STATE OF SOUTH DAKOTA
Dennis Daugaard, Governor

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
Steven M. Pirner, Secretary

DIVISION OF FINANCIAL AND TECHNICAL ASSISTANCE
James Feeney, Director

GEOLOGICAL SURVEY PROGRAM
Derric L. Iles, State Geologist

OPEN-FILE REPORT 95-UR

INVESTIGATION OF THE IMPACT OF GROUND WATER DRAWDOWN NEAR THE LEWIS & CLARK REGIONAL WATER SYSTEM WELLFIELD IN CLAY COUNTY, SOUTH DAKOTA

DRAGAN FILIPOVIC

Akeley-Lawrence Science Center
University of South Dakota
Vermillion, South Dakota

2016

GEOLOGICAL SURVEY PROGRAM

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
AKELEY-LAWRENCE SCIENCE CENTER, USD
414 EAST CLARK STREET
VERMILLION, SOUTH DAKOTA 57069-2390
(605) 677-5227

Derric L. Iles, M.S., C.P.G.	State Geologist
Timothy C. Cowman, M.S.	Environmental Scientist Manager
Priscilla E. Young, B.S.	Senior Secretary
Jeffrey J. Allen, B.A.	Geologist
Sarah A. Chadima, M.S., C.P.G.	Geologist
Wesley P. Christensen, B.S.	Geologist
Dragan Filipovic, M.S.	Hydrologist
Stevie L. Holmes, B.S.	Geologist
Ann R. Jensen, B.S.	Geologist
Darren J. Johnson, M.S.	Geologist
Thomas R. Marshall, Ph.D.	Geologist
Matthew T. Noonan, B.S.	Hydrologist
Thomas B. Rich, M.S.	Hydrologist
Layne D. Schulz, B.S.	Geologist
Scott W. Jensen	Civil Engineering Technician
Christopher A. Lanoue, B.A.	Natural Resources Technician
Ted R. Miller, B.S.	Civil Engineering Technician
James R. Olson, B.S.	Civil Engineering Technician
Lori L. Roinstad	Cartographer

RAPID CITY OFFICE
2050 WEST MAIN, SUITE 1
RAPID CITY, SOUTH DAKOTA 57702-2493
(605) 394-2229

Brian A. Fagnan, M.S,, C.P.G.	Geologist
Mark D. Fahrenbach, Ph.D.	Geologist
Joanne M. Noyes, M.S., P.E.	Hydrologist

CONTENTS

FIGURES

TABLE

APPENDICES

INTRODUCTION

The purpose of this investigation was to evaluate the impacts on the water table resulting from pumping of ground water from the Lewis & Clark Regional Water System (LCRWS) wellfield. This information was needed by the Ground Water Quality Program, Department of Environment and Natural Resources, to delineate an appropriate source water protection area for the LCRWS wellfield.

The study was conducted in an area of approximately 4.6 square miles, southwest of Vermillion, South Dakota, (fig. 1), from February through September 2015. Field work included the installation of five monitoring wells in the Missouri aquifer, measurement of ground-water levels from eight monitoring wells, and measurement of the elevation of the Missouri River.

The LCRWS has 11 production wells located in sections 15 and 22, T. 32.N, R. 4 E. within the study area adjacent to the Missouri River. Figure 2 shows locations of production wells, monitoring wells, nearby irrigation wells, and an automated gaging station operated and maintained by U.S. Geological Survey.

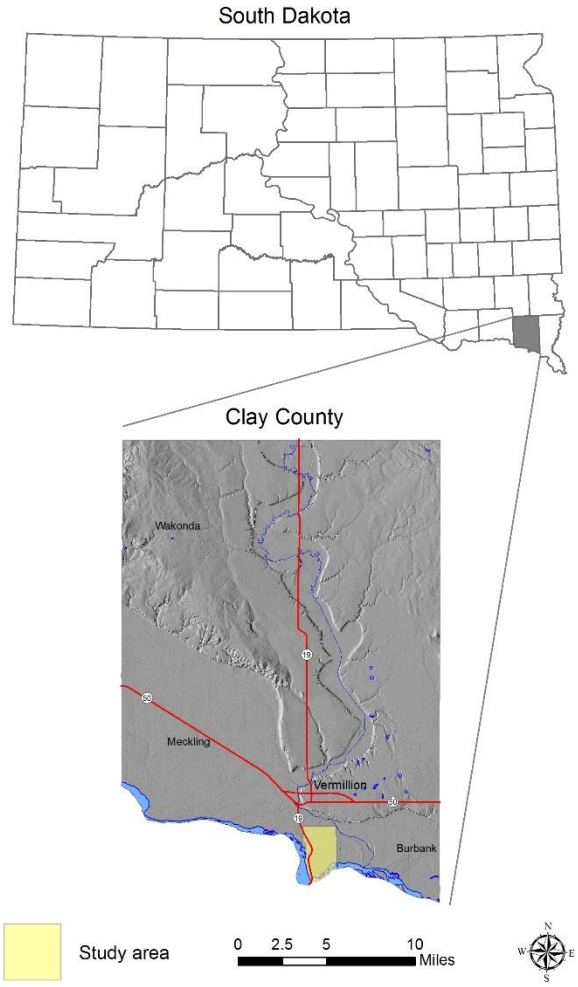
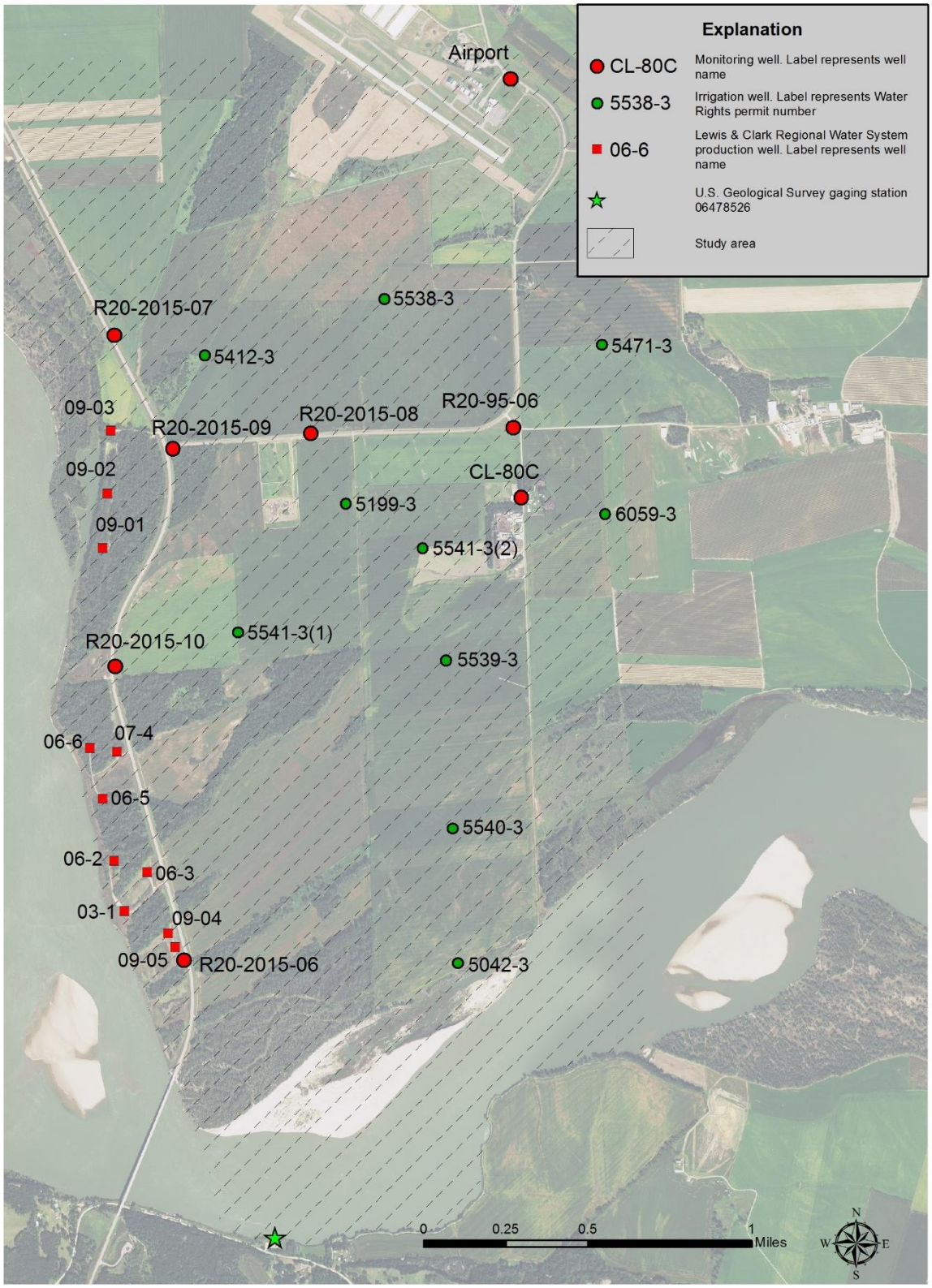


Figure 1. Location of study area.



Map base from USDA NAIP Imagery, 2014 series

Figure 2. Locations of wells and a gaging station used in the study.

METHODS

The general geology of the study area was determined using geologic maps and test-hole and well logs, and by reviewing previous reports (Christensen, 1967; Stephens, 1967; Layne Hydro, 2011; Wittman Hydro Planning Associates, Inc., 2008). Cross sections A-A' and B-B' represent the generalized subsurface geology of the LCRWS wellfield and vicinity (figs. 3 and 4).

Field work was conducted from February through September 2015 and included drilling and installing five monitoring wells in the Missouri aquifer (app. A). Water-level data were collected from March 4 through September 30, 2015, from eight monitoring wells, three of which were installed for previous studies. Water-level data for the Missouri River were obtained from a gaging station on the Nebraska side of the Missouri River just south of the LCRWS wellfield (fig. 2; app. B).

In order to better understand and illustrate the impact of pumping by the LCRWS on the water table, the wells comprising the LCRWS wellfield (app. C) were arbitrarily divided in three groups: north, middle, and south. The north group consists of production wells 09-01, 09-02, and 09-03. The middle group consists of production wells 06-5, 06-6, and 07-4. The south group consists of production wells 03-1, 06-2, 06-3, 09-04, and 09-05.

Records of irrigation wells in the study area were compiled (app. D) but no water level measurements were obtained. These records were compiled primarily to serve as a resource in any future assessment of increased pumping by the LCRWS.

Water-level data from monitoring wells, LCRWS production wells, and the Missouri River (app. B) were used for constructing water-table contour maps and estimating the direction of ground water flow (figs. 5, 6, and 7) and for constructing hydrographs (figs. 8, 9, 10, and 11). The water-table maps and hydrographs illustrate the relationship between pumping rate, the elevation of the Missouri River, and the elevation of the water table in the vicinity of the LCRWS wellfield.

RESULTS AND INTERPRETATION

The surface sediment is a variable mix of sand, silt, and clay resulting from the action of, and deposition by, the Missouri River. That same variability, including coarser sediments (gravel), is present in the subsurface as illustrated in figures 3 and 4.

Saturated sediments above the bedrock surface in the Missouri River valley are considered to be part of the Missouri aquifer. The Missouri aquifer in the study area is under unconfined and semi-confined conditions (Rich, 2006). The sources of recharge to the Missouri aquifer in the study area are the Missouri River and precipitation. Discharge from the Missouri aquifer is through pumping from the LCRWS production wells, irrigation wells, evapotranspiration, and seepage to the Missouri River.

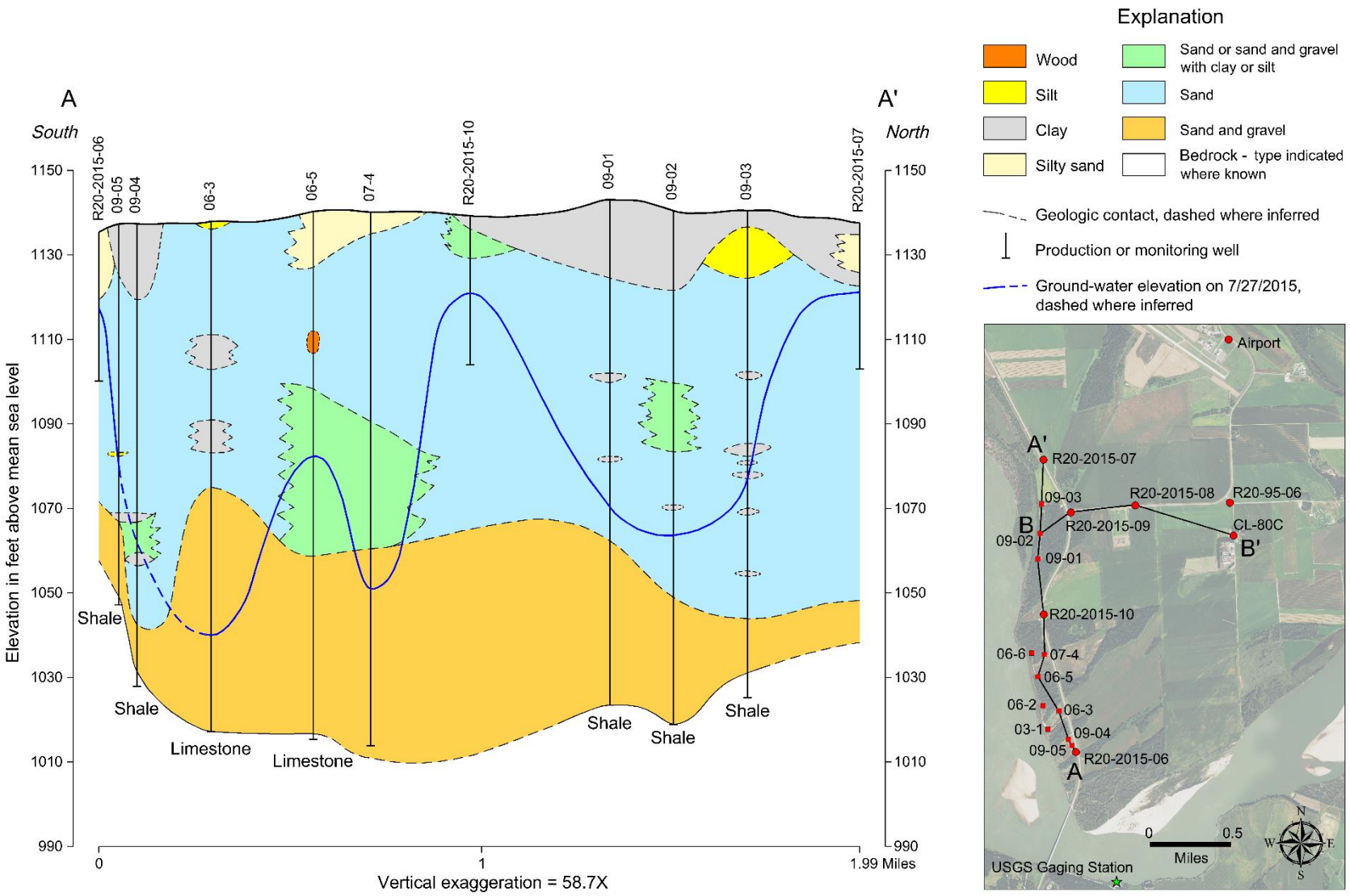


Figure 3. Cross section A-A'

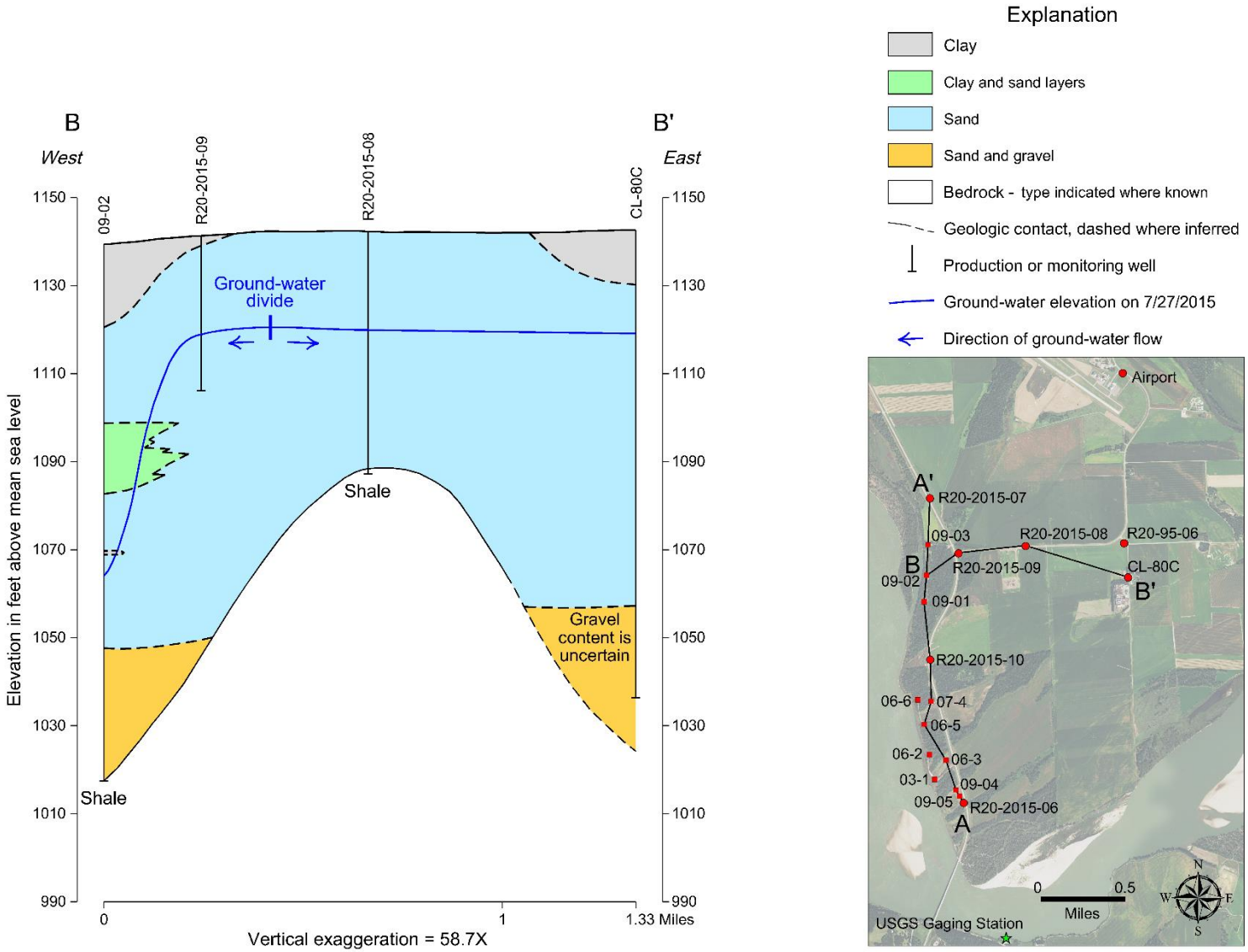


Figure 4. Cross section B-B'

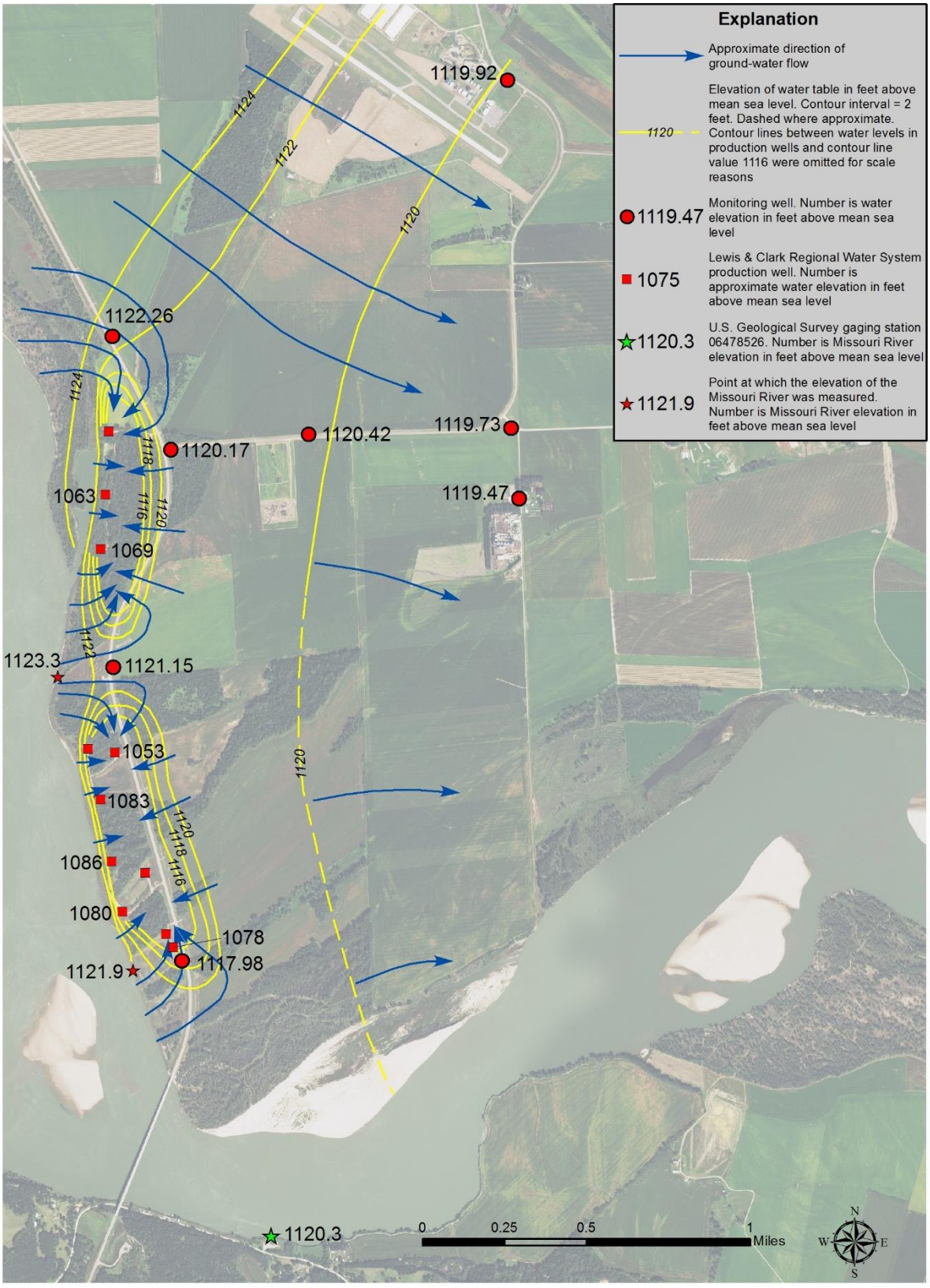


Figure 5. Water-table map and ground-water flow direction on April 22, 2015.

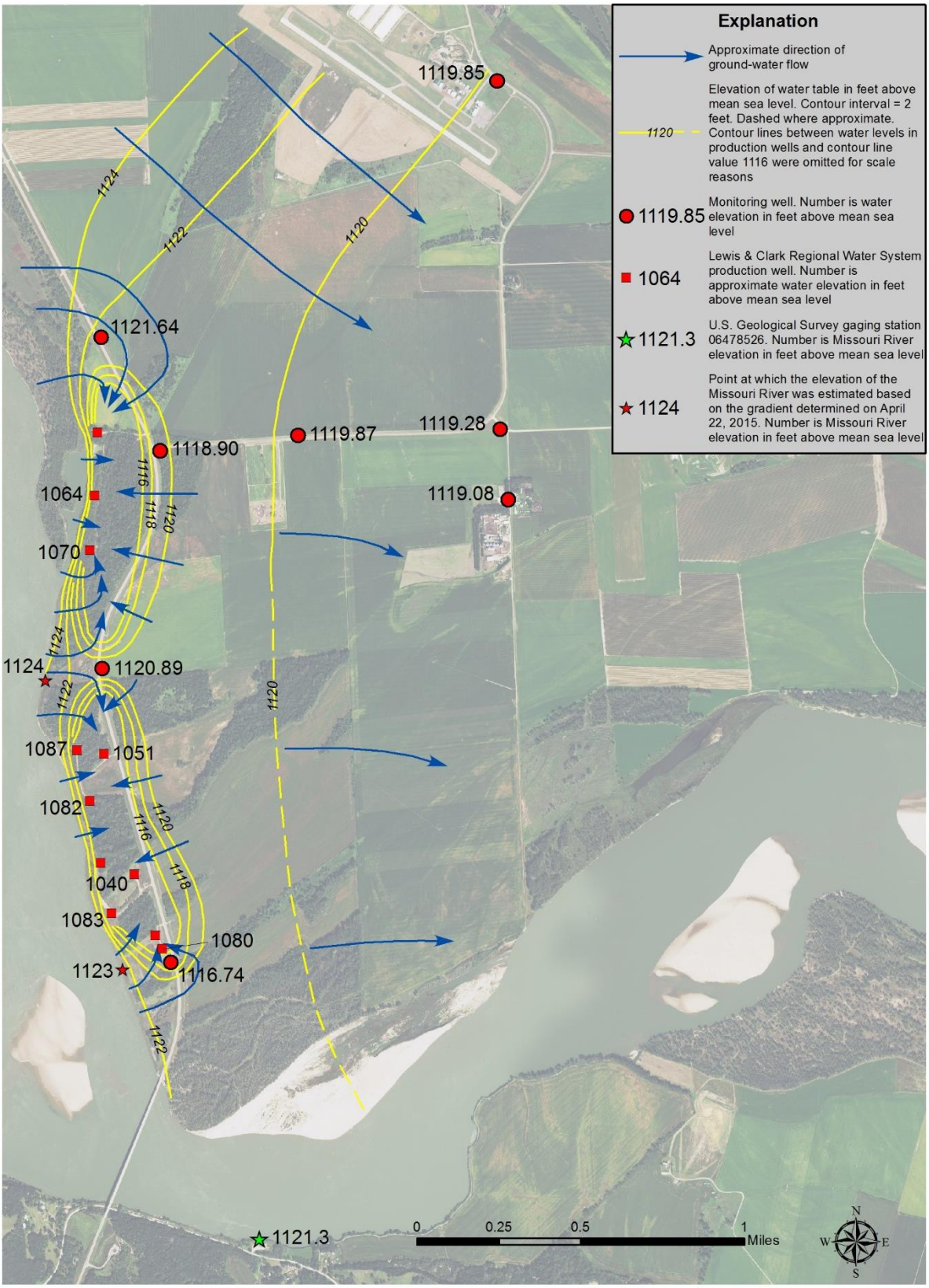


Figure 6. Water-table map and ground-water flow direction on July 27, 2015.

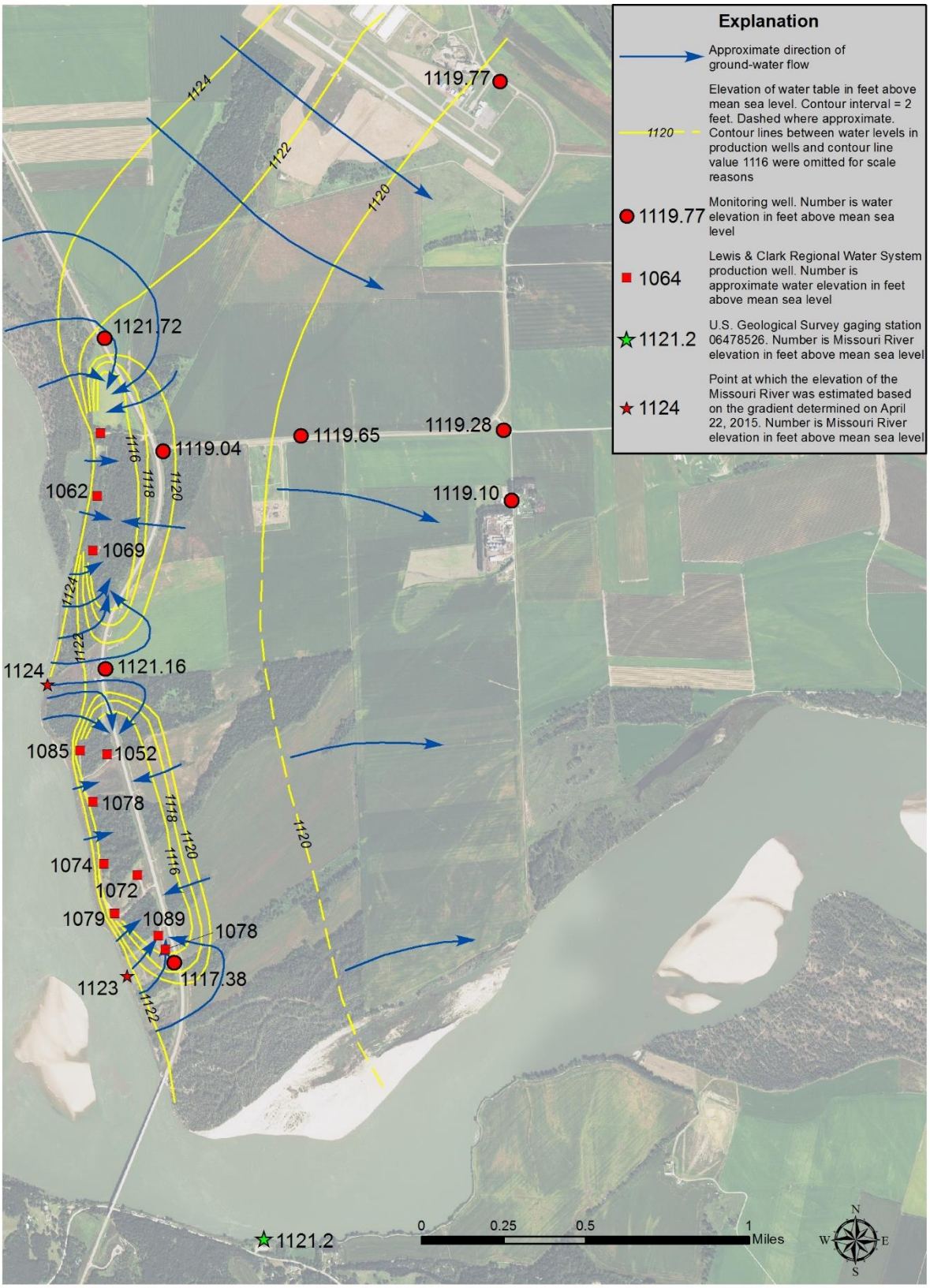


Figure 7. Water-table map and ground-water flow direction on September 30, 2015.

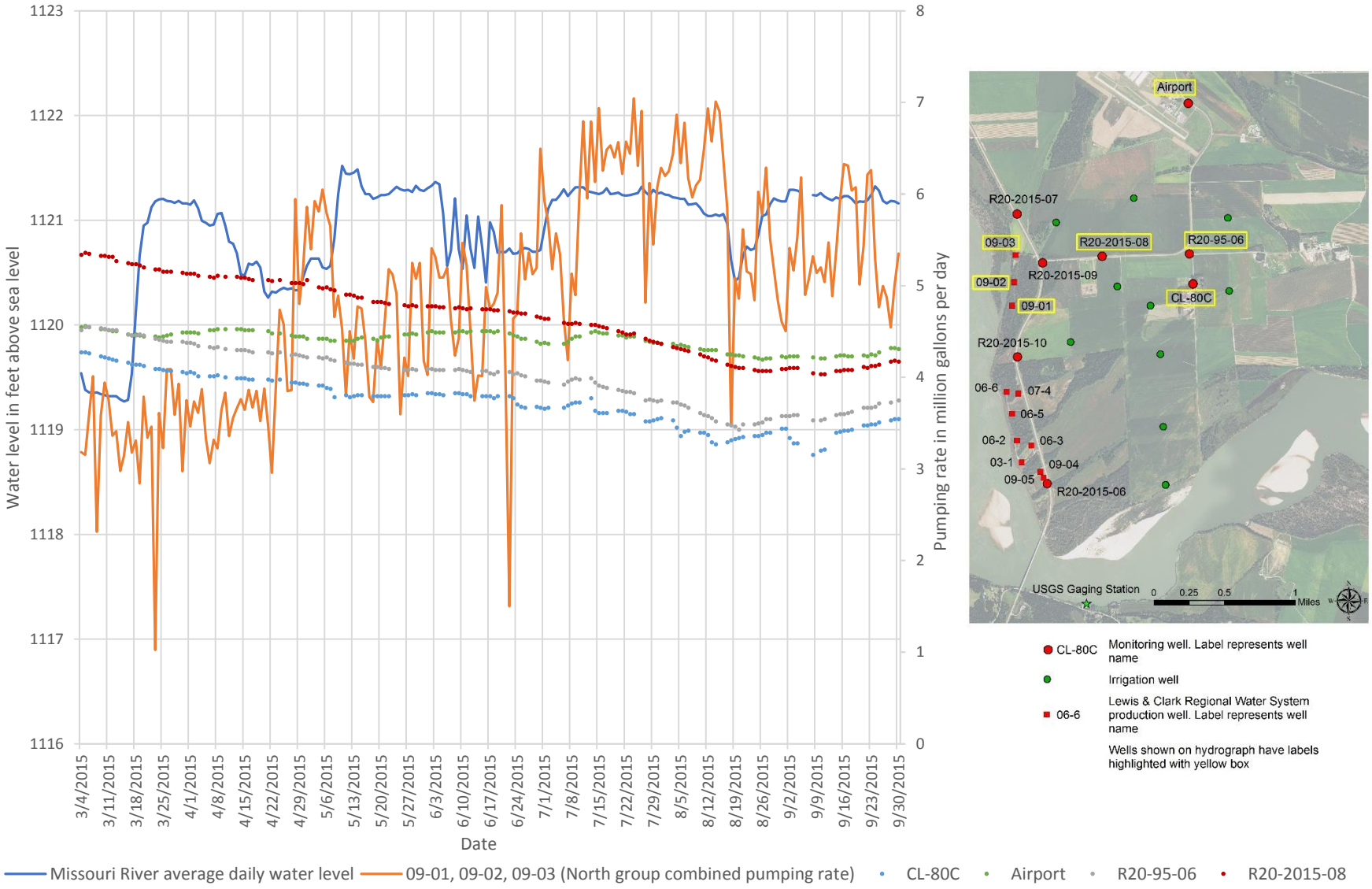


Figure 8. Graph showing the combined pumping rate of the north group of LCRWS production wells, water levels in distant monitoring wells, and the average daily water level of the Missouri River.

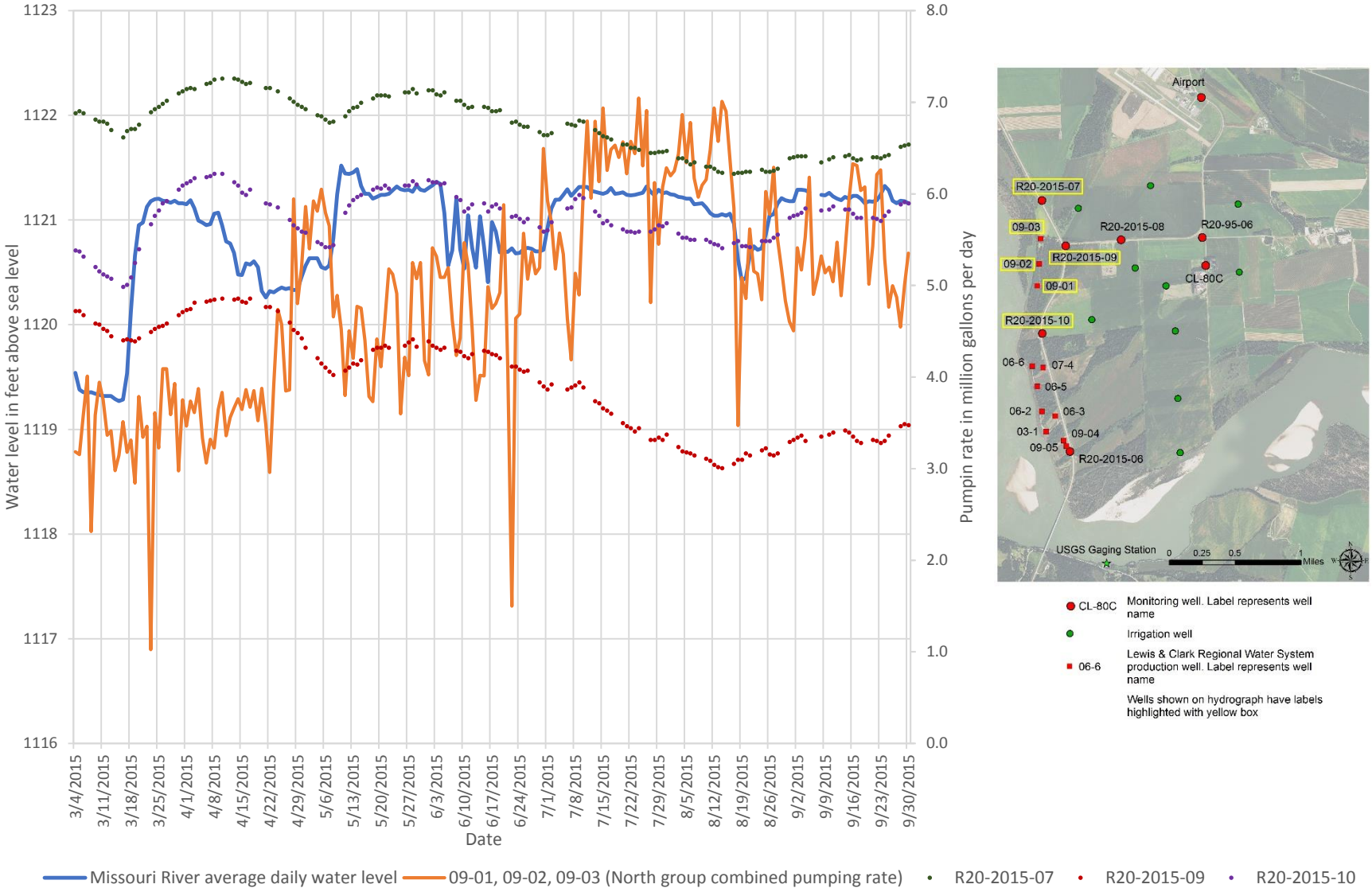


Figure 9. Graph showing the combined pumping rate of the north group of LCRWS production wells, water levels in nearby monitoring wells, and the average daily water level of the Missouri River.

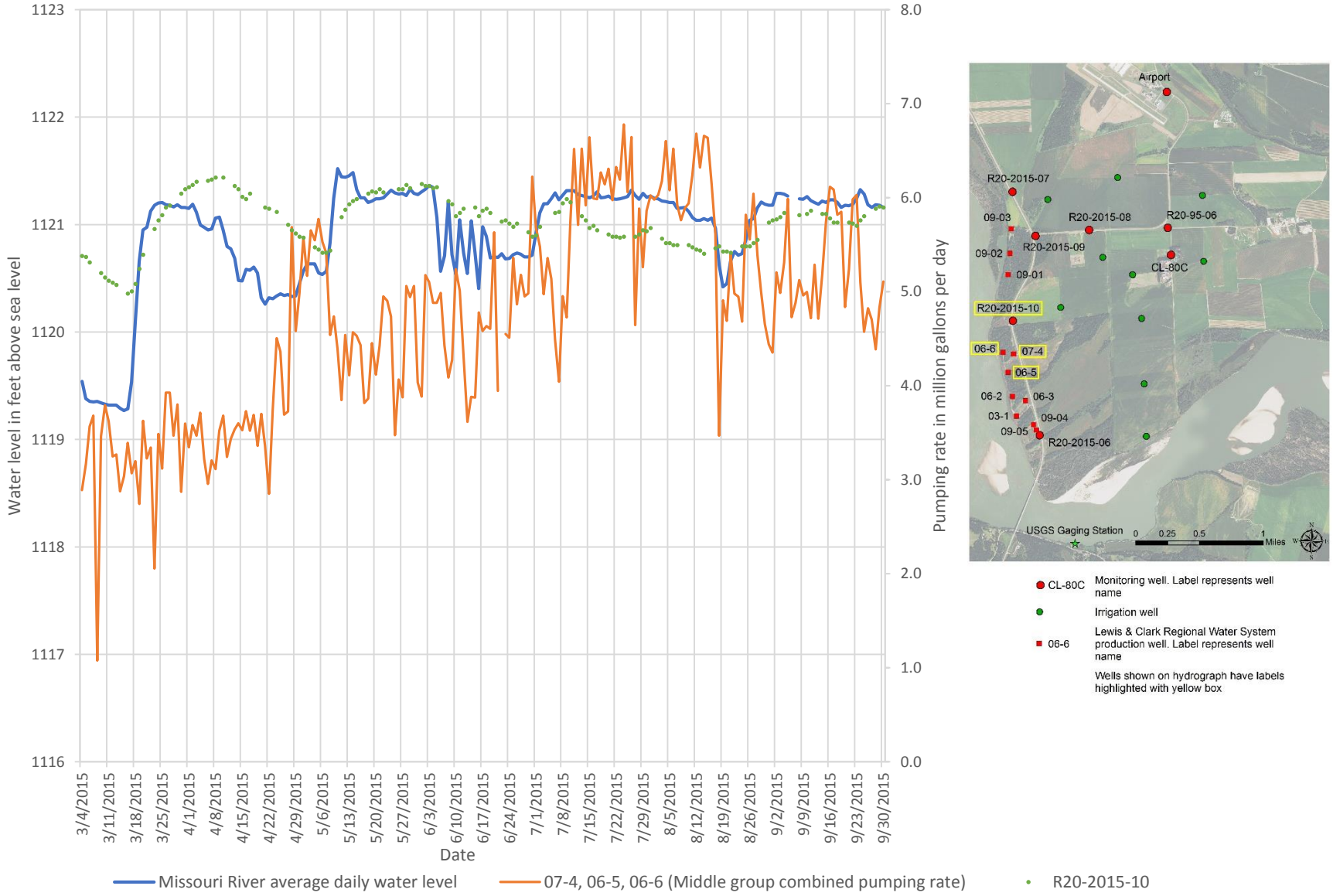


Figure 10. Graph showing the combined pumping rate of the middle group of LCRWS production wells, the water level in a nearby monitoring well, and the average daily water level of the Missouri River.

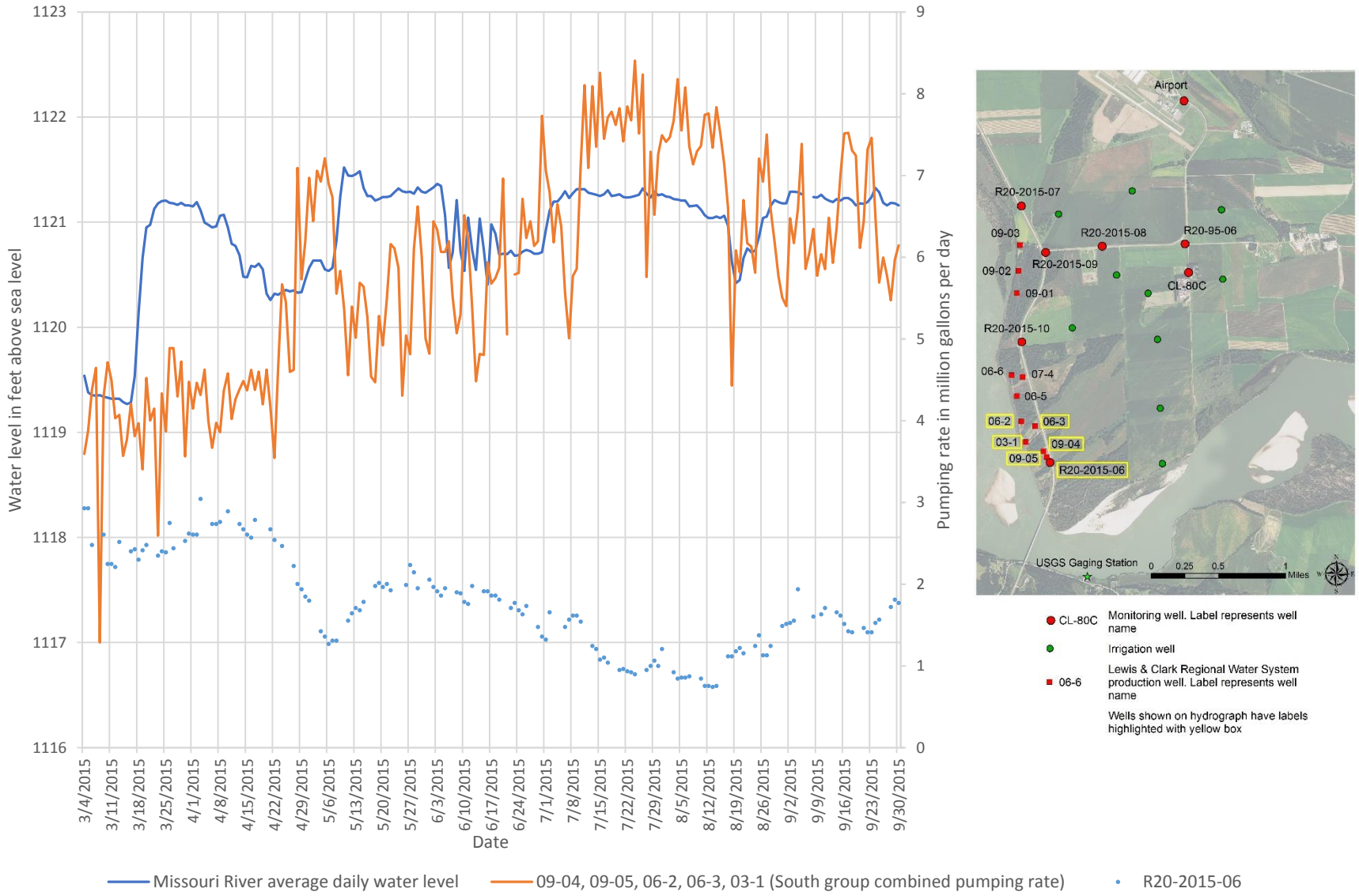


Figure 11. Graph showing the combined pumping rate of the south group of LCRWS production wells, the water level in a nearby monitoring well, and the average daily water level of the Missouri River.

The arrangement of production wells in the wellfield is approximately linear and parallel with the Missouri River (fig. 2). Pumping from the production wells causes water from the Missouri River to infiltrate into the aquifer through the riverbed and riverbank, and flow eastward toward production wells. On the east (landward) side of the wellfield, ground water in close proximity to the wellfield flows westward toward the line of production wells (figs. 4, 5, 6, and 7). During the period of record for this study, the drawdown of water levels to the east of the LCRWS wellfield is interpreted to extend less than 0.4 mile eastward from the wellfield.

Information on hydraulic conductivity and transmissivity of the Missouri aquifer are available for 10 of the 11 LCRWS production wells and an additional location where there is presently no permanent production well. These data are presented in table 1.

Table 1. Hydraulic conductivity and transmissivity for LCRWS production wells

Well[1]	Well type	Hydraulic conductivity (ft/day)	Transmissivity (ft^2/day)
Temporary[2]	vertical	219	20,300
06-2[2]	angle	599	49,100
06-3[2]	vertical	654	69,300
06-5[2]	angle	699	74,100
06-6[2]	angle	233	24,500
07-4[2]	vertical	499	54,900
09-01[3]	vertical	643	64,322
09-02[3]	vertical	322	30,598
09-03[3]	vertical	221	18,763
09-04[3]	vertical	287	35,276
09-05[3]	vertical	172	12,382

[1] Well locations are shown on figure 2 except for the "temporary" well. The "temporary" well was located very near the shore of the Missouri River west of monitoring well R20-2015-10.
[2] Data from Wittman Hydro Planning Associates, Inc. (2008).
[3] Data from Layne Hydro (2011).

Transmissivities were found to range from 12,382 ft^2/day (well 09-05) to 74,100 ft^2/day (well 06-5), which is characteristic of the heterogeneity of the Missouri aquifer. The hydraulic conductivities are in the "high" range and are characteristic of clean sand, and sand and gravel (U.S. Department of the Interior, Bureau of Reclamation, 1995).

Water levels in the study area can be directly impacted by several variables, such as (1) fluctuations in the stage of the Missouri River, (2) pumping rates of wells in the wellfield, (3) duration of pumping, and (4) seasonal variations in precipitation and evapotranspiration. Pumping duration and rate vary daily and seasonally (winter scenario and summer scenario). During the winter scenario, pumping duration is from 6.5 to 8 hours per day resulting in the pumping 9 to 12.9 million gallons per day. In the summer scenario, pumping duration is from 10 to 14 hours per day resulting in the pumping of 11.4 to 22.2 millions of gallons per day. The summer scenario began on April 24, 2015, and still was in place when monitoring activities concluded for this study on September 30, 2015. That pumping regime with daily recovery time helps to sustain the relatively high withdrawal rate from the wellfield.

Water levels in the four monitoring wells highlighted on figure 8 (R20-2015-08, R20-95-06, CL-80C, and Airport) showed an overall decline during the study. The closest of these monitoring wells to the "north" group of production wells is R20-2015-08 at a distance of 0.6 mile from production well 09-03. The farthest of these monitoring wells from the "north" group of production wells is the well identified as "Airport" at a distance of 1.7 miles from production well 09-03. None of these four monitoring wells were impacted by pumping activities in the LCRWS wellfield nor by fluctuation of the Missouri River level.

Conversely, water levels in the monitoring wells highlighted on figures 9, 10, and 11, and which are closer to the Missouri River and the LCRWS wellfield than those highlighted on figure 8, did react to changes in the Missouri River level and pumping of the LCRWS wellfield. Those monitoring wells are R20-2015-06, R20-2015-07, R20-2015-09, and R20-2015-10 and, during the period of record, had fluctuations of 1.79, 0.91, 1.62, and 0.71 feet, respectively.

SUMMARY

The direction of ground-water flow near the LCRWS wellfield is dictated by (1) pumping from the wellfield, (2) the location and level of the Missouri River, and (3) hydrologic characteristics of the Missouri aquifer. Results of this study show that the eastward impact of pumping from the 11 LCRWS production wells is limited to a distance of less than 0.4 mile from the wellfield. Results also show that the Missouri River, located to the west of the wellfield, is a significant source of recharge to the LCRWS wellfield. Ground water has a short flow path from the Missouri River to the production wells. A steep hydraulic gradient is present on both the west and east sides of the wellfield.

When planned increases in the duration and volume of pumping by the LCRWS occur, there will be an impact on nearby water levels and the shape and extent of the area of drawdown, particularly to the east. It is recommended that water levels continue to be monitored and that LCRWS consider the installation of additional monitoring wells to document the area affected.

REFERENCES

Christensen, C.M., 1967, *Geology and water resources of Clay County, South Dakota Part I, Geology*: South Dakota Geological Survey Bulletin 19, 86 p.

Layne Hydro, 2011, *Well field analysis report, Mulberry Point sites A and E, Lewis and Clark Rural Water System*: Bloomington, IN.

Rich, T.B., 2006, *Results of an aquifer test at Vermillion, South Dakota*: South Dakota Geological Survey Open File Report UR-91, 8 p.

Stephens, J.C., 1967, *Geology and water resources of Clay County, South Dakota Part II, Water Resources*: South Dakota Geological Survey Bulletin 19, 62 p.

U.S. Department of Interior, Bureau of Reclamation, 1995, *Ground water manual*: A Water Resources Technical Publication, U.S. Government Printing Office, 662 p.

U.S. Environmental Protection Agency, 1987, *Guidelines for Delineation of Wellhead Protection Areas*: Office of Ground-Water Protection, Washington, D.C.

Wittman Hydro Planning Associates, Inc., 2008, *Wellfield analysis report, Mulberry Point sites C and D, Lewis and Clark Rural Water System*: Bloomington, IN.

This page intentionally left blank

APPENDIX A

RECORDS OF MONITORING WELLS

This appendix contains information on the following wells and in the following order.

See figure 2 for well location.

- CL-80C
- R20-95-06
- R20-2015-06
- R20-2015-07
- R20-2015-08
- R20-2015-09
- R20-2015-10

- Airport: No log is available for this well but it was measured to be 42 feet deep from the top of the casing.

Location Information

Legal Location:	SE SE NE SW SEC. 14, T. 032 N., R. 04 E.		
County:	CLAY	Location:	032N04E14CADD 1
		Latitude:	42.747100
Hydrologic Unit Code:	10170101	Longitude:	- 96.927514
Land Owner:		Ground Surface Elev. (ft.):	1142.11 I

Project Information

Project:	WATER RIGHTS		
Drill Date:	06/01/1980	Geologist:	S. BURCH
Company:	SDGS	Geologist's Log:	X
Drilling Method:	ROTARY	Driller:	B. GARRISON
Test Hole Number:	CL-80-2	Driller's Log:	
		Total Drill Hole Depth (ft.):	107.0

Well Information

SDGS Well Name:		Aquifer:	MISSOURI
Water Rights Well:	CL-80C	Management Unit:	
Other Well Name:		Casing Top Elev. (ft.):	1144.51 I
Casing Type:	PVC, SCH 80	Casing Diameter (in.):	2.0
Screen Type:	PVC, MFG.	Screen Length (ft.):	20.0
Total Casing and Screen (ft.):	93.4	Casing Stick-up (ft.):	2.40 I

Geophysical Information

E-logs Available:	NO

Notes

LOWERMOST 15 FEET OF CASING SLOTTED ABOVE SANDPOINT. THIS WELL REPLACES CL-57E. Location description changed from 092N52W36AACA 2 to match Nebraska plss survey (4/21/2016)

Lithologic Information

Elevation (ft.)	Depth (ft.)	Description
1142.1 - 1141.1	0.0 - 1.0	TOPSOIL, BLACK
1141.1 - 1130.1	1.0 - 12.0	CLAY, YELLOW-BROWN, SANDY
1130.1 - 1057.1	12.0 - 85.0	SAND, GRAY, MEDIUM TO COARSE; OCCASIONAL CLAY LAYER
1057.1 - 1035.1	85.0 - 107.0	SAND, GRAY, MEDIUM TO VERY COARSE; PERHAPS SOME VERY FINE GRAVEL

Location Information

Legal Location:	SE SE SE NW SEC. 14, T. 032 N., R. 04 E.		
County:	CLAY	Location:	032N04E14BDDD
		Latitude:	42.750209
Hydrologic Unit Code:	10170101	Longitude:	- 96.927904
Land Owner:		Ground Surface Elev. (ft.):	1141 T

Project Information

Project:	STATEWIDE MONITORING		
Drill Date:	05/30/1995	Geologist:	L. SCHULZ
Company:	SDGS	Geologist's Log:	X
Drilling Method:	HOLLOWSTEM	Driller:	D. IVERSON
Test Hole Number:	R20-95-06	Driller's Log:	
		Total Drill Hole Depth (ft.):	45.0

Well Information

SDGS Well Name:	R20-95-06	Aquifer:	MISSOURI
Water Rights Well:		Management Unit:	ELK POINT
Other Well Name:		Casing Top Elev. (ft.):	1143 T
Casing Type:	PVC, SCH. 40	Casing Diameter (in.):	4.0
Screen Type:	PVC, MFG., SLOT SIZE=0.018 IN.	Screen Length (ft.):	5.4
Total Casing and Screen (ft.):	44.1	Casing Stick-up (ft.):	2.00 T

Geophysical Information

E-logs Available: NO

Notes

WELL INFORMATION: SCREENED INTERVAL FROM 44.05 TO 38.67 FEET BELOW CASING TOP. NATURAL FILTER PACK FROM 45 TO 13.9 FEET BELOW LAND SURFACE. CUTTINGS FROM 13.9 TO 7.0 FEET BELOW LAND SURFACE. GRANULAR BENTONITE FROM 7.0 TO 4.0 FEET BELOW LAND SURFACE. CEMENT GROUT FROM 4.0 FEET TO GROUND LEVEL. ONE WELL PROTECTOR.

Lithologic Information

Elevation (ft.)	Depth (ft.)	Description
1141.0 - 1140.0	0.0 - 1.0	TOPSOIL
1140.0 - 1138.0	1.0 - 3.0	SILT, BROWN, CLAY (ALLUVIUM)
1138.0 - 1133.0	3.0 - 8.0	SAND, BROWN, FINE TO MEDIUM; SOME SILT AND CLAY
1133.0 - 1121.0	8.0 - 20.0	SAND, BROWN, FINE, SILTY
1121.0 - 1096.0	20.0 - 45.0	SAND, GRAY, MEDIUM TO COARSE; CLEAN; SOME GRAVEL

WELLS ARE LOCATED 2 MILES SOUTH OF VERMILLION. SEE LATITUDE AND LONGITUDE FOR MORE ACCURATE LEGAL DESCRIPTION.

Location Information

Legal Location:	NW NE NE NW SEC. 27, T. 032 N., R. 04 E.		
County:	CLAY	Location:	032N04E27BAAB
		Latitude:	42.727008
Hydrologic Unit Code:	10170101	Longitude:	- 96.948436
Land Owner:		Ground Surface Elev. (ft.):	1135.18 I

Project Information

Project:	LEWIS AND CLARK RWS		
Drill Date:	02/22/2015	Geologist:	D. FILIPOVIC
Company:	SDGS	Geologist's Log:	X
Drilling Method:	HOLLOWSTEM	Driller:	T. MILLER
Test Hole Number:	R20-2015-06	Driller's Log:	
		Total Drill Hole Depth (ft.):	35.0

Well Information

SDGS Well Name:	R20-2015-06	Aquifer:	MISSOURI
Water Rights Well:		Management Unit:	ELK POINT
Other Well Name:		Casing Top Elev. (ft.):	1135.12 I
Casing Type:	PVC, SCH. 40	Casing Diameter (in.):	2.0
Screen Type:	PVC, SCH. 40	Screen Length (ft.):	10.0
Total Casing and Screen (ft.):	32.9	Casing Stick-up (ft.):	

Geophysical Information

E-logs Available:	NO

Notes

NATURAL COLLAPSED SAND FROM 35 TO 15 FEET. REMOVED 2.06 FEET OF STICK-UP, INSTALLED A FLUSH MOUNT WELL PROTECTOR AND REMOVED FENCE POSTS ON 11/09/2015.

Lithologic Information

Elevation (ft.)	Depth (ft.)	Description
1135.2 - 1125.2	0.0 - 10.0	SAND, BROWN TO TAN, SILTY
1125.2 - 1119.2	10.0 - 16.0	SAND, GRAY, SILTY, FINE
1119.2 - 1100.2	16.0 - 35.0	SAND, GRAY, FINE TO MEDIUM

Location Information

Legal Location:	NW SW NE NW SEC. 15, T. 032 N., R. 04 E.		
County:	CLAY	Location:	032N04E15BACB
		Latitude:	42.754706
Hydrologic Unit Code:	1010701	Longitude:	- 96.951708
Land Owner:		Ground Surface Elev. (ft.):	1136.84 I

Project Information

Project:	LEWIS AND CLARK RWS		
Drill Date:	02/23/2015	Geologist:	D. FILIPOVIC
Company:	SDGS	Geologist's Log:	X
Drilling Method:	HOLLOWSTEM	Driller:	J. OLSON
Test Hole Number:	R20-2015-07	Driller's Log:	
		Total Drill Hole Depth (ft.):	35.0

Well Information

SDGS Well Name:	R20-2015-07	Aquifer:	MISSOURI
Water Rights Well:		Management Unit:	ELK POINT
Other Well Name:		Casing Top Elev. (ft.):	1136.63 I
Casing Type:	PVC, SCH. 40	Casing Diameter (in.):	2.0
Screen Type:	PVC, SCH. 40	Screen Length (ft.):	10.0
Total Casing and Screen (ft.):	29.6	Casing Stick-up (ft.):	

Geophysical Information

E-logs Available: NO

Notes

NATURAL COLLAPSED SAND FROM 35 TO 13 FEET. REMOVED 2.21 FEET OF STICK-UP AND REPLACE WELL PROTECTOR WITH FLUSH MOUNT WELL PROTECTOR, AND REMOVED FENCE POSTS ON 11/09/2015.

Lithologic Information

Elevation (ft.)	Depth (ft.)	Description
1136.8 - 1135.8	0.0 - 1.0	TOPSOIL
1135.8 - 1133.8	1.0 - 3.0	CLAY, BROWN, SANDY
1133.8 - 1124.8	3.0 - 12.0	SAND, BROWN TO TAN, SILTY, FINE TO MEDIUM
1124.8 - 1121.8	12.0 - 15.0	CLAY AND SAND, GRAY, FINE
1121.8 - 1101.8	15.0 - 35.0	SAND, GRAY, FINE TO MEDIUM

Location Information

Legal Location:	SE SW SE NE SEC. 15, T. 032 N., R. 04 E.		
County:	CLAY	Location:	032N04E15ADCD
		Latitude:	42.750177
Hydrologic Unit Code:	10170101	Longitude:	- 96.940027
Land Owner:		Ground Surface Elev. (ft.):	1142.08 I

Project Information

Project:	LEWIS AND CLARK RWS		
Drill Date:	02/23/2015	Geologist:	D. FILIPOVIC
Company:	SDGS	Geologist's Log:	X
Drilling Method:	HOLLOWSTEM	Driller:	T. MILLER
Test Hole Number:	R20-2015-08	Driller's Log:	
		Total Drill Hole Depth (ft.):	55.0

Well Information

SDGS Well Name:	R20-2015-08	Aquifer:	MISSOURI
Water Rights Well:		Management Unit:	ELK POINT
Other Well Name:		Casing Top Elev. (ft.):	1142.06 I
Casing Type:	PVC, SCH. 40	Casing Diameter (in.):	2.0
Screen Type:	PVC, SCH. 40	Screen Length (ft.):	10.0
Total Casing and Screen (ft.):	53.9	Casing Stick-up (ft.):	

Geophysical Information

E-logs Available:	NO

Notes

NATURAL COLLAPSED SAND FROM 55 TO 20 FEET. REMOVED 2.02 FEET OF STICK-UP, WELL PROTECTOR AND FENCE POSTS. REPLACE WELL PROTECTOR WITH FLUSH MOUNT WELL PROTECTOR ON 11/09/2015.

Lithologic Information

Elevation (ft.)	Depth (ft.)	Description
1142.1 - 1104.1	0.0 - 38.0	SAND, BROWN TO TAN, FINE
1104.1 - 1088.1	38.0 - 54.0	SAND, GRAY, FINE TO MEDIUM
1088.1 - 1087.1	54.0 - 55.0	SHALE, DARK-GRAY TO BLACK

Location Information

Legal Location:	NE NE NE SW SEC. 15, T. 032 N., R. 04 E.		
County:	CLAY	Location:	032N04E15CAAA
		Latitude:	42.749644
Hydrologic Unit Code:	10170101	Longitude:	- 96.948347
Land Owner:		Ground Surface Elev. (ft.):	1141.48 I

Project Information

Project:	LEWIS AND CLARK RWS		
Drill Date:	02/23/2015	Geologist:	D. FILIPOVIC
Company:	SDGS	Geologist's Log:	X
Drilling Method:	HOLLOWSTEM	Driller:	J. OLSON
Test Hole Number:	R20-2015-09	Driller's Log:	
		Total Drill Hole Depth (ft.):	35.0

Well Information

SDGS Well Name:	R20-2015-09	Aquifer:	MISSOURI
Water Rights Well:		Management Unit:	ELK POINT
Other Well Name:		Casing Top Elev. (ft.):	1141.26 I
Casing Type:	PVC, SCH. 40	Casing Diameter (in.):	2.0
Screen Type:	PVC, SCH. 40	Screen Length (ft.):	10.0
Total Casing and Screen (ft.):	33.8	Casing Stick-up (ft.):	0.00 I

Geophysical Information

E-logs Available:	NO

Notes

NATURAL COLLAPSED SAND FROM 35 TO 18 FEET. REMOVED 2.22 FEET OF STICK-UP AND REPLACED WELL PROTECTOR WITH FLUSH MOUNT WELL PROTECTOR ON 11/09/2015.

Lithologic Information

Elevation (ft.)	Depth (ft.)	Description
1141.5 - 1139.5	0.0 - 2.0	CLAY, BROWN TO TAN, SANDY
1139.5 - 1131.5	2.0 - 10.0	SAND, BROWN TO TAN, SILTY
1131.5 - 1114.5	10.0 - 27.0	SAND, BROWN, FINE
1114.5 - 1106.5	27.0 - 35.0	SAND, GRAY, FINE TO MEDIUM

Location Information

Legal Location:	SE NE NW NW SEC. 22, T. 032 N., R. 04 E.		
County:	CLAY	Location:	032N04E22BBAD
		Latitude:	42.740075
Hydrologic Unit Code:	10170101	Longitude:	- 96.952139
Land Owner:		Ground Surface Elev. (ft.):	1138.85 I

Project Information

Project:	LEWIS AND CLARK RWS		
Drill Date:	02/23/2015	Geologist:	D. FILIPOVIC
Company:	SDGS	Geologist's Log:	X
Drilling Method:	HOLLOWSTEM	Driller:	T. MILLER
Test Hole Number:	R20-2015-10	Driller's Log:	
		Total Drill Hole Depth (ft.):	35.0

Well Information

SDGS Well Name:	R20-2015-10	Aquifer:	MISSOURI
Water Rights Well:		Management Unit:	ELK POINT
Other Well Name:		Casing Top Elev. (ft.):	1138.93 I
Casing Type:	PVC, SCH. 40	Casing Diameter (in.):	2.0
Screen Type:	PVC, SCH. 40	Screen Length (ft.):	10.0
Total Casing and Screen (ft.):	31.2	Casing Stick-up (ft.):	0.10 I

Geophysical Information

E-logs Available:	NO

Notes

NATURAL COLLAPSED SAND FROM 35 TO 16 FEET. REMOVED 1.92 FEET OF STICK-UP, WELL PROTECTOR AND FENCE POSTS, INSTALLED FLUSH MOUNT WELL PROTECTOR ON 11/09/2015.

Lithologic Information

Elevation (ft.)	Depth (ft.)	Description
1138.9 - 1135.9	0.0 - 3.0	CLAY, BROWN TO TAN, SANDY
1135.9 - 1128.9	3.0 - 10.0	SAND, BROWN TO TAN, CLAYEY
1128.9 - 1112.9	10.0 - 26.0	SAND, BROWN, FINE
1112.9 - 1103.9	26.0 - 35.0	SAND, GRAY, FINE TO MEDIUM

APPENDIX B. MEASURED ELEVATIONS OF GROUND WATER AND THE MISSOURI RIVER, AND PUMPING AMOUNTS FROM GROUPS OF PRODUCTION WELLS

	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
												North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
3/4/2015	1119.74	1119.98	1119.95	1118.28	1122.02	1120.67	1120.13	1120.71	1119.34	1119.74	1119.54	3.2	2.9	3.6
3/5/2015	1119.74	1119.99	1119.98	1118.28	1122.04	1120.69	1120.13	1120.70	1119.32	1119.44	1119.38	3.2	3.2	3.9
3/6/2015	1119.73	1119.98	1119.98	1117.93	1122.02	1120.68	1120.09	1120.65	1119.33	1119.38	1119.355	3.6	3.6	4.4
3/7/2015	---	---	---	---	---	---	---	---	1119.32	1119.38	1119.35	4.0	3.7	4.6
3/8/2015	---	---	---	---	---	---	---	---	1119.32	1119.39	1119.355	2.3	1.1	1.3
3/9/2015	1119.70	1119.96	1119.97	1118.03	1121.96	1120.66	1120.01	1120.55	1119.30	1119.38	1119.34	3.6	3.5	4.3
3/10/2015	1119.69	1119.96	1119.96	1117.75	1121.94	1120.66	1120.00	1120.51	1119.29	1119.37	1119.33	3.9	3.8	4.7
3/11/2015	1119.68	1119.95	1119.95	1117.75	1121.94	1120.65	1119.96	1120.48	1119.29	1119.35	1119.32	3.8	3.6	4.5
3/12/2015	1119.67	1119.94	1119.95	1117.72	1121.92	1120.65	1119.94	1120.46	1119.29	1119.35	1119.32	3.4	3.2	4.0
3/13/2015	1119.66	1119.94	1119.95	1117.96	1121.86	1120.61	1119.89	1120.44	1119.28	1119.36	1119.32	3.4	3.3	4.1
3/14/2015	---	---	---	---	---	---	---	---	1119.25	1119.33	1119.29	3.0	2.9	3.6
3/15/2015	---	---	---	---	---	---	---	---	1119.21	1119.33	1119.27	3.1	3.0	3.8
3/16/2015	1119.64	1119.91	1119.91	1117.87	1121.79	1120.59	1119.85	1120.36	1119.23	1119.34	1119.285	3.5	3.4	4.2
3/17/2015	1119.62	1119.90	1119.90	1117.89	1121.85	1120.58	1119.86	1120.38	1119.20	1119.87	1119.535	3.2	3.1	3.8
3/18/2015	1119.62	1119.91	1119.90	1117.79	1121.87	1120.58	1119.85	1120.45	1119.86	1120.39	1120.125	3.3	3.2	4.0
3/19/2015	1119.62	1119.90	1119.91	1117.88	1121.87	1120.57	1119.84	1120.59	1120.38	1120.94	1120.66	2.8	2.7	3.4
3/20/2015	1119.61	1119.89	1119.90	1117.93	1121.91	1120.55	1119.87	1120.72	1120.91	1120.99	1120.95	3.8	3.6	4.5

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
3/21/2015	---	---	---	---	---	---	---	---	1120.90	1121.05	1120.975	3.3	3.2	4.0
3/22/2015	---	---	---	---	---	---	---	---	1121.01	1121.24	1121.125	3.5	3.3	4.1
3/23/2015	1119.58	1119.89	1119.87	1117.83	1122.03	1120.53	1119.93	1120.96	1121.15	1121.21	1121.18	1.0	2.1	2.6
3/24/2015	1119.58	1119.88	1119.86	1117.87	1122.06	1120.53	1119.96	1121.04	1121.14	1121.26	1121.2	3.6	3.5	4.3
3/25/2015	1119.57	1119.89	1119.85	1117.86	1122.08	1120.51	1119.98	1121.09	1121.15	1121.26	1121.205	3.2	3.1	3.9
3/26/2015	1119.56	1119.90	1119.84	1118.14	1122.11	1120.51	1119.99	1121.16	1121.16	1121.21	1121.185	4.1	3.9	4.9
3/27/2015	1119.56	1119.91	1119.84	1117.90	1122.14	1120.51	1120.01	1121.18	1121.15	1121.21	1121.18	4.1	3.9	4.9
3/28/2015	---	---	---	---	---	---	---	---	1121.14	1121.19	1121.165	3.6	3.5	4.3
3/29/2015	---	---	---	---	---	---	---	---	1121.10	1121.27	1121.185	3.9	3.8	4.7
3/30/2015	1119.55	1119.93	1119.84	1117.97	1122.21	1120.50	1120.09	1121.29	1121.11	1121.21	1121.16	3.0	2.9	3.6
3/31/2015	1119.54	1119.93	1119.83	1118.04	1122.23	1120.49	1120.12	1121.33	1121.12	1121.20	1121.16	3.8	3.6	4.5
4/1/2015	1119.55	1119.93	1119.83	1118.03	1122.25	1120.49	1120.14	1121.35	1121.11	1121.19	1121.15	3.5	3.3	4.1
4/2/2015	1119.54	1119.93	1119.82	1118.03	1122.26	1120.49	1120.15	1121.37	1121.15	1121.23	1121.19	3.7	3.6	4.5
4/3/2015	1119.51	1119.92	1119.80	1118.37	1122.25	1120.47	1120.21	1121.40	1121.06	1121.17	1121.115	3.6	3.5	4.3
4/4/2015	---	---	---	---	---	---	---	---	1120.95	1121.04	1120.995	3.9	3.7	4.6
4/5/2015	---	---	---	---	---	---	---	---	1120.94	1121.01	1120.975	3.3	3.2	4.0
4/6/2015	1119.51	1119.95	1119.79	1118.13	1122.30	1120.46	1120.22	1121.41	1120.87	1121.03	1120.95	3.1	3.0	3.7
4/7/2015	1119.51	1119.95	1119.78	1118.13	1122.31	1120.45	1120.23	1121.42	1120.87	1121.05	1120.96	3.3	3.2	4.0

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
4/8/2015	1119.52	1119.96	1119.79	1118.15	1122.34	1120.47	1120.24	1121.44	1121.04	1121.08	1121.06	3.2	3.1	3.9
4/9/2015	---	---	---	---	---	---	---	---	1121.03	1121.11	1121.07	3.6	3.5	4.4
4/10/2015	1119.50	1119.96	1119.77	1118.25	1122.35	1120.46	1120.25	1121.44	1120.87	1121.03	1120.95	3.8	3.7	4.6
4/11/2015	---	---	---	---	---	---	---	---	1120.73	1120.86	1120.795	3.4	3.2	4.0
4/12/2015	---	---	---	---	---	---	---	---	1120.74	1120.81	1120.775	3.6	3.4	4.3
4/13/2015	1119.49	1119.96	1119.76	1118.13	1122.35	1120.46	1120.24	1121.36	1120.60	1120.77	1120.685	3.7	3.5	4.4
4/14/2015	1119.49	1119.96	1119.76	1118.08	1122.34	1120.45	1120.25	1121.33	1120.37	1120.59	1120.48	3.8	3.6	4.5
4/15/2015	1119.49	1119.95	1119.76	1118.03	1122.32	1120.45	1120.22	1121.26	1120.37	1120.58	1120.475	3.6	3.5	4.4
4/16/2015	1119.48	1119.95	1119.75	1118.00	1122.30	1120.44	1120.21	1121.24	1120.56	1120.61	1120.585	3.9	3.7	4.6
4/17/2015	1119.48	1119.95	1119.74	1118.17	1122.31	1120.43	1120.25	1121.29	1120.55	1120.60	1120.575	3.7	3.5	4.4
4/18/2015	---	---	---	---	---	---	---	---	1120.56	1120.65	1120.605	3.9	3.7	4.6
4/19/2015	---	---	---	---	---	---	---	---	1120.46	1120.64	1120.55	3.5	3.4	4.2
4/20/2015	---	---	---	---	---	---	---	---	1120.18	1120.46	1120.32	3.9	3.7	4.6
4/21/2015	1119.48	1119.94	1119.74	1118.08	1122.26	1120.43	1120.17	1121.16	1120.18	1120.34	1120.26	3.5	3.4	4.2
4/22/2015	1119.47	1119.92	1119.73	1117.98	1122.26	1120.42	1120.17	1121.15	1120.29	1120.35	1120.32	3.0	2.9	3.5
4/23/2015	---	---	---	---	---	---	---	---	1120.29	1120.33	1120.31	3.9	3.7	4.7
4/24/2015	1119.48	1119.92	1119.74	1117.92	1122.23	1120.43	1120.13	1121.12	1120.29	1120.38	1120.335	4.7	4.5	5.7
4/25/2015	---	---	---	---	---	---	---	---	1120.34	1120.37	1120.355	4.6	4.4	5.5

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
4/26/2015	---	---	---	---	---	---	---	---	1120.32	1120.36	1120.34	3.8	3.7	4.6
4/27/2015	1119.45	1119.9	1119.71	1117.73	1122.16	1120.40	1120.02	1121.00	1120.32	1120.38	1120.35	3.9	3.7	4.6
4/28/2015	1119.45	1119.89	1119.72	1117.56	1122.13	1120.40	1119.95	1120.95	1120.29	1120.37	1120.33	5.9	5.7	7.1
4/29/2015	1119.44	1119.89	1119.71	1117.51	1122.10	1120.40	1119.92	1120.92	1120.29	1120.38	1120.335	4.8	4.6	5.7
4/30/2015	1119.44	1119.89	1119.70	1117.44	1122.08	1120.39	1119.87	1120.89	1120.36	1120.55	1120.455	5.2	5.0	6.2
5/1/2015	1119.43	1119.87	1119.69	1117.40	1122.06	1120.43	1119.78	1120.88	1120.48	1120.65	1120.565	5.9	5.6	7.0
5/2/2015	---	---	---	---	---	---	---	---	1120.60	1120.67	1120.635	5.4	5.2	6.4
5/3/2015	---	---	---	---	---	---	---	---	1120.56	1120.71	1120.635	5.9	5.7	7.1
5/4/2015	1119.42	1119.87	1119.69	1117.11	1122.00	1120.36	1119.68	1120.79	1120.59	1120.68	1120.635	5.8	5.5	6.9
5/5/2015	1119.42	1119.87	1119.68	1117.06	1121.99	1120.35	1119.63	1120.77	1120.49	1120.61	1120.55	6.1	5.8	7.2
5/6/2015	1119.40	1119.87	1119.69	1116.99	1121.96	1120.36	1119.59	1120.74	1120.50	1120.57	1120.535	5.8	5.5	6.9
5/7/2015	1119.39	1119.85	1119.67	1117.02	1121.93	1120.34	1119.55	1120.74	1120.52	1120.61	1120.565	5.6	5.4	6.7
5/8/2015	1119.31	1119.85	1119.66	1117.02	1121.94	1120.33	1119.52	1120.76	1120.59	1121.06	1120.825	4.7	4.5	5.6
5/9/2015	---	---	---	---	---	---	---	---	1121.05	1121.44	1121.245	4.9	4.7	5.8
5/10/2015	---	---	---	---	---	---	---	---	1121.42	1121.62	1121.52	4.5	4.4	5.4
5/11/2015	1119.33	1119.85	1119.64	1117.21	1121.99	1120.29	1119.56	1121.07	1121.39	1121.50	1121.445	3.8	3.8	4.6
5/12/2015	1119.31	1119.85	1119.63	1117.28	1122.04	1120.29	1119.59	1121.14	1121.37	1121.51	1121.44	4.5	4.5	5.4
5/13/2015	1119.32	1119.85	1119.63	1117.33	1122.07	1120.28	1119.63	1121.19	1121.41	1121.50	1121.455	4.2	4.1	5.0

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
5/14/2015	1119.33	1119.87	1119.62	1117.31	1122.08	1120.26	1119.62	1121.22	1121.43	1121.54	1121.485	4.8	4.6	5.7
5/15/2015	1119.33	1119.88	1119.62	1117.39	1122.12	1120.26	1119.66	1121.24	1121.23	1121.42	1121.325	4.8	4.5	5.6
5/16/2015	---	---	---	---	---	---	---	---	1121.22	1121.28	1121.25	4.4	4.4	5.3
5/17/2015	---	---	---	---	---	---	---	---	1121.21	1121.29	1121.25	3.8	3.8	4.5
5/18/2015	1119.32	1119.87	1119.60	1117.54	1122.16	1120.22	1119.76	1121.29	1121.17	1121.24	1121.205	3.7	3.9	4.5
5/19/2015	1119.32	1119.85	1119.60	1117.57	1122.19	1120.22	1119.78	1121.31	1121.17	1121.27	1121.22	4.4	4.5	5.3
5/20/2015	1119.32	1119.88	1119.59	1117.53	1122.19	1120.22	1119.78	1121.30	1121.21	1121.27	1121.24	4.1	4.1	4.9
5/21/2015	1119.32	1119.89	1119.59	1117.56	1122.19	1120.21	1119.80	1121.33	1121.21	1121.27	1121.24	4.6	4.4	5.5
5/22/2015	1119.32	1119.89	1119.58	1117.50	1122.18	1120.20	1119.78	1121.30	1121.20	1121.30	1121.25	5.2	5.0	6.2
5/23/2015	---	---	---	---	---	---	---	---	1121.25	1121.32	1121.285	5.1	4.9	6.1
5/24/2015	---	---	---	---	---	---	---	---	1121.30	1121.34	1121.32	4.9	4.7	5.9
5/25/2015	---	---	---	---	---	---	---	---	1121.27	1121.32	1121.295	3.6	3.5	4.3
5/26/2015	1119.33	1119.91	1119.57	1117.55	1122.22	1120.19	1119.80	1121.33	1121.26	1121.31	1121.285	4.2	4.1	5.0
5/27/2015	1119.33	1119.91	1119.57	1117.74	1122.22	1120.18	1119.83	1121.33	1121.25	1121.33	1121.29	4.0	3.9	4.8
5/28/2015	1119.34	1119.92	1119.58	1117.67	1122.25	1120.19	1119.86	1121.37	1121.24	1121.30	1121.27	5.2	5.1	6.1
5/29/2015	1119.33	1119.91	1119.57	1117.52	1122.21	1120.18	1119.79	1121.34	1121.27	1121.39	1121.33	5.1	4.9	6.6
5/30/2015	---	---	---	---	---	---	---	---	1121.26	1121.32	1121.29	5.2	5.1	6.0
5/31/2015	---	---	---	---	---	---	---	---	1121.24	1121.32	1121.28	4.2	4.0	5.0

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
6/1/2015	1119.35	1119.93	1119.58	1117.60	1122.24	1120.18	1119.84	1121.38	1121.26	1121.35	1121.305	4.0	3.9	4.8
6/2/2015	1119.35	1119.94	1119.58	1117.53	1122.24	1120.18	1119.80	1121.36	1121.30	1121.36	1121.33	5.4	5.2	6.4
6/3/2015	1119.34	1119.93	1119.57	1117.49	1122.20	1120.18	1119.78	1121.36	1121.32	1121.41	1121.365	5.3	5.1	6.3
6/4/2015	1119.34	1119.93	1119.57	1117.45	1122.19	1120.17	1119.76	1121.34	1121.31	1121.38	1121.345	5.1	4.9	6.1
6/5/2015	1119.33	1119.93	1119.57	1117.52	1122.22	1120.17	1119.78	1121.35	1120.76	1121.37	1121.065	5.1	4.9	6.1
6/6/2015	---	---	---	---	---	---	---	---	1120.39	1120.74	1120.565	5.2	5.0	6.2
6/7/2015	---	---	---	---	---	---	---	---	1120.40	1121.02	1120.71	4.6	4.4	5.5
6/8/2015	1119.35	1119.93	1119.57	1117.48	1122.14	1120.16	1119.75	1121.22	1121.04	1121.38	1121.21	4.2	4.1	5.1
6/9/2015	1119.35	1119.94	1119.58	1117.47	1122.14	1120.17	1119.74	1121.19	1120.41	1121.03	1120.72	4.4	4.3	5.3
6/10/2015	1119.34	1119.94	1119.57	1117.39	1122.10	1120.16	1119.70	1121.08	1120.39	1120.68	1120.535	5.5	5.2	6.5
6/11/2015	1119.34	1119.93	1119.56	1117.37	1122.07	1120.15	1119.68	1121.11	1120.71	1121.38	1121.045	5.2	5.0	6.2
6/12/2015	1119.32	1119.94	1119.55	1117.54	1122.08	1120.16	1119.72	1121.15	1120.41	1121.06	1120.735	4.5	4.3	5.4
6/13/2015	---	---	---	---	---	---	---	---	1120.40	1120.69	1120.545	3.7	3.6	4.5
6/14/2015	---	---	---	---	---	---	---	---	1120.70	1121.37	1121.035	4.0	3.9	4.8
6/15/2015	1119.32	1119.94	1119.56	1117.49	1122.08	1120.15	1119.75	1121.16	1120.44	1121.04	1120.74	4.0	3.9	4.8
6/16/2015	1119.32	1119.94	1119.56	1117.49	1122.07	1120.15	1119.74	1121.08	1120.35	1120.46	1120.405	5.0	4.8	5.9
6/17/2015	1119.32	1119.94	1119.54	1117.45	1122.04	1120.15	1119.72	1121.13	1120.65	1121.31	1120.98	4.7	4.6	5.7
6/18/2015	1119.30	1119.93	1119.53	1117.45	1122.04	1120.14	1119.71	1121.15	1120.67	1121.11	1120.89	4.8	4.6	5.7

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
6/19/2015	1119.32	1119.94	1119.55	1117.41	1122.05	1120.14	1119.68	1121.11	1120.66	1120.72	1120.69	4.9	4.6	5.9
6/20/2015	---	---	---	---	---	---	---	---	1120.65	1120.75	1120.7	5.9	5.6	7.0
6/21/2015	---	---	---	---	---	---	---	---	1120.65	1120.74	1120.695	4.1	3.9	5.1
6/22/2015	1119.32	1119.92	1119.55	1117.33	1121.93	1120.13	1119.60	1121.03	1120.65	1120.81	1120.73	2	---	---
6/23/2015	1119.30	1119.9	1119.53	1117.38	1121.94	1120.12	1119.60	1121.04	1120.63	1120.73	1120.68	4.6	4.5	5.8
6/24/2015	1119.24	1119.89	1119.54	1117.31	1121.91	1120.12	1119.57	1121.01	1120.64	1120.73	1120.685	4.7	4.5	5.8
6/25/2015	1119.22	1119.87	1119.52	1117.27	1121.89	1120.11	1119.55	1120.98	1120.69	1120.75	1120.72	5.6	5.4	6.7
6/26/2015	1119.21	1119.87	1119.51	1117.35	1121.89	1120.11	1119.56	1121.01	1120.69	1120.78	1120.735	5.1	4.9	6.2
6/27/2015	---	---	---	---	---	---	---	---	1120.69	1120.76	1120.725	5.4	5.2	6.4
6/28/2015	---	---	---	---	---	---	---	---	1120.67	1120.73	1120.7	5.1	4.9	6.1
6/29/2015	1119.22	1119.84	1119.47	1117.15	1121.84	1120.08	1119.45	1120.93	1120.67	1120.73	1120.7	5.2	5.0	6.2
6/30/2015	1119.21	1119.82	1119.47	1117.06	1121.81	1120.07	1119.41	1120.89	1120.67	1120.76	1120.715	6.5	6.2	7.7
7/1/2015	1119.20	1119.83	1119.46	1117.03	1121.81	1120.06	1119.38	1120.90	1120.77	1121.08	1120.925	5.9	5.7	7.1
7/2/2015	1119.21	1119.82	1119.45	1117.29	1121.83	1120.06	1119.43	1120.98	1121.02	1121.20	1121.11	5.7	5.5	6.8
7/3/2015	---	---	---	---	---	---	---	---	1121.16	1121.23	1121.195	5.2	5.0	6.2
7/4/2015	---	---	---	---	---	---	---	---	1121.16	1121.23	1121.195	5.6	5.4	6.6
7/5/2015	---	---	---	---	---	---	---	---	1121.16	1121.32	1121.24	5.3	5.1	6.4
7/6/2015	1119.21	1119.82	1119.43	1117.15	1121.92	1120.02	1119.38	1121.11	1121.20	1121.39	1121.295	4.6	4.5	5.6

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
7/7/2015	1119.23	1119.84	1119.46	1117.22	1121.91	1120.01	1119.40	1121.12	1121.20	1121.26	1121.23	4.2	4.0	5.0
7/8/2015	1119.25	1119.87	1119.48	1117.26	1121.90	1120.01	1119.42	1121.20	1121.22	1121.33	1121.275	5.1	5.0	5.8
7/9/2015	1119.26	1119.89	1119.49	1117.26	1121.95	1120.02	1119.45	1121.24	1121.28	1121.35	1121.315	4.9	4.7	5.9
7/10/2015	1119.26	1119.89	1119.48	1117.20	1121.94	1120.01	1119.40	1121.21	1121.29	1121.34	1121.315	6.0	5.7	7.1
7/11/2015	---	---	---	---	---	---	---	---	1121.28	1121.35	1121.315	6.8	6.5	8.1
7/12/2015	---	---	---	---	---	---	---	---	1121.24	1121.32	1121.28	6.0	5.7	7.1
7/13/2015	1119.30	1119.93	1119.49	1116.97	1121.86	1120.00	1119.27	1121.08	1121.24	1121.30	1121.27	6.8	6.5	8.1
7/14/2015	1119.18	1119.94	1119.45	1116.94	1121.83	1120.00	1119.25	1121.04	1121.23	1121.29	1121.26	6.1	5.9	7.4
7/15/2015	1119.16	1119.93	1119.42	1116.84	1121.80	1119.99	1119.20	1120.97	1121.23	1121.27	1121.25	6.9	6.6	8.3
7/16/2015	1119.16	1119.92	1119.41	1116.86	1121.79	1119.98	1119.18	1120.99	1121.24	1121.29	1121.265	6.3	6.0	7.4
7/17/2015	1119.16	1119.92	1119.40	1116.81	1121.77	1119.97	1119.15	1120.95	1121.28	1121.33	1121.305	6.5	6.0	7.7
7/18/2015	---	---	---	---	---	---	---	---	1121.21	1121.29	1121.25	6.5	6.3	7.8
7/19/2015	---	---	---	---	---	---	---	---	1121.22	1121.29	1121.255	6.4	6.1	7.6
7/20/2015	1119.18	1119.9	1119.38	1116.74	1121.72	1119.94	1119.06	1120.91	1121.23	1121.30	1121.265	6.6	6.3	7.8
7/21/2015	1119.18	1119.9	1119.37	1116.75	1121.72	1119.93	1119.03	1120.89	1121.21	1121.27	1121.24	6.2	6.0	7.4
7/22/2015	1119.17	1119.88	1119.36	1116.73	1121.69	1119.91	1119.01	1120.89	1121.20	1121.27	1121.235	6.6	6.3	7.8
7/23/2015	1119.15	1119.89	1119.36	1116.72	1121.69	1119.91	1118.98	1120.88	1121.21	1121.27	1121.24	6.4	6.2	7.7
7/24/2015	1119.15	1119.89	1119.35	1116.70	1121.67	1119.92	1119.01	1120.89	1121.22	1121.28	1121.25	7.0	6.8	8.4

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
7/25/2015	---	---	---	---	---	---	---	---	1121.20	1121.32	1121.26	6.3	6.1	7.5
7/26/2015	---	---	---	---	---	---	---	---	1121.24	1121.40	1121.32	6.9	6.6	8.2
7/27/2015	1119.08	1119.85	1119.28	1116.74	1121.64	1119.87	1118.90	1120.89	1121.22	1121.32	1121.27	4.8	4.6	5.8
7/28/2015	1119.08	1119.84	1119.29	1116.78	1121.64	1119.85	1118.90	1120.91	1121.21	1121.26	1121.235	6.1	5.9	7.3
7/29/2015	1119.09	1119.83	1119.28	1116.83	1121.65	1119.84	1118.92	1120.95	1121.26	1121.32	1121.29	5.5	5.3	6.5
7/30/2015	1119.10	1119.83	1119.27	1116.78	1121.65	1119.83	1118.90	1120.94	1121.21	1121.30	1121.255	6.1	5.9	7.3
7/31/2015	1119.11	1119.82	1119.28	1116.94	1121.66	1119.82	1118.95	1120.97	1121.23	1121.30	1121.265	6.3	6.0	7.5
8/1/2015	---	---	---	---	---	---	---	---	1121.21	1121.28	1121.245	6.2	6.0	7.4
8/2/2015	---	---	---	---	---	---	---	---	1121.20	1121.28	1121.24	6.3	6.0	7.5
8/3/2015	1119.09	1119.82	1119.26	1116.72	1121.59	1119.79	1118.83	1120.87	1121.19	1121.25	1121.22	6.4	6.2	7.7
8/4/2015	1119.02	1119.80	1119.26	1116.66	1121.59	1119.78	1118.79	1120.83	1121.19	1121.24	1121.215	6.9	6.6	8.2
8/5/2015	1118.94	1119.81	1119.24	1116.67	1121.56	1119.77	1118.78	1120.83	1121.18	1121.23	1121.205	6.3	6.1	7.5
8/6/2015	1118.98	1119.80	1119.23	1116.67	1121.53	1119.76	1118.77	1120.81	1121.17	1121.24	1121.205	6.8	6.5	8.1
8/7/2015	1118.99	1119.79	1119.21	1116.68	1121.55	1119.75	1118.75	1120.81	1121.12	1121.18	1121.15	6.2	5.9	7.4
8/8/2015	---	---	---	---	---	---	---	---	1121.13	1121.18	1121.155	6.0	5.8	7.1
8/9/2015	---	---	---	---	---	---	---	---	1121.13	1121.19	1121.16	6.1	5.9	7.3
8/10/2015	1118.97	1119.77	1119.16	1116.66	1121.51	1119.72	1118.72	1120.81	1121.04	1121.20	1121.12	6.2	5.9	7.4
8/11/2015	1118.97	1119.76	1119.14	1116.59	1121.51	1119.70	1118.70	1120.79	1121.03	1121.10	1121.065	6.5	6.2	7.7

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
8/12/2015	1118.95	1119.76	1119.13	1116.59	1121.49	1119.69	1118.66	1120.77	1121.01	1121.07	1121.04	6.9	6.7	7.8
8/13/2015	1118.88	1119.76	1119.11	1116.58	1121.46	1119.67	1118.64	1120.76	1121	1121.08	1121.04	6.6	6.3	7.3
8/14/2015	1118.86	1119.76	1119.08	1116.59	1121.45	1119.66	1118.63	1120.73	1121.03	1121.08	1121.055	7.0	6.7	7.8
8/15/2015	---	---	---	---	---	---	---	---	1121.02	1121.06	1121.04	6.9	6.6	7.5
8/16/2015	---	---	---	---	---	---	---	---	1121.02	1121.10	1121.06	6.4	6.1	7.1
8/17/2015	1118.88	1119.72	1119.05	1116.87	1121.44	1119.62	1118.67	1120.78	1120.82	1121.11	1120.965	5.8	5.6	6.6
8/18/2015	1118.90	1119.72	1119.04	1116.87	1121.45	1119.61	1118.71	1120.80	1120.45	1120.79	1120.62	3.5	3.5	4.4
8/19/2015	1118.91	1119.71	1119.03	1116.92	1121.45	1119.60	1118.71	1120.75	1120.37	1120.47	1120.42	5.1	4.9	6.1
8/20/2015	1118.92	1119.71	1119.00	1116.95	1121.46	1119.59	1118.77	1120.75	1120.38	1120.52	1120.45	4.9	4.7	5.8
8/21/2015	1118.93	1119.70	1119.05	1116.90	1121.46	1119.59	1118.75	1120.74	1120.53	1120.79	1120.66	5.6	5.4	6.7
8/22/2015	---	---	---	---	---	---	---	---	1120.71	1120.79	1120.75	5.2	5.0	6.2
8/23/2015	---	---	---	---	---	---	---	---	1120.67	1120.76	1120.715	5.1	4.9	6.1
8/24/2015	1118.94	1119.69	1119.05	1116.97	1121.48	1119.57	1118.80	1120.80	1120.69	1120.77	1120.73	4.8	4.7	5.8
8/25/2015	1118.94	1119.68	1119.06	1117.07	1121.46	1119.56	1118.82	1120.80	1120.69	1121.03	1120.86	6.0	5.8	7.2
8/26/2015	1118.95	1119.67	1119.07	1116.88	1121.46	1119.56	1118.76	1120.80	1121.02	1121.06	1121.04	5.8	5.6	6.9
8/27/2015	1118.97	1119.68	1119.10	1116.88	1121.47	1119.56	1118.75	1120.83	1121.02	1121.09	1121.055	6.3	6.0	7.5
8/28/2015	1118.97	1119.68	1119.10	1116.97	1121.49	1119.56	1118.77	1120.86	1121.07	1121.24	1121.155	5.5	5.4	6.6
8/29/2015	---	---	---	---	---	---	---	---	1121.16	1121.26	1121.21	5.2	5.0	6.2

Appendix B - continued

												Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
8/30/2015	---	---	---	---	---	---	---	---	1121.15	1121.23	1121.19	4.8	4.7	5.8
8/31/2015	1119.01	1119.70	1119.13	1117.16	1121.59	1119.58	1118.88	1121.02	1121.15	1121.21	1121.18	4.6	4.4	5.5
9/1/2015	1119.01	1119.69	1119.13	1117.18	1121.60	1119.58	1118.90	1121.04	1121.15	1121.21	1121.18	4.5	4.4	5.4
9/2/2015	1118.92	1119.70	1119.13	1117.19	1121.61	1119.59	1118.92	1121.05	1121.26	1121.32	1121.29	5.4	5.2	6.5
9/3/2015	1118.87	1119.70	1119.14	1117.21	1121.61	1119.59	1118.94	1121.07	1121.26	1121.32	1121.29	5.2	5.0	6.2
9/4/2015	1118.87	1119.70	1119.14	1117.51	1121.61	1119.59	1118.89	1121.11	1121.25	1121.32	1121.285	5.5	5.3	6.6
9/5/2015	---	---	---	---	---	---	---	---	1121.25	1121.28	1121.265	6.2	6.0	7.4
9/6/2015	---	---	---	---	---	---	---	---	---	---	---	4.9	4.7	5.9
9/7/2015	---	---	---	---	---	---	---	---	---	---	---	5.1	4.9	6.1
9/8/2015	1118.76	1119.69	1119.09	1117.25	1121.55	1119.54	1118.93	1121.09	1121.22	1121.26	1121.24	5.3	5.1	6.3
9/9/2015	---	---	---	---	---	---	---	---	1121.19	1121.28	1121.235	5.1	5.0	5.8
9/10/2015	1118.80	1119.68	1119.09	1117.27	1121.58	1119.53	1118.95	1121.10	1121.22	1121.30	1121.26	5.2	5.0	6.0
9/11/2015	1118.81	1119.68	1119.10	1117.33	1121.60	1119.53	1118.97	1121.13	1121.20	1121.25	1121.225	5.0	4.7	5.9
9/12/2015	---	---	---	---	---	---	---	---	1121.18	1121.23	1121.205	5.5	5.3	6.5
9/13/2015	---	---	---	---	---	---	---	---	1121.17	1121.21	1121.19	4.9	4.7	5.9
9/14/2015	1118.97	1119.70	1119.14	1117.29	1121.61	1119.56	1118.99	1121.10	1121.18	1121.26	1121.22	5.4	5.2	6.4
9/15/2015	1118.98	1119.71	1119.15	1117.26	1121.62	1119.56	1118.97	1121.10	1121.18	1121.23	1121.205	5.9	5.7	7.0
9/16/2015	1118.99	1119.71	1119.15	1117.18	1121.59	1119.57	1118.93	1121.06	1121.20	1121.26	1121.23	6.3	6.1	7.5

Appendix B - continued

	Well name and elevation of water in feet above sea level								Missouri River elevation in feet above sea level[1]			Daily pumping amounts, in millions of gallons per day, from selected groups of Lewis & Clark Regional Water System production wells[2]		
												North group	Middle group	South group
Date	CL-80C	Airport	R20-95-06	R20-2015-06	R20-2015-07	R20-2015-08	R20-2015-09	R20-2015-10	Daily minimum	Daily maximum	Daily average	wells 09-01, 09-02, and 09-03	wells 07-4, 06-5, and 06-6	wells 03-1, 06-2, 06-3, 09-04, and 09-05
9/17/2015	1118.99	1119.7	1119.16	1117.11	1121.57	1119.57	1118.89	1121.02	1121.20	1121.26	1121.23	6.3	6.1	7.5
9/18/2015	1119.00	1119.70	1119.17	1117.10	1121.58	1119.57	1118.87	1121.02	1121.17	1121.24	1121.205	6.0	5.8	7.3
9/19/2015	---	---	---	---	---	---	---	---	1121.13	1121.19	1121.16	6.1	5.8	7.2
9/20/2015	---	---	---	---	---	---	---	---	1121.14	1121.22	1121.18	5.0	4.8	6.1
9/21/2015	1119.04	1119.71	1119.21	1117.14	1121.60	1119.60	1118.90	1121.02	1121.16	1121.19	1121.175	5.4	5.2	6.4
9/22/2015	1119.04	1119.70	1119.21	1117.10	1121.60	1119.59	1118.89	1121.01	1121.12	1121.26	1121.19	6.2	6.0	7.3
9/23/2015	1119.05	1119.72	1119.21	1117.10	1121.59	1119.61	1118.87	1120.99	1121.02	1121.46	1121.24	6.3	6.0	7.5
9/24/2015	1119.05	1119.71	1119.22	1117.19	1121.61	1119.61	1118.89	1121.04	1121.27	1121.38	1121.325	5.3	5.1	6.5
9/25/2015	1119.07	1119.74	1119.25	1117.22	1121.62	1119.62	1118.94	1121.08	1121.21	1121.36	1121.285	4.8	4.6	5.7
9/26/2015	---	---	---	---	---	---	---	---	1121.15	1121.22	1121.185	5.0	4.8	6.0
9/27/2015	---	---	---	---	---	---	---	---	1121.14	1121.18	1121.16	4.9	4.7	5.8
9/28/2015	1119.09	1119.78	1119.26	1117.34	1121.70	1119.65	1119.03	1121.15	1121.15	1121.22	1121.185	4.5	4.4	5.5
9/29/2015	1119.10	1119.78	---	1117.41	1121.71	1119.66	1119.05	1121.17	1121.15	1121.21	1121.18	5.0	4.8	6.0
9/30/2015	1119.10	1119.77	1119.28	1117.38	1121.72	1119.65	1119.04	1121.16	1121.14	1121.18	1121.16	5.4	5.1	6.1

[1] Daily maximum and minimum elevations of the Missouri River were obtained from USGS gaging station number 06478526. This gage is located on the south side of the Missouri River, downstream from the Newcastle-Vermillion Bridge, at Mulberry Bend Wildlife Management Area. Latitude = 42°42'52.9" and longitude = 96°56'37" in Dixon County, Nebraska.

[2] Data obtained from the Lewis & Clark Regional Water System.

APPENDIX C

RECORDS OF LEWIS & CLARK REGIONAL WATER SYSTEM PRODUCTION WELLS

This appendix contains information on the following wells and in the following order.

See figure 2 for well location.

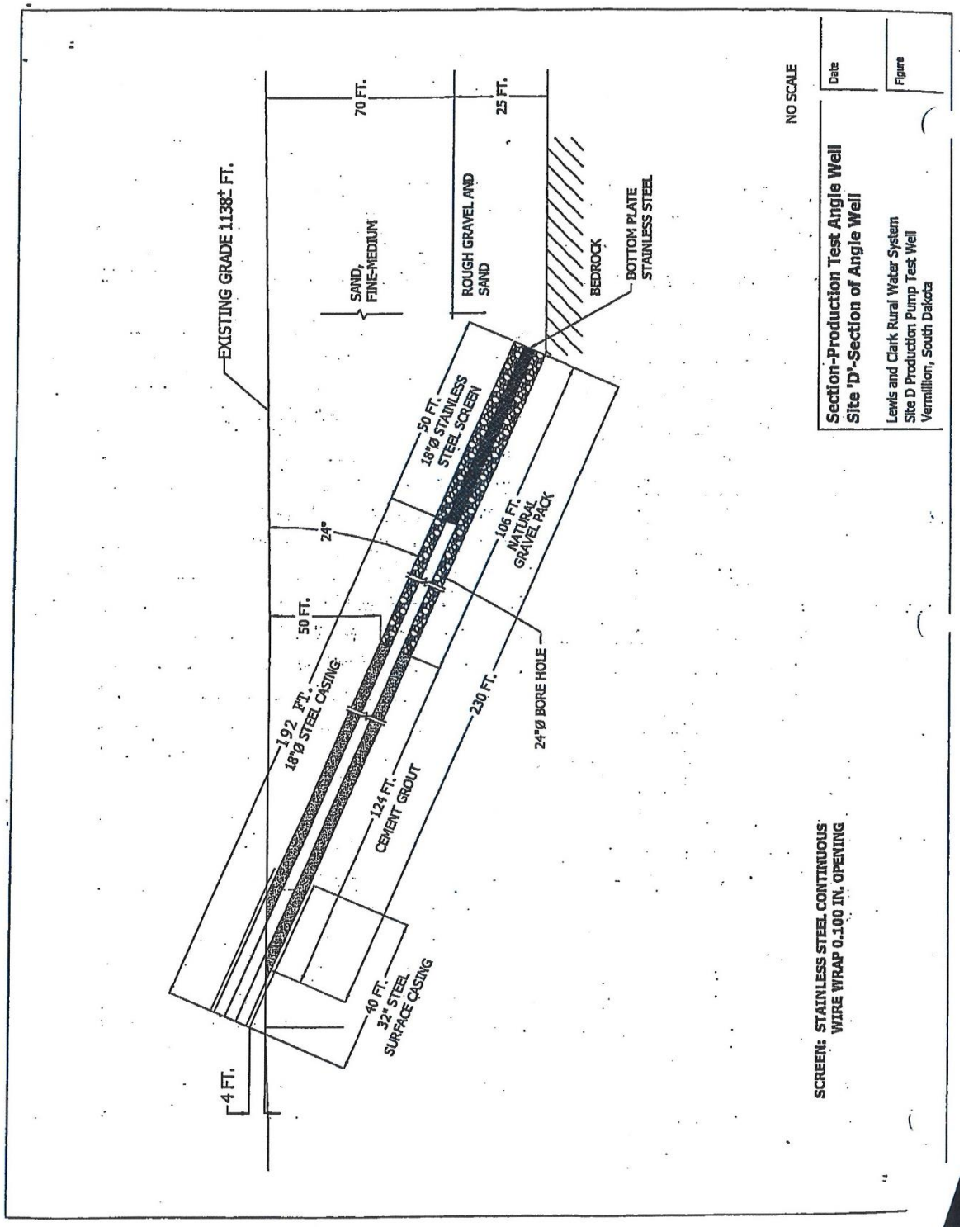
Angle-well sites

- Well 03-1
- Test hole “1” adjacent to well 03-1
- Well 06-2
- Test hole “06-2 Test Boring” adjacent to well 06-2
- Well 06-5
- Test hole “06-5 Test Boring” adjacent to well 06-5
- Well 06-6
- Test hole “06-6 Test Boring” adjacent to well 06-6

Vertical-well sites

- Well 06-3
- Well 07-4
- Well 09-01
- Well 09-02
- Well 09-03
- Test hole “TH-03 Site A” adjacent to well 09-03
- Well 09-04
- Well 09-05

Proposed, not as-built, construction for angle well 03-1



Vertical test hole "1" drilled adjacent to angle well 03-1
This log was used in lieu of the log for angle well 03-1 in constructing figure 3.

TEST HOLE REPORT

LAYNE-WESTERN
VALLEY, NEBRASKA
(402) 359-2042

Contract Name	*Lewis & Clark Rural Water*		Test Hole No. *1*
Job No.	*72-6357*	Date *08/23/2003*	
City	*Vermillion*	State *SD*	Driller: *H. Leslie*

Test Hole Location _____
Distance and Direction from Permanent Landmark or Previous Test Hole

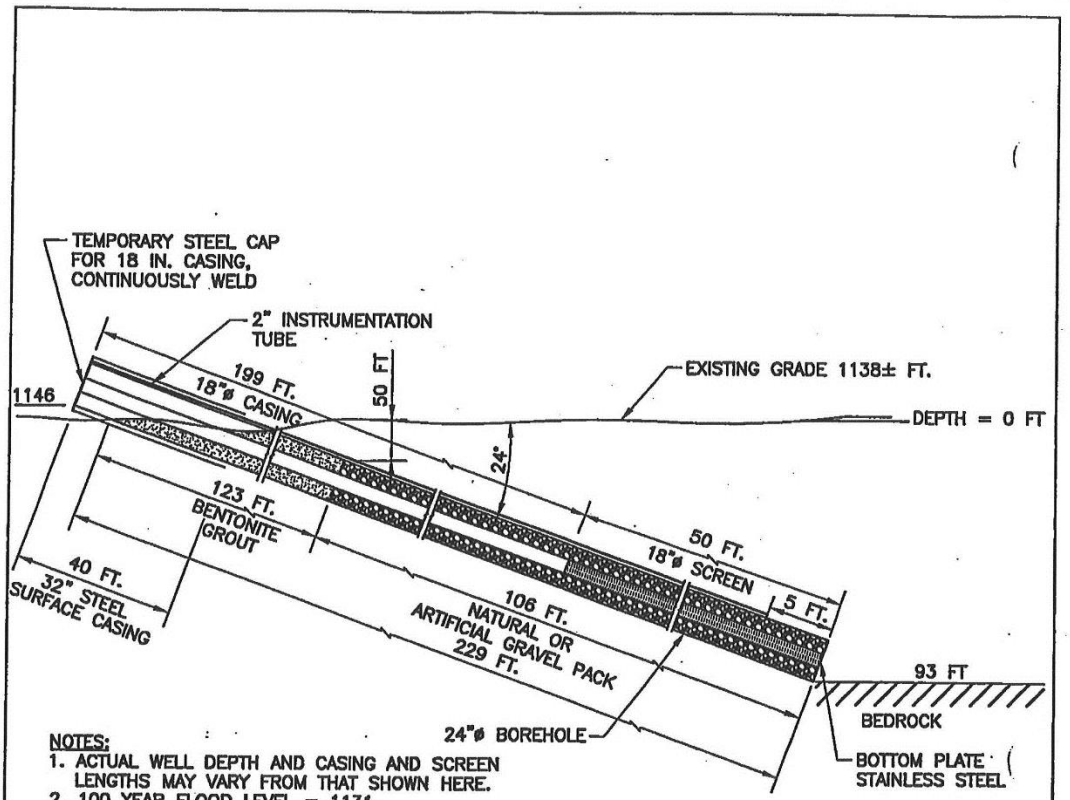
Test Log

FROM	TO	MARSH FUNNEL VISCOSITY SECONDS	MUD PIT LOSS INCHES	STATIC WATER LEVEL MEASURED HOURS AFTER COMPLETION FORMATION
0	*10*	*32*	*0*	*Grey clay*
10	*20*	*32*	*1"*	*Medium - coarse sand*
20	*40*	*32*	*0*	*Medium - coarse sand w/ clay layers*
40	*60*	*32*	*0*	*Medium - coarse sand w/ clay layers*
60	*72*	*34*	*1"*	*Fine - medium sand*
72	*80*	*34*	*2"*	*Cemented gravel (boulders)*
80	*100*	*34*	*1"*	*Coause gravel with coal stringers*
100	*110*	*34*	*0*	*Medium coarse sand some gravel*
110				*Shale*

NOTES: Size of Pit 4 x 8 x 18" DEEP

COMMENTS: _____

Proposed, not as-built, construction for angle well 06-2



NOTES:
1. ACTUAL WELL DEPTH AND CASING AND SCREEN LENGTHS MAY VARY FROM THAT SHOWN HERE.
2. 100 YEAR FLOOD LEVEL = 1131.
3. TEMPORARILY SUPPORT CASING ABOVE GROUND AS REQUIRED UNTIL WELL PAD IS CONSTRUCTED.

NOT TO SCALE

C:\PWworkin\OMA\dms51950\FIG0F12.DWG, Plot, 5/25/2006 11:20:47 AM, mchristi

HDR

Angle Well 06-2 Section
Site D

Lewis and Clark Rural Water System
Well Field Production Wells—Sites C and D
Sioux Falls, South Dakota

DATE
Mar. 200(

SHEET
6 of 12

Log along trace of angle well 06-2

SD EForm - 1621 V1

6736-3

SOUTH DAKOTA WATER WELL COMPLETION REPORT

11-02

Location NE ¼ SW ¼ Sec 22 Twp 91N Rg 52W

County Clay

SITE D
06-2

Please mark well location with an "X"

North / W / E / X

1 Mile

Well Completion Date
11-20-06

Distance to nearest potential pollution source (Septic tank, abandoned well, feed lot, etc.)
? 200 ft. from Missouri River (identify source)

PROPOSED USE:
☐ Domestic/Stock ☒ Municipal ☐ Business ☐ Test Holes
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING:
Dual Rotary

CASING DATA: ☒ Steel ☐ Plastic ☐ Other
If other describe

WEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
70.59 LB/FT	18 IN	+8 FT	183 FT	24 IN
157.52 LB/FT	30 IN	0 FT	100 FT	30 IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
Portland	276	15 Lb/gal	0 Ft	100 Ft
		Lb/gal	Ft	Ft

Describe grouting procedure Neat cement pumped through theimi pipe 100' to 0' at 24 degree angled well.

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 18 Inches Length 55 Feet
Material Stainless V-Slot Johnson
Slot Size ____ Set From 183 Feet to 238 Feet
Other Information 183-203 .050 Slot, 203-215 .070 Slot, 215-223 .060 Slot, 223-230 .020 Slot, 230-238 .050 Slot

WAS A PACKER OR SEAL USED? ☐ Yes ☒ No
If so, what material?
Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?
☒ Yes, How? chlorine solution
☐ No, Why Not?

ab sample sent to for water quality analysis
yes

Well Owner: Lewis & Clark Rural Water Association, Inc
Business Name: Lewis & Clark Rural Water Association, Inc
Address:
City, State, Zip: Sioux Falls, SD

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Silty Clay - Brown	0	5
Silty Sand - Brown	5	20
Silty Clay - Gray	20	30
Sand (Med.) - Brown	30	82
Silty Sand w/Clay & Coal Lenses	82	107
Sand & Gravel - Brown	107	126
Sand & Gravel w/Silt Layers	126	141
Sand & Gravel w/Clay Layers	141	171
Sand (Coarse) - Grey	171	180

CONT..

STATIC WATER LEVEL 14' Vertical FEET
If flowing: closed in pressure ____ PSI
GPM flow ____ through ____ inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other ____
Reduced flow rate ____ GPM
Can well be completely shut in?

WELL TEST DATA:
☒ Pumped Describe: Submersible Pump
☐ Bailed
☐ Other
Pumping Level Below Land Surface
33' Vertical Ft. After 72 Hrs. pumped 2,000 GPM
____ Ft. After ____ Hrs. pumped ____ GPM
If pump installed, pump rate: ____ GPM

REMARKS Well Drilled at 24 degree angle ← Surface

This well was drilled under license # 600
And this report is true and accurate.
Drilling firm: Mark J. Traut Wells, Inc.
Signature of License Representative:
Mark J. Traut
Signature of Well Owner or Equitable Property Holder:

RECEIVED
JAN - 5 2007
WATER RIGHTS PROGRAM

Date: 11-22-06

1-5-07

Log along trace of angle well 06-2 - continued

.....Geological Materials Continued

FORMATION	DEPTH From	To
Sand & Gravel (fine to coarse) - multi	180	224
Sand (fine-med) - multi	224	228
Sand & Coarse Gravel - multi	228	238
Sand (fine-med w/coal) dirty- grey/black	238	240

Vertical test hole "06-2 Test Boring" drilled adjacent to angle well 06-2
This log was used in lieu of the log for angle well 06-2 in constructing figure 3.

FIELD BORING LOG

Cahoy

411 E. Main Street
P.O. Box 309
Fredericksburg, IA 50630-0309
563-237-5361
FAX 563-237-6517

2905 SW 7th Street
Atlantic, IA 50022
712-243-5830
FAX 712-243-5831

Well And Pump Service
Municipal Industrial
Irrigation Residential

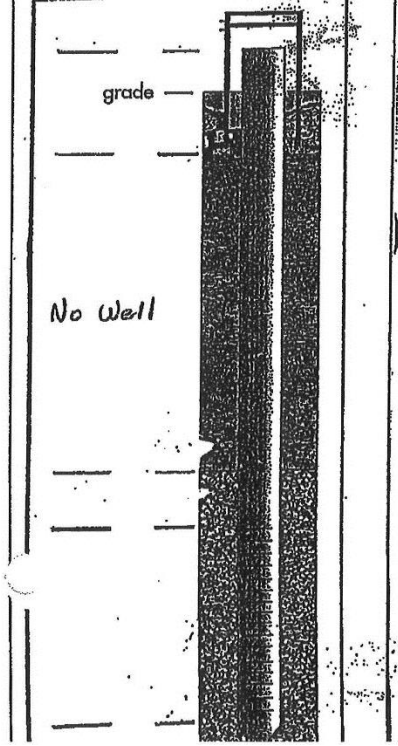
Project Name: Lewis + Clark Rural Water
Boring No.: 06-2 Test Boring
Date Started: 9-12-06
Date Completed: 9-13-06
Drilled By: Denny, Danny
Logged By: Denny

water levels

While Drilling ____
0 Hours A.B. ____
____ Hours A.B. ____

well details

Stick-up Cover ____
Flush Mount Cover ____



subsurface stratigraphy

Flight Auger ____ Size ____
H.S. Auger ____ Size ____
Rotary X Size 6"

From	To	Description
0	10	Silty brown clay with organics
10	21	Very fine silty brown sand
21	22	Wood
22	50	Fine gray-brown sand
50	76	Fine to coarse sand with clay seams
76	96	Medium to coarse sand + gravel with cobbles; coal at 86' and 96'
96	101	Fine to coarse sand with gravel
101		Limestone

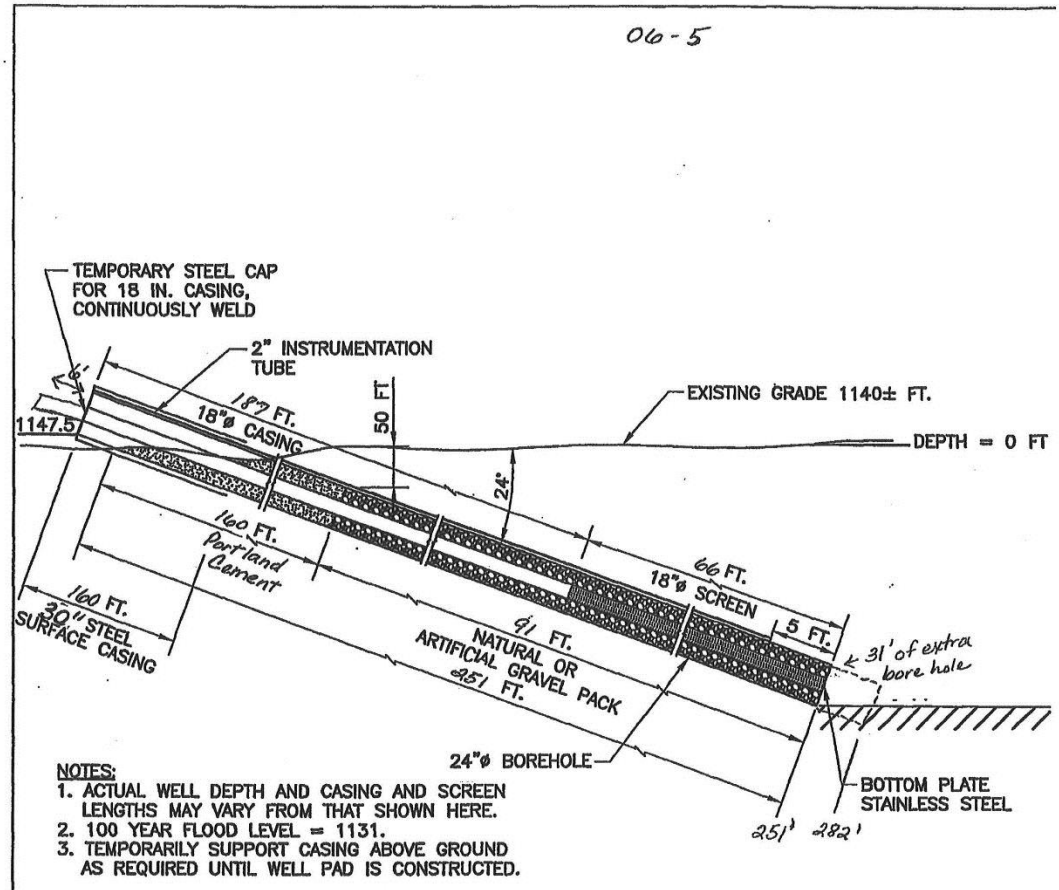
Bottom of Boring 101

sample data

Depth	Number/Type	Depth	Number/Type
18-20	SS-1		
28-30	SS-2		
38-40	SS-3		
48-50	SS-4		
58-60	SS-5		
68-70	SS-6		
78-80	SS-7		
88-90	SS-8		
98-100	SS-9		

ARS (air rotary sample)

Proposed, not as-built construction for angle well 06-5



NOT TO SCALE

RECEIVED
JAN - 5 2007
WATER RIGHTS PROGRAM

C:\PWworkin... ...\AVdms51950\FIG7OF12.DWG, Plot, 5/25/2006 11:21:11 AM, mchristi

HDR

Angle Well 06-5 Section
Site C

Lewis and Clark Rural Water System
Well Field Production Wells—Sites C and D
Sioux Falls, South Dakota

DATE: Mar. 2006
SHEET: 7 of 12

Log along trace of angle well 06-5

SD EForm - 1621 V1

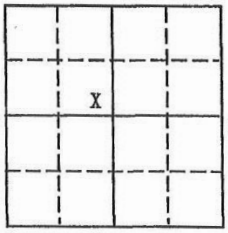
SOUTH DAKOTA WATER WELL COMPLETION REPORT 11-02

Location SE ¼ NW ¼ Sec 22 Twp 91N Rg 52W

County: Clay

SITE C

06-5 Please mark well location with an "X"



Well Completion Date: Oct. 2006

Distance to nearest potential pollution source (Septic tank, abandoned well, feed lot, etc.)

? 150 ft. from wetland (identify source)

PROPOSED USE: ☐ Domestic/Stock ☐ Irrigation ☒ Municipal ☐ Industrial ☐ Business ☐ Institutional ☐ Test Holes ☐ Monitoring well

METHOD OF DRILLING: Dual Rotary

CASING DATA: ☒ Steel ☐ Plastic ☐ Other

If other describe

WEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
157.53 LB/FT	30 IN	0 FT	160 FT	30 IN
70.59 LB/FT	18 IN	+4 FT	187 FT	24 IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
Portland	322	15 Lb/gal	160 Ft	to surface Ft
		Lb/gal	Ft	Ft

Describe grouting procedure

Continuous pump through trimie pipe

SCREEN: ☐ Perforated pipe ☒ Manufactured

Diameter 18 Inches Length 66 Feet

Material Stainless Steel

Slot Size Varied Set From 185 Feet to 251 Feet

Other information .025 from 185-190', .080 from 190-216' .065 from 216-227',.045 from 227-230', tight wrap from 230'-245', .025 from 245-251'

WAS A PACKER OR SEAL USED? ☐ Yes ☒ No

If so, what material?

Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?

☒ Yes, How? Flushed with Chlorine

☐ No, Why Not?

Lab sample sent to for water quality analysis

Well Owner: Lewis & Clark Rural Water Association

Business Name: Lewis & Clark Rural Water Association

Address:

City, State, Zip: Sioux Falls, SD

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Fine tan sand	0	30
Tan to grey silty sand	30	40
Grey Silty Sand	40	60
Grey SiltySand & Coal Layers	60	88
Grey Silty Sand, Clay, Gravel	88	100
Grey Silty Sand	100	125
Grey Silty Sand & Gravel	125	130
Grey Silty Sand	130	155
Grey Silty Sand & Clay Layers	155	160 cont...

STATIC WATER LEVEL 16" Vertical FEET

If flowing: closed in pressure PSI

GPM flow through Inch pipe

Controlled by ☐ Valve ☐ Reducers ☐ Other

Reduced flow rate GPM

Can well be completely shut in?

WELL TEST DATA:

☒ Pumped Describe:

☐ Bailed

☐ Other

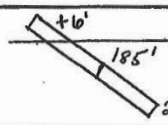
Pumping Level Below Land Surface

15 Ft. After 72 Hrs. pumped 2,200 GPM

Ft. After Hrs. pumped GPM

If pump installed, pump rate: GPM

REMARKS



This well was drilled under license # 600

And this report is true and accurate.

Drilling firm: Mark J. Traut Wells, Inc.

Signature of License Representative:

Signature of Well Owner or Equitable Property Holder:

Date: 12-13-06

RECEIVED
JAN - 5 2007
WATER RIGHTS PROGRAM

1-5-07

Log along trace of angle well 06-5 - continued

.....Geological Materials Continued

FORMATION	DEPTH From	To
Silty Sand, Clay & Gravel Layers - Grey	160	165
Silty Sand, Clay, Gravel, Coal Layers - Grey	165	175
Fine to Med. Sand & Gravel - Grey	175	187
Coarse Sand & Gravel - Brown	187	232
Fine Sand - Grey	232	241
Med. To Coarse Sand, Some Gravel - Grey	241	251
Fine Silty Sand - Grey	251	274
Fine Sand & Coal - Grey/Black	274	282

Vertical test hole "06-5 Test Boring" drilled adjacent to angle well 06-5
This log was used in lieu of the log for angle well 06-5 in constructing figure 3.

FIELD BORING LOG 06-05

Cahoy

Well And Pump Service
Municipal Industrial
Irrigation Residential

411 E. Main Street
P.O. Box 309
Fredericksburg, IA 50630-0309
563-237-5361
FAX 563-237-6517

2905 SW 7th Street
Atlantic, IA 50022
712-243-5830
FAX 712-243-5831

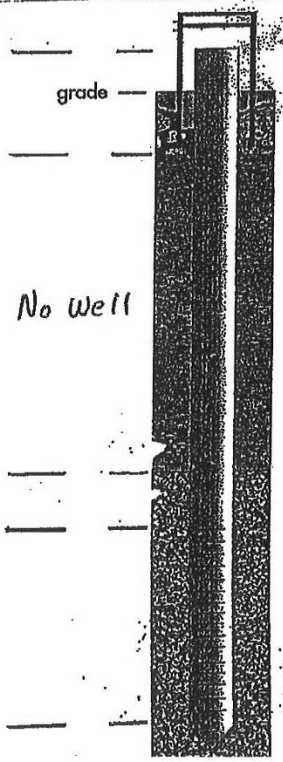
Project Name: Lewis + Clark Rural Water
Boring No.: 06-5 Test Boring
Date Started: 9-13-06
Date Completed: 9-15-06
Drilled By: Denny, Denny
Logged By: Denny

water levels

While Drilling
0 Hours A.B.
Hours A.B.

well details

Stick-up Cover
Flush Mount Cover



subsurface stratigraphy

Flight Auger ___ Size ___
H.S. Auger ___ Size ___
Rotary X Size 4 1/2"

From	To	Description
0	3	Gray-black silt
3	13	Very fine brown silty sand
13	28	Fine gray sand
28	34	Wood
34	42	Fine gray sand
42	60	Fine gray sand with clay seams
60	82	Fine to medium sand with clay lense and coal
82	124	Brown sand and gravel with cobbles and coal at 102' + 113'
124	125	Limestone

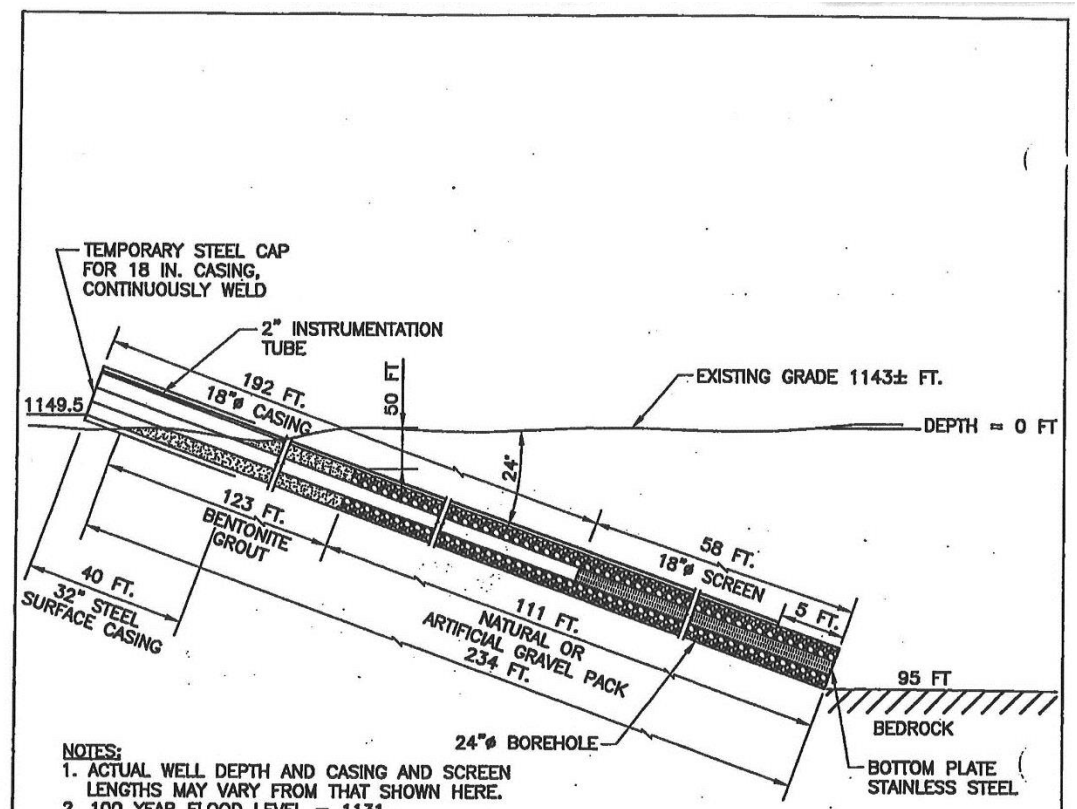
Bottom of Boring 125 Hole abandoned

sample data

Depth	Number/Type	Depth	Number/Type
18-20	SS-1	108-110	SS-9
28-30	No sample	118-120	No sample
38-40	SS-2		
48-50	SS-3		
58-60	SS-4		
68-70	SS-5		
78-80	SS-6		
88-90	SS-7		
98-100	SS-8		

AS (auger sample) CS (continuous sample) ARS (air rotary sample)

Proposed, not as-built construction for angle well 06-6



NOTES:
1. ACTUAL WELL DEPTH AND CASING AND SCREEN LENGTHS MAY VARY FROM THAT SHOWN HERE.
2. 100 YEAR FLOOD LEVEL = 1131.
3. TEMPORARILY SUPPORT CASING ABOVE GROUND AS REQUIRED UNTIL WELL PAD IS CONSTRUCTED.

NOT TO SCALE

HDR

Angle Well 06-6 Section
Site C

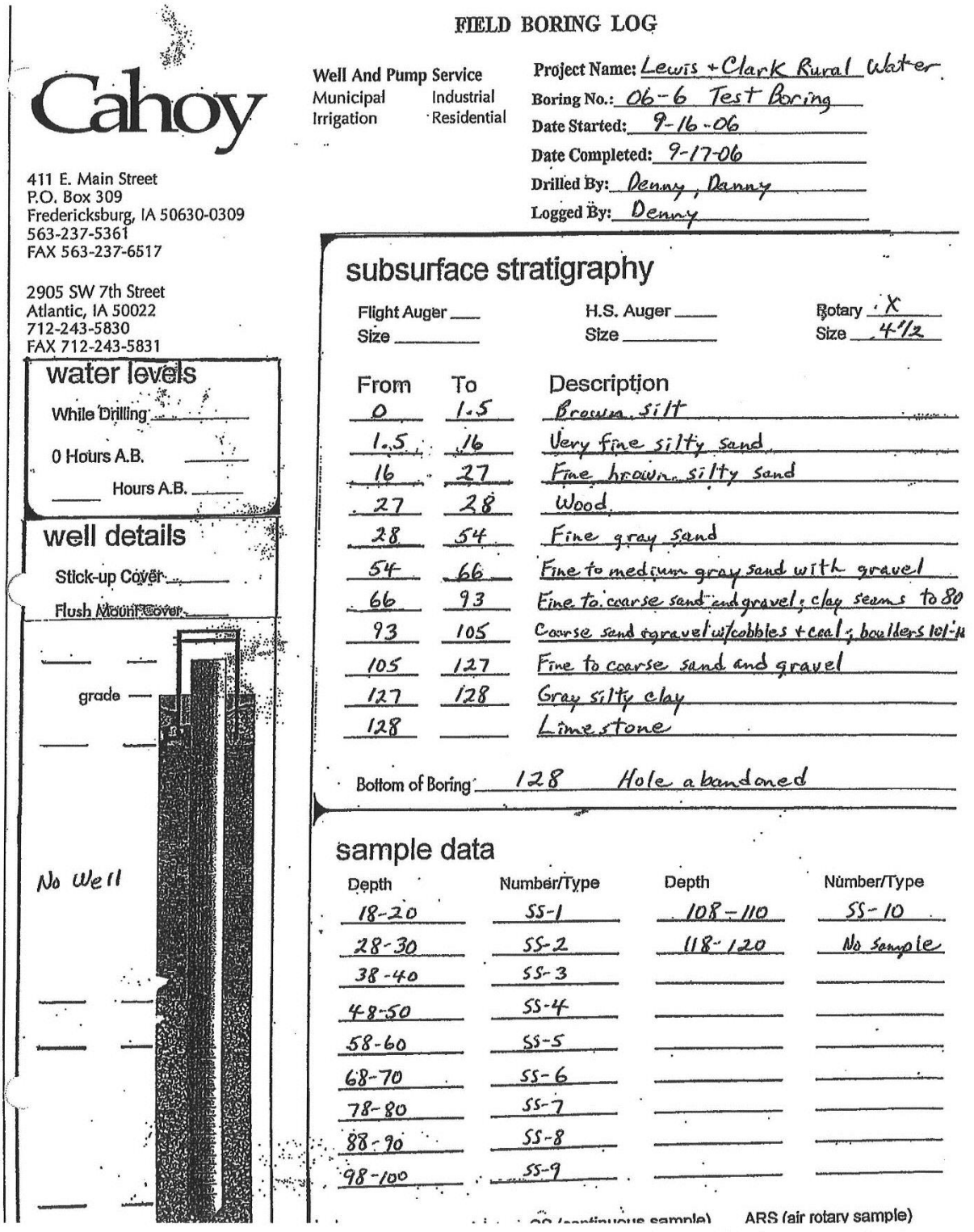
Lewis and Clark Rural Water System
Well Field Production Wells–Sites C and D
Sioux Falls, South Dakota

DATE
Mar. 2006

SHEET
8 of 12

C:\PW\working\C\MA\dms51950\FIG8OF12.DWG, Plot, 5/25/2006 11:21:36 AM, mchristi

Vertical test hole "06-6 Test Boring" drilled adjacent to angle well 06-6
This log was used in lieu of the log for angle well 06-6 in constructing figure 3.



FIELD BORING LOG

Cahoy

411 E. Main Street
P.O. Box 309
Fredericksburg, IA 50630-0309
563-237-5361
FAX 563-237-6517

2905 SW 7th Street
Atlantic, IA 50022
712-243-5830
FAX 712-243-5831

Well And Pump Service
Municipal Industrial
Irrigation Residential

Project Name: Lewis + Clark Rural Water
Boring No.: 06-6 Test Boring
Date Started: 9-16-06
Date Completed: 9-17-06
Drilled By: Denny, Danny
Logged By: Denny

water levels
While Drilling
0 Hours A.B.
Hours A.B.

well details
Stick-up Cover
Flush Mount Cover
grade
No Well

subsurface stratigraphy

Flight Auger Size
H.S. Auger Size
Rotary X Size 4 1/2

From	To	Description
0	1.5	Brown silt
1.5	16	Very fine silty sand
16	27	Fine brown silty sand
27	28	Wood
28	54	Fine gray sand
54	66	Fine to medium gray sand with gravel
66	93	Fine to coarse sand and gravel; clay seams to 80
93	105	Coarse sand & gravel w/cobbles + coal; boulders 101'-1
105	127	Fine to coarse sand and gravel
127	128	Gray silty clay
128		Limestone

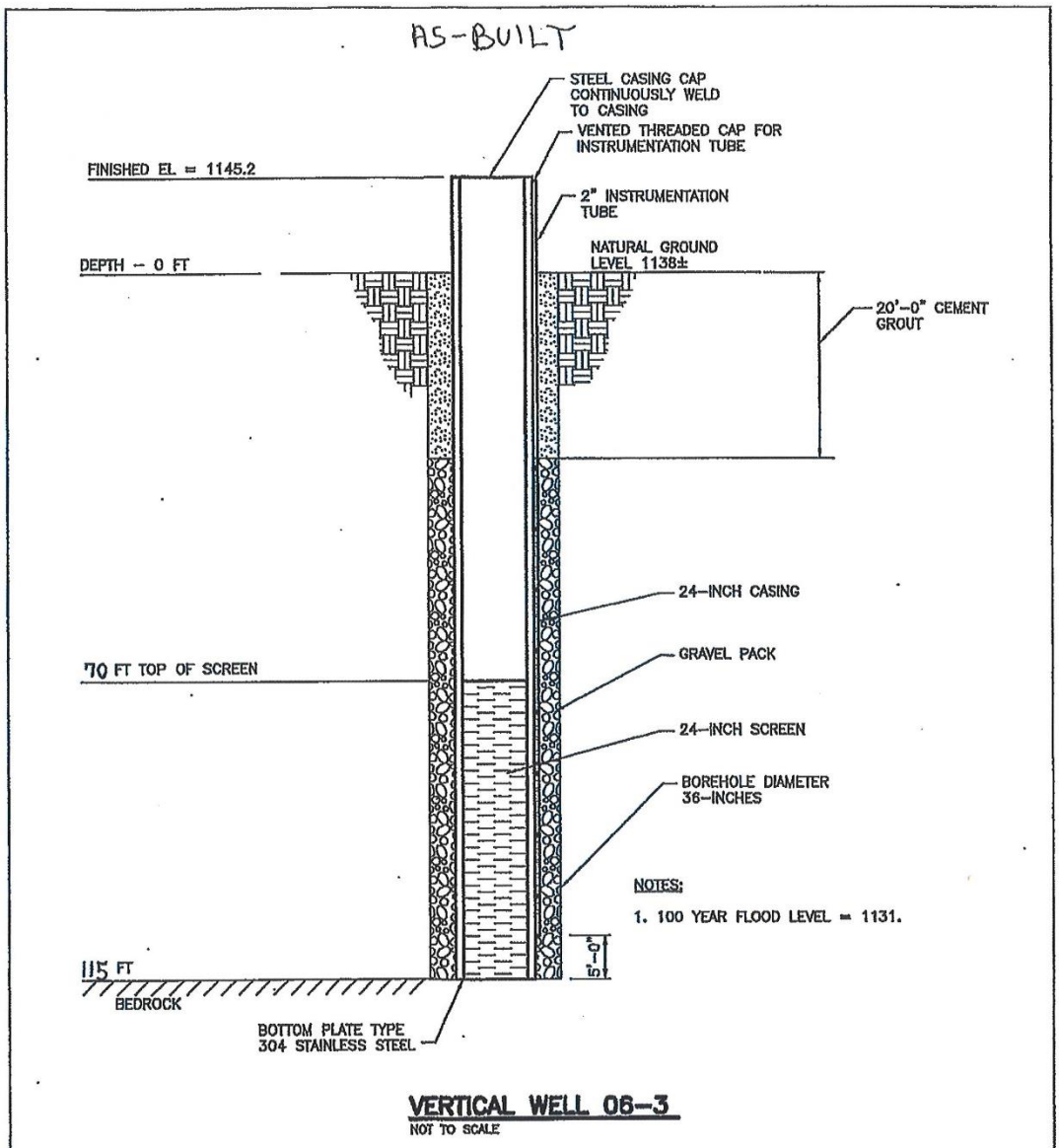
Bottom of Boring 128 Hole abandoned

sample data

Depth	Number/Type	Depth	Number/Type
18-20	SS-1	108-110	SS-10
28-30	SS-2	118-120	No Sample
38-40	SS-3		
48-50	SS-4		
58-60	SS-5		
68-70	SS-6		
78-80	SS-7		
88-90	SS-8		
98-100	SS-9		

CC (continuous sample) ARS (air rotary sample)

As-built construction for vertical well 06-3



HDR	**Vertical Well 06-3** **Site D** Lewis and Clark Rural Water System Well Field Production Wells–Sites C and D Sioux Falls, South Dakota	DATE Mar. 2006 SHEET 9 of 12

Vertical well 06-3

D EForm - 1621 V1

SOUTH DAKOTA WATER WELL COMPLETION REPORT

11-02

Location NE ¼ SW ¼ Sec 22 Twp 91N Rg 52W

County: Clay

Please mark well location with an "X"

Well Completion Date: 10-31-06

Distance to nearest potential pollution source (Septic tank, abandoned well, feed lot, etc.)

? ft. from None Known within 1 mile (identify source)

PROPOSED USE: Rural Water
☐ Domestic/Stock ☒ Municipal ☐ Business ☐ Test Hole
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING: Reverse - Circulation Rotary

CASING DATA: ☒ Steel ☐ Plastic ☐ Other
Other describe

WEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
LB/FT	24 IN	+1 FT	115 FT	36 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
Neat Cement	60	Lb/gal	0 Ft	20 Ft
		Lb/gal	Ft	Ft

Describe grouting procedure

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 24 Inches Length 45 Feet
Material #304 Stainless Steel
Slot Size 70 Set From 70 Feet to 115 Feet
Other information
Stainless steel plate on bottom of screen

WAS A PACKER OR SEAL USED? ☐ Yes ☒ No
If so, what material?
Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?
☒ Yes, How? Chlorination ☐ No,
Is sample sent to for water quality analysis

WELL # 06-3

Well Owner: Lewis and Clark Rural Water System
Business Name: Lewis and Clark Rural Water System
Address: 401 E. 8th Street, Suite 306
City, State, Zip: Sioux Falls, S.D. 57103

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Brown silt	0	3
Gray sand, gravel; wood particles @ 27'; clay seam set 27-35 and 47-55	3	63
Gray sand, gravel with cobbles and boulders	63	121
Limestone	121	

STATIC WATER LEVEL 15 FEET
If flowing: closed in pressure N/A PSI
GPM flow through Inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
Reduced flow rate GPM
Can well be completely shut in?

WELL TEST DATA:
☒ Pumped Describe: Test Pumped at 2,010 GPM
☐ Bailed
☐ Other
Pumping Level Below Land Surface
34 Ft. After 24 Hrs. pumped 2,010 GPM
34 Ft. After 72 Hrs. pumped 2,010 GPM
If pump installed, pump rate: 2,010 GPM

REMARKS

This well was drilled under license # 735
And this report is true and accurate.
Drilling firm: Cahoy Pump Service
Signature of License Representative:
Mark Claassen
Signature of Well Owner or Equitable Property Holder:
Date:

Vertical well 07-4

SD EForm - 1621 V1

6736-3

SOUTH DAKOTA WATER WELL COMPLETION REPORT

11-02

Location SE ¼ NW ¼ Sec 28 Twp 91N Rg 52W

County: Clay

northing 165354.05
easting 2876683.55

07-4

Please mark well location with an "X"

North / W / E

1 Mile

Well Completion Date: 8-31-07

Distance to nearest potential pollution source (Septic tank, abandoned well, feed lot, etc.)
? 750 ft. from River (identify source)

PROPOSED USE:
☐ Domestic/Stock ☒ Municipal ☐ Business ☐ Test Holes
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING: Dual Rotary

CASING DATA: ☒ Steel ☐ Plastic ☐ Other
If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
125.49 LB/FT	24 IN	+2 FT	81 FT	30 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
neat cement	27	18 Lb/gal	0 Ft	20 Ft
		Lb/gal	Ft	Ft

Describe grouting procedure

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 24 Inches Length 46 Feet
Material Stainless
Slot Size .070 Set From 81 Feet to 127 Feet
Other information

WAS A PACKER OR SEAL USED? ☐ Yes ☒ No
If so, what material?
Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?
☒ Yes, How? granular chlorine
☐ No, Why Not?
Lab sample sent to for water quality analysis

Well Owner: Lewis & Clark Rural Water Dist.
Business Name: Same
Address: 401 East 8th St., Suite 306
City, State, Zip: Sioux Falls, SD 57103

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Brown Silty Sand	0	5
Brown Sand Fine	5	45
Gray Coarse Sand	45	50
Gray Clay & Gravel	50	63
Gray Sand & Gravel w/clay lyers	63	80
Gray Coarse Sand & Gravel w/rcks	80	127

STATIC WATER LEVEL 17' below FEET
If flowing: closed in pressure PSI
GPM flow through Inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
Reduced flow rate GPM
Can well be completely shut in?

WELL TEST DATA:
☐ Pumped Describe:
☐ Bailed
☐ Other
Pumping Level Below Land Surface
44' Ft. After 30 Hrs. pumped 800 GPM
Ft. After Hrs. pumped GPM
If pump installed, pump rate: GPM

REMARKS

RECEIVED
SEP 24 2007
WATER RIGHTS PROGRAM

This well was drilled under license # 600
And this report is true and accurate.
Drilling firm: MARK J TRAUT WELLS, INC.
Signature of License Representative:
Signature of Well Owner or Equitable Property Holder:
Date:

Vertical well 09-01

7207-3

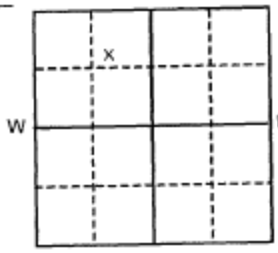
SD EForm - 1621LD V1

SOUTH DAKOTA WATER WELL COMPLETION REPORT 11-02

Location NE ¼ NW ¼ Sec 15 Twp 91N Rg 52W

County Clay

Please mark well location with an "X"



Well Completion Date

January 6, 2011

Distance to nearest potential pollution source (septic tank, abandoned well, feed lot, etc.)?

1,000.0 ft. from MO River (identify source)

PROPOSED USE:
☐ Domestic/Stock ☑ Municipal ☐ Business ☐ Test holes
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING:
DUAL ROTARY

CASING DATA: ☑ Steel ☐ Plastic ☐ Other
If other describe

PIPE WEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
125.5 LB/FT	24.00 IN	0.0 FT	79.0 FT	30.00 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
Neat Cement	44	15.2 Lb/gal	20.0 Ft	0.0 Ft
		Lb/gal	Ft	Ft

Describe grouting procedure
Tremie

SCREEN: ☐ Perforated pipe ☑ Manufactured
Diameter 24.00 Inches Length 40.0 Feet
Material Stainless Steel
Slot Size 50 Set From 79.0 Feet to 119.0 Feet
Other information

WAS A PACKER OR SEAL USED? ☐ Yes ☑ No
If so, what material?
Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?
☑ Yes, How? Chlorine
☐ No, Why Not?
Lab to which water quality sample sent for analysis

Well Owner: Lewis & Clark Regional Water System
Business Name:
Address: 401 East 8th Street, Suite 306
City, State, Zip: Sioux Falls SD 57013

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Brown Silty Clay	0	19
Fine Sand	19	30
Fine - Med Sand, Trace of Coarse	30	41
Grey Clay	41	43
Fine - Med Sand, Trace of Coarse	43	61
Grey Clay	61	62
Fine Sand	62	81
Fine - Coarse Sand With Gravel	81	120
Shale	120	

STATIC WATER LEVEL 19.1 FEET
If flowing: closed in pressure PSI
GPM flow through Inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
Reduced flow rate GPM
Can well be completely shut in?

WELL TEST DATA:
☑ Pumped ☐ Bailed ☐ Other
Describe: Completed an 8-HR step test and 72-HR constant-rate pumping test using temp. test pumping equipment.
Pumping Level Below Land Surface
39.4 Ft. After 72.0 Hrs. pumped 2,305.0 GPM
Ft. After Hrs. pumped GPM
If pump installed, pump rate: GPM

REMARKS
Well #09-01

RECEIVED
AUG - 3 2011
WATER RIGHTS PROGRAM

This well was drilled under license # 513 and this report is true and accurate.
Drilling firm: Layne Christensen Company
Signature of License Representative:

Signature of Well Owner or Equitable Property Holder:

Date: 7-27-11

Vertical well 09-02

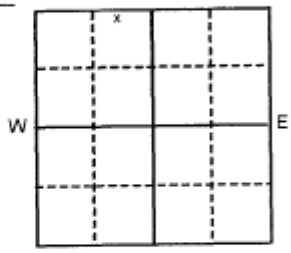
SD EForm - 1621LD V1

SOUTH DAKOTA WATER WELL COMPLETION REPORT 11-02

Location NE ¼ NW ¼ Sec 15 Twp 91N Rg 52W

County Clay

Please mark well location with an "X"



Well Completion Date
January 26, 2011

Distance to nearest potential pollution source (septic tank, abandoned well, feed lot, etc.)?
1,000.0 ft. from MO River (identify source)

PROPOSED USE:
☐ Domestic/Stock ☑ Municipal ☐ Business ☐ Test holes
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING:
DUAL ROTARY

CASING DATA: ☑ Steel ☐ Plastic ☐ Other
If other describe

PIPE WEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
125.5 LB/FT	24.00 IN	0.0 FT	75.5 FT	30.00 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
Neat Cement	40	15.2 Lb/gal	20.0 Ft	0.0 Ft
		Lb/gal	Ft	Ft

Describe grouting procedure
Tremie

SCREEN: ☐ Perforated pipe ☑ Manufactured
Diameter 24.00 Inches Length 46.5 Feet
Material Stainless Steel
Slot Size 50 Set From 75.5 Feet to 122.0 Feet
Other information

WAS A PACKER OR SEAL USED? ☐ Yes ☑ No
If so, what material?
Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?
☑ Yes, How? Chlorine
☐ No, Why Not?
Lab to which water quality sample sent for analysis

Well Owner: Lewis & Clark Regional Water System
Business Name:
Address: 401 East 8th Street, Suite 306
City, State, Zip: Sioux Falls SD 57013

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Brown Silty Clay	0	19
Fine Sand	19	37
Fine - Med Sand, Trace of Coarse	37	41
Grey Clay and Sand Layers	41	57
Fine - Med Sand, Trace of Coarse	43	70
Grey Clay With Sand	70	71
Fine - Med Sand Some Coarse	71	92
Fine - Coarse Sand With Gravel	92	122
Shale	122	

STATIC WATER LEVEL 17.5 FEET
If flowing: closed in pressure PSI
GPM flow through inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
Reduced flow rate GPM
Can well be completely shut in?

WELL TEST DATA:
☑ Pumped ☐ Bailed ☐ Other
Describe: Completed an 8-HR step test and 48-HR constant-rate pumping test using temp. test pumping equipment.
Pumping Level Below Land Surface
37.8 Ft. After 48.0 Hrs. pumped 2,305.0 GPM
Ft. After Hrs. pumped GPM
If pump installed, pump rate: GPM

REMARKS
Well #09-02

RECEIVED
AUG - 3 2011
WATER RIGHTS PROGRAM

This well was drilled under license # 513 and this report is true and accurate.
Drilling firm: Layne Christensen Company
Signature of Licensee Representative:
Bradley Harris
Signature of Well Owner or Equitable Property Holder:
J. Anderson
Date: 7-27-11

Vertical well 09-03

SD EForm - 1621LD V1

SOUTH DAKOTA WATER WELL COMPLETION REPORT 11-02

Location SE ¼ NW ¼ Sec 27 Twp 91N Rg 52W

County Clay

Please mark well location with an "X"

North

W X E

1 Mile

Well Completion Date

February 11, 2011

Distance to nearest potential pollution source (septic tank, abandoned well, feed lot, etc.)?

1,050.0 ft. from Missouri River (identify source)

PROPOSED USE:

☐ Domestic/Stock ☑ Municipal ☐ Business ☐ Test holes
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING:

Dual Rotary

CASING DATA: ☑ Steel ☐ Plastic ☐ Other

If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
125.5 LB/FT	24.00 IN	0.0 FT	73.0 FT	30.00 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
Neat Cement	47	15.2 Lb/gal	20.0 Ft	0.0 Ft
		Lb/gal	Ft	Ft

Describe grouting procedure

SCREEN: ☐ Perforated pipe ☑ Manufactured

Diameter 24.00 Inches Length 36.0 Feet

Material Stainless Steel

Slot Size 50 Set From 73.0 Feet to 109.0 Feet

Other information

WAS A PACKER OR SEAL USED? ☐ Yes ☑ No

If so, what material?

Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?

☑ Yes, How? Chlorine ☐ No, Why Not?

Lab to which water quality sample sent for analysis

Well Owner: Lewis & Clark Regional Water System

Business Name:

Address: 401 East 8th Street, Suite 306

City, State, Zip: Sioux Falls SD 57013

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Clay w/sand and gravel seams	0	63
Sand, some small gravel, fine sand	63	91
Coarse sand and gravel	91	112
Shale	112	

STATIC WATER LEVEL 15.7 FEET

If flowing: closed in pressure PSI

GPM flow through Inch pipe

Controlled by ☐ Valve ☐ Reducers ☐ Other

Reduced flow rate GPM

Can well be completely shut in?

WELL TEST DATA:

☑ Pumped ☐ Bailed ☐ Other Describe: Completed an 8-HR step test and 48-HR constant-rate pumping test using temp. test pumping equipment.

Pumping Level Below Land Surface

45.6 Ft. After 48.0 Hrs. pumped 1,999.0 GPM

Ft. After Hrs. pumped GPM

If pump installed, pump rate: GPM

REMARKS

Well #09-03

RECEIVED
AUG - 3 2011
WATER RIGHTS PROGRAM

This well was drilled under license # 513 and this report is true and accurate.

Drilling firm: Layne Christensen Company

Signature of License Representative:

Signature of Well Owner or Equitable Property Holder:

Date: 7-27-11

Vertical test hole “TH-03 Site A” drilled adjacent to vertical well 09-03
This log was used in lieu of the log for vertical well 09-03 in constructing figure 3.

Layne	Project / No. Lewis and Clark Project 98-1081	Figure 1	Boring No. TH-03 Site A
	Location Vermillion, SD		Page 1 of 4

Driller		Ending Depth (bgs) 115	Static Water Level (bgs)
Geologist	M. Vishnefske	Boring Dia. (in.) 4"	Sample Method Core Barrel-Continuous
Driller Rig		Drilling Type Rotosonic	Data Started 8/5/2009
			Data Completed 8/5/2009

Depth	Sample ID	Recovery (feet)	Lithology	Description (Interpreted from Geophysical Log)	Remarks
0–3				3/3 10YR Dark Brown CH-Fat Clay, High Plasticity, Stiff,Moist	
4–10		6.5/10		8/2 10YR Brown Silt-Dry	
11–15		6/10			
16–20				Very Fine Sand-Dry	
21–25		7/10		Very Fine Sand-Moist	
26–30				Fine Sand with Silt and Tree Roots	
31–32				Fine Sand with Silt and Trace of Coarse Gravel	

Vertical test hole “TH-03 Site A” - continued

Project / No.	Lewis and Clark Project 98-1081	Figure 1	Boring No. TH-03 Site A
Location	Vermillion, SD		Page 2 of 4

Driller		Ending Depth (bgs) 115	Static Water Level (bgs)
Geologist	M. Vishnefske	Boring Dia. (in.) 4"	Sample Method Core Barrel-Continuous
Driller Rig		Drilling Type Rotosonic	Data Started 8/5/2009
			Data Completed 8/5/2009

Depth	Sample ID	Recovery (feet)	Lithology	Description (Interpreted from Geophysical Log)	Remarks
33–38		10/10		Fine to Medium Sand with Trace of Coarse Sand and Gravel	
38–40				5/1 10 YR Grey Sandy CH-Fat Clay with Fine Sand	
40–45		10/10		Fine to Medium Sand with Trace of Coarse Sand and Gravel	
45–50				Fine to Medium Sand with Coarse Sand and Trace of Gravel and Clay (Clay Balls)	
50–52		10/10		Fine to Medium Sand with Trace of Coarse Gravel and Some Clay	
52–55				Fine Sand	
55–58				5/1 10 YR Grey CH-Fat Clay, High Plasticity, Stiff, Moist	
58–59				Fine Sand	
59–60				5/1 10 YR Grey Sandy CH-Fat Clay with Fine Sand	
60–62				Fine to Medium Sand with Trace of Gravel	
62–63				5/1 10YR Grey Sandy CH-Fat Clay with Fine Sand	
63–64					

Vertical test hole “TH-03 Site A” - continued

Project / No.	Lewis and Clark Project 98-1081	Figure 1	Boring No. TH-03 Site A
Location	Vermillion, SD		Page 3 of 4

Driller		Ending Depth (bgs)	115	Static Water Level (bgs)	
Geologist	M. Vishnefske	Boring Dia. (in.)	4"	Sample Method	Core Barrel-Continuous
Driller Rig		Drilling Type	Rotosonic	Data Started	8/5/2009
				Data Completed	8/5/2009

Depth	Sample ID	Recovery (feet)	Lithology	Description (Interpreted from Geophysical Log)	Remarks
65		10/10		Fine Sand with Trace of Lignite	
66					
67					
68					
69					
70					
71				5/1 10YR Grey Sandy CH-Fat Clay with Fine Sand	
72				Fine to Medium Sand with Some Coarse Sand and Trace of Gravel and Cobbles	
73					
74					
75		10/10			
76					
77				Fine to Medium Sand with Trace of Lignite	
78					
79					
80					
81				Fine to Medium Sand with Some Coarse Sand and Trace of Gravel	
82					
83					
84					
85		10/10			
86				4/1 5YR Dark Grey Sandy CH-Fat Clay with Fine Sand	
87				Medium to Coarse Sand with Trace of Gravel and 2" Lignite Seam	
88					
89					
90					
91				Fine to Medium Sand with Trace of Coarse Sand and Gravel	
92					
93				Fine to Medium Sand with Clay Seams and Lignite	
94					
95		10/10		Fine Sand with Lignite and Some Clay	
96					
97					

Vertical test hole “TH-03 Site A” - continued

Layne	Project / No. Lewis and Clark Project 98-1081	Figure 1	Boring No. TH-03 Site A	
	Location Vermillion, SD		Page 4 of 4	
Driller		Ending Depth (bgs) 115	Static Water Level (bgs)	
Geologist	M. Vishnefske	Boring Dia. (in.) 4"	Sample Method	Core Barrel-Continuous
Driller Rig		Drilling Type Rotosonic	Data Started	8/5/2009
			Data Completed	8/5/2009

Depth	Sample ID	Recovery (feet)	Lithology	Description (Interpreted from Geophysical Log)	Remarks
98					
99					
100					
101					
102		4/5		Medium to Coarse Sand and Gravel with Trace of Cobbles	
103					
104					
105					
106					
107					
108					
109					
110		10/10			
111					
112				Grey Shale	
113					
114					
115					

Vertical well 09-04

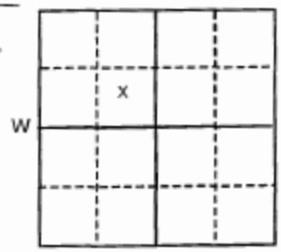
SD EForm - 1621LD V1

SOUTH DAKOTA WATER WELL COMPLETION REPORT 11-02

Location SE ¼ NW ¼ Sec 27 Twp 91N Rg 52W

County Clay

Please mark well location with an "X"



Well Completion Date

December 7, 2010

Distance to nearest potential pollution source (septic tank, abandoned well, feed lot, etc.)?

750.0 ft. from MO River (identify source)

PROPOSED USE:
☐ Domestic/Stock ☑ Municipal ☐ Business ☐ Test holes
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING:
Dual Rotary

CASING DATA: ☑ Steel ☐ Plastic ☐ Other
If other describe

PIPE WEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
125.5 LB/FT	24.00 IN	0.0 FT	82.0 FT	30.00 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
neat cement	41	15.2 Lb/gal	20.0 Ft	0.0 Ft
		Lb/gal	Ft	Ft

Describe grouting procedure
Tremie

SCREEN: ☐ Perforated pipe ☑ Manufactured
Diameter 24.00 Inches Length 22.0 Feet
Material Stainless Steel
Slot Size 50 Set From 82.0 Feet to 104.0 Feet
Other information

WAS A PACKER OR SEAL USED? ☐ Yes ☑ No
If so, what material?
Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?
☑ Yes, How? Chlorine
☐ No, Why Not?
Lab to which water quality sample sent for analysis

Well Owner: Lewis & Clark Regional Water System
Business Name:
Address: 401 East 8th Street, Suite 306
City, State, Zip: Sioux Falls SD 57103

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Br Silty Clay	0	18
Fine - Med Sand, Trace of Coarse	18	69
Grey Clay	69	71
Fine to Coarse Sand, Some Clay	71	78
Grey Clay	78	81
Fine - Med Sand	81	95
Med- Coarse Sand & Gravel	95	104
Fine - Med Sand	104	106
Grey Shale	106	110

STATIC WATER LEVEL 15.9 FEET
If flowing: closed in pressure PSI
GPM flow through Inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
Reduced flow rate GPM
Can well be completely shut in?

WELL TEST DATA:
☑ Pumped Describe: Completed an 8-HR step test and 72-HR constant-rate pumping test using temp. test pumping equipment.
☐ Bailed
☐ Other
Pumping Level Below Land Surface
33.6 Ft. After 72.0 Hrs. pumped 2,000.0 GPM
Ft. After Hrs. pumped GPM
If pump installed, pump rate: GPM

REMARKS
Well #09-04

RECEIVED
AUG - 3 2011
WATER RIGHTS PROGRAM

This well was drilled under license # 513 and this report is true and accurate.
Drilling firm: Layne Christensen Company
Signature of License Representative:
Signature of Well Owner or Equitable Property Holder:
Date: 7-27-11

Vertical well 09-05

SD EForm - 1621LD V1

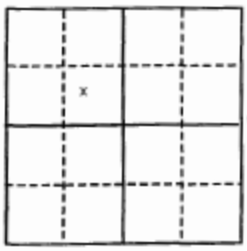
SOUTH DAKOTA WATER WELL COMPLETION REPORT 11- 02

Location SE ¼ NW ¼ Sec 27 Twp 91N Rg 52W

County Clay

Please mark well location with an "X"

North / W / E



1 Mile

Well Completion Date

December 13, 2011

Distance to nearest potential pollution source (septic tank, abandoned well, feed lot, etc.)?

800.0 ft. from MO River (identify source)

PROPOSED USE:

☐ Domestic/Stock ☑ Municipal ☐ Business ☐ Test holes
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING:

DUAL ROTARY

CASING DATA: ☑ Steel ☐ Plastic ☐ Other

If other describe

PIPE WEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
70.6 LB/FT	18.00 IN	0.0 FT	74.0 FT	30.00 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
Neat Cement	52	15.2 Lb/gal	30.0 Ft	0.0 Ft
		Lb/gal	Ft	Ft

Describe grouting procedure

Tremie

SCREEN: ☐ Perforated pipe ☑ Manufactured

Diameter 18.00 Inches Length 14.0 Feet

Material Stainless Steel

Slot Size 50 Set From 74.0 Feet to 88.0 Feet

Other information

WAS A PACKER OR SEAL USED? ☐ Yes ☑ No

If so, what material?

Describe packer(s) and location

DISINFECTION: Was well disinfected upon completion?

☑ Yes, How? Chlorine

☐ No, Why Not?

Lab to which water quality sample sent for analysis

Well Owner: Lewis & Clark Regional Water System

Business Name:

Address: 401 East 8th Street, Suite 306

City, State, Zip: Sioux Falls SD 57013

WELL LOG:

FORMATION	DEPTH FROM	DEPTH TO
Brown Silty Clay	0	12
Fine Sane	12	20
Fine - Med Sand, Some Coarse	20	54
Dark Grey Silt	54	55
Fine Sand, Trace of Silt	55	68
Dark Grey Clay	68	70.5
Fine - Coarse Sand With Gravel	70.5	88
Shale	88	90

STATIC WATER LEVEL 16.0 FEET

If flowing: closed in pressure PSI

GPM flow through Inch pipe

Controlled by ☐ Valve ☐ Reducers ☐ Other

Reduced flow rate GPM

Can well be completely shut in?

WELL TEST DATA:

☑ Pumped ☐ Bailed ☐ Other

Describe: Completed an 8-HR step test and 72-HR constant-rate pumping test using temp. test pumping equipment.

Pumping Level Below Land Surface

42.6 Ft. After 72.0 Hrs. pumped 870.0 GPM

Ft. After Hrs. pumped GPM

If pump installed, pump rate: GPM

REMARKS

Well #09-05

RECEIVED
AUG - 3 2011
WATER RIGHTS PROGRAM

This well was drilled under license # 513 and this report is true and accurate.

Drilling firm: Layne Christensen Company

Signature of License Representative:

Signature of Well Owner or Equitable Property Holder:

Date: 7-27-11

This page intentionally left blank

APPENDIX D

RECORDS OF IRRIGATION WELLS

This appendix contains information on the following wells which are listed in order by the associated Water Right permit number.

See figure 2 for well location.

5042-3
5412-3
5199-3
5471-3
5538-3
5539-3
5540-3
5541-3 (well 1 of 2)
5541-3 (well 2 of 2)
6059-3

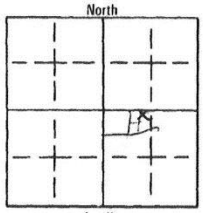
5042-3

SOUTH DAKOTA WATER WELL COMPLETION REPORT 10-85

Location NE ¼ NE ¼ Sec 1 Twp 91 Rg 52 NW¼

County Clay

Please mark well location with an "X"



Well Completion Date 8-12-85

PROPOSED USE:
☐ Domestic ☐ Municipal ☐ Test Holes
☒ Irrigation ☐ Industrial ☐ Stock

Method of Drilling: Rotary

CASING DATA:
☐ Steel ☒ Plastic ☐ Other
If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
½" wall LB/FT	0 IN	~~0~~ 2 FT	106 FT	22 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUT:
Was the well grouted? ☒ YES ☐ NO
To what depth? 20' FEET
What is grouting material? cement
If cement, number of sacks? 25
Describe grouting procedure pumped w tremie pipe
What was grout weight? 61.5 LB/GAL

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 16 IN Length 40 FEET
Material PVC
Slot Size 100 Set From ~~100~~ 66 Feet To 106 Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Other information

Was a packer or seal used? ☐ YES ☒ NO
If so, what material?
Describe packer(s) and location?

Was well disinfected upon completion? ☒ YES ☐ NO
Explain chlorine solution
Bacteriological analysis ☐ YES ☒ NO
Laboratory sent to

Well Owner:
Name NELS SORENSEN
Address RT 3 Box 23 VERMILLION SD 57069

Well Log:

Formation	Depth From	Depth To
top soil	0	2
fine sand + clay	2	12
fine sand	12	36
fine - med sand	36	67
coarse sand + gravel	67	106

STATIC WATER LEVEL 19 Feet
If flowing: closed in pressure PSI
GPM flow through inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
If other; specify
Can well be completely shut in?

WELL TEST DATA:
☒ Pumped
☐ Bailed Describe:
☐ Other
Pumping Level Below Land Surface
23 ft. After 1 Hrs. pumped 1304 GPM
____ ft. After ____ Hrs. pumped ____ GPM
____ ft. After ____ Hrs. pumped ____ GPM

REMARKS:

This well was drilled under license # 341
And this report is true and accurate.
Drilling firm Watmore
Signature of License Representative:
James Watmore
Signature of Well Owner:
Date 12-5-90

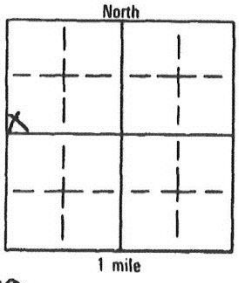
5412-3

SOUTH DAKOTA WATER WELL COMPLETION REPORT 10-85

Location SW¼SE¼ Sec 26 Twp 29N Rg 52W

County CLAY

Please mark well location with an "X"



Well Completion Date 7/90

PROPOSED USE:
- ☐ Domestic ☐ Municipal ☐ Test Holes
- ☒ Irrigation ☐ Industrial ☐ Stock

Method of Drilling: REVERSE ROTARY

CASING DATA:
- ☐ Steel ☒ Plastic ☐ Other

If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
SCED 40 LB/FT	16 IN	0 FT	100 FT	26 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUT:
Was the well grouted? ☒ YES ☐ NO
To what depth? 0-20 FEET
What is grouting material? PORTLAND NEAT
If cement, number of sacks? 12
Describe grouting procedure TREMIE POUR

What was grout weight? [redacted] LB/GAL
APPX 104

SCREEN: ☑ Perforated pipe ☐ Manufactured
Diameter 16 IN Length 30 FEET
Material PVC SCED 40
Slot Size ____ Set From ____ Feet To ____ Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Other information

Well Owner:
Name NELS SORENSEN
Address VERMILLION S. D.

Well Log:

Formation	Depth From	Depth To
TOP SOIL + SANDY CLAY	0	10
MED SAND	10	20
VERY COURSE SAND	20	50
MED SAND	50	65
COURSE SAND	65	95
COURSE GRAVEL + ROCKS	95	100

STATIC WATER LEVEL 16 Feet
If flowing: closed in pressure ____ PSI
GPM flow ____ through ____ inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
If other; specify
Can well be completely shut in?

WELL TEST DATA:
☑ Pumped TURBINE LINESHAFT TYPE
☐ Bailed Describe:
☐ Other

Pumping Level Below Land Surface
35 ft. After 1 Hrs. pumped 950 GPM
____ ft. After ____ Hrs. pumped ____ GPM
____ ft. After ____ Hrs. pumped ____ GPM

REMARKS:

DEC 1990
DIVISION OF
WATER RIGHTS
Pierre, SD

5199-3

#2

SOUTH DAKOTA WATER WELL COMPLETION REPORT 10-85

Location ¼ NW¼ Sec 36 Twp 91-72N Rg 61-52W

County

North

Please mark well location with an "X"

W E

1 mile

Well Completion Date 6-14-87

PROPOSED USE:
☐ Domestic ☐ Municipal ☐ Test Holes
☑ Irrigation ☐ Industrial ☐ Stock

Method of Drilling:
ROTARY

CASING DATA:
☐ Steel ☑ Plastic ☐ Other
If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
____ LB/FT	16" IN	0 FT	123 FT	20 IN
____ LB/FT	____ IN	____ FT	____ FT	____ IN
____ LB/FT	____ IN	____ FT	____ FT	____ IN
____ LB/FT	____ IN	____ FT	____ FT	____ IN

GROUT:
Was the well grouted? ☑ YES ☐ NO
To what depth? 6-20' FEET
What is grouting material? cement
If cement, number of sacks? 16
Describe grouting procedure tremie pipe pumped
What was grout weight? 15.6 LB/GAL

SCREEN: ☐ Perforated pipe ☑ Manufactured
Diameter 16 IN Length 40' FEET
Material PVC slotted 100 slot
Slot Size 100 Set From 83 Feet To 123 Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Other information

Was a packer or seal used? ☐ YES ☑ NO

Well Owner:
Name NELS SORENSEN
RT 3 BOX 23
Address

Well Log:

Formation	Depth From	Depth To
top soil	0	2
clay & fine sand	2	38
fine sand w/ clay stringers	38	80
coarse sand & gravel	80	123

RECEIVED MAR 1991 DIVISION OF WATER RIGHTS Pierre, SD

STATIC WATER LEVEL 21 Feet
If flowing: closed in pressure ____ PSI
GPM flow ____ through ____ inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
If other; specify
Can well be completely shut in?

WELL TEST DATA:
☑ Pumped
☐ Bailed Describe: Line shaft turbine
☐ Other pump test.
Pumping Level Below Land Surface
36 ft. After 2 Hrs. pumped 1500 GPM
____ ft. After ____ Hrs. pumped ____ GPM
____ ft. After ____ Hrs. pumped ____ GPM

REMARKS:

RECEIVED MAY 1988 DIVISION OF WATER RIGHTS Pierre, SD

5471-3

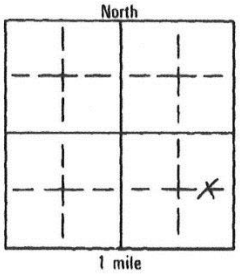
5471-3

SOUTH DAKOTA WATER WELL COMPLETION REPORT 10-85

Location E ½ SE ¼ Sec 25 Twp 92N Rg 51-52-W

County _____

Please mark well location with an "X"



Well Completion Date 5-14-90

PROPOSED USE:
☐ Domestic ☐ Municipal ☐ Test Holes
☒ Irrigation ☐ Industrial ☐ Stock

Method of Drilling:
ROTARY

CASING DATA:
☐ Steel ☒ Plastic ☐ Other
If other describe _____

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
½" wall LB/FT	12 IN	0 FT	120 FT	18 IN
_____ LB/FT	_____ IN	_____ FT	_____ FT	_____ IN
_____ LB/FT	_____ IN	_____ FT	_____ FT	_____ IN
_____ LB/FT	_____ IN	_____ FT	_____ FT	_____ IN

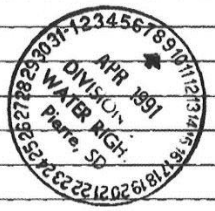
GROUT:
Was the well grouted? ☒ YES ☐ NO
To what depth? 12 FEET
What is grouting material? cement
If cement, number of sacks? 18
Describe grouting procedure pumped in from trench pipe
What was grout weight? 15.5 LB/GAL

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 12 IN Length 40 FEET
Material PVC
Slot Size 80 Set From 80 Feet To 120 Feet
Slot Size _____ Set From _____ Feet To _____ Feet
Slot Size _____ Set From _____ Feet To _____ Feet
Other information _____

Well Owner:
Name Francis Heine
Address RR 3 Box 21 Vermillion SD 57069

Well Log:

Formation	Depth From	Depth To
top soil	0	2
fine sand & clay mix	2	58
coarse sand & gravel	58	120



STATIC WATER LEVEL 18 Feet
If flowing: closed in pressure _____ PSI
GPM flow _____ through _____ inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
If other; specify _____
Can well be completely shut in? _____

WELL TEST DATA:
☒ Pumped
☐ Bailed Describe: line shaft turbine
☐ Other

Pumping Level Below Land Surface
41 ft. After 2 Hrs. pumped 650 GPM
_____ ft. After _____ Hrs. pumped _____ GPM
_____ ft. After _____ Hrs. pumped _____ GPM

REMARKS:

5538-3

NOTICE OF WELL CONSTRUCTION

Clay

(1) WELL CONSTRUCTION

Location of well: NE 1/4 ____ 1/4 ____ Section 25 Township 31-32N Range 6E-7E

Well owner: N. L. Sorenson RR3 Kennewick

Date well drilling completed 12-28-83 Purpose of well: Irrigation

WELL LOG

Depths Penetrated (Ft. to Ft.)	Description of Water
0 - 1	top soil
1 - 8	clay
8 - 81	fine sand
81 - 110'	coarse sand
110 - 112	clay

Attach sheet if more space is needed

Depth to top of water producing aquifer 81 ft.

Depth to static water level 15 ft.

Name of producing aquifer (if known) ____

Total depth of drill hole 112 ft.

Depth to bottom of casing 110 ft.

Casing information: In the space below show kind, size, weight, length and diameter, etc., for production casing and surface casing, if used.

82' x 16" PVC

Screen information: In the space below show length of screen below bottom of casing, diameter and kind of screen or casing perforations.

16" x 28' x .100 slot Stainless Steel Screen

If a flowing well, flow of completed well ____ G.P.M.

James Lightner
Name of Drilling Contractor

(2) PUMP INSTALLATION

Company name and size of pump Western Land Roller 14C HP 10.0

Type of pump Turbine Capacity of installed pump 3 stage 1500 G.P.M.

Depth of pump placement 60 ft., Date of pump installation 1-10-84

(3) WATER SURFACE MEASURING TUBE

On some wells an air-tight water surface measuring tube is required. See Section 46-400 of Chapter 460, WELL CONSTRUCTION STANDARDS.

Show exact vertical length of water surface measuring tube, when installed 60 ft., tube diameter 1/2", tube material PVC.

James Lightner
Signature of Well Driller

STATE OF WASHINGTON DEPARTMENT OF WATER RESOURCES

6-7-84

Water Right permit no. 5539-3

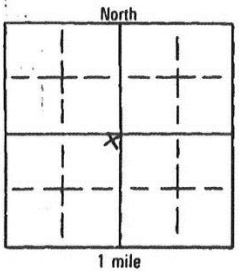
SOUTH DAKOTA WATER WELL COMPLETION REPORT

10-85

Location NE¼ NE¼ Sec 36 Twp 91 Rg 52 SW¼

County Clay

Please mark well location with an "X".



Well Completion Date _____

PROPOSED USE:
☐ Domestic ☐ Municipal ☐ Test Holes
☒ Irrigation ☐ Industrial ☐ Stock

Method of Drilling: Rotary

CASING DATA:
☐ Steel ☒ Plastic ☐ Other
If other describe _____

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
½" wall LB/FT	16 IN	61 FT	101 FT	____ IN
____ LB/FT	____ IN	____ FT	____ FT	____ IN
____ LB/FT	____ IN	____ FT	____ FT	____ IN
____ LB/FT	____ IN	____ FT	____ FT	____ IN

GROUT:
Was the well grouted? ☒ YES ☐ NO
To what depth? 20 FEET
What is grouting material? cement
If cement, number of sacks? 25
Describe grouting procedure pumped tremie pipe
What was grout weight? 61.6 LB/GAL

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 16 IN Length 40 FEET
Material PVC
Slot Size 100 Set From 61 Feet To 101 Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Other information _____

Was a packer or seal used? ☐ YES ☒ NO

Well Owner:
Name Nels Sorensen
Address RT 5 Box 23 Vermillion SD 57069

Well Log:

Formation	Depth From	Depth To
top soil	0	1
fine sand	1	41
coarse sand & gravel	41	101

STATIC WATER LEVEL 21 Feet
If flowing: closed in pressure _____ PSI
GPM flow _____ through _____ inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
If other; specify _____
Can well be completely shut in? _____

WELL TEST DATA:
☒ Pumped
☐ Bailed Describe: _____
☐ Other
Pumping Level Below Land Surface
25 ft. After 1 Hrs. pumped 1300 GPM
____ ft. After ____ Hrs. pumped ____ GPM
____ ft. After ____ Hrs. pumped ____ GPM

REMARKS:

5540-3

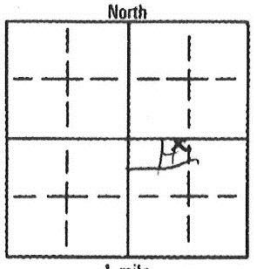
SOUTH DAKOTA WATER WELL COMPLETION REPORT

10-85

Location NE ¼ NE ¼ Sec 1 Twp 91 Rg 52
NW¼

County Clay

Please mark well location with an "X"



Well Completion Date 6-12-85

PROPOSED USE:
☐ Domestic ☐ Municipal ☐ Test Holes
☒ Irrigation ☐ Industrial ☐ Stock

Method of Drilling: Rotary

CASING DATA:
☐ Steel ☒ Plastic ☐ Other
If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
½ "wall" LB/FT	0 IN	~~106~~ 0 FT	106 FT	22 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUT:
Was the well grouted? ☒ YES ☐ NO
To what depth? 20' FEET
What is grouting material? cement
If cement, number of sacks? 25
Describe grouting procedure pumped in from 3 pigs
What was grout weight? 61.5 LB/GAL

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 16 IN Length 40 FEET
Material PVC
Slot Size 100 Set From ~~66~~ 66 Feet To 106 Feet
Slot Size Set From Feet To Feet
Slot Size Set From Feet To Feet
Other information

Well Owner:
Name NELS SORENSEN
Address RT 3 Box 23 VERMILLION SD 57069

Well Log:

Formation	Depth From	Depth To
top soil	0	2
fine sand + clay	2	12
fine sand	12	36
fine coarse sand	36	67
course sand & gravel	67	106

STATIC WATER LEVEL 19 Feet
If flowing: closed in pressure PSI
GPM flow through inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
If other; specify
Can well be completely shut in?

WELL TEST DATA:
☒ Pumped
☐ Bailed Describe:
☐ Other
Pumping Level Below Land Surface
23 ft. After 1 Hrs. pumped 1300 GPM
ft. After Hrs. pumped GPM
ft. After Hrs. pumped GPM

REMARKS:

Water Right permit no. 5541-3 (well 1 of 2)

5541-3 (1)

3

SOUTH DAKOTA WATER WELL COMPLETION REPORT 10-85

Location: SE ¼ Sec. 35 Twp. 92 N Rge. 52 W

County: CLAY

Well Owner
Name: NELS SORENSEN
Address: VERMILLION SD

	From	To
top soil	0	1.5
clay + sand mix	1.5	16
fine sand	16	68
coarse sand + gravel mix	68	116
shale	116	118

Well Completion Date: 6 - 10 - 87?

PROPOSED USE: ☐ Domestic ☐ Municipal ☐ Test Hole ☒ Irrigation ☐ Industrial ☐ Stock

Method of Drilling: ROTARY

CASING DATA: ☐ Steel ☑ Plastic ☐ Other

If other describe:

PIPE WEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
LB/FT	16 IN	0 FT	116 FT	20 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

STATIC WATER LEVEL: 18 Feet
If flowing, control or pressure: PSI
GPM flow through inch pipe
Controlled by: ☐ Valve ☐ Reducers ☐ Other
If other, specify:
Can well be completely shut in?

GROUT
Was the well grouted? ☑ YES ☐ NO
To what depth? 20' FEET
What is grouting material? cement
If cement, number of sacks? 12
Describe grouting procedure: tremie pipe pumped
What was grout weight? 15.5 LB/GAL

WELL TEST DATA
☑ Pumped
☐ Bailed Describe: Line shaft turbine pump used
☐ Other
Pumping Level Below Land Surface
33? ft After 4 Hrs. pumped 1200 GPM
ft After Hrs. pumped GPM
ft After Hrs. pumped GPM

SCREEN ☐ Perforated pipe ☑ Manufactured
Diameter 16 IN Length 40 FEET
Material PVC
Slot Size 100 Set From 76 Feet To 116 Feet
Slot Size Set From Feet To Feet
Slot Size Set From Feet To Feet
Other information:

REMARKS

MAY 1988 DIVISION OF WATER RIGHTS Pierre, SD

Was a packer or seal used? ☐ YES ☑ NO
If so, what material?
Describe packer or seal location?

This well was drilled under license # 341
And this report is true and accurate.
Drilling firm: Wetmore
Signature of License Representative:

Was well disinfected upon completion? ☑ YES ☐ NO
Explain: chlorine solution
Bacteriological analysis? ☐ YES ☐ NO

Signature of Well Owner:

Water Right permit no. 5541-3 (well 2 of 2)

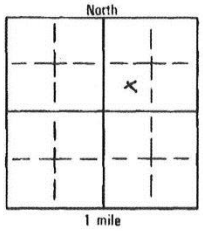
5541-3 (2)

SOUTH DAKOTA WATER WELL COMPLETION REPORT 10-85

Location SW ¼ NE ¼ Sec 36 Twp 94 N Rg 57 W

County CLAY

Please mark well location with an "X"



Well Completion Date 3-18-87

PROPOSED USE:
☒ Domestic ☐ Municipal ☐ Test Holes
☐ Irrigation ☐ Industrial ☒ Stock

Method of Drilling: ROTARY

CASING DATA:
☐ Steel ☒ Plastic ☐ Other
If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
250 PVC LB/FT	6 IN	0 FT	110 FT	8 ¼ IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUT:
Was the well grouted? ☒ YES ☐ NO
To what depth? 6-26' FEET
What is grouting material? cement
If cement, number of sacks? 6
Describe grouting procedure tremie pipe pumped
What was grout weight? 16.5 LB/GAL

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 6 IN Length 5 FEET
Material PVC
Slot Size 40 Set From 105 Feet To 110 Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Slot Size ____ Set From ____ Feet To ____ Feet
Other information

Was a packer or seal used? ☐ YES ☒ NO
If so, what material?
Describe packer(s) and location?

Was well disinfected upon completion? ☒ YES ☐ NO
Explain chlorine solution 200 PPM
Bacteriological analysis ☒ YES ☐ NO

Well Owner:
Name NELS SORENSEN
Address RT 3 BOX 25 Vermillion, S.D.

Well Log: Depth

Formation	From	To
top soil	0	2
clay	2	16
fine sand	16	91
coarse sand	91	110

STATIC WATER LEVEL 16 Feet
If flowing: closed in pressure ____ PSI
GPM flow ____ through ____ inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
If other; specify
Can well be completely shut in?

WELL TEST DATA:
☒ Pumped
☐ Bailed Describe:
☐ Other
Pumping Level Below Land Surface
19 ft. After 1 Hrs. pumped 17 GPM
____ ft. After ____ Hrs. pumped ____ GPM
____ ft. After ____ Hrs. pumped ____ GPM

REMARKS:

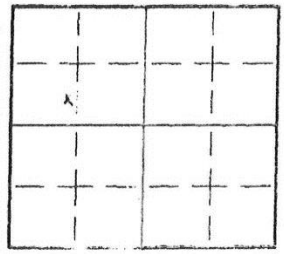
APR 1988
DIVISION OF WATER RIGHTS
Pierre, SD

This well was drilled under license # 341
And this report is true and accurate.
Drilling firm [illegible]
Signature of License Representative:
[signature]
Signature of Well Owner:

SOUTH DAKOTA WATER WELL COMPLETION REPORT 6059-3

Location SW ¼ NW ¼ Sec. 30 Twp 92N Rg 52W (51W) County Clay

Please mark well location with an "X"



Well Completion Date 4-2-02

Well Owner: FRANCES HEINE

Business Name:

Address: Vermillion SD

WELL LOG:

FORMATION	DEPTH FROM	TO
Clay, Gray Brn	0	17
Sand, med-fine	17	75
GRAVEL; Med	75	106
Shale, gray	106	109
Sandstone, LT. GRAY	109	120

LOCATION:
Distance from nearest potential pollution source (septic tank, abandoned well, feed lot, etc.)? 900 ft. from Septic (identify source)

PROPOSED USE:
☐ Domestic/Stock ☐ Municipal ☐ Business ☐ Test Holes
☒ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING: Rotary

CASING DATA: ☐ Steel ☒ Plastic ☐ Other
other describe

PIPE WEIGHT	DIAMETER	FROM		HOLE DIAMETER
Sch 40 LB/FT	12 IN	0 FT	73 FT	18 IN
LB/FT	IN	FT	FT	IN
LB/FT	IN	FT	FT	IN

GROUTING DATA

Grout Type	No. of Sacks	Grout Weight	From	To
Bent GROUT	28	710 lb./	20 ft	70 ft
Neat cement	12	lb./	0 ft	20 ft

Describe grouting procedure Tremie

SCREEN: ☐ Perforated pipe ☒ Manufactured
Diameter 12 IN Length 40 FEET
Material PVC
Slot Size .060 Set From 73 Feet to 113 Feet
Other information

WAS A PACKER OR SEAL USED? ☐ YES ☒ NO
If so, what material?
Describe packer(s) and location?

DISINFECTION: Was well disinfected upon completion?
X YES, How HTH
___ NO, Why Not
Laboratory sent to for water quality analysis

STATIC WATER LEVEL 22 Feet
If flowing: closed in pressure PSI
GPM flow through inch pipe
Controlled by ☐ Valve ☐ Reducers ☐ Other
Reduced Flowrate GPM
Can well be completely shut in?

WELL TEST DATA:
☒ Pumped Describe.
☐ Bailed
☐ Other
Pumping Level Below Land Surface
31 ft. After 10 Hrs. pumped 600 GPM
ft. After Hrs. pumped GPM
If pump installed, pump rate 500 GPM

REMARKS

This well was drilled under license # 666
And this report is true and accurate.
Drilling firm HAMMOND Water Well Drilling
Signature of License Representative:

RECEIVED
JAN 30 2003
WATER RIGHTS PROGRAM

Signature of Well Owner or Equitable Property Holder: