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**Award Number:** G22AS00002

New Mexico Bureau of Geology and Mineral Resources at New Mexico Tech  
New Mexico Bureau of Geology and Mineral Resources Groundwater Level Monitoring  
Network Year 6

**Authors:**

Ethan Mamer, Hydrogeologist  
Laila Sturgis, Aquifer Mapping Program Manager

Primary contact: Ethan Mamer, Hydrogeologist  
575-835-5118  
[ethan.mamer@nmt.edu](mailto:ethan.mamer@nmt.edu)

New Mexico Bureau of Geology and Mineral Resources  
New Mexico Institute of Mining and Technology  
801 Leroy Place  
Socorro, NM 87801

**Term of award:** September 15, 2022, to September 14, 2023

**Date:** January 10, 2024

**Major Goals 2022–2023:**

To support persistent data services as an existing data provider for the National Ground Water Monitoring Network (NGWMN) by adding new sites, maintaining current sites, maintaining web services, keeping the site list up to date, keeping metadata current, and providing updates to the NGWMN Data Provider page for the New Mexico Bureau of Geology and Mineral Resources (NMBGMR).

To continue serving continuous monitoring data to the NGWMN portal via the GroundwaterML2 (GWML2) XML schema.

To visit and download pressure transducer data loggers and barometer data loggers at selected NGWMN sites, maintaining continuous water level data throughout our network.

To review active and ‘pumping’ wells measured by the NMBGMR’s Healy Collaborative Groundwater Monitoring Network to determine which wells are appropriate to add to the NGWMN as ‘surveillance’ sites. The wells selected will meet minimum data requirements; their well depth and well construction information and the lithology of the subsurface must be known for inclusion in the NGWMN.

**Project Summary:**

The NMBGMR was awarded Grant No. G22AS00002 to support persistent data services, update the data service format, and purchase continuous monitoring equipment. The period of work was between September 15, 2022, and September 14, 2023. Work included selecting additional sites for network inclusion, obtaining construction information, maintaining existing NGWMN sites, keeping metadata current, and providing updates to the NGWMN Data Provider page for the NMBGMR. The format of data served was updated to the GWML2 XML schema.

**Work done to support the NGWMN as a data provider:**

For the year 2022–2023, our team focused on Objective 2 (supporting persistent data services). For Objective 2A, our team consisted of an IT manager, database administrator, software engineer, hydrogeology program manager, hydrogeologist, and research scientist. With U.S. Geological Survey (USGS) funds, the hydrogeology program manager worked with our in-house Aquifer Mapping Program (AMP) database to keep the NGWMN sites up to date. The program manager helped identify prospective wells, assisted with quality assurance/quality control procedures, and reviewed the final report. The hydrogeologist identified prospective sites for potential inclusion in the network, processed data collected from the sites with continuous data loggers installed, contacted owners of prospective wells, and compiled the final report. Their time was supported by federal USGS funding.

We added seven new sites to the monitoring network this year (Table 1, Fig. 1). We added two sites within the Rio Grande aquifer system. We added, categorized, and turned ‘on’ one site (WL-0250), and we added an additional site that has not yet been categorized (WL-0227; Table 1, Fig. 1). We acquired construction data for one site (WL-0250) using a 1,000-foot-length Laval Underground borehole camera (R-CAM 1000 TLE Level Wind) owned by the NMBGMR. We

undertook this data collection using internal NMBGMR funds. The remaining five sites that were added to the network this year are classified as ‘other aquifers.’ We had sufficient well construction information, lithology, and water level records to categorize and active three of the wells (SM-0257, SM-0258, and SM-0259). The remaining two wells (WL-0191 and NM-23292) located in ‘other aquifers’ will be surveyed with our borehole camera within the next year in order to fill in missing construction information.

Following further review of the hydrographs at five of the sites already found in the network, we have changed the Well Classification Subnetwork identification from ‘Suspected/Anticipated Changes’ to ‘Documented Changes.’ Two additional sites added in 2022, located in the Roswell Basin aquifer system (NM-00367 and NM-00643; Table 1, Fig. 1), have been made visible to the public as we have confirmed lithology and construction information.

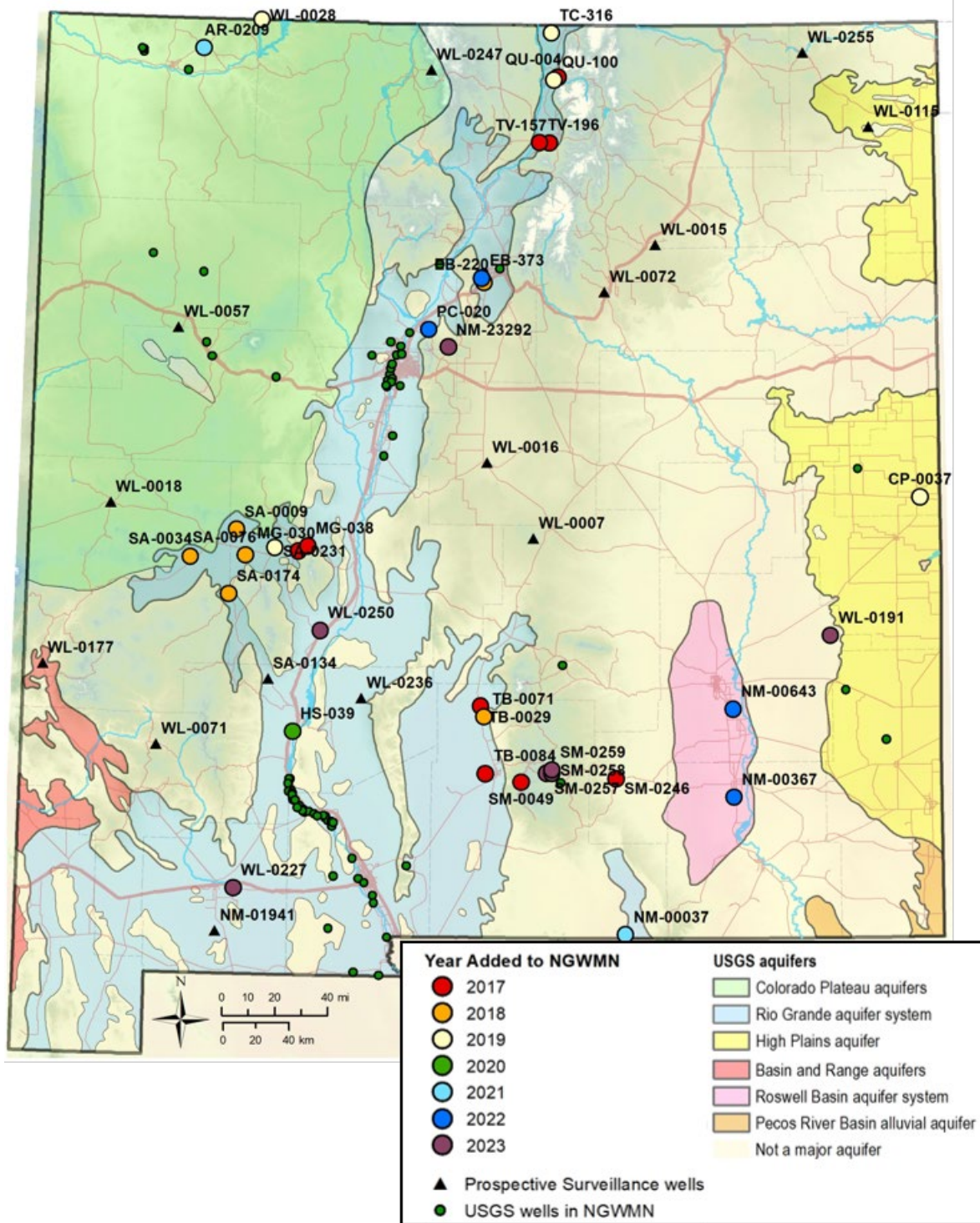
**Table 1. Updates to NGWMN sites.**

| Point ID | Principal Aquifer            | Well Depth (ft) | Subnetwork        | Monitoring Category | Monitoring Frequency | Action   |
|----------|------------------------------|-----------------|-------------------|---------------------|----------------------|--|
| WL-0191  | Other aquifer system         | 185             | Background        | Trend               | Manual               | Added, categorized                                       |
| WL-0227  | Rio Grande aquifer system    | 229             | Suspected changes | Trend               | Continuous           | Added, categorized                                       |
| WL-0250  | Roswell Basin aquifer system | 293             | Background        | Trend               | Continuous           | Construction information added, categorized, turned ‘on’ |
| SM-0257  | Other aquifer system         | 70              | Background        | Trend               | Continuous           | Construction information added, categorized, turned ‘on’ |
| SM-0258  | Other aquifer system         | 110             | Background        | Trend               | Continuous           | Construction information added, categorized, turned ‘on’ |
| SM-0259  | Other aquifer system         | 410             | Background        | Trend               | Continuous           | Construction information added, categorized, turned ‘on’ |
| NM-00367 | Roswell Basin aquifer system | 320             | Known changes     | Trend               | Continuous           | Construction information added, turned ‘on’              |
| NM-00643 | Roswell Basin aquifer system | 231             | Known changes     | Trend               | Continuous           | Construction information added, turned ‘on’              |
| NM-23292 | Other aquifer system         | 500             | Suspected changes | Trend               | Continuous           | Added, categorized                                       |

This year, we also reviewed the active and ‘pumping’ wells currently being measured through the NMBGMR’s Healy Collaborative Groundwater Monitoring Network to determine which wells are candidates to add to the NGWMN. The pumping wells will be classified as ‘surveillance’ sites. The majority of pumping wells currently monitored are domestic wells, but a few are irrigation wells. Most of the wells selected as candidates for inclusion meet minimum data requirements; the well depth, construction information and the lithology of the subsurface must be known for inclusion in the NGWMN. Wells that do not meet the minimum requirements will be further investigated to fill the data gaps. The goal of adding pumping wells to the NGWMN is to expand water level data into regions of the state where open monitoring wells are not available. At present, we have identified 14 potential surveillance wells that are being further evaluated for inclusion in the NGWMN (Table 2, Fig. 1). The pumps in these wells will be shut off for the length of time required for the water level to return to the static water level of the local aquifer, after which the depth to water below ground surface will be measured manually at least annually. The process for determining the time necessary for the depth to water to reach the static water level in each pumping well will be documented in the following final technical report upon finalizing the prospective sites and added to the NMBGMR’s Data Provider page.

**Table 2. Prospective wells to be reviewed as surveillance sites.**

| <b>Point ID</b> | <b>Principal Aquifer</b>  | <b>Well Depth (ft)</b> | <b>Lithology</b> | <b>Construction Information</b> | <b>Monitoring Frequency</b> | <b>Existing Water Level Record (years)</b> |
|-----------------|---------------------------|------------------------|------------------|---------------------------------|-----------------------------|--|
| NM-01941        | Rio Grande aquifer system | 200                    | No               | No                              | Manual annual               | 65   |
| SA-0134         | Rio Grande aquifer system | 215                    | Yes              | Yes                             | Manual annual               | 14   |
| WL-0007         | Other aquifer system      | 925                    | Yes              | Yes                             | Manual annual               | 7  |
| WL-0015         | Other aquifer system      | 245                    | Yes              | Yes                             | Manual annual               | 7  |
| WL-0016         | Other aquifer system      | 240                    | Yes              | Yes                             | Manual annual               | 6  |
| WL-0018         | Colorado Plateau aquifers | 240                    | Yes              | Yes                             | Manual annual               | 6  |
| WL-0057         | Colorado Plateau aquifers | 270                    | Yes              | No                              | Manual annual               | 6  |
| WL-0071         | Other aquifer system      | 793                    | Yes              | Yes                             | Manual annual               | 6  |
| WL-0072         | Other aquifer system      | 690                    | Yes              | Yes                             | Diver/ annual               | 6  |
| WL-0115         | High Plains aquifer       | 205                    | Yes              | Yes                             | Manual annual               | 5  |
| WL-0177         | Basin and Range aquifers  | 300                    | Yes              | Yes                             | Manual annual               | 4  |
| WL-0236         | Rio Grande aquifer system | 300                    | Yes              | Yes                             | Manual annual               | 2  |
| WL-0247         | Colorado Plateau aquifers | 400                    | Yes              | Yes                             | Manual annual               | 2  |
| WL-0255         | Other aquifer system      | 100                    | Yes              | Yes                             | Manual annual               | 2  |



**Figure 1.** Principal aquifers, USGS NGWMN sites, and NMBGMR sites selected for inclusion in the NGWMN in 2022–2023. Prospective surveillance wells shown by triangles.

The IT manager and database manager provided persistent web services, backups, and database support. The software developer ensured correct data transfers from the AMP database to the NGWMN portal and periodically checked user load on the network. Their time was supported by federal USGS funding. This team structure proved effective in maintaining a high quality standard of data submitted to the NGWMN.

Under Objective 2B (occasional work needed to upgrade services or add new services), the software developer and database manager updated the web service to provide data using GWML2 XML schema data standards (<https://docs.ogc.org/is/19-013/19-013.html>). The GWML2 documents are generated dynamically from the NMBGMR's database using a combination of SQL and Python scripting.

**Completed data collection:**

A variety of data collection and database maintenance tasks were performed. Fieldwork was performed to collect manual measurements using standardized methods. Field sheets and notebooks were copied or scanned upon returning to the office and stored on the NMBGMR network server, where they are backed up daily. Within two weeks, quality checks were completed and the data were entered into the AMP database. All well locations, well construction information, and manual water level data are maintained in the AMP database, and the data fields are aligned with those in the NGWMN database. We maintained a reliable database link between the AMP database and the NGWMN database. All efforts to provide data to the NGWMN complement the NMBGMR's mission to provide water level data to the public.

The NMBGMR's current hydrologic team contributing to the NGWMN consisted of a program manager and a hydrogeologist. USGS funds supported selection and classification of wells in the network, upgrades and expansion of web services, and documentation of work in the final report.

**Updates made to web services:**

The NMBGMR has a custom WebAPI for sharing data with the NGWMN. The WebAPI has specific endpoints, allowing seamless data transfer from the AMP internal database to the NGWMN database. Three full-time staff are dedicated to providing support for core IT infrastructure for the NMBGMR. IT staff worked with the AMP team on the NGWMN thanks to financial support provided by the USGS.

**Problems encountered in serving data to the NGWMN data portal:**

None.

**Notice of changes in databases or web services that would impact future integration with data portal:**

The AMP SQL Server database will undergo a major redesign and refactoring in late 2023 and into early 2024. Data entry is moving from an Access front end to web-based forms and reports. We anticipate minimal disruption of data flow to the NGWMN.

**Conclusions:**

The NMBGMR is successfully connected to the USGS NGWMN, and is now showing 30 sites on the USGS website and has a total of 34 sites serving data to the NGWMN portal. The NMBGMR will continue to grow and add new sites, as well as improve data quality at existing sites. We look forward to continuing to work with the USGS toward this important endeavor for a national coverage of groundwater monitoring.