Iowa GS FY2024 NGWMN Project

Final Report
4 August 2025

Submitted by:
Rick Langel
Iowa Geological Survey
University of Iowa
327 Trowbridge Hall
Iowa City, IA 52242
319-335-1575
richard-langel@uiowa.edu

Award Number G24AC00294
Period Covered: 01 Aug 2024 – 31 Jul 2025

INTRODUCTION

The National Ground-Water Monitoring Network (NGWMN) provides a unique opportunity to collect and share water-level and water-quality data from different states and agencies. The Iowa Geological Survey (IGS) at the University of Iowa joined the NGWMN in 2017. The IGS contributes data from 40 wells, completed in the Cambrian-Ordovician (USGS national code S300CAMORD), Cretaceous (N300lLCRTCS), Mississippian (N500MSSPPI), and Silurian-Devonian (N400SLRDVN) aquifers, where quarterly static water-level measurements are collected to the NGWMN.

The United States Geological Survey (USGS) awarded funding to the IGS to pump and hydraulically test six Devonian wells through cooperative agreement G24AC00294. This report describes the work performed and results obtained under this award.

Objective 4: Site maintenance

The IGS proposed to pump and hydraulically test six Devonian wells this objective. Figure 1 shows the six wells location. Appendix B contains more detailed information on the wells.

Because of the small casing diameter (1.5 inches) and the depth to water in each well, airlifting water from these wells was the only method available to purge water. Water was purged from each site until three well volumes of water had been removed.

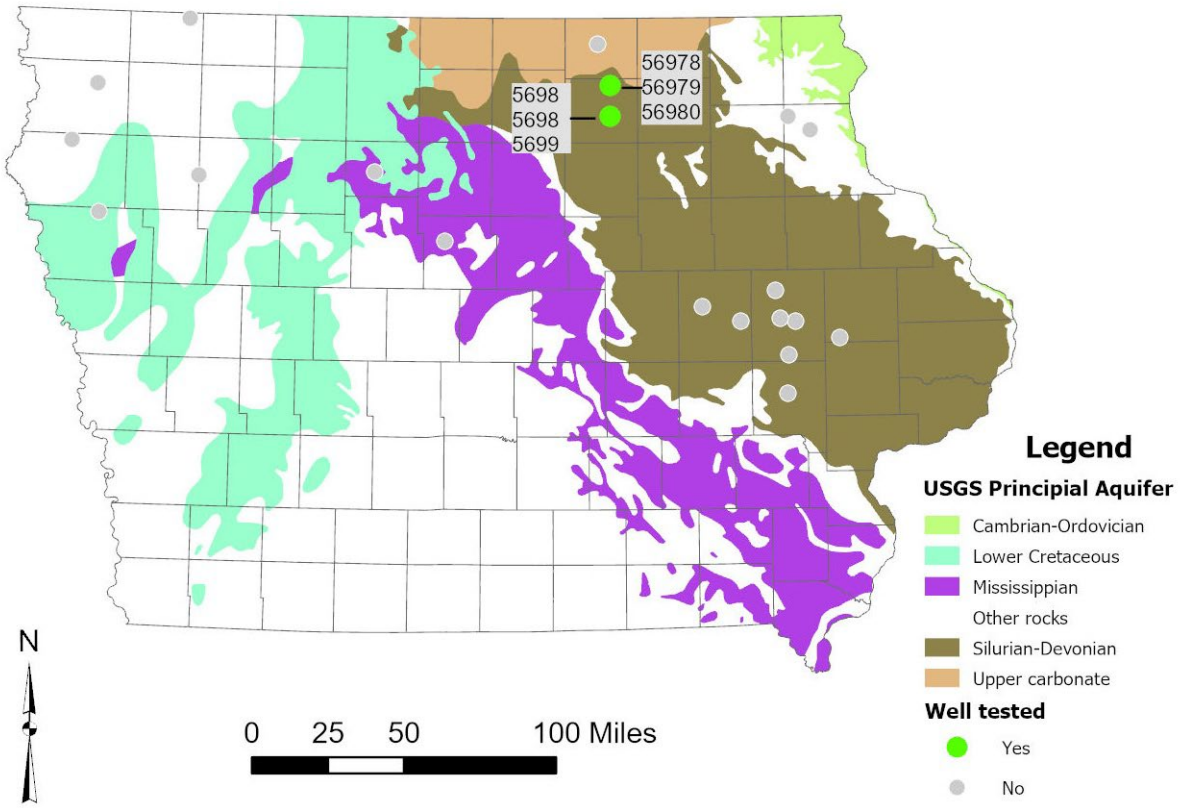


Figure 1. Location of wells selected for pumping and hydraulic testing.

Mechanical slug tests were conducted on all wells. The slug tests followed procedures established in the USGS' groundwater technical procedure document (GWPD) 17 (Cunningham and Schalk, 2011). A 3/4 inch diameter, 2 foot long slug was used. A minimum of four slug tests were conducted at each site (two slug in and two slug out tests). Additional slug in or slug out tests were conducted at sites if any of the original tests seemed anomalous.

Water levels during the slug tests were collected using a pressure transducer with a built-in data logger (In-Situ Level TROLL 700). The data collection interval varied from 0.5 to five seconds depending on the anticipated response of the aquifer to the slug's introduction and removal. Data from the slug tests was processed in Microsoft Excel and analyzed using the AquiferTest 10.0 software (Waterloo Hydrogeologic). Two separate test methods were used to analyze the slug tests and determine hydraulic conductivity (K): Hvorslev (1951) and Bulter et al. (2003). The Hvorslev method was used in wells where the water level response to the introduction/removal of the slug had minimal oscillations. The Butler method was used in wells where the water level response to the introduction/removal of the slug showed oscillations.

Slug test results are presented in Table 1. Appendix A compares the results of the 2024 slugs test to the results of the 2019 slug tests. The IGS believes no significant degradation has occurred in the wells because the hydraulic conductivities have similar magnitudes.

Table 1. Results from aquifer recovery or slug tests conducted on the NGWMN wells.

Site (NGWMN ID)	Hydraulic Conductivity (ft/day)		Method
	Average	Range	
FM1-2 (56978)	0.1	0.1 to 0.2	Horslev
FM1-3 (56979)	25	24 to 27	Butler
FM1-4 (56980)	18	15 to 20	Butler
FM3-2 (56988)	61	51 to 65	Butler
FM3-3 (56989)	49	45 to 51	Butler
FM3-4 (56990)	62	58 to 65	Butler

The raw data and analysis results of the slug tests have been entered into IGS Pump Test (https://igs.iihr.uiowa.edu/igs/pump-test/) to allow public access. Entries into IGS Pump Test were screened randomly to ensure data standards are maintained.

WEBSERVICE AND DATABASES

The IGS did not encounter any problems with its web services transferring data to the NGWMN Data Portal during the contract period of this award. The water level web service was updated to the WaterML2 standard and incorporates both discrete and continuous water level measurement during the contract period, but under a different award (G23AC00302).

SUMMARY

The IGS has achieved its project goals and verified six Devonian wells still have good connection to the Devonian aquifer and are functioning properly.

References

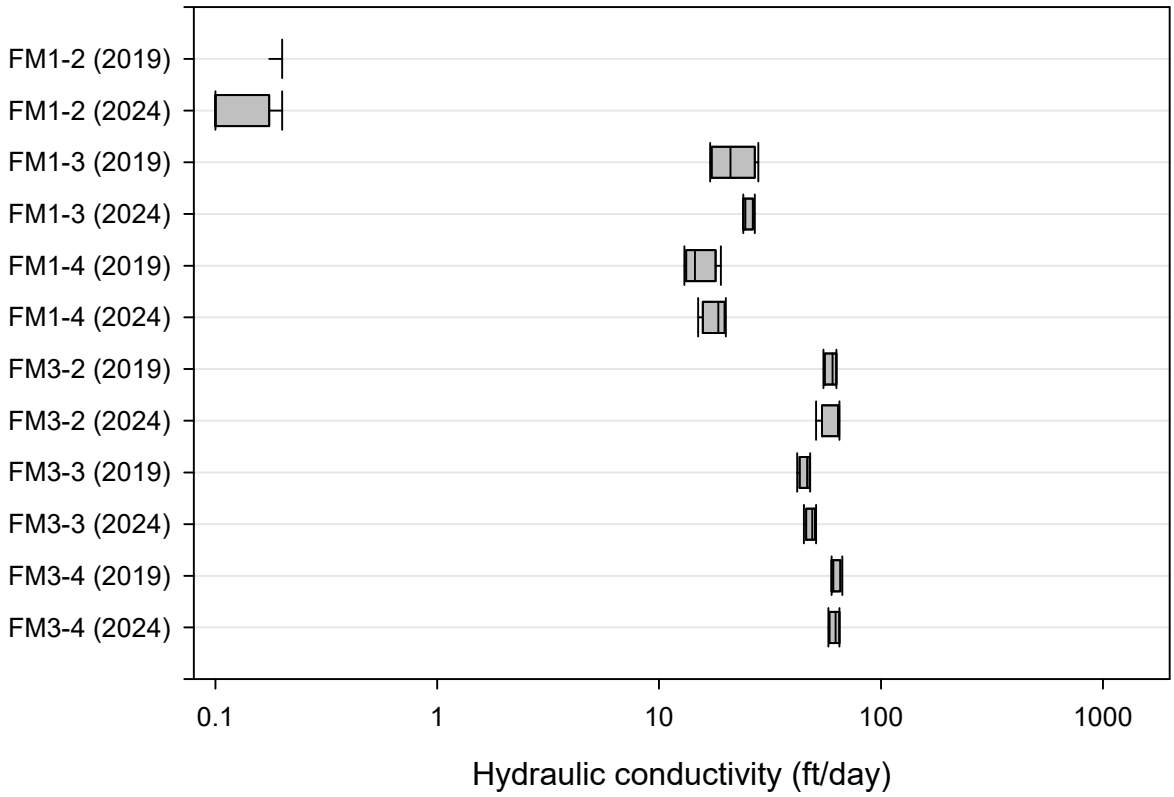
Butler Jr, J. J., Garnett, E. J., and Healey, J. M., 2003, Analysis of Slug Tests in Formations of High Hydraulic Conductivity, Groundwater, 41(5), 620-631.

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater Technical Procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1–A1, 151 p.

Hvorslev, M. J., 1951, Time Lag and Soil Permeability in Ground-Water Observations, Vicksburg, MS: U.S. Army Waterways Experiment Station

APPENDIX A

HYDRAULIC CONDUCTIVY COMPARISON


FM1-2 (2019)
FM1-2 (2024)
FM1-3 (2019)
FM1-3 (2024)
FM1-4 (2019)
FM1-4 (2024)
FM3-2 (2019)
FM3-2 (2024)
FM3-3 (2019)
FM3-3 (2024)
FM3-4 (2019)
FM3-4 (2024)
0.1
1
10
100
1000
Hydraulic conductivity (ft/day)

APPENDIX B

DETAILED WELL INFORMATION

Name	NGWMN ID	County	Drill Date	Well Depth	Prinicipal Aquifer
FM1-2	56978	Floyd	9/20/1984	138	Devonian
FM1-3	56979	Floyd	9/20/1984	240	Devonian
FM1-4	56980	Floyd	9/19/1984	357	Devonian
FM3-2	56988	Floyd	9/25/1984	207	Devonian
FM3-3	56989	Floyd	9/25/1984	297	Devonian
FM3-4	56990	Floyd	9/24/1984	360	Devonian

Name	GeoSam Link
FM1-2	https://igs.iihr.uiowa.edu/igs/geosam/well/56978/general-information
FM1-3	https://igs.iihr.uiowa.edu/igs/geosam/well/56979/general-information
FM1-4	https://igs.iihr.uiowa.edu/igs/geosam/well/56980/general-information
FM3-2	https://igs.iihr.uiowa.edu/igs/geosam/well/56988/general-information
FM3-3	https://igs.iihr.uiowa.edu/igs/geosam/well/56989/general-information
FM3-4	https://igs.iihr.uiowa.edu/igs/geosam/well/56990/general-information