

**Illinois State Geological Survey/Illinois State Water Survey  
Prairie Research Institute  
University of Illinois**

**Final Technical Report**

**Installation of New Monitoring Wells for the National Ground-Water Monitoring  
Network in Illinois to Fill in Spatial Data Gaps.**

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**FY2017 Award Term  
July 1, 2017-June 30, 2018; extension to December 31, 2018**

**January 24, 2018**

## **Overview**

The Illinois State Geological Survey (ISGS) installed 5 groundwater monitoring wells into the Principal Aquifer in northeast Illinois. These wells were installed to fill in spatial data gaps within existing NGWMN subnetworks that are managed by the Illinois State Water Survey (ISWS). These activities were in congruence with Objective 5 (Well Drilling) of the FY2017 request for proposals.

In collaboration with the ISWS, the ISGS focused the study in northeast Illinois within the glacial sand and gravel Principal Aquifer. More specifically, the project was aimed at expanding the well subnetwork through the area of Kane County, Illinois. In this area, shallow sand and gravel aquifers fill major bedrock valleys and their tributaries, and they are the primary source of drinking water for many municipal and domestic supplies. Prior to this project, only 5 NGWMN wells existed within the Principal Aquifer in Kane County. The new NGWMN wells will contribute to a more robust understanding of regional groundwater flow and local pumping effects within the aquifer.

The FY2017 contract award term was scheduled for July 1, 2017 through June 30, 2018. A 6-month extension was requested for the award term until December 31, 2018. This extra period was critical for efficient workflow and project success. The award granted from the NGWMN for FY2017 was \$89,508. Final expenditures of the award totaled \$88,492.42.

## **Project objectives**

### **Introduction**

The FY2017 award was aimed exclusively at Objective 5 (Well Drilling) of the request for proposals. The contract award funded personnel and drilling activities associated with Objective 5. No other objectives were included in the proposal. Thus, this section describes site selection, scientific relevance, and well-drilling activities/outcomes associated with the project.

### **Regional location**

The ISGS and ISWS collaborated to install 5 groundwater monitoring wells into the Principal Aquifer in the area of Kane County, IL (Figure 1). The Principal Aquifer of interest in this area is composed sand and gravel deposits that infill a network of regional buried bedrock valleys. The St. Charles bedrock valley constrains a large portion of the sand and gravel aquifer (locally named the St. Charles Aquifer), but numerous tributary bedrock valleys (i.e. Elburn Bedrock Valley/Aurora Bedrock Valley, and their associated sand-gravel deposits) also contribute to the regional Principal Aquifer (Figure 1).

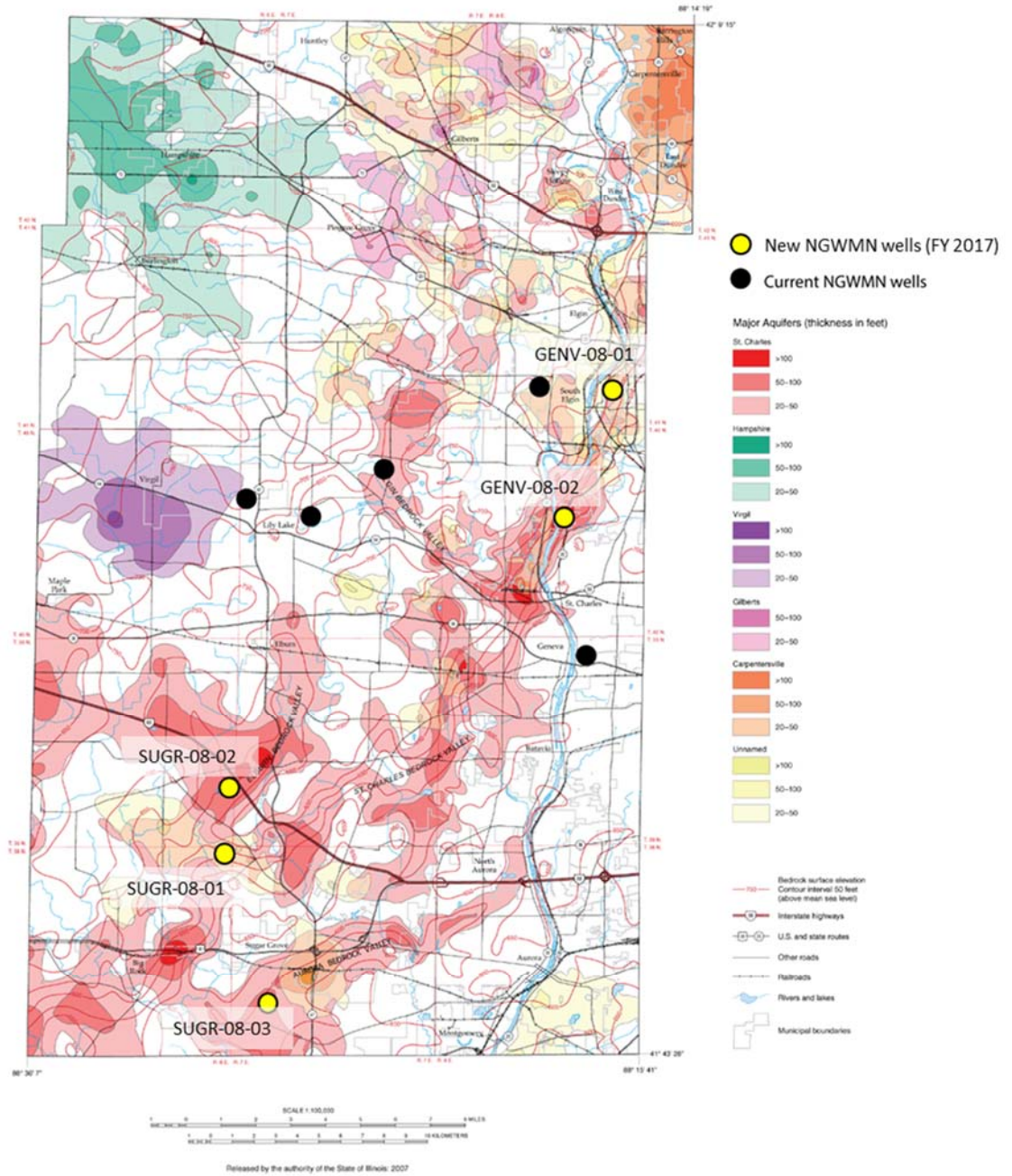


Figure 1. Locations of NGWMM wells to date in Kane County, Illinois. Map indicates location and thickness of six different sand/gravel aquifers in the region (St. Charles Bedrock Valley and tributaries shown in red).

### Drilling operation

The ISGS operates and maintains a Central Mining Equipment (CME) mud-rotary drilling rig that is instrumented with a wireline coring system (Figure 2). The system allows the collection of 2.25-inch or 3.0-inch continuous core of geologic materials, up to 10 feet in length, to depths of up to 500 feet. Core recovery is more successful in clay-rich materials, but it generally ranges from 40-100%. The ISGS also operates a wireline downhole geophysical logging system. When feasible, at every borehole location, a downhole natural-gamma ray log is collected to the total drilling depth. The natural-gamma ray log adds information relative to the grain-size fraction of geologic materials and helps with stratigraphic interpretation of core samples. Natural gamma ray logs are included with lithologic logs and well-construction details in Appendix A.



Figure 2. (a) Rear view of CME drilling rig operated by the ISGS and (b) extraction of continuous core from the wireline sampler.

### **Site selection**

Drilling sites were selected to expand the local monitoring network and fill in spatial data gaps within it. Four of the monitoring wells are located on Kane County Forest Preserve District (KCFPD) properties, and one well is located on private property. Public properties, such as county or municipal properties, were prioritized as site locations due to the anticipated longevity (30+ years) of property ownership. For FY2017, the Kane County Forest Preserve District was extremely cooperative and generous with access to sites, logistical support to drilling, and a long-term commitment to collaboration with the ISGS and ISWS. One monitoring well is located on the private property of a local Kane County resident who is familiar with NGWMN objectives and strongly supportive of them.

Two monitoring well sites were located in northeast Kane County, near the cities of South Elgin and St. Charles, Illinois (GENV-08-01 and GENV-08-02, respectively). These wells were installed on KCFPD property (Figures 3 and 4, respectively), and they are intended to monitor water levels in heavily-populated regions that include high-capacity municipal pumping wells. These monitoring wells were screened within the main branch of the St. Charles bedrock valley, which provides large portions water resources to those respective cities and other local residents.

Three monitoring well sites are located in southeast Kane County within the southeast portion of the St. Charles bedrock valley and tributary valleys. One well (SUGR-08-01; Figure 5) is located within the main branch of the St. Charles bedrock valley on KCFPD property. A second well (SUGR-08-02; Figure 6) is installed on KCFPD property within the Elburn Bedrock Valley, which is a tributary valley to the St. Charles Bedrock Valley. Lastly, the third well (SUGR-08-03; Figure 7) in this region is located on private property near Sugar Grove, IL. The well is installed within the Aurora Bedrock Valley, which is also a mapped tributary valley to the St. Charles Bedrock Valley. Significant sand and gravel was not encountered in this borehole, so the well is screened within the shallow, fractured bedrock.

### **Well construction**

Monitoring wells were constructed to the standards of the Illinois State Water Well Construction Code 920. Wells were constructed with 2-inch diameter PVC riser and slotted screen components. Sand pack materials encased the screened interval, bentonite plug bounded the sandpack materials, and bentonite grout filled the rest of the borehole column. Each well was finished at land surface with a locked, flush-mount wellhead protector encased in concrete (Figure 8). The wells were developed using compressed-air surging methods. A summary of the new wells that were drilled/installed and added to the NGWMN during FY2017 is included in Table 1. Details of well construction and geologic materials at each monitoring-well location are available in Appendix A.

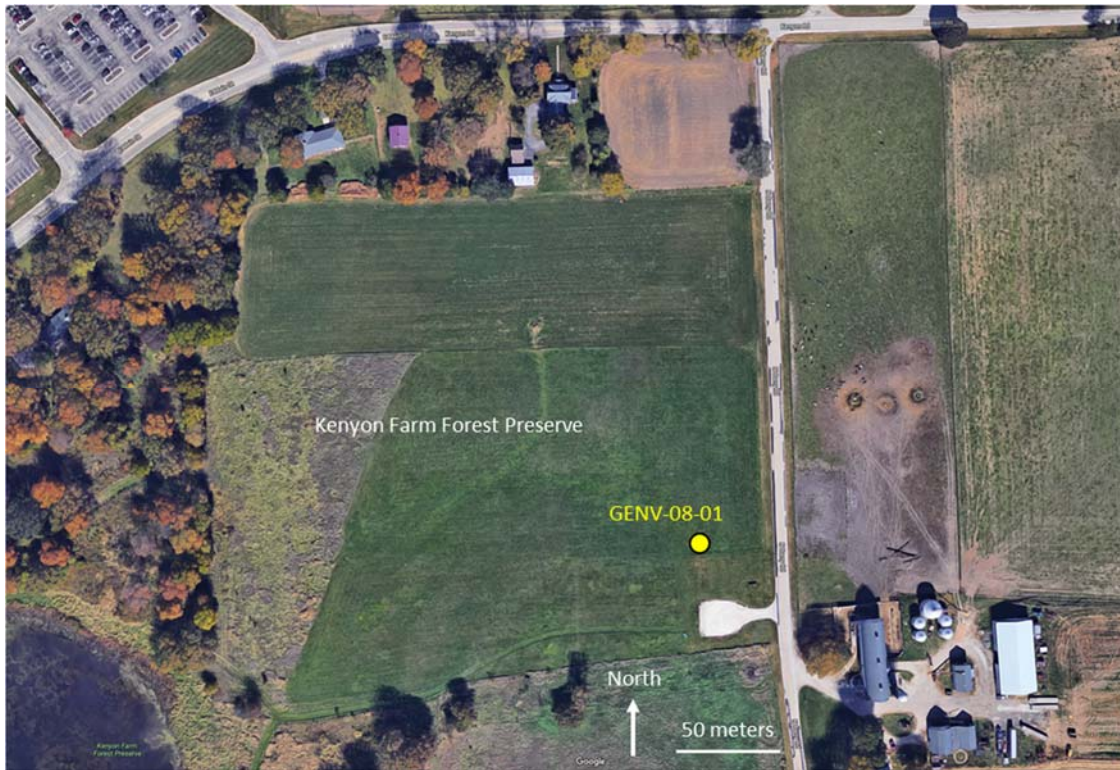


Figure 3. Aerial view of well location near South Elgin, Illinois (well GENV-08-01).



Figure 4. Aerial view of well location near St. Charles, Illinois (well GENV-08-02).



Figure 5. Aerial view of well location in the St. Charles Bedrock Valley near Sugar Grove, Illinois (well SUGR-08-01).



Figure 6. Aerial view of well location in the Elburn Bedrock Valley north of Sugar Grove, Illinois (well SUGR-08-02).



Figure 7. Aerial view of well location in the Aurora Bedrock Valley southwest of Sugar Grove, Illinois (well SUGR-08-03).





Figure 8. (a) 2-inch PVC casing and screen ready for installation, (b) installing sandpack material, (c) well casing with lockable cap and (d) completed wellhead protector.

Table 1. New wells installed for NGWMN (FY2017) in northeast Illinois.

WELL NAME	PRINCIPAL AQUIFER	NGWMN SITE NO.	WELL DEPTH (FT)	LAT	LONG
GENV-18-01	Sand and gravel	120893719000	135	41.998174	-88.277802
GENV-18-02	Sand and gravel	120893719100	85	41.954638	-88.308611
SUGR-18-01	Sand and gravel	120893718900	58	41.808309	-88.493737
SUGR-18-02	Sand and gravel	120893719200	135	41.830320	-88.489510
SUGR-18-03	Sand and gravel	120893719300	122	41.743211	-88.463186

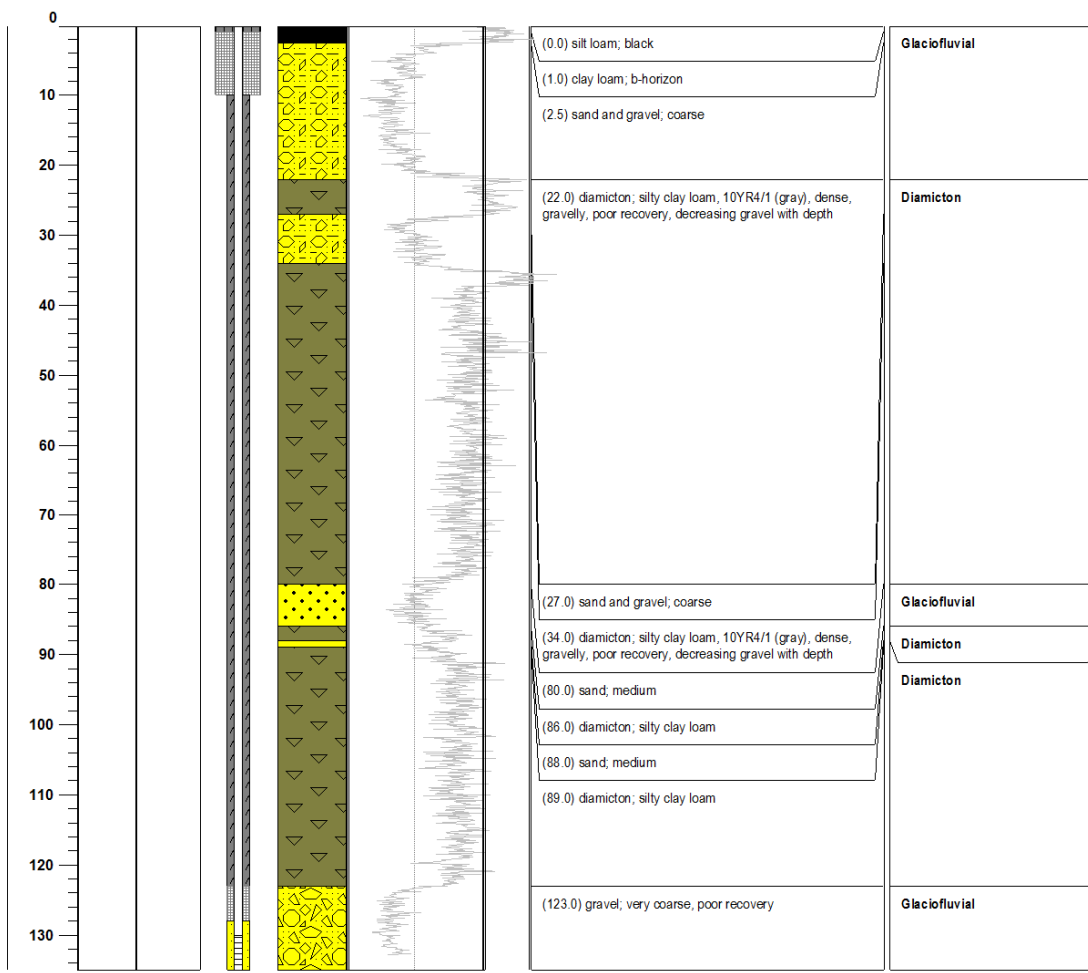
**APPENDIX A.**

**Drilling logs and well-construction details**



LOGGED BY <b>J. Thomason</b>		API NO. <b>120893719000</b>
DRILLING METHOD <b>CME 75 - Wireline</b>	DATE LOGGED <b>26-Sept-2018</b>	BOREHOLE NUMBER <b>GENV-08-01</b>
TOWNSHIP/RANGE/SECTION <b>T41N, R8E, SENWNW, Sec 36</b>		CORE NUMBER
NEAREST CITY / TOWN / LANDMARK <b>South Elgin, IL</b>		COUNTY <b>Kane</b>
WATER LEVEL		QUADRANGLE <b>Geneva</b>
TIME		DRILLED BY <b>Rich Padilla (ISGS)</b>
DATUM <b>NAD 83</b>	ELEVATION <b>755</b>	LOCATION OF BORING <b>N: 41.998174 E:-88.277802</b>
DATE		START TIME
LOCATION Kenyon Farm Forest Preserve, flush-mount well in prairie grass at northwest corner of parking area		END TIME
CASING DEPTH		START DATE
		END DATE

Depth (ft.)	Rec/Drive	Sample	Well	Graphic	Gamma 50 (cps)	Facies Code	Geologic Material Description	Interpretation
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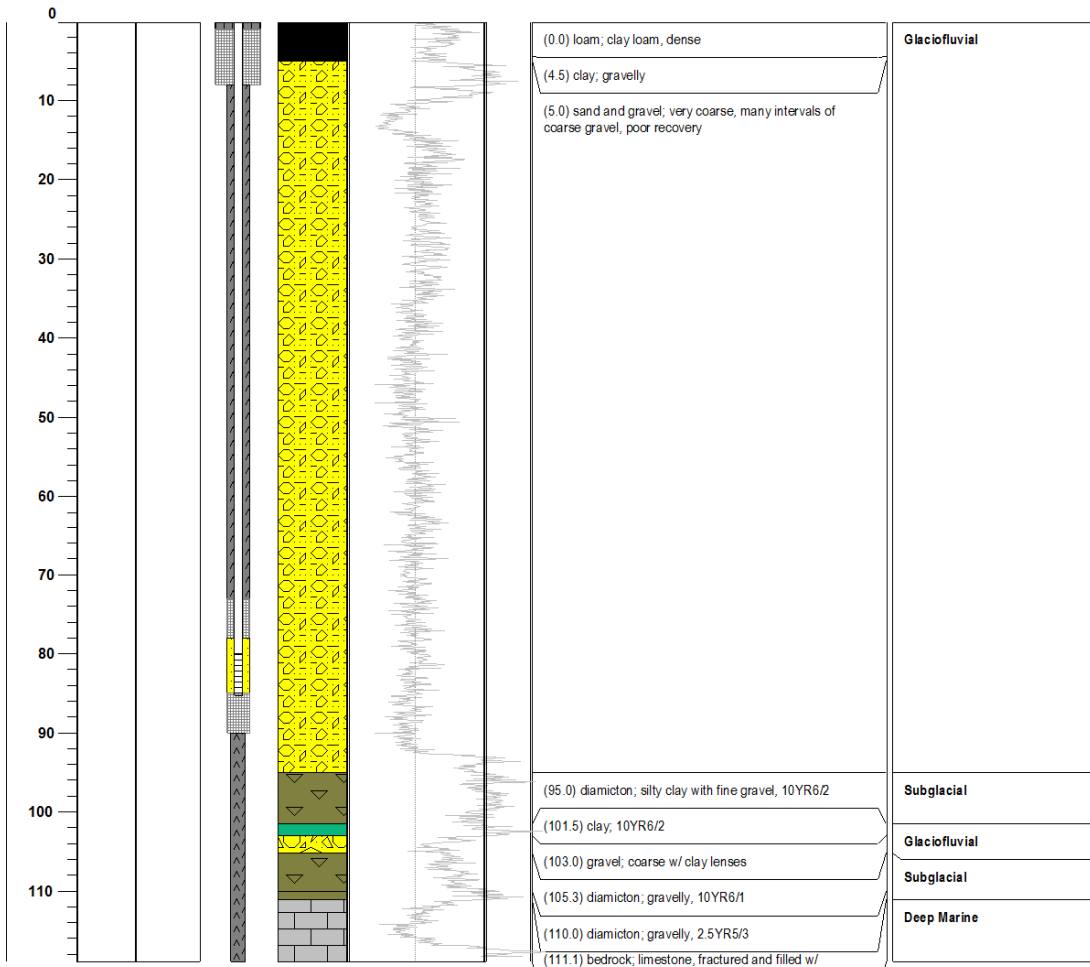
Sheet 1 of 1    API No.: 120893719000    BH Number: GENV-08-01    Core Number:

Figure A1. Lithologic log, gamma log, and well construction details of NGWMN Site No. 120893719000 (GENV-08-01).



LOGGED BY <b>J. Thomason</b>		API NO. <b>120893719100</b>	
DRILLING METHOD <b>CME 75 - Wireline</b>	DATE LOGGED <b>03-October-2018</b>		BOREHOLE NUMBER <b>GENV-08-02</b>
TOWNSHIP/RANGE/SECTION <b>T40, R8E, SENWNE, Sec 15</b>			CORE NUMBER
NEAREST CITY / TOWN / LANDMARK <b>St. Charles, IL</b>			COUNTY <b>Kane</b>
WATER LEVEL		QUADRANGLE <b>Geneva</b>	
TIME		DRILLED BY <b>Aaron Blacker (ISGS)</b>	
DATUM <b>NAD 83</b>	ELEVATION <b>723</b>	LOCATION OF BORING <b>N: 41.954638 E: -88.308611</b>	DATE
LOCATION Fox River Bluff East Forest Preserve, flush-mount well in prairie grass on north side of parking area		CASING DEPTH	START TIME / END TIME
			START DATE / END DATE

Depth (ft.)	Rec/Drive	Sample	Well	Graphic	Gamma 50 (cps)	Facies Code	Geologic Material Description	Interpretation
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Sheet 1 of 2    API No.: 120893719100    BH Number: GENV-08-02    Core Number:

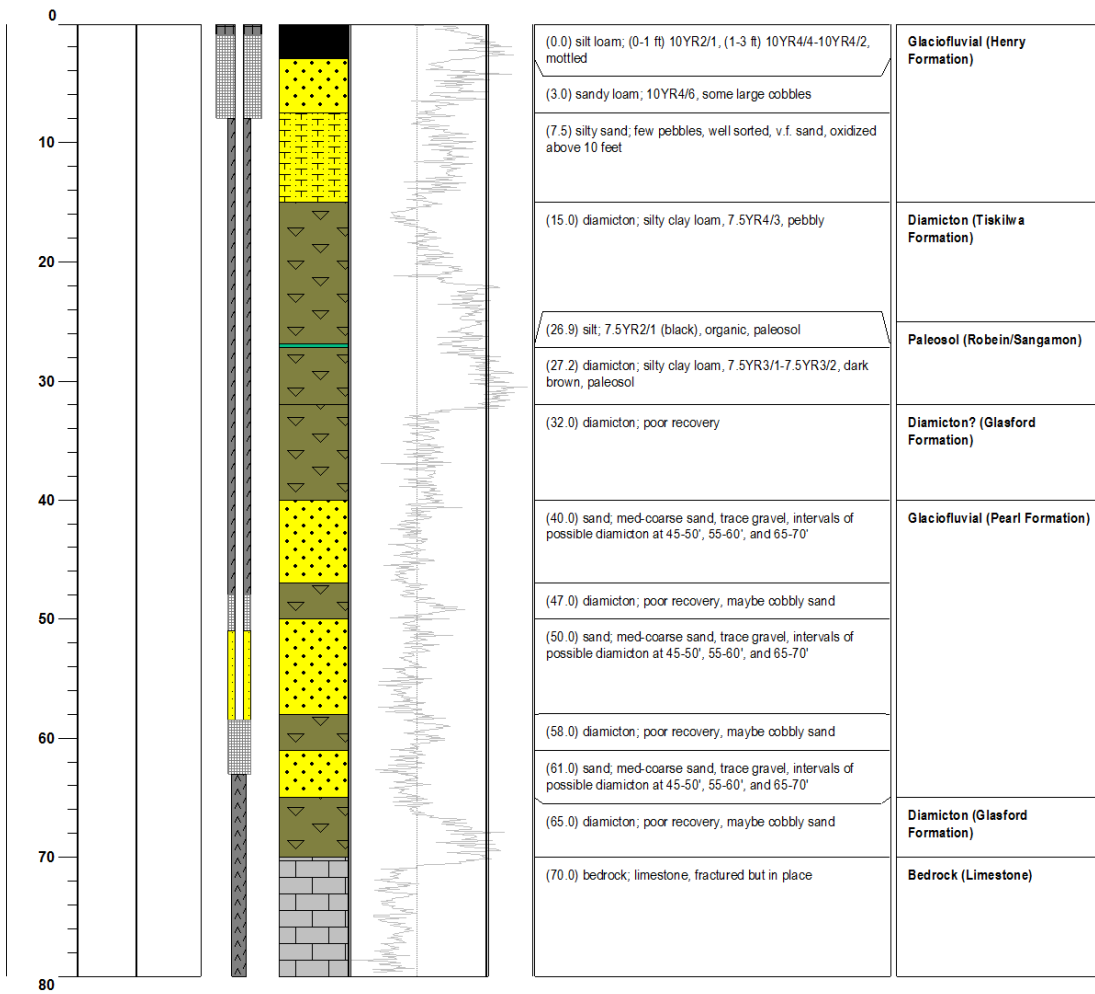
Figure A2. Lithologic log, gamma log, and well construction details of NGWMN Site No. 120893719100 (GENV-08-02).



LOGGED BY <b>J. Thomason</b>		API NO. <b>120893718900</b>
DRILLING METHOD <b>CME 75 - Wireline</b>	DATE LOGGED <b>18-Sept-2018</b>	BOREHOLE NUMBER <b>SUGR-08-01</b>
TOWNSHIP/RANGE/SECTION <b>T38N, R6E, NWNENE, Sec 1</b>		CORE NUMBER
NEAREST CITY / TOWN / LANDMARK <b>Sugar Grove, IL</b>		COUNTY <b>Kane</b>
WATER LEVEL		QUADRANGLE <b>Sugar Grove</b>
TIME		DRILLED BY <b>Rich Padilla (ISGS)</b>
DATUM <b>NAD 83</b>	ELEVATION <b>740</b>	LOCATION OF BORING <b>N: 41.808309 E: -88.493737</b>
DATE		START TIME
DATE		END TIME
LOCATION Sauer Family Forest Preserve, Kane County, flush-mount well located approximately 2800 feet east of Lasher/Harter		CASING DEPTH
START DATE		END DATE

PROJECT NAME <b>USGS National Groundwater Monitoring Network</b>		
OWNER <b>Kane County Forest Preserve</b>		
DATUM <b>NAD 83</b>	ELEVATION <b>740</b>	LOCATION OF BORING <b>N: 41.808309 E: -88.493737</b>
LOCATION Sauer Family Forest Preserve, Kane County, flush-mount well located approximately 2800 feet east of Lasher/Harter		

Depth (ft.)	Rec/Drive	Sample	Well	Graphic	Gamma 50 (cps)	Facies Code	Geologic Material Description	Interpretation
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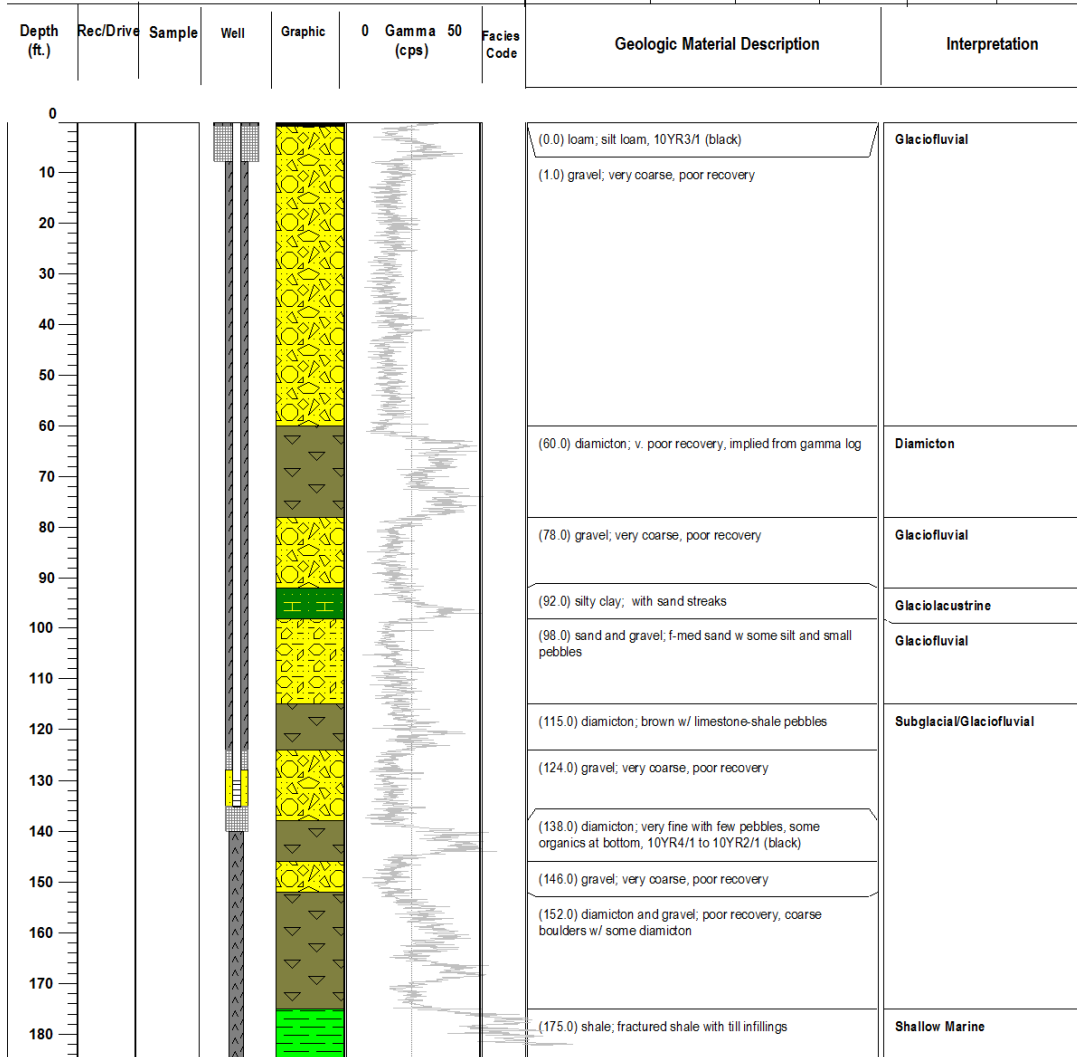


Sheet 1 of 1    API No.: 120893718900    BH Number: SUGR-08-01    Core Number:

Figure A3. Lithologic log, gamma log, and well construction details of NGWMN Site No. 120893718900 (SUGR-08-01).



LOGGED BY <b>J. Thomason</b>		API NO. <b>120893719200</b>
DRILLING METHOD <b>CME 75 - Wireline</b>	DATE LOGGED <b>17-October-2018</b>	BOREHOLE NUMBER <b>SUGR-08-02</b>
TOWNSHIP/RANGE/SECTION <b>T39N, R6E, SESENE, Sec 25</b>		CORE NUMBER
NEAREST CITY / TOWN / LANDMARK <b>Sugar Grove, IL</b>		COUNTY <b>Kane</b>
PROJECT NAME <b>USGS National Groundwater Monitoring Network</b>		WATER LEVEL
OWNER <b>Kane County Forest Preserve</b>		TIME
DATUM <b>NAD 83</b>	ELEVATION <b>723</b>	LOCATION OF BORING <b>N: 41.830320 E:-88.489510</b>
LOCATION Alden Underwood Prairie Forest Preserve, flush-mount well in prairie grass on north side of parking area		CASING DEPTH
		START TIME
		END TIME
		START DATE
		END DATE



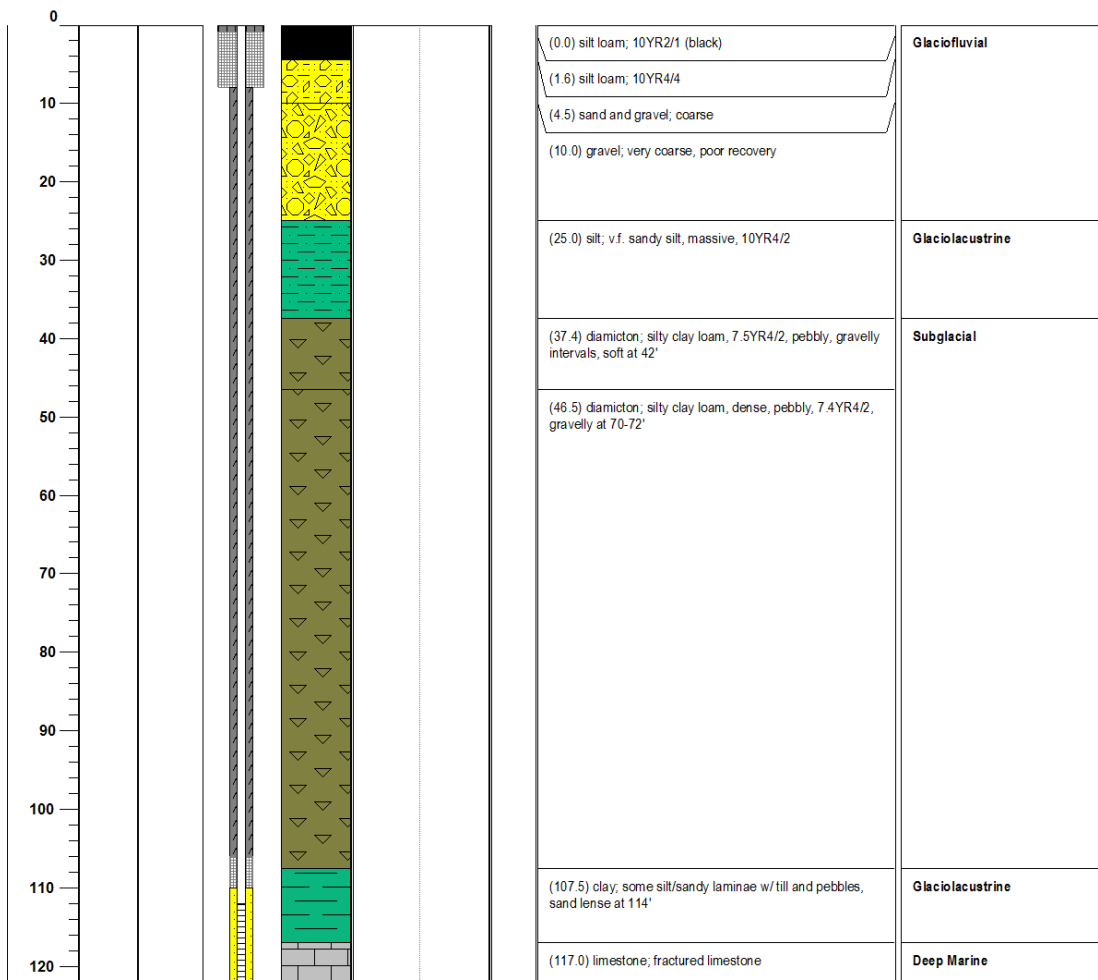
Sheet 1 of 1    API No.: 120893719200    BH Number: SUGR-08-02    Core Number:

Figure A4. Lithologic log, gamma log, and well construction details of NGWMN Site No. 120893719200 (SUGR-08-02).



LOGGED BY <b>J. Thomason</b>		API NO. <b>120893719300</b>
DRILLING METHOD <b>CME 75 - Wireline</b>	DATE LOGGED <b>25-October-2018</b>	BOREHOLE NUMBER <b>SUGR-08-03</b>
TOWNSHIP/RANGE/SECTION <b>T38N, R7E, NENENSW, Sec 29</b>		CORE NUMBER
NEAREST CITY / TOWN / LANDMARK <b>Sugar Grove, IL</b>		COUNTY <b>Kane</b>
WATER LEVEL		QUADRANGLE <b>Yorkville</b>
TIME		DRILLED BY <b>Rich Padilla (ISGS)</b>
DATUM <b>NAD 83</b>	ELEVATION <b>714</b>	LOCATION OF BORING <b>N: 41.743211 E: -88.463186</b>
DATE		START TIME
CASING DEPTH		END DATE
LOCATION Nagel Property at S-curve bend along Prairie Street, Sugar Grove, IL		

Depth (ft.)	Rec/Drive	Sample	Well	Graphic	0 Gamma 50 (cps)	Facies Code	Geologic Material Description	Interpretation
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Sheet 1 of 1    API No.: 120893719300    BH Number: SUGR-08-03    Core Number:

Figure A5. Lithologic log, gamma log, and well construction details of NGWMN Site No. 120893719300 (SUGR-08-03).