Formation	61	UNCONFINED	Background
125FF13001	Tuscaloosa	33.22831	-87.6387	Southeastern Coastal Plain aquifer system	Coker Formation	109	UNCONFINED	Background
125SS22001	Tuscaloosa	33.04269	-87.76966	Southeastern Coastal Plain aquifer system	Coker aquifer	446	CONFINED	Background

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GSAL_ID	**County**	**Latitude**	**Longitude**	**Principal Aquifer**	**Local Aquifer**	**Well Depth**	**Aquifer Type**	**Well Classification Subnetwork**
127T26001	Walker	33.71806	-87.34689	Pennsylvanian aquifers	Pottsville aquifer	55	UNCONFINED	Background
129H17001	Washington	31.581205	-88.29888	Southeastern Coastal Plain aquifer system	Cocoa Sand	270	CONFINED	Background
131GG12001	Wilcox	31.848611	-87.01111	Southeastern Coastal Plain aquifer system	Clayton aquifer	380	CONFINED	Suspected/Anticipated Changes
131H15002	Wilcox	32.098333	-87.36306	Southeastern Coastal Plain aquifer system	Clayton aquifer	30	UNCONFINED	Background
131T08001	Wilcox	31.944338	-86.98055	Southeastern Coastal Plain aquifer system	Clayton Formation	61	CONFINED	Background
133G23001	Winston	34.16515	-87.44513	Pennsylvanian aquifers	Pottsville aquifer	125	UNCONFINED	Background
133J28001	Winston	34.146817	-87.1821	Pennsylvanian aquifers	Pottsville aquifer	115	UNCONFINED	Background

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