

**USGS National Groundwater Monitoring Network Cooperative Agreement  
Final Technical Report**

**Award Number:** G21AC10421

**Agency Name:** Missouri Department of Natural Resources, Missouri Geological Survey

**Title:** Missouri Geological Survey's proposal to rehabilitate groundwater observation wells and purchase monitoring equipment.

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## **Description of work done to support the NGWMN**

The Missouri Geological Survey (MGS) has been collecting groundwater level data for over 60 years and is an existing data provider to USGS. MGS currently operates 150 groundwater observation wells. Under a previous NGWMN grant, MGS conducted aquifer pump tests on nine groundwater observation wells in southeast Missouri. These tests revealed that five of the wells had accumulated sediment in the screened interval leading to inefficient communication with the aquifer. During this grant period, remediation activities were performed under Objective 4-Well Maintenance to successfully clean out the well and improve the connectivity to the aquifer.

Under another previous NGWMN grant, MGS conducted downhole camera investigation of Missouri's groundwater observation wells. This investigation revealed the Neosho Ozark Aquifer groundwater observation well had multiple holes in the casing allowing shallow groundwater to enter the well. Under the provisions of Objective 4-Well Maintenance in this grant, a small diameter liner was installed to seal out the shallow water.

Finally, MGS purchased 14 pressure transducers for existing groundwater observation wells under Objective 6-Purchase Equipment to Support Continuous Water Level Data Collection. The pressure transducers were purchased for existing groundwater observation wells to replace old or failing transducers and replace float/counterweight systems where those are no longer functioning properly

## **Describe Well Maintenance Activities**

### **Description of Southeast Missouri Well Cleaning Project**

In order for an observation well to be able to accurately measure the water level of an aquifer, the well must be in communication with the water producing formation. MGS conducted pump tests on nine wells during a previous NGWMN grant period to determine the connectivity of the water in the well to the aquifer. As part of these tests the total depth of the well was measured to compare with existing well log records. Additionally, downhole camera investigations were previously conducted on these wells under the activities of another former NGWMN grant. These efforts have revealed that four wells have accumulated sediment in the well completely filling the screened interval and thus reducing the total depth of the well. Additionally, after conducting the pump test, it was determined that the Qulin well had poor communication between the well and the aquifer.

Utilizing funding from this grant, MGS cleaned four existing wells that had accumulated sediment in their screened interval by using an air lift method to "blow" the well clean and then swab the well to clean the screen. Once the wells were cleaned an aquifer pump test was conducted to verify connectivity of the well with the aquifer. The total depth of the Qulin well

match our records but since the aquifer test revealed poor communication, this well was swabbed to clean the well screen. See Table 1 for list of wells that were cleaned under this project.

### **Description of Neosho Reconstruction Project**

The Neosho Ozark Aquifer groundwater observation well was originally drilled in 2007 to a depth of 696 feet and had 462 feet of casing. The casing originally sealed out the shallow Springfield Plateau Aquifer. However, holes the casing were allowing shallow groundwater to enter the well bore and compromise the data collected from the deeper Ozark Aquifer. Geologic units from the underlying Ozark Aquifer are open and contributing to the water level measured in this well. The Springfield Plateau and Ozark aquifers are both part of the USGS Ozark Plateau Principle Aquifer.

On June 2, 2022 contractors arrived at the site to commence reconstruction activities. A 2-inch PVC liner was successfully installed to a depth of 693 feet and included a well screen of 140 feet at the bottom. Gravel pack was installed around the well screen from the bottom of the well up to a depth of 482 feet. A 40-foot pelletize bentonite plug was placed above the gravel pack and overlapped the bottom of the original casing at a depth of 462 feet. The remaining annular space was filled with bentonite slurry grout.

This project ultimately resulted in the holes in the casing being sealed and eliminated the shallow water from the Springfield Plateau Aquifer entering the well. The well is now capable of collecting accurate water level data from the Ozark Aquifer as it was originally constructed to do.

### **Description of Purchasing Equipment to Support Continuous Water Level Data Collection Activities**

MGS utilized federal funds to purchase five pressure transducers (along with associated cabling, humidity control, equipment hangers, and lightning protection). MGS purchased an additional nine pressure transducers utilizing state agency funds.

Three pressure transducers, and associated equipment, were purchased to replace the oldest transducers in the network, five to replace existing transducers that had failed, four to replace float/counterweight systems where the float would frequently get lodged in the well bore, one to replace float/counterweight system where water levels fluctuated very fast causing the float tape to come off of the shaft encoder, and one in the Neosho Ozark Aquifer well after the small diameter liner was installed during reconstruction described above. See Table 2 for a list of sites where the new pressure transducers were installed.

Site Number	Site Name	County	Original TD	Current TD	Screen Interval	Aquifer
371125089445301	Delta	Cape Girardeau	75	60	71-75	Alluvial
362955089581801	Malden	Dunklin	108	104	104-108	Alluvial
363442090364301	Naylor	Ripley	65	53	61-65	Alluvial
363551090152801	Qulin	Butler	81	81	76-81	Alluvial
365319089331001	Sikeston	Scott	146	142	142-146	Alluvial

Table 1: Wells cleaned utilizing grant funding

USGS ID	Site Name	Date Installed	Reason For Installation
365415093342301	Crane	7/8/2021	Float Sticking
370907093144101	Valley Park	10/20/2021	Existing PT failure
384258091243001	Hermann	11/18/2021	Existing PT failure
375306090125301	Weingarten	12/21/2021	SWL moves very fast
371125089445301	Delta	1/11/2022	Float Sticking
384534093431101	Warrensburg	5/11/2022	Existing PT failure
391236094170201	Atherton	5/11/2022	Existing PT failure
373620093470301	North Hawker	5/12/2022	Float Sticking
364453093543601	Butterfield Springfield	5/18/2022	Old existing PT
364818094185302	Neosho Ozark	6/6/2022	Well Rehab
371036094171301	Carthage	6/14/2022	Float Sticking
370828094274101	Webb City	8/31/2022	Existing PT failure
371435093134701	Springfield	9/14/2022	Old existing PT
364324091515001	West Plains	10/4/2022	Old existing PT

Table 2: Sites where new pressure transducers were installed