

April 22, 2020

Chris Klein  
L. G. Everist, Inc.  
350 South Main Avenue, Suite 400  
Sioux Falls, South Dakota 57104

**Subject: 2019 Annual Groundwater Monitoring Report  
Myrl & Roy's Rowena Quarry**

Dear Mr. Klein:

Houston Engineering Inc. (HEI) has reviewed the historical quarterly groundwater elevation monitoring information for the above reference site and prepared this annual report which summarizes the 2019 quarterly monitoring data. The performance of quarterly groundwater elevation monitoring was required by the Minnehaha County Planning and Zoning Conditional Use Permit for the site. A map showing the monitoring well locations is presented on **Figure 1**.

## **SCOPE OF WORK**

The scope of services HEI performed on this portion of the project consisted of the following:

- reviewing the historical groundwater elevation data (collected by others) for the period 1997 through 2018;
- obtaining groundwater elevation data in three quarterly events in 2019 from the three onsite monitoring wells (MW-6, MW-7 and MW-8), the one onsite domestic well (Myrl & Roy's Quarry well) and the three South Dakota Geological Survey (SDGS) monitoring wells (G-2, G-6 and MA-80CA); and,
- preparing and submitting an annual monitoring report including data generated during our field work with our conclusions and recommendations based on that data.

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## GROUNDWATER ELEVATIONS

In 2019, groundwater elevation data were collected from the available wells on June 7, September 25, and December 23, 2019. The usual first-quarter monitoring event for 2019 was not performed due to an oversight by the previous environmental contractor, prior to the authorization of HEI on the project.

The elevation data were collected using the methods presented in **Appendix A**. The groundwater elevations are presented in **Table 1** along with historical groundwater elevation data for comparison. Graphical representations of current and historic groundwater elevations are presented in the hydrograph on **Figure 2**. SDGS monitoring well G-1, which was originally included in the monitoring plan, was found to be damaged beyond repair during the July 2016 event, and has been unavailable for monitoring since that time.

The groundwater elevation data collected during 2019 for upgradient and control wells G-2, G-6, and MA-80CA indicate stable, then slightly decreasing groundwater elevations in 2019. The mid- to late-2018 and early-2019 groundwater elevations measured at each of the upgradient and control locations are among the highest groundwater elevations measured at the locations, consistent with the near-record precipitation in the region during that time.

MW-6, MW-7 and MW-8 are hydrogeologically downgradient of the quarry and serve as sentinel wells for the nearby housing development. Groundwater elevation data for 2019 in onsite wells MW-6 and MW-7 are generally within the range of historical data for the locations (MW-6 was marginally less than a 2012 groundwater elevation, which has since recovered). Groundwater elevations in MW-8 are measured at a historical high elevation in June 2019, then diminish in the last two quarters of the year to within the historical range.

The 2019 groundwater elevations in the Myrl & Roy's quarry well decreased relative to 2018 and prior elevations, and in December 2019, were the lowest elevations recorded since monitoring began in 1997. Historically, the Myrl & Roy's well is pumped heavily during summer months for onsite uses such as dust control for haul trucks, and road maintenance / dust control and as such, the fluid levels measured do not reflect static, equilibrated, groundwater conditions. For this reason, the summer measurements (June, July, and August) are not typically included on the **Figure 2** hydrograph. In 2019 the quarry production was at a record or near-record tonnage, which continued late into the fall of 2019, and likely significantly contributed to the measured decrease in groundwater elevation for the onsite well. With this heavy usage in 2019, the well did not recover as expected; however, information from the spring of 2020 indicates groundwater elevations in the Myrl & Roy's onsite well have increased, and appear to be recovering.

## DISCUSSIONS AND CONCLUSIONS

The groundwater elevations measured in 2019 in the upgradient / control wells G-1, G-2, G-6 are generally consistent with the historical groundwater elevations. Groundwater elevations in these wells are similar to historic baseline data and indicate no significant increasing or decreasing trends. MA-80CA is completed in a location adjacent to the Big Sioux River and in part, reflects the fluctuation of the river stages, which generally mimics the groundwater elevation in the balance of the upgradient and control wells. The groundwater elevations in the upgradient and control wells remain unaffected by quarry operations.

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The groundwater elevations measured in the Myrl & Roy's well decreased throughout 2019 to the lowest elevation measured to date. The decreasing elevations are likely a result of heavier-than-normal usage of the well during a record or near-record quarry production year. Groundwater elevations in the spring of 2020 increased slightly, suggesting the groundwater elevation may be recovering.

Downgradient wells MW-6, MW-7 and MW-8 serve as sentinel wells for the nearby housing development and associated private wells. While there are minor decreases in the elevations in the latter-half of 2019, the late-2018 and early-2019 groundwater elevations were among the highest measured to date and overall, the groundwater elevations are generally returning to within the historical range. As a result, there does not appear to be a correlation between quarry operations and groundwater elevations at the sentinel well locations MW-6, MW-7, or MW-8, which is consistent with previous observations.

The remaining groundwater monitoring events for 2020 are scheduled for June, September, and December.

## RECOMMENDATIONS

Based on the results of this report, we recommend the following:

- providing a copy of this report to the Minnehaha County Planning and Zoning office; and
- continuing the performance of groundwater monitoring as required by the Conditional Use Permit.

If you have any questions or require additional information, please feel free to contact me at (605) 271-0378.

Sincerely,

HOUSTON ENGINEERING, INC.



Bradley J. Peschong, CPG  
Project Manager

BJP:kk

Enclosures

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# TABLE

Table 1

**Groundwater Elevation Data (All units in feet)**  
**Myrl & Roy's Paving, Inc.**  
**Rowena Quarry Area**  
**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
MYRL&ROY WELL	30-Apr-97	28.91	1356.00	1327.09
MYRL&ROY WELL	20-Oct-97	31.42	1356.00	1324.58
MYRL&ROY WELL	09-Feb-98	32.05	1356.00	1323.95
MYRL&ROY WELL	11-May-98	27.34	1356.00	1328.66
MYRL&ROY WELL	11-Aug-98	29.83	1356.00	1326.17
MYRL&ROY WELL	07-Dec-98	29.13	1356.00	1326.87
MYRL&ROY WELL	08-Mar-99	30.08	1356.00	1325.92
MYRL&ROY WELL	21-Jun-99	28.83	1356.00	1327.17
MYRL&ROY WELL	18-Oct-99	33.16	1356.00	1322.84
MYRL&ROY WELL	19-Oct-99	32.87	1356.00	1323.13
MYRL&ROY WELL	13-Dec-99	30.81	1356.00	1325.19
MYRL&ROY WELL	13-Mar-00	32.23	1356.00	1323.77
MYRL&ROY WELL	05-Jun-00	35.99	1356.00	1320.01
MYRL&ROY WELL	11-Sep-00	43.11	1356.00	1312.89
MYRL&ROY WELL	08-Jan-01	33.07	1356.00	1322.93
MYRL&ROY WELL	23-Apr-01	28.71	1356.00	1327.29
MYRL&ROY WELL	16-Jul-01	35.82	1356.00	1320.18
MYRL&ROY WELL	22-Oct-01	32.92	1356.00	1323.08
MYRL&ROY WELL	21-Jan-02	30.79	1356.00	1325.21
MYRL&ROY WELL	29-Apr-02	34.67	1356.00	1321.33
MYRL&ROY WELL	22-Jul-02	43.35	1356.00	1312.65
MYRL&ROY WELL	21-Oct-02	35.06	1356.00	1320.94
MYRL&ROY WELL	20-Jan-03	32.81	1356.00	1323.19
MYRL&ROY WELL	21-Apr-03	33.60	1356.00	1322.40
MYRL&ROY WELL	28-Jul-03	40.02	1356.00	1315.98
MYRL&ROY WELL	27-Oct-03	38.82	1356.00	1317.18
MYRL&ROY WELL	25-Jan-04	37.00	1356.00	1319.00
MYRL&ROY WELL	26-Apr-04	37.91	1356.00	1318.09
MYRL&ROY WELL	21-Jun-04	39.31	1356.00	1316.69
MYRL&ROY WELL	08-Nov-04	42.50 <sup>1</sup>	1356.00	1313.50
MYRL&ROY WELL	31-Jan-05	35.68	1356.00	1320.32
MYRL&ROY WELL	18-Apr-05	36.78	1356.00	1319.22
MYRL&ROY WELL	25-Jul-05	43.73	1356.00	1312.27
MYRL&ROY WELL	10-Oct-05	40.45	1356.00	1315.55
MYRL&ROY WELL	16-Jan-06	34.44	1356.00	1321.56
MYRL&ROY WELL	01-May-06	35.43	1356.00	1320.57
MYRL&ROY WELL	24-Jul-06	51.02	1356.00	1304.98
MYRL&ROY WELL	30-Oct-06	38.99	1356.00	1317.01
MYRL&ROY WELL	22-Jan-07	39.20	1356.00	1316.80
MYRL&ROY WELL	16-Apr-07	37.93	1356.00	1318.07
MYRL&ROY WELL	24-Jul-07	57.53	1356.00	1298.47
MYRL&ROY WELL	30-Jul-07	54.13	1356.00	1301.87
MYRL&ROY WELL	05-Nov-07	45.91	1356.00	1310.09
MYRL&ROY WELL	04-Feb-08	41.52	1356.00	1314.48
MYRL&ROY WELL	11-May-08	42.95	1356.00	1313.05
MYRL&ROY WELL	04-Aug-08	59.18	1356.00	1296.82
MYRL&ROY WELL	20-Oct-08	46.95	1356.00	1309.05
MYRL&ROY WELL	09-Feb-09	43.98	1356.00	1312.02
MYRL&ROY WELL	20-Apr-09	42.95	1356.00	1313.05
MYRL&ROY WELL	27-Jul-09	56.52	1356.00	1299.48
MYRL&ROY WELL	26-Oct-09	46.25	1356.00	1309.75
MYRL&ROY WELL	07-Feb-10	44.72	1356.00	1311.28
MYRL&ROY WELL	19-Apr-10	45.32	1356.00	1310.68
MYRL&ROY WELL	12-Jul-10	49.39	1356.00	1306.61
MYRL&ROY WELL	01-Dec-10	44.84	1356.00	1311.16
MYRL&ROY WELL	01-Feb-11	40.27	1356.00	1315.73

Table 1

**Groundwater Elevation Data (All units in feet)**  
**Myrl & Roy's Paving, Inc.**  
**Rowena Quarry Area**  
**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
MYRL&ROY WELL	11-Apr-11	40.28	1356.00	1315.72
MYRL&ROY WELL	05-Jul-11	71.86	1356.00	1284.14
MYRL&ROY WELL	17-Oct-11	48.48	1356.00	1307.52
MYRL&ROY WELL	16-Jan-12	43.19	1356.00	1312.81
MYRL&ROY WELL	07-May-12	47.27	1356.00	1308.73
MYRL&ROY WELL	23-Jul-12	75.19	1356.00	1280.81
MYRL&ROY WELL	07-Dec-12	49.16	1356.00	1306.84
MYRL&ROY WELL	19-Mar-13	50.43	1356.00	1305.57
MYRL&ROY WELL	01-Jul-13	57.48	1356.00	1298.52
MYRL&ROY WELL	30-Sep-13	56.75	1356.00	1299.25
MYRL&ROY WELL	16-Dec-13	53.61	1356.00	1302.39
MYRL&ROY WELL	17-Feb-14	52.86	1356.00	1303.14
MYRL&ROY WELL	30-Jun-14	56.51	1356.00	1299.49
MYRL&ROY WELL	22-Sep-14	55.34	1356.00	1300.66
MYRL&ROY WELL	22-Dec-14	49.39	1356.00	1306.61
MYRL&ROY WELL	09-Mar-15	48.75	1356.00	1307.25
MYRL&ROY WELL	18-May-15	49.37	1356.00	1306.63
MYRL&ROY WELL	30-Sep-15	51.15	1356.00	1304.85
MYRL&ROY WELL	21-Dec-15	47.35	1356.00	1308.65
MYRL&ROY WELL	18-Apr-16	50.41	1356.00	1305.59
MYRL&ROY WELL	18-Jul-16	64.17	1356.00	1291.83
MYRL&ROY WELL	31-Oct-16	49.72	1356.00	1306.28
MYRL&ROY WELL	27-Dec-16	46.85	1356.00	1309.15
MYRL&ROY WELL	13-Feb-17	48.38	1356.00	1307.62
MYRL&ROY WELL	23-Jun-17	46.21	1356.00	1309.79
MYRL&ROY WELL	05-Sep-17	45.75	1356.00	1310.25
MYRL&ROY WELL	11-Dec-17	46.91	1356.00	1309.09
MYRL&ROY WELL	12-Feb-18	45.66	1356.00	1310.34
MYRL&ROY WELL	07-May-18	45.42	1356.00	1310.58
MYRL&ROY WELL	30-Jul-18	84.41	1356.00	1271.59
MYRL&ROY WELL	29-Oct-18	53.45	1356.00	1302.55
MYRL&ROY WELL	07-Jun-19	58.77	1356.00	1297.23
MYRL&ROY WELL	25-Sep-19	60.45	1356.00	1295.55
MYRL&ROY WELL	23-Dec-19	61.78	1356.00	1294.22
MW-06	24-Jul-07	15.17	1333.27	1318.10
MW-06	29-Oct-07	16.05	1335.75 <sup>(2)</sup>	1319.70
MW-06	04-Feb-08	18.42	1335.75	1317.33
MW-06	05-May-08	15.85	1335.75	1319.90
MW-06	04-Aug-08	15.39	1335.75	1320.36
MW-06	20-Oct-08	18.84	1335.75	1316.91
MW-06	09-Feb-09	19.79	1335.75	1315.96
MW-06	20-Apr-09	20.44	1335.75	1315.31
MW-06	27-Jul-09	19.89	1335.75	1315.86
MW-06	26-Oct-09	19.84	1335.75	1315.91
MW-06	08-Feb-10	19.39	1335.75	1316.36
MW-06	19-Apr-10	16.11	1335.75	1319.64
MW-06	12-Jul-10	15.70	1335.75	1320.05
MW-06	01-Dec-10	17.59	1335.75	1318.16
MW-06	01-Feb-11	19.22	1335.75	1316.53
MW-06	11-Apr-11	17.36	1335.75	1318.39
MW-06	05-Jul-11	15.89	1335.75	1319.86
MW-06	17-Oct-11	19.26	1335.75	1316.49
MW-06	16-Jan-12	22.77	1335.75	1312.98
MW-06	07-May-12	20.56	1335.75	1315.19
MW-06	23-Jul-12	21.25	1335.75	1314.50

Table 1

**Groundwater Elevation Data (All units in feet)**  
**Myrl & Roy's Paving, Inc.**  
**Rowena Quarry Area**  
**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
MW-06	07-Dec-12	24.87	1335.75	1310.88
MW-06	19-Mar-13	22.65	1335.75	1313.10
MW-06	25-Jun-13	16.49	1335.75	1319.26
MW-06	30-Sep-13	21.18	1335.75	1314.57
MW-06	16-Dec-13	22.62	1335.75	1313.13
MW-06	17-Feb-14	24.28	1335.75	1311.47
MW-06	30-Jun-14	15.86	1335.75	1319.89
MW-06	22-Sep-14	17.89	1335.75	1317.86
MW-06	22-Dec-14	21.02	1335.75	1314.73
MW-06	09-Mar-15	20.12	1335.75	1315.63
MW-06	18-May-15	18.95	1335.75	1316.80
MW-06	30-Sep-15	18.11	1335.75	1317.64
MW-06	21-Dec-15	17.85	1335.75	1317.90
MW-06	18-Apr-16	17.07	1335.75	1318.68
MW-06	18-Jul-16	19.99	1335.75	1315.76
MW-06	31-Oct-16	18.29	1335.75	1317.46
MW-06	27-Dec-16	17.96	1335.75	1317.79
MW-06	13-Feb-17	18.73	1335.75	1317.02
MW-06	23-Jun-17	18.82	1335.75	1316.93
MW-06	05-Sep-17	19.26	1335.75	1316.49
MW-06	11-Dec-17	20.07	1335.75	1315.68
MW-06	12-Feb-18	23.08	1335.75	1312.67
MW-06	07-May-18	17.40	1335.75	1318.35
MW-06	30-Jul-18	15.42	1335.75	1320.33
MW-06	29-Oct-18	15.97	1335.75	1319.78
MW-06	07-Jun-19	17.64	1335.75	1318.11
MW-06	25-Sep-19	21.51	1335.75	1314.24
MW-06	23-Dec-19	25.57	1335.75	1310.18
MW-07	24-Jul-07	12.63	1329.95	1317.32
MW-07	29-Oct-07	8.64	1332.78 <sup>(2)</sup>	1324.14
MW-07	04-Feb-08	13.33	1332.78	1319.45
MW-07	05-May-08	7.36	1332.78	1325.42
MW-07	04-Aug-08	8.69	1332.78	1324.09
MW-07	20-Oct-08	12.45	1332.78	1320.33
MW-07	09-Feb-09	11.60	1332.78	1321.18
MW-07	20-Apr-09	9.24	1332.78	1323.54
MW-07	27-Jul-09	11.81	1332.78	1320.97
MW-07	26-Oct-09	10.95	1332.78	1321.83
MW-07	08-Feb-10	10.48	1332.78	1322.30
MW-07	19-Apr-10	7.71	1332.78	1325.07
MW-07	12-Jul-10	8.13	1332.78	1324.65
MW-07	01-Dec-10	9.70	1332.78	1323.08
MW-07	01-Feb-11	11.63	1332.78	1321.15
MW-07	11-Apr-11	9.04	1332.78	1323.74
MW-07	05-Jul-11	9.01	1332.78	1323.77
MW-07	17-Oct-11	14.09	1332.78	1318.69
MW-07	16-Jan-12	18.31	1332.78	1314.47
MW-07	07-May-12	13.52	1332.78	1319.26
MW-07	23-Jul-12	16.83	1332.78	1315.95
MW-07	07-Dec-12	20.54	1332.78	1312.24
MW-07	19-Mar-13	16.18	1332.78	1316.60
MW-07	25-Jun-13	9.63	1332.78	1323.15
MW-07	30-Sep-13	17.04	1332.78	1315.74
MW-07	16-Dec-13	18.09	1332.78	1314.69
MW-07	17-Feb-14	19.72	1332.78	1313.06

Table 1

**Groundwater Elevation Data (All units in feet)**  
**Myrl & Roy's Paving, Inc.**  
**Rowena Quarry Area**  
**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
MW-07	30-Jun-14	8.20	1332.78	1324.58
MW-07	22-Sep-14	10.74	1332.78	1322.04
MW-07	22-Dec-14	15.40	1332.78	1317.38
MW-07	09-Mar-15	14.51	1332.78	1318.27
MW-07	18-May-15	10.08	1332.78	1322.70
MW-07	30-Sep-15	10.65	1332.78	1322.13
MW-07	21-Dec-15	9.97	1332.78	1322.81
MW-07	18-Apr-16	9.51	1332.78	1323.27
MW-07	18-Jul-16	11.95	1332.78	1320.83
MW-07	31-Oct-16	11.75	1332.78	1321.03
MW-07	27-Dec-16	11.22	1332.78	1321.56
MW-07	13-Feb-17	11.87	1332.78	1320.91
MW-07	23-Jun-17	11.97	1332.78	1320.81
MW-07	05-Sep-17	13.10	1332.78	1319.68
MW-07	11-Dec-17	15.00	1332.78	1317.78
MW-07	12-Feb-18	18.90	1332.78	1313.88
MW-07	07-May-18	10.67	1332.78	1322.11
MW-07	30-Jul-18	11.93	1332.78	1320.85
MW-07	29-Oct-18	12.22	1332.78	1320.56
MW-07	07-Jun-19	11.60	1332.78	1321.18
MW-07	25-Sep-19	12.51	1332.78	1320.27
MW-07	23-Dec-19	15.29	1332.78	1317.49
MW-08	24-Jul-07	12.35	1334.85	1322.50
MW-08	29-Oct-07	14.54	1337.90 <sup>(2)</sup>	1323.36
MW-08	04-Feb-08	15.69	1337.90	1322.21
MW-08	05-May-08	14.22	1337.90	1323.68
MW-08	04-Aug-08	12.76	1337.90	1325.14
MW-08	20-Oct-08	14.42	1337.90	1323.48
MW-08	09-Feb-09	14.36	1337.90	1323.54
MW-08	20-Apr-09	15.34	1337.90	1322.56
MW-08	27-Jul-09	15.96	1337.90	1321.94
MW-08	26-Oct-09	16.39	1337.90	1321.51
MW-08	08-Feb-10	16.21	1337.90	1321.69
MW-08	19-Apr-10	12.99	1337.90	1324.91
MW-08	12-Jul-10	11.90	1337.90	1326.00
MW-08	01-Dec-10	11.58	1337.90	1326.32
MW-08	01-Feb-11	12.64	1337.90	1325.26
MW-08	11-Apr-11	11.35	1337.90	1326.55
MW-08	05-Jul-11	10.32	1337.90	1327.58
MW-08	17-Oct-11	12.71	1337.90	1325.19
MW-08	16-Jan-12	13.85	1337.90	1324.05
MW-08	07-May-12	13.65	1337.90	1324.25
MW-08	23-Jul-12	14.68	1337.90	1323.22
MW-08	07-Dec-12	16.03	1337.90	1321.87
MW-08	19-Mar-13	14.07	1337.90	1323.83
MW-08	25-Jun-13	13.31	1337.90	1324.59
MW-08	30-Sep-13	14.77	1337.90	1323.13
MW-08	16-Dec-13	15.58	1337.90	1322.32
MW-08	17-Feb-14	17.12	1337.90	1320.78
MW-08	30-Jun-14	10.18	1337.90	1327.72
MW-08	22-Sep-14	16.28	1337.90	1321.62
MW-08	22-Dec-14	14.49	1337.90	1323.41
MW-08	09-Mar-15	13.59	1337.90	1324.31
MW-08	18-May-15	14.49	1337.90	1323.41
MW-08	30-Sep-15	13.52	1337.90	1324.38

Table 1

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**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
MW-08	21-Dec-15	13.34	1337.90	1324.56
MW-08	18-Apr-16	12.97	1337.90	1324.93
MW-08	18-Jul-16	12.07	1337.90	1325.83
MW-08	31-Oct-16	11.44	1337.90	1326.46
MW-08	27-Dec-16	10.98	1337.90	1326.92
MW-08	13-Feb-17	11.97	1337.90	1325.93
MW-08	23-Jun-17	12.03	1337.90	1325.87
MW-08	05-Sep-17	15.81	1337.90	1322.09
MW-08	11-Dec-17	14.87	1337.90	1323.03
MW-08	12-Feb-18	14.43	1337.90	1323.47
MW-08	07-May-18	13.56	1337.90	1324.34
MW-08	30-Jul-18	12.01	1337.90	1325.89
MW-08	29-Oct-18	12.31	1337.90	1325.59
MW-08	07-Jun-19	8.24	1337.90	1329.66
MW-08	25-Sep-19	9.07	1337.90	1328.83
MW-08	23-Dec-19	11.99	1337.90	1325.91
G-1	30-Apr-97	41.31	1321.50	1280.19
G-1	20-Oct-97	47.72	1321.50	1273.78
G-1	09-Feb-98	48.79	1321.50	1272.71
G-1	11-May-98	46.73	1321.50	1274.77
G-1	11-Aug-98	48.12	1321.50	1273.38
G-1	07-Dec-98	46.40	1321.50	1275.10
G-1	10-Mar-99	47.25	1321.50	1274.25
G-1	21-Jun-99	45.90	1321.50	1275.60
G-1	18-Oct-99	47.92	1321.50	1273.58
G-1	13-Dec-99	48.38	1321.50	1273.12
G-1	13-Mar-00	48.54	1321.50	1272.96
G-1	05-Jun-00	47.59	1321.50	1273.91
G-1	11-Sep-00	49.45	1321.50	1272.05
G-1	08-Jan-01	49.38	1321.50	1272.12
G-1	23-Apr-01	42.14	1321.50	1279.36
G-1	16-Jul-01	44.61	1321.50	1276.89
G-1	22-Oct-01	46.74	1321.50	1274.76
G-1	21-Jan-02	46.90	1321.50	1274.60
G-1	29-Apr-02	46.61	1321.50	1274.89
G-1	22-Jul-02	48.59	1321.50	1272.91
G-1	21-Oct-02	48.52	1321.50	1272.98
G-1	20-Jan-03	48.91	1321.50	1272.59
G-1	21-Apr-03	48.36	1321.50	1273.14
G-1	28-Jul-03	49.17	1321.50	1272.33
G-1	27-Oct-03	49.68	1321.50	1271.82
G-1	26-Jan-04	49.63	1321.50	1271.87
G-1	26-Apr-04	49.00	1321.50	1272.50
G-1	15-Jun-04	47.42	1321.50	1274.08
G-1	08-Nov-04	48.37	1321.50	1273.13
G-1	31-Jan-05	48.75	1321.50	1272.75
G-1	18-Apr-05	48.36	1321.50	1273.14
G-1	25-Jul-05	48.54	1321.50	1272.96
G-1	10-Oct-05	47.30	1321.50	1274.20
G-1	16-Jan-06	47.93	1321.50	1273.57
G-1	01-May-06	44.83	1321.50	1276.67
G-1	24-Jul-06	47.68	1321.50	1273.82
G-1	29-Oct-06	47.51	1321.50	1273.99
G-1	22-Jan-07	47.48	1321.50	1274.02
G-1	16-Apr-07	43.85	1321.50	1277.65
G-1	24-Jul-07	47.65	1321.50	1273.85

Table 1

**Groundwater Elevation Data (All units in feet)**  
**Myrl & Roy's Paving, Inc.**  
**Rowena Quarry Area**  
**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
G-1	29-Oct-07	46.41	1321.50	1275.09
G-1	04-Feb-08	47.49	1321.50	1274.01
G-1	05-May-08	45.70	1321.50	1275.80
G-1	04-Aug-08	46.78	1321.50	1274.72
G-1	20-Oct-08	47.47	1321.50	1274.03
G-1	09-Feb-09	47.40	1321.50	1274.10
G-1	20-Apr-09	45.84	1321.50	1275.66
G-1	27-Jul-09	47.76	1321.50	1273.74
G-1	26-Oct-09	48.18	1321.50	1273.32
G-1	08-Feb-10	47.72	1321.50	1273.78
G-1	19-Apr-10	43.74	1321.50	1277.76
G-1	12-Jul-10	42.49	1321.50	1279.01
G-1	01-Dec-10	43.34	1321.50	1278.16
G-1	01-Feb-11	44.23	1321.50	1277.27
G-1	11-Apr-11	39.16	1321.50	1282.34
G-1	05-Jul-11	40.74	1321.50	1280.76
G-1	17-Oct-11	44.39	1321.50	1277.11
G-1	16-Jan-12	45.58	1321.50	1275.92
G-1	07-May-12	45.54	1321.50	1275.96
G-1	23-Jul-12	47.35	1321.50	1274.15
G-1	07-Dec-12	48.68	1321.50	1272.82
G-1	19-Mar-13	48.27	1321.50	1273.23
G-1	25-Jun-13	46.68	1321.50	1274.82
G-1	30-Sep-13	48.92	1321.50	1272.58
G-1	16-Dec-13	48.85	1321.50	1272.65
G-1	17-Feb-14	48.90	1321.50	1272.60
G-1	30-Jun-14	43.31	1321.50	1278.19
G-1	22-Sep-14	47.30	1321.50	1274.20
G-1	22-Dec-14	47.85	1321.50	1273.65
G-1	09-Mar-15	47.94	1321.50	1273.56
G-1	18-May-15	47.61	1321.50	1273.89
G-1	30-Sep-15	47.64	1321.50	1273.86
G-1	21-Dec-15	47.58	1321.50	1273.92
G-1	18-Apr-16	46.30	1321.50	1275.20
G-1	18-Jul-16	NM	1321.50	
G-1	31-Oct-16	NM	1321.50	
G-1	27-Dec-16	NM	1321.50	
G-1	13-Feb-17	NM	1321.50	
G-1	23-Jun-17	NM	1321.50	
G-1	05-Sep-17	NM	1321.50	
G-1	11-Dec-17	NM	1321.50	
G-1	12-Feb-18	NM	1321.50	
G-1	07-May-18	NM	1321.50	
G-1	30-Jul-18	NM	1321.50	
G-1	29-Oct-18	NM	1321.50	
G-2	30-Apr-97	6.36	1363.40	1357.04
G-2	20-Oct-97	9.75	1363.40	1353.65
G-2	09-Feb-98	10.76	1363.40	1352.64
G-2	11-May-98	6.55	1363.40	1356.85
G-2	11-Aug-98	8.81	1363.40	1354.59
G-2	07-Dec-98	8.38	1363.40	1355.02
G-2	10-Mar-99	8.35	1363.40	1355.05
G-2	21-Jun-99	7.25	1363.40	1356.15
G-2	18-Oct-99	10.23	1363.40	1353.17
G-2	13-Dec-99	10.96	1363.40	1352.44
G-2	13-Mar-00	11.27	1363.40	1352.13

Table 1

**Groundwater Elevation Data (All units in feet)**  
**Myrl & Roy's Paving, Inc.**  
**Rowena Quarry Area**  
**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
G-2	05-Jun-00	10.38	1363.40	1353.02
G-2	11-Sep-00	11.57	1363.40	1351.83
G-2	08-Jan-01	12.21	1363.40	1351.19
G-2	23-Apr-01	5.72	1363.40	1357.68
G-2	16-Jul-01	7.33	1363.40	1356.07
G-2	22-Oct-01	9.80	1363.40	1353.60
G-2	21-Jan-02	8.56	1363.40	1354.84
G-2	29-Apr-02	8.17	1363.40	1355.23
G-2	22-Jul-02	9.57	1363.40	1353.83
G-2	21-Oct-02	9.06	1363.40	1354.34
G-2	20-Jan-03	9.83	1363.40	1353.57
G-2	21-Apr-03	9.39	1363.40	1354.01
G-2	28-Jul-03	9.53	1363.40	1353.87
G-2	27-Oct-03	11.08	1363.40	1352.32
G-2	26-Jan-04	11.58	1363.40	1351.82
G-2	26-Apr-04	10.57	1363.40	1352.83
G-2	15-Jun-04	8.83	1363.40	1354.57
G-2	08-Nov-04	11.10	1363.40	1352.30
G-2	31-Jan-05	11.67	1363.40	1351.73
G-2	18-Apr-05	11.02	1363.40	1352.38
G-2	25-Jul-05	8.90	1363.40	1354.50
G-2	10-Oct-05	10.46	1363.40	1352.94
G-2	16-Jan-06	9.59	1363.40	1353.81
G-2	01-May-06	4.64	1363.40	1358.76
G-2	24-Jul-06	7.91	1363.40	1355.49
G-2	29-Oct-06	10.18	1363.40	1353.22
G-2	22-Jan-07	9.92	1363.40	1353.48
G-2	16-Apr-07	5.95	1363.40	1357.45
G-2	24-Jul-07	9.09	1363.40	1354.31
G-2	29-Oct-07	8.99	1363.40	1354.41
G-2	05-Nov-07	9.02	1363.40	1354.38
G-2	04-Feb-08	9.81	1363.40	1353.59
G-2	05-May-08	5.90	1363.40	1357.50
G-2	04-Aug-08	7.13	1363.40	1356.27
G-2	20-Oct-08	9.63	1363.40	1353.77
G-2	09-Feb-09	9.62	1363.40	1353.78
G-2	20-Apr-09	8.36	1363.40	1355.04
G-2	27-Jul-09	8.44	1363.40	1354.96
G-2	26-Oct-09	9.76	1363.40	1353.64
G-2	08-Feb-10	10.22	1363.40	1353.18
G-2	19-Apr-10	5.87	1363.40	1357.53
G-2	12-Jul-10	5.64	1363.40	1357.76
G-2	01-Dec-10	6.11	1363.40	1357.29
G-2	01-Feb-11	7.21	1363.40	1356.19
G-2	11-Apr-11	5.46	1363.40	1357.94
G-2	05-Jul-11	6.06	1363.40	1357.34
G-2	17-Oct-11	8.47	1363.40	1354.93
G-2	16-Jan-12	9.12	1363.40	1354.28
G-2	07-May-12	7.09	1363.40	1356.31
G-2	23-Jul-12	9.13	1363.40	1354.27
G-2	07-Dec-12	11.66	1363.40	1351.74
G-2	19-Mar-13	11.73	1363.40	1351.67
G-2	25-Jun-13	9.30	1363.40	1354.10
G-2	30-Sep-13	11.24	1363.40	1352.16
G-2	16-Dec-13	11.70	1363.40	1351.70
G-2	17-Feb-14	12.13	1363.40	1351.27
G-2	30-Jun-14	6.03	1363.40	1357.37

Table 1

**Groundwater Elevation Data (All units in feet)  
Myrl & Roy's Paving, Inc.  
Rowena Quarry Area  
Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
G-2	22-Sep-14	9.12	1363.40	1354.28
G-2	22-Dec-14	9.85	1363.40	1353.55
G-2	09-Mar-15	9.58	1363.40	1353.82
G-2	18-May-15	7.31	1363.40	1356.09
G-2	30-Sep-15	damaged	1363.40	
G-2	21-Dec-15	damaged	1363.40	
G-2	18-Apr-16	5.62	1363.40	1357.78
G-2	18-Jul-16	7.75	1363.40	1355.65
G-2	31-Oct-16	7.53	1363.40	1355.87
G-2	27-Dec-16	5.81	1363.40	1357.59
G-2	13-Feb-17	6.27	1363.40	1357.13
G-2	23-Jun-17	6.69	1363.40	1356.71
G-2	05-Sep-17	7.14	1363.40	1356.26
G-2	11-Dec-17	6.34	1363.40	1357.06
G-2	12-Feb-18	7.80	1363.40	1355.60
G-2	07-May-18	5.57	1363.40	1357.83
G-2	30-Jul-18	6.97	1363.40	1356.43
G-2	29-Oct-18	6.00	1363.40	1357.40
G-2	17-Jun-19	6.25	1363.40	1357.15
G-2	25-Sep-19	6.47	1363.40	1356.93
G-2	23-Dec-19	7.17	1363.40	1356.23
G-6	30-Apr-97	14.83	1295.30	1280.47
G-6	20-Oct-97	20.37	1295.30	1274.93
G-6	09-Feb-98	21.98	1295.30	1273.32
G-6	11-May-98	18.92	1295.30	1276.38
G-6	11-Aug-98	20.09	1295.30	1275.21
G-6	07-Dec-98	19.81	1295.30	1275.49
G-6	10-Mar-99	20.21	1295.30	1275.09
G-6	21-Jun-99	18.30	1295.30	1277.00
G-6	18-Oct-99	20.82	1295.30	1274.48
G-6	13-Dec-99	21.85	1295.30	1273.45
G-6	13-Mar-00	20.33	1295.30	1274.97
G-6	05-Jun-00	22.06	1295.30	1273.24
G-6	11-Sep-00	21.13	1295.30	1274.17
G-6	08-Jan-01	23.67	1295.30	1271.63
G-6	23-Apr-01	17.36	1295.30	1277.94
G-6	16-Jul-01	14.56	1295.30	1280.74
G-6	22-Oct-01	17.24	1295.30	1278.06
G-6	21-Jan-02	18.84	1295.30	1276.46
G-6	29-Apr-02	19.74	1295.30	1275.56
G-6	22-Jul-02	21.19	1295.30	1274.11
G-6	21-Oct-02	21.44	1295.30	1273.86
G-6	20-Jan-03	22.04	1295.30	1273.26
G-6	21-Apr-03	22.43	1295.30	1272.87
G-6	28-Jul-03	21.71	1295.30	1273.59
G-6	27-Oct-03	22.61	1295.30	1272.69
G-6	26-Jan-04	23.03	1295.30	1272.27
G-6	26-Apr-04	22.18	1295.30	1273.12
G-6	15-Jun-04	20.08	1295.30	1275.22
G-6	08-Nov-04	21.80	1295.30	1273.50
G-6	31-Jan-05	22.57	1295.30	1272.73
G-6	18-Apr-05	22.92	1295.30	1272.38
G-6	25-Jul-05	21.28	1295.30	1274.02
G-6	10-Oct-05	20.89	1295.30	1274.41
G-6	16-Jan-06	19.95	1295.30	1275.35
G-6	01-May-06	15.69	1295.30	1279.61

Table 1

**Groundwater Elevation Data (All units in feet)**  
**Myrl & Roy's Paving, Inc.**  
**Rowena Quarry Area**  
**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
G-6	24-Jul-06	16.22	1295.30	1279.08
G-6	29-Oct-06	19.37	1295.30	1275.93
G-6	22-Jan-07	20.05	1295.30	1275.25
G-6	16-Apr-07	17.11	1295.30	1278.19
G-6	24-Jul-07	16.82	1295.30	1278.48
G-6	29-Oct-07	18.83	1295.30	1276.47
G-6	04-Feb-08	19.60	1295.30	1275.70
G-6	05-May-08	19.21	1295.30	1276.09
G-6	04-Aug-08	16.26	1295.30	1279.04
G-6	20-Oct-08	19.02	1295.30	1276.28
G-6	09-Feb-09	20.59	1295.30	1274.71
G-6	20-Apr-09	19.84	1295.30	1275.46
G-6	27-Jul-09	20.84	1295.30	1274.46
G-6	26-Oct-09	21.95	1295.30	1273.35
G-6	08-Feb-10	20.92	1295.30	1274.38
G-6	19-Apr-10	15.73	1295.30	1279.57
G-6	12-Jul-10	13.91	1295.30	1281.39
G-6	01-Dec-10	12.93	1295.30	1282.37
G-6	01-Feb-11	15.40	1295.30	1279.90
G-6	11-Apr-11	13.22	1295.30	1282.08
G-6	05-Jul-11	12.07	1295.30	1283.23
G-6	17-Oct-11	13.82	1295.30	1281.48
G-6	16-Jan-12	17.51	1295.30	1277.79
G-6	07-May-12	18.81	1295.30	1276.49
G-6	23-Jul-12	18.88	1295.30	1276.42
G-6	07-Dec-12	22.37	1295.30	1272.93
G-6	19-Mar-13	22.53	1295.30	1272.77
G-6	25-Jun-13	19.23	1295.30	1276.07
G-6	30-Sep-13	20.27	1295.30	1275.03
G-6	16-Dec-13	22.13	1295.30	1273.17
G-6	17-Feb-14	22.79	1295.30	1272.51
G-6	30-Jun-14	13.39	1295.30	1281.91
G-6	22-Sep-14	17.24	1295.30	1278.06
G-6	22-Dec-14	19.97	1295.30	1275.33
G-6	09-Mar-15	21.06	1295.30	1274.24
G-6	18-May-15	20.44	1295.30	1274.86
G-6	30-Sep-15	19.48	1295.30	1275.82
G-6	21-Dec-15	20.01	1295.30	1275.29
G-6	18-Apr-16	18.02	1295.30	1277.28
G-6	18-Jul-16	16.37	1295.30	1278.93
G-6	31-Oct-16	17.77	1295.30	1277.53
G-6	27-Dec-16	17.29	1295.30	1278.01
G-6	13-Feb-17	17.32	1295.30	1277.98
G-6	23-Jun-17	16.63	1295.30	1278.67
G-6	05-Sep-17	17.59	1295.30	1277.71
G-6	11-Dec-17	16.85	1295.30	1278.45
G-6	12-Feb-18	18.60	1295.30	1276.70
G-6	07-May-18	15.28	1295.30	1280.02
G-6	30-Jul-18	10.30	1295.30	1285.00
G-6	29-Oct-18	8.77	1295.30	1286.53
G-6	17-Jun-19	8.58	1295.30	1286.72
G-6	25-Sep-19	9.08	1295.30	1286.22
G-6	23-Dec-19	11.63	1295.30	1283.67
MA-80CA	02-Sep-97	9.50	1280.00	1270.50
MA-80CA	24-Oct-97	14.90	1280.00	1265.10
MA-80CA	12-May-98	13.30	1280.00	1266.70

Table 1

**Groundwater Elevation Data (All units in feet)**  
**Myrl & Roy's Paving, Inc.**  
**Rowena Quarry Area**  
**Rowena, South Dakota**

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
MA-80CA	14-Jul-98	14.80	1280.00	1265.20
MA-80CA	11-Aug-98	15.00	1280.00	1265.00
MA-80CA	16-Sep-98	16.10	1280.00	1263.90
MA-80CA	18-Mar-99	12.40	1280.00	1267.60
MA-80CA	18-Nov-99	15.90	1280.00	1264.10
MA-80CA	23-Mar-00	16.00	1280.00	1264.00
MA-80CA	26-Jul-00	16.10	1280.00	1263.90
MA-80CA	13-Sep-00	16.90	1280.00	1263.10
MA-80CA	18-Oct-00	16.70	1280.00	1263.30
MA-80CA	16-Jul-01	13.31	1280.00	1266.69
MA-80CA	22-Oct-01	15.45	1280.00	1264.55
MA-80CA	21-Jan-02	14.83	1280.00	1265.17
MA-80CA	29-Apr-02	13.90	1280.00	1266.10
MA-80CA	22-Jul-02	16.54	1280.00	1263.46
MA-80CA	21-Oct-02	15.93	1280.00	1264.07
MA-80CA	20-Jan-03	16.10	1280.00	1263.90
MA-80CA	21-Apr-03	13.95	1280.00	1266.05
MA-80CA	28-Jul-03	16.44	1280.00	1263.56
MA-80CA	27-Oct-03	16.70	1280.00	1263.30
MA-80CA	26-Jan-04	16.45	1280.00	1263.55
MA-80CA	26-Apr-04	15.85	1280.00	1264.15
MA-80CA	15-Jun-04	13.50	1280.00	1266.50
MA-80CA	08-Nov-04	15.63	1280.00	1264.37
MA-80CA	31-Jan-05	15.84	1280.00	1264.16
MA-80CA	18-Apr-05	14.22	1280.00	1265.78
MA-80CA	25-Jul-05	15.04	1280.00	1264.96
MA-80CA	10-Oct-05	13.30	1280.00	1266.70
MA-80CA	16-Jan-06	14.83	1280.00	1265.17
MA-80CA	01-May-06	11.16	1280.00	1268.84
MA-80CA	24-Jul-06	15.97	1280.00	1264.03
MA-80CA	29-Oct-06	15.67	1280.00	1264.33
MA-80CA	22-Jan-07	15.14	1280.00	1264.86
MA-80CA	16-Apr-07	10.64	1280.00	1269.36
MA-80CA	24-Jul-07	15.70	1280.00	1264.30
MA-80CA	29-Oct-07	13.77	1280.00	1266.23
MA-80CA	04-Feb-08	15.05	1280.00	1264.95
MA-80CA	05-May-08	11.97	1280.00	1268.03
MA-80CA	04-Aug-08	15.02	1280.00	1264.98
MA-80CA	20-Oct-08	15.52	1280.00	1264.48
MA-80CA	09-Feb-09	14.94	1280.00	1265.06
MA-80CA	20-Apr-09	12.83	1280.00	1267.17
MA-80CA	27-Jul-09	15.03	1280.00	1264.97
MA-80CA	26-Oct-09	14.97	1280.00	1265.03
MA-80CA	08-Feb-10	14.56	1280.00	1265.44
MA-80CA	19-Apr-10	11.12	1280.00	1268.88
MA-80CA	12-Jul-10	9.78	1280.00	1270.22
MA-80CA	01-Dec-10	13.38	1280.00	1266.62
MA-80CA	01-Feb-11	13.55	1280.00	1266.45
MA-80CA	11-Apr-11	5.86	1280.00	1274.14
MA-80CA	05-Jul-11	9.13	1280.00	1270.87
MA-80CA	17-Oct-11	14.72	1280.00	1265.28
MA-80CA	16-Jan-12	14.97	1280.00	1265.03
MA-80CA	07-May-12	10.26	1280.00	1269.74
MA-80CA	23-Jul-12	15.78	1280.00	1264.22
MA-80CA	07-Dec-12	16.17	1280.00	1263.83
MA-80CA	19-Mar-13	15.13	1280.00	1264.87
MA-80CA	25-Jun-13	12.52	1280.00	1267.48

Table 1

Groundwater Elevation Data (All units in feet)  
 Myrl & Roy's Paving, Inc.  
 Rowena Quarry Area  
 Rowena, South Dakota

WELL NO.	DATE	DEPTH TO WATER	ELEVATION TOC	ELEVATION WATER
MA-80CA	30-Sep-13	16.16	1280.00	1263.84
MA-80CA	16-Dec-13	15.89	1280.00	1264.11
MA-80CA	17-Feb-14	15.61	1280.00	1264.39
MA-80CA	30-Jun-14	10.98	1280.00	1269.02
MA-80CA	22-Sep-14	15.47	1280.00	1264.53
MA-80CA	22-Dec-14	15.74	1280.00	1264.26
MA-80CA	09-Mar-15	15.05	1280.00	1264.95
MA-80CA	18-May-15	13.44	1280.00	1266.56
MA-80CA	30-Sep-15	15.03	1280.00	1264.97
MA-80CA	21-Dec-15	14.77	1280.00	1265.23
MA-80CA	18-Apr-16	13.70	1280.00	1266.30
MA-80CA	18-Jul-16	14.10	1280.00	1265.90
MA-80CA	31-Oct-16	14.54	1280.00	1265.46
MA-80CA	27-Dec-16	13.06	1280.00	1266.94
MA-80CA	13-Feb-17	13.25	1280.00	1266.75
MA-80CA	23-Jun-17	13.68	1280.00	1266.32
MA-80CA	05-Sep-17	14.01	1280.00	1265.99
MA-80CA	11-Dec-17	13.82	1280.00	1266.18
MA-80CA	12-Feb-18	14.45	1280.00	1265.55
MA-80CA	07-May-18	8.56	1280.00	1271.44
MA-80CA	30-Jul-18	10.97	1280.00	1269.03
MA-80CA	29-Oct-18	10.90	1280.00	1269.10
MA-80CA	07-Jun-19	8.09	1280.00	1271.91
MA-80CA	25-Sep-19	damaged	1280.00	
MA-80CA	23-Dec-19	13.49	1280.00	1266.51

<sup>1</sup> = Water levels rising, well not equilibrated

<sup>2</sup> = New top of casing elevation following surface completion

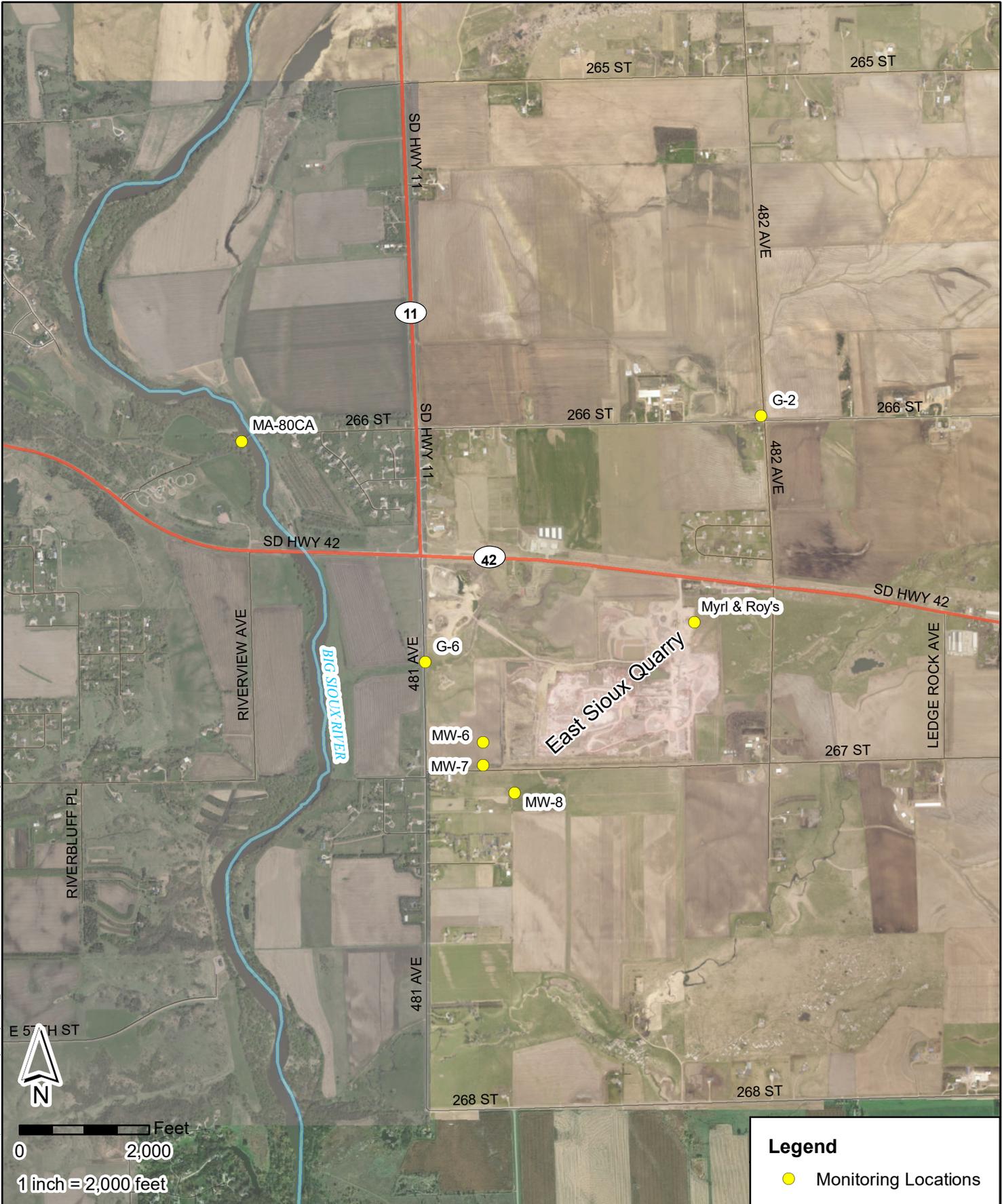
TOC = Top of casing

NM = Not measured



# FIGURES

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**Legend**

- Monitoring Locations



**HOUSTON ENGINEERING INC.**  
 3900 W Technology Circle, Suite 6  
 Sioux Falls, SD 57106  
 605.271.0378

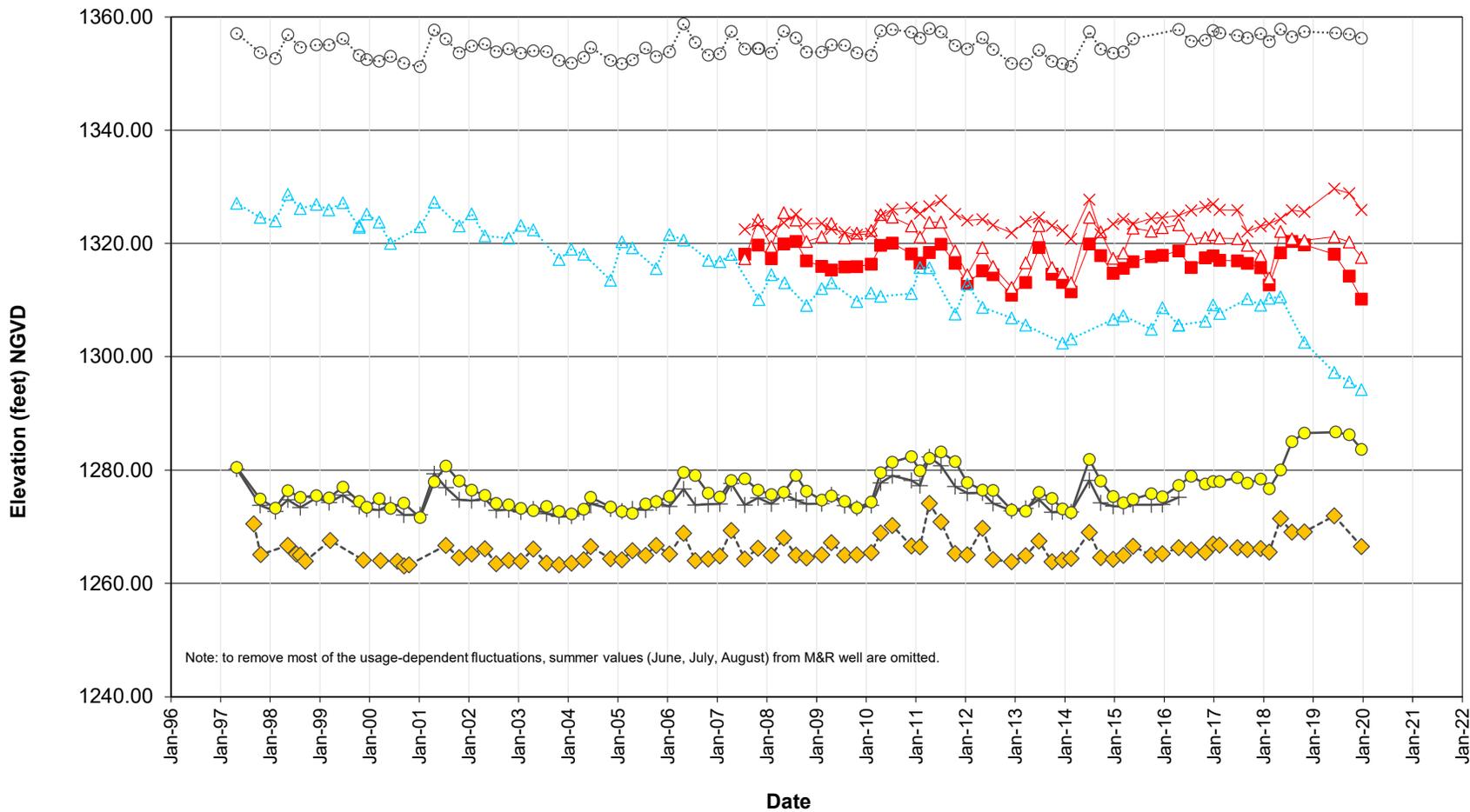
**EAST SIOUX QUARRY**  
 ROWENA, SOUTH DAKOTA

Client:  
 MYRL and ROY'S PAVING, INC.  
 Project Number: 10477\_001

**Groundwater Monitoring Locations**

Drawn by: bp	Checked: kk	Date: 20 May 19	Figure: 1
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**Figure 2**  
**Groundwater Elevations**  
**East Sioux Quarry**  
**Rowena, SD**





# APPENDIX A

## Methodologies

# METHODOLOGIES

## Groundwater Monitoring

Fluid-level elevations are measured to the nearest 0.01 foot using the top of well casing as a reference point with an electronic water-level indicator. Prior to insertion into each monitor well, the measuring device is cleaned with alcohol and rinsed with distilled water.