

LEGGETTE, BRASHEARS & GRAHAM, INC.

PROFESSIONAL GROUNDWATER AND ENVIRONMENTAL ENGINEERING SERVICES

8 PINE TREE DRIVE
SUITE 250
ST. PAUL, MN 55112
(651) 490-1405
FAX (651) 490-1006
www.lbgweb.com

January 15, 2014

Kristina Handt
Administrator
City of Scandia
14727 209th Street North
Scandia, MN 55073

Re: 2013 Groundwater Monitoring Summary
Zavoral Aggregate Mining and Reclamation Project
City of Scandia, Minnesota

Dear Ms. Handt:

On behalf of the City of Scandia (City), Leggette, Brashears & Graham, Inc. (LBG) has reviewed the 2013 groundwater monitoring data collected from the Tiller Corporation's (Tiller) Zavoral Aggregate Mining and Reclamation Project (Site) (Figure 1). The purpose of the monitoring is to evaluate groundwater and surface water conditions across the Site and compare these data to current and future mining and reclamation activities, and to ensure the conditions of the February 19, 2013 Conditional Use Permit (CUP) and Annual Operating Permit (AOP) for the Site have been met.

LBG was retained by the City to monitor and report on groundwater conditions at the Site. The Washington County Conservation District (WCD) was retained by the City to monitor and report on surface waters. Although LBG's scope focuses on groundwater, both parties have collaborated on the review of both data sets considering the hydraulic connection between groundwater and surface water across the Site. The WCD's report will be submitted by the WCD under separate cover.

LBG's report includes the following information:

- A brief summary of background information related to groundwater monitoring;
- Groundwater monitoring field procedures;
- Monitoring results and discussion;
- Summary of the findings; and,
- Recommendations.

BACKGROUND

Overview of CUP Groundwater Conditions

As part of the CUP Tiller was required to meet the following conditions related to groundwater monitoring,:

- Maintain a separation distance of 25 feet for less between the maximum depth of mining and the highest groundwater level on the Site;
- Keep daily pumping from the existing Zavoral Site Well production well (Zavoral Site Well)
- Pumping cannot exceed a rate 10,000 gallons a day at a maximum pumping rate of 1,200 gallons per minute (gpm), with the annual volume below 1 million gallon per year;
- Install and maintain the required on-Site monitoring wells; and,
- Revise and implement their *Groundwater Quality Protection Plan* (GWQPP).

Monitoring Well Installation

It was predetermined during the CUP review and approval process that four monitoring wells would serve as locations for groundwater level measurements and groundwater sampling at the Site. One monitoring well (MW-1) and two observation wells (PZ-1 and PZ-2) were installed in January 2013. The difference between the “MW” designation and a “PZ” designation is that the former is permitted for groundwater quality sampling in accordance with the Minnesota Department of Health’s (MDH) Well Code. The fourth well is the existing private Trails End well (Trails End Well) located just west of the Site (Figure 1).

Monitoring well MW-1 is located adjacent to the Zavoral Site Well and hydraulically down gradient (i.e., “downstream”) of the on-Site refueling area (Figure 1). The well was installed on January 9, 2013 by Braun Intertec Corporation (Braun). This well is screened in sand and gravel water table aquifer from 80 to 90 feet below grade (ft bg). This well is used for groundwater sampling and groundwater level measurements.

The two observation wells PZ-1 and PZ-2 are located on the southern and northern ends of the Site, respectively. PZ-1 was installed by on January 15, 2013 by Braun and is screened in St. Lawrence Formation from 88 to 103 ft bg. PZ-2 was installed by Traut Wells, Inc. on January 18, 2013 and is screened in the Jordan Sandstone from 100 to 110 ft bg. The purpose of these wells is to collect groundwater level measurements only. Both of these wells are screened in the water table aquifer, which was the first groundwater encountered during drilling. Representatives from Tiller were Site to log the boreholes and observe well installation.

The Trails End well does not have a well log, but was measured previously as part of the Draft EIS work. A depth of approximately 139 ft bg was measured.

The well and boring records for the monitoring wells are included in Attachment 1 and a well construction summary is presented in Table 1. Figure 2 shows a conceptual hydrogeologic cross section and the relative completions depths and geologic formations encountered during well installation.

GROUNDWATER MONITORING PROCEDURES

As outlined in the GWQPP baseline water levels and groundwater samples were collected at the Site prior to 2013 mining operations beginning. The initial groundwater levels were measured by Tiller with an electronic water level meter immediately after the monitoring and observation wells were installed in January 2013. LBG made regular visits to collect manual water levels and download data from the automated monitoring equipment that was installed in each well in June 2013. Pace Analytical Services, Inc. (Pace) was on Site to collect groundwater samples from MW-1 in September 2013.

Groundwater Monitoring Equipment

Groundwater level and water quality data are being measured at the Site using In-Situ, Inc. (In-Situ) electronic data loggers (loggers). Dedicated loggers were installed in the four monitoring wells by LBG in June 12, 2013. The objective of loggers is to collect continuous data, which allows for better characterization of groundwater conditions. Three of the four wells in the Site's monitoring network have Level 500 loggers, which are connected to a pressure transducer and temperature probe. This setup allows for water level and temperature data to be measured and recorded. An AquaTroll 200 was installed in MW-1. This measures and records water quality data in addition to water level and temperature data. Water quality is of interest in MW-1 due to its proximity to the Zavoral Site Well and on-Site refueling station, and its central location in the mining area. All instruments were programmed to log readings at a 1 hour interval. The data collected at each well are as follows:

Well	Pressure (Water Level)	Temp. (°F)	Conductivity (µS)	Resistivity (ohm-cm)	Total Dissolved Solids (TDS) (ppm)	Salinity (ppm)
MW-1	Yes	Yes	Yes	Yes	Yes	Yes
PZ-1	Yes	Yes	No	No	No	No
PZ-2	Yes	Yes	No	No	No	No
Trails End	Yes	Yes	No	No	No	No

Groundwater Level and Water Quality Parameter Measurements

After the initial January groundwater level measurements completed by Tiller, LBG visited the Site six times (March, June, July, September, November and December 2013). In March, only manual groundwater levels were measured and in the June 2013 LBG installed the loggers. Data were downloaded from the loggers and manual water level measurements were made by LBG during subsequent visits.

Groundwater Sampling

Pace visited the Site on September 10, 2013 to collect groundwater samples from MW-1. The samples were analyzed by Pace for Diesel Range Organics (DRO), benzene, ethylbenzene, toluene and xylene (Total) (BTEX). The field data sheets and lab results are provided in Attachment 2, and summarized in Table 2.

GROUNDWATER MONITORING RESULTS AND DISCUSSION

Groundwater Level Measurements

Groundwater levels across the Site were relatively stable for 2013 and showed no effects from mining operations and from pumping the Zavoral Site Well. This is shown by the well hydrographs on Figures 3 and 4, and in Attachment 3. Groundwater levels in PZ-2 and MW-1 rose by approximately 0.8 feet from June through September 2013 then began to slowly drop by approximately 0.5 feet between October and December 2013. These trends are consistent with seasonal variations that typically occur with spring recharge followed by drier summer months. The graphs also show that the precipitation events recorded by the WCD at their Bone Lake weather station located approximately miles 4 miles to the west-northwest showed no measurable effects on water levels at the Site. This assumes the events at Bone Lake also occurred on Site. The slight deviation from the established groundwater level trend that occurred in MW-1 in early September was in conjunction with the Pace groundwater sampling event on September 10th. The cause of this deviation is discussed later.

Groundwater Flow Direction

Groundwater surface contour maps are shown on Figures 5 and 6 for measurements collected on June 12 and September 12, 2013. These dates represent low and high groundwater level conditions, respectively. The maps show the configuration of the groundwater surface is consistent for both circumstances. Groundwater flow across the Site is from the west-northwest to the east-southeast and toward the St. Croix River. Based on these results MW-1 is placed in the optimum location for detecting any potential impacts to groundwater from mine operations.

Mining Depth and Groundwater Levels

Tiller reported that the deepest the mine advanced in 2013 was at an elevation between 850 and 855 feet above mean seal level (ft-amsl). Based on the groundwater elevations shown on Figures 5 and 6, the estimated separation distance between the bottom of the mine and the groundwater surface in 2013 would have been in the range of approximately 40 to 65 feet. This puts the bottom of the mine well above the 25 foot minimum separation distance specified in the conditions of the CUP.

Zavoral Site Well Pumping

Tiller pumped the Zavoral Site Well on two occasions summarized below. The water was used to fill the water truck for dust control and for watering planted trees. No impact to water levels

monitored at the Site occurred as a result of pumping this well. The pumping amounts met the conditions of the CUP for 2013 (Figure 4).

Date	Amount Pumped (gallons)
October 16, 2013	8,000
November 1, 2013	8,000
Total for 2013	16,000

Groundwater Quality (MW-1)

The groundwater quality parameters collected in MW-1 using the AquaTroll 200 shows conductivity, TDS and salinity decreased slightly throughout the monitoring period, and resistivity (the inverse of conductivity) increased slightly over the same time period (Attachment 2). Conductivity values ranged from approximately 365 to 420 μ S, resistivity 2,380 to 2,735 ohm-cm, TDS 338 to 390 parts per million (ppm), and salinity 250 to 290 ppm. The levels of all parameters remained stable during the mining operations indicating no changes in the groundwater conditions. Note the above range of values for each parameter do not take into consideration the anomaly that occurred beginning on the September 10th, which is discussed in more detail below.

Groundwater Analytical Results (PACE Labs)

The groundwater analytical results from MW-1 show DRO and BTEX were not detected at or above the method detection limits. The results are summarized and included in Table2.

September 2013 Groundwater Level and Water Quality Parameters Deviation

The anomaly in the In Situ data from MW-1 occurred during the monitoring period beginning on September 10, 2013. This date corresponds with the Pace sampling event at MW-1. During the event, Pace had to remove the AquaTroll 200 from MW-1 in order to sample the well. Per communication with Tiller, the AquaTroll 200 was removed from the well for approximately 45 minutes then reinstalled to its original position. The removal and purging of water from the well during sampling resulted in the groundwater quality conditions changing. The data anomaly is shown on the graphs for each parameter, which are included in Attachment 2.

LBG contacted In-Situ who confirmed the instrument sensors were logging correctly as indicated by the data trends for each parameter returning to its pre-anomaly trend, albeit slowly. Therefore, the anomaly can be disregarded and there are no data integrity concerns as a result of the significant deviation from the originally established data trends for each groundwater quality parameter in MW-1

SUMMARY

The following summarizes the 2013 groundwater monitoring results at the Site as they related to the conditions of the CUP:

- The GWQPP was revised to address LBG's comments and implemented by Tiller in January 2013;
- The monitoring well network at the Site was established in January 2013 with the installation of three monitoring wells (MW-1, PZ-1 and PZ-2) at the locations approved by LBG. The Trails End Well was also included in the network. These wells monitor the water table aquifer;
- The four wells are instrumented with data loggers to continuously monitor groundwater levels and temperature, and water quality parameters (MW-1 only);
- Groundwater level data shows groundwater flows across the Site from west-northwest to south-southeast toward the St. Croix River;
- The deepest mining in 2013 was at elevation of approximately 850 ft amsl, which is approximately 40 to 65 feet above the water table surface;
- The Zavoral Site Well was pumped two times at rates and volumes below the maximum allowable limits outlined in CUP conditions, and no impacts to the water table aquifer were observed as a result of pumping;
- The groundwater levels and groundwater quality parameters remained relatively stable during 2013, particularly during the mining operations; and,
- No impacts to groundwater levels or quality were observed as a result of the 2013 mining operations.

RECOMMENDATIONS

Based on the evaluation of the 2013 monitoring data all CUP conditions related to the groundwater have been met by Tiller. At this time, LBG recommends the conditions of the CUP and AOP remain in place and the GWQPP continue to be followed.

Sincerely,

LEGGETTE, BRASHEARS & GRAHAM, INC



Roscoe F. Sopiwnik, GISP
Environmental Scientist II



David S. Hume, PG
Senior Associate

DSH:

S:\Tech\Scandia Aggregate\Zavoral\Monitoring Reports\2013\2013 Monitoring Data Review (final).doc

TABLES

TABLE 1

MONITORING AND OBSERVATION WELL CONSTRUCTION SUMMARY

ZAVORAL AGGREGATE MINING AND RECLAMATION PROJECT

SCANDIA, MN

Well Number	Install Date	Grade Elevation (feet AMSL)	Top of Casing Elevation (feet AMSL)	Total Depth (feet BG)	Total Depth Elevation (feet AMSL)	Top of Screen Elevation (feet AMSL)	Screened Interval (feet BG)	Depth to Water at Installation (feet BG)	Groundwater Elevation (feet AMSL)
MW-1	9-Jan-13	864.43	867.43	90.00	774.43	784.43	80-90	85.00	779.43
PZ-1	15-Jan-19	854.94	857.94	103.00	751.94	766.94	88-103	89.00	765.94
PZ-2	18-Jan-13	889.89	892.89	110.00	779.89	789.89	100-110	91.00	798.89
Trails End	Unknown	929.38	932.38	~139	799.38	Unknown	Unknown	115.75*	813.63

AMSL: above mean sea level
 BG: below grade
 * Water level collected 6/12/2013

TABLE 2

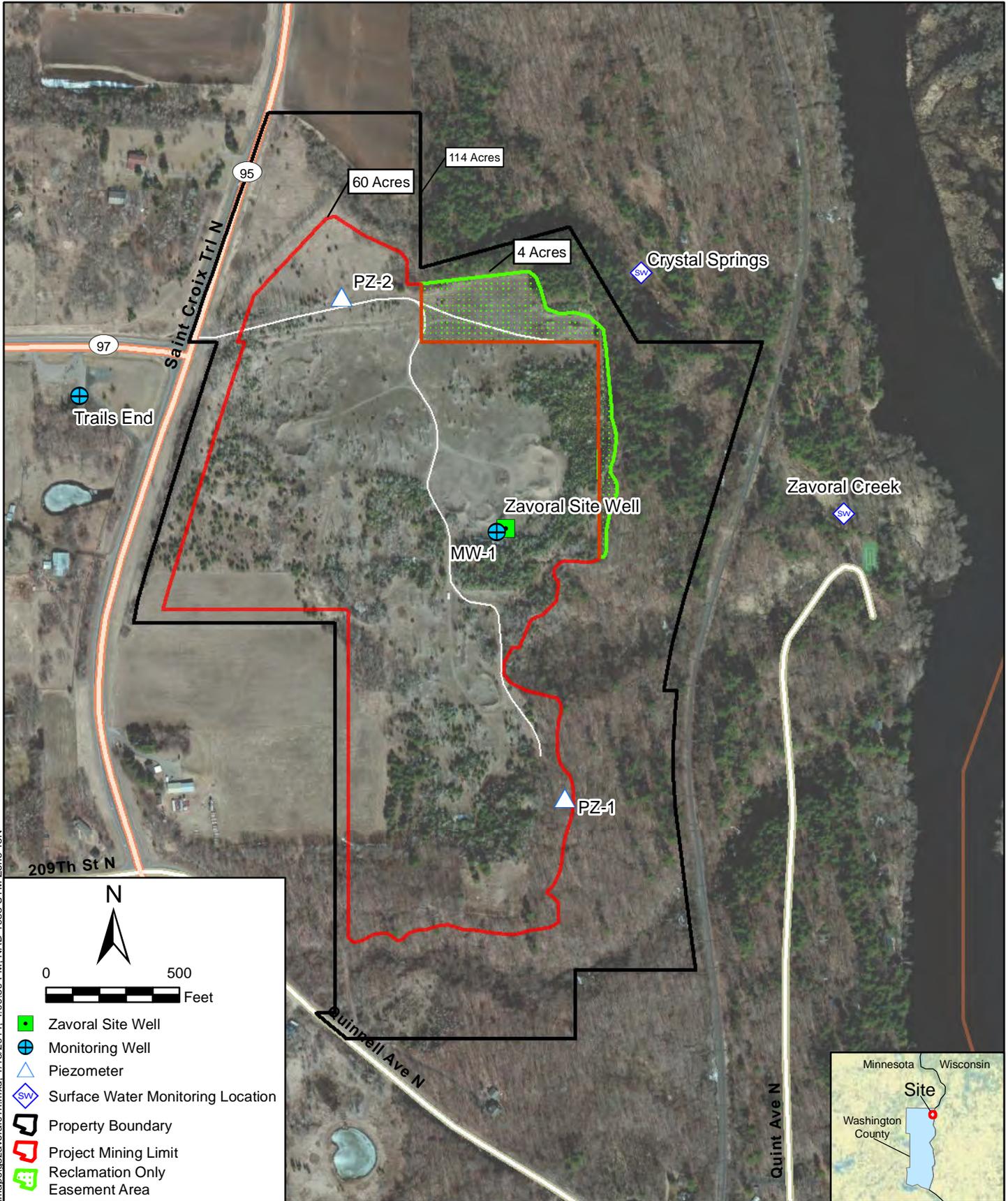
**ZAVORAL AGGREGATE MINING AND RECLAMATION PROJECT
SCANDIA, MN**

**MW-1 GROUNDWATER ANALYTICAL RESULTS
2013**

Sample Date	Diesel Range Organics (DRO)	Benzene	Ethylbenzene	Toluene	Xylene (Total)
Units	mg/L	ug/L	ug/L	ug/L	ug/L
Method Detection Limit	0.10	1.0	1.0	1.0	3.0
10-Sep-13	<0.10	<1.0	<1.0	<1.0	<3.0

mg/L: Milligrams per Liter
ug/L: Micrograms per Liter

FIGURES



G:\GIS\Tiller_Zavoral_Mine\maps\g3zavoral01h.mxd, 1/15/2014, 4:09:59 PM, NAD 1983 UTM Zone 15N

Source: Well Locations Located by LBG. Surface Water Monitoring Locations from MNWCD. Property boundaries from Tiller Corporation, Inc.

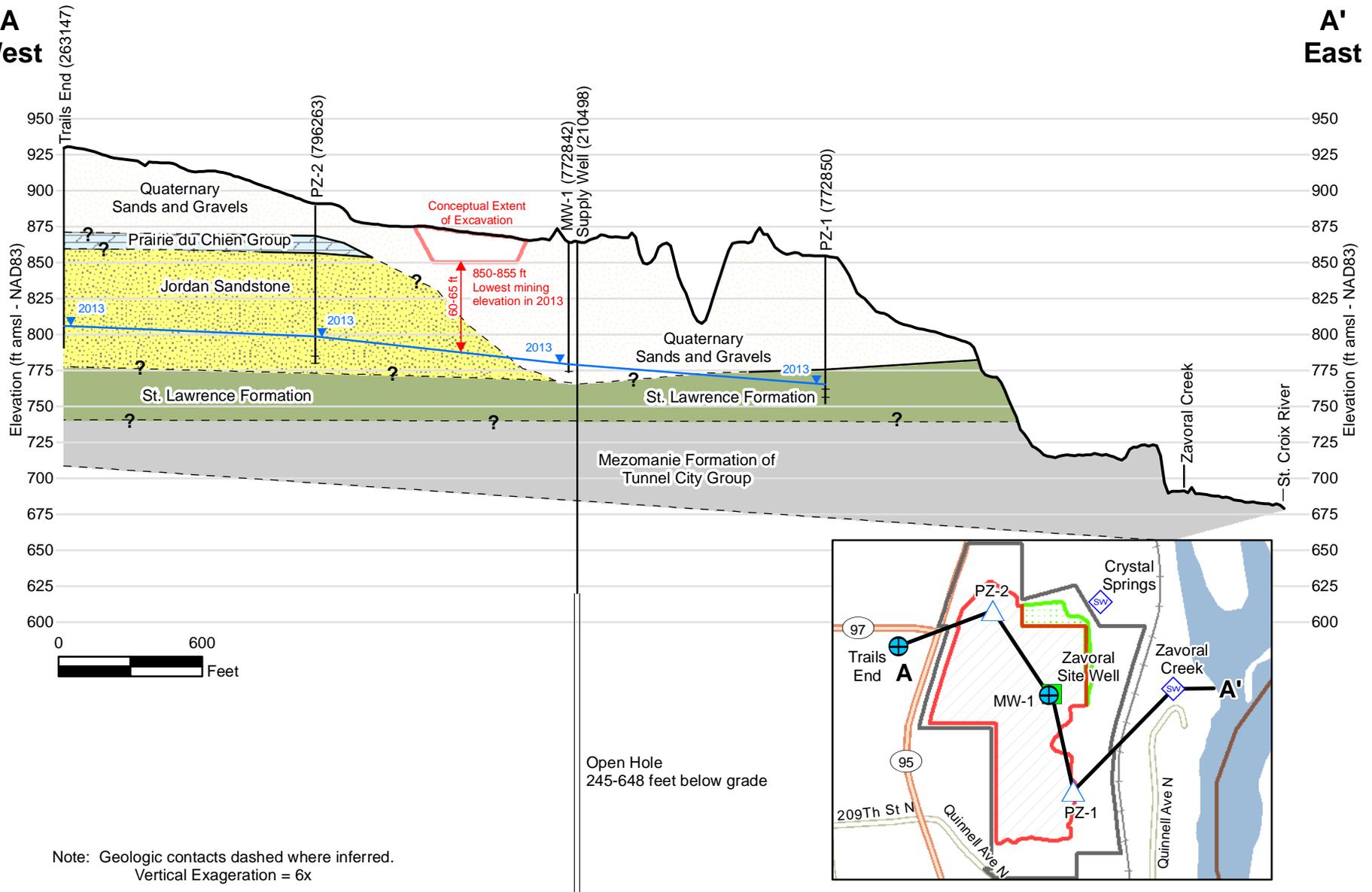


Prepared By:
LEGGETTE, BRASHEARS & GRAHAM, INC.
 Professional Groundwater and
 Environmental Engineering Services
 8 Pine Tree Drive, Suite 250
 St. Paul, Minnesota 55112
 (651) 470-1405

CITY OF SCANDIA SCANDIA, MINNESOTA		
ZAVORAL MINING AND RECLAMATION PROJECT SITE FEATURES		
FILE: g3zavoral01h.MXD	DATE: 1/15/2014	FIGURE: 1

A
West

A'
East



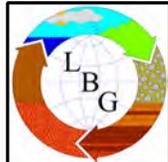
Note: Geologic contacts dashed where inferred.
Vertical Exaggeration = 6x

Open Hole
245-648 feet below grade

Screened Interval

Open Hole

9/12/2013 Water Level Representative of
the Highest Elevation Measured During the
2013 Monitoring Period



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CITY OF SCANDIA
SCANDIA, MINNESOTA

CONCEPTUAL HYDROGEOLOGIC CROSS SECTION A-A'

FILE: g3zavoral01i.MXD

DATE: 1/15/2014

FIGURE: 2

Figure 3

MW-1 Monitoring Well and PZ-1, PZ-2, and Trails End Observation Wells
Groundwater Elevation (ft amsl) vs Time
Zavoral Aggregate Mining and Reclamation Project
Scandia, Minnesota

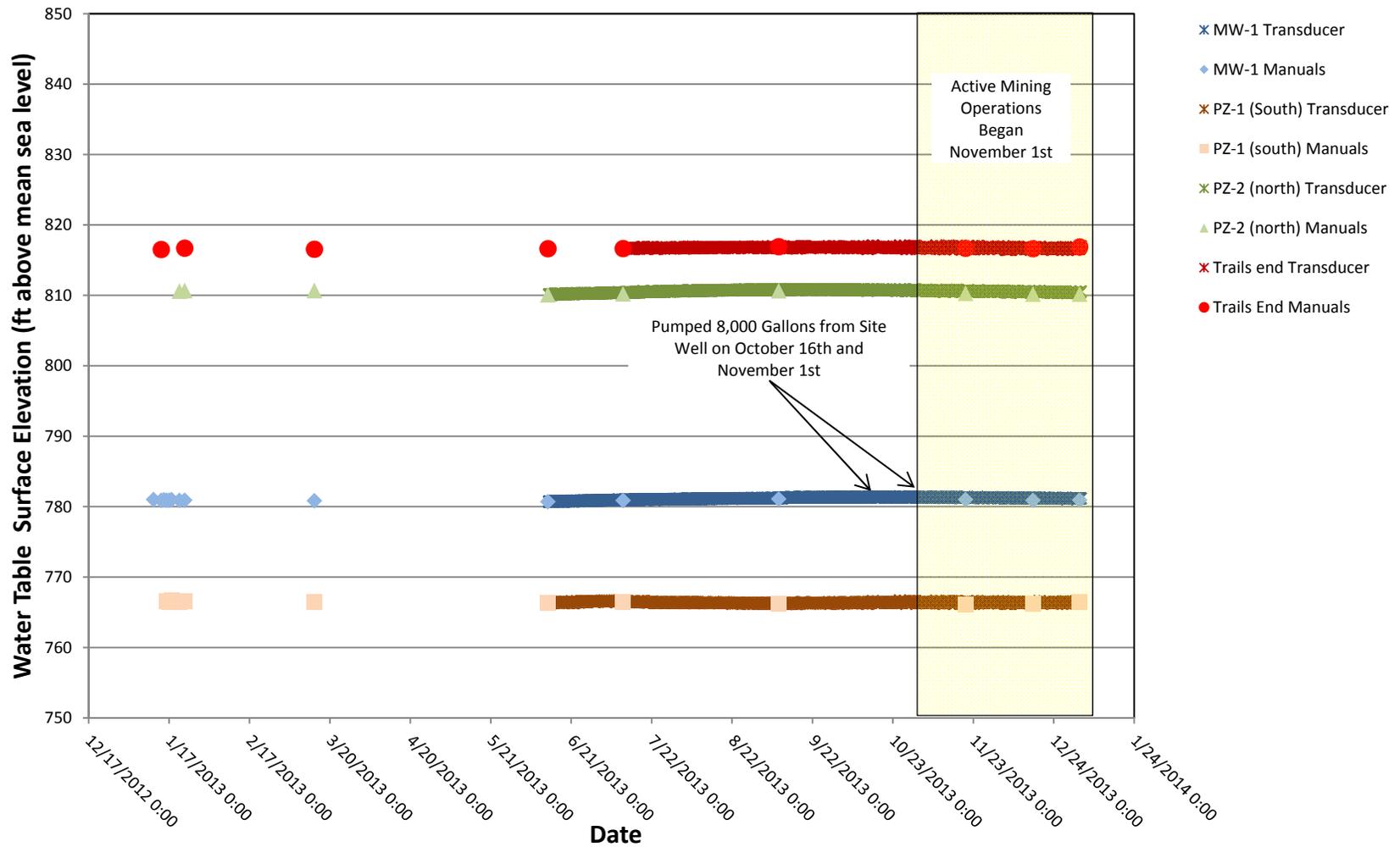
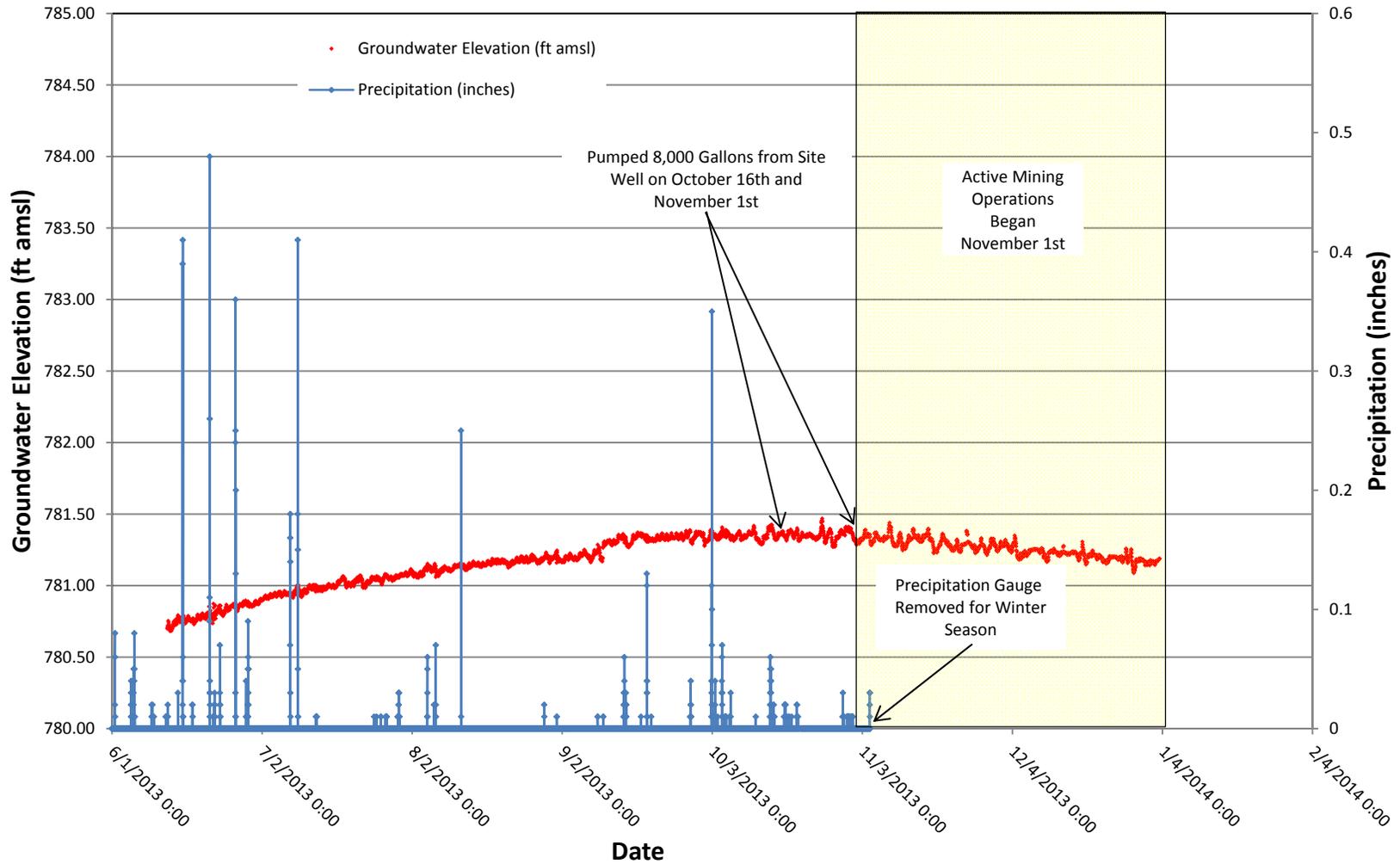


Figure 4

MW-1
Groundwater Elevation (ft amsl) and Precipitation (inches) vs Time
Zavoral Mining and Reclamation Project
Scandia, MN





G:\GIS\Tiler_Zavoral_Mine\maps\g3zavoral01e.mxd, 1/15/2014, 4:43:14 PM, NAD 1983 UTM Zone 15N

0 400
Feet

- Zavoral Site Well
- ⊕ Monitoring Well
- △ Piezometer
- ◇ Surface Water Monitoring Location
- Groundwater Elevation Contour (ft amsl)
dashed where inferred
- ➔ Groundwater Flow Direction
- * Not Used in Contouring

Source: LIDAR DEM from Minnesota Geospatial Information Office. Well Locations Located by LBG. Surface Water Monitoring Locations from MNWCD.



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 Professional Groundwater and
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 8 Pine Tree Drive, Suite 250
 St. Paul, Minnesota 55112
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CITY OF SCANDIA SCANDIA, MINNESOTA		
GROUNDWATER ELEVATIONS (LOW PERIOD) JUNE 12, 2013		
FILE: g3zavoral01e.MXD	DATE: 1/15/2014	FIGURE: 5



G:\GIS\Tiler_Zavoral_Mine\maps\g3zavoral01f.mxd, 1/15/2014, 4:48:59 PM, NAD 1983, UTM Zone 15N

0 400 Feet

- Site Well
- ⊕ Monitoring Well
- ▲ Piezometer
- ◊ Surface Water Monitoring Location
- Groundwater Elevation Contour (ft amsl)
dashed where inferred
- Groundwater Flow Direction
- * Not Used in Contouring

Source: LIDAR DEM from Minnesota Geospatial Information Office. Well Locations Located by LBG. Surface Water Monitoring Locations from MNWCD.



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 Environmental Engineering Services
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 St. Paul, Minnesota 55112
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CITY OF SCANDIA SCANDIA, MINNESOTA		
GROUNDWATER ELEVATIONS (HIGH PERIOD) SEPTEMBER 12, 2013		
FILE: g3zavoral01f.MXD	DATE: 1/15/2014	FIGURE: 6

ATTACHMENT 1
WELL AND BORING RECORDS

MW-1

Minnesota Unique Well No.

772842

County Washington
 Quad Scandia
 Quad ID 134D

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
 Minnesota Statutes Chapter 103I

Entry Date 05/16/2013
 Update Date 02/25/2013
 Received Date

Well Name MW-1		Well Depth	Depth Completed	Date Well Completed
Township Range Dir Section Subsections Elevation		91 ft.	90 ft.	01/09/2013
32	19 W 18 CDCABB	Elevation Method DEM (MNDNR)		
Well Address IN REMARKS SCANDIA MN 55073		Drilling Method Auger (non-specified)		
Geological Material		Drilling Fluid	Well Hydrofractured? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
CLAYEY SAND, DENSE	BROWN	-	From Ft. to Ft.	
SANDY SILT, MED. DENSE	BROWN	Use Monitor well		
SAND, MED. DENSE	BROWN	Casing Type Plastic Joint Threaded Drive Shoe? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
CLAYED SAND W/GRAVEL, MED. DENSE	BROWN	Above/Below ft.		
		Casing Diameter	Weight	Hole Diameter
		2 in. to 80 ft.	lbs./ft.	8 in. to 90 ft.
		Open Hole from ft. to ft.		
		Screen YES Make MONOFLEX Type plastic		
		Diameter	Slot/Gauze	Length Set Between
		2	10	10 80 ft. and 90 ft.
		Static Water Level		
		85 ft. from Land surface Date Measured 01/09/2013		
		PUMPING LEVEL (below land surface)		
		ft. after hrs. pumping g.p.m.		
		Well Head Completion		
		Pitless adapter manufacturer Model		
		<input checked="" type="checkbox"/> Casing Protection Y <input checked="" type="checkbox"/> 12 in. above grade		
		<input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)		
REMARKS		Grouting Information Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
SE QUAD OF CO. HWYS. 95 & 97, SCANDIA, 55073		Grout Material: Bentonite from 4 to 74 ft. 2.5 bags		
Located by: Minnesota Department of Health		Grout Material: CONCRETE from to 4 ft. 4 bags		
Method: Digitization (Screen) - Map (1:24,000)		Nearest Known Source of Contamination		
Unique Number Verification: Info/GPS from data source		_feet _direction _type		
Input Date: 02/13/2013		Well disinfected upon completion? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
System: UTM - Nad83, Zone15, Meters		Pump <input type="checkbox"/> Not Installed Date Installed		
X: 518263 Y: 5011261		Manufacturer's name Model number HP Volts		
		Length of drop Pipe ft. Capacity g.p.m. Type Material		
		Abandoned Wells Does property have any not in use and not sealed well(s)? <input type="checkbox"/>		
		Yes <input type="checkbox"/> No		
		Variance Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
First Bedrock		Well Contractor Certification		
Last Strat pebbly sand/silt/clay-brown		Braun Intertec Corp. 1323 MCLEAN.S.		
Aquifer Quat. Buried Unconf. Aquife		License Business Name Lic. Or Reg. No. Name of Driller		
Depth to Bedrock ft.				
County Well Index Online Report		772842		Printed 5/16/2013
				HE-01205-07

P-1

Minnesota Unique Well No.

772850

County Washington
 Quad Scandia
 Quad ID 134D

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
 Minnesota Statutes Chapter 103I

Entry Date 04/24/2013
 Update Date 05/16/2013
 Received Date 02/25/2013

Well Name P-1		Well Depth 103 ft.	Depth Completed 103 ft.	Date Well Completed 01/15/2013
Township Range Dir Section Subsections Elevation 854 ft.		Drilling Method Multiple methods used		
32 19 W 19 BABDAA Elevation Method LIDAR 1m DEM (MNDNR)		Drilling Fluid -		
Well Address IN REMARKS SCANDIA MN 55073		Well Hydrofractured? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No From Ft. to Ft.		
Geological Material Color Hardness From To		Use Environ. Bore Hole		
CLAYEY SAND, DENSE BROWN 0 18	Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? <input type="checkbox"/>			
SAND W/GRAVEL, MED. DENSE BROWN 18 79	Yes <input checked="" type="checkbox"/> No Above/Below ft.			
LIMESTONE YEL/BRN HARD 79 100	Casing Diameter Weight Hole Diameter			
SHALEY LAYERS, V. DENSE DK. GRY 100 101	2 in. to 88 ft.	3.75 lbs./ft.	8 in. to 80 ft.	
LIMESTONE YEL/BRN HARD 101 103	Open Hole from ft. to ft.			
<p><i>St. Lawrence</i> <i>775 ft. AMSL</i></p>		Screen YES Make MONOFLEX Type plastic		
		Diameter Slot/Gauze Length Set Between		
		2 10 15 88 ft. and 103 ft.		
		Static Water Level 89 ft. from Land surface Date Measured 01/15/2013		
<p>NO REMARKS</p>		PUMPING LEVEL (below land surface) ft. after hrs. pumping g.p.m.		
		Well Head Completion Pitless adapter manufacturer Model		
		<input checked="" type="checkbox"/> Casing Protection Y <input checked="" type="checkbox"/> 12 in. above grade		
		<input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)		
<p>Located by: Minnesota Department of Health Method: Digitization (Screen) - Map (1:24,000) Unique Number Verification: Info/GPS from data source System: UTM - Nad83, Zone15, Meters</p>		Grouting Information Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
		Grout Material: Neat Cement from 4 to 66 ft. 2.5 bags		
		Grout Material: Bentonite from 66 to 84 ft. 5 bags		
		Grout Material: CONCRETE from to 4 ft. 3 bags		
<p>Input Date: 02/13/2013 X: 518341 Y: 5010954</p>		Nearest Known Source of Contamination _feet _direction _type		
		Well disinfected upon completion? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
		Pump <input type="checkbox"/> Not Installed Date Installed		
		Manufacturer's name Model number HP Volts Length of drop Pipe ft. Capacity g.p.m. Type Material		
<p>First Bedrock St.Lawrence Formation Last Strat St.Lawrence Formation</p>		Abandoned Wells Does property have any not in use and not sealed well(s)? <input type="checkbox"/>		
		Yes <input type="checkbox"/> No		
		Variance Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
		Well Contractor Certification		
<p>Aquifer St.Lawrence Depth to Bedrock 79 ft.</p>		<p>Braun Intertec Corp. 1323 MCLEAN S. License Business Name Lic. Or Reg. No. Name of Driller</p>		
<p>County Well Index Online Report</p>		<p>772850</p>		<p>Printed 5/16/2013 HE-01205-07</p>

P-2

Minnesota Unique Well No. 796263	County Washington
Quad Scandia	Quad ID 134D

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103I

Entry Date 04/24/2013
Update Date 05/16/2013
Received Date 02/25/2013

Well Name ZAVORAL, DR. JAMES Township Range Dir Section Subsections Elevation 32 19 W 18 CBDDBD Elevation Method	891 ft. LIDAR 1m DEM (MNDNR)	Well Depth 110 ft.	Depth Completed 110 ft.	Date Well Completed 01/18/2013
Well Address 95 & 97 HY SCANDIA MN		Drilling Method Vibracore/rotasonic		
Geological Material		Drilling Fluid Water	Well Hydrofractured? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No From Ft. to Ft.	
TOP SOIL	BROWN SOFT 0 1	Use Piezometer		
SAND & GRAVEL	BROWN SOFT 1 9	Casing Type Steel (black or low carbon) Joint Threaded Drive Shoe? <input type="checkbox"/>		
BOULDER/SAND	BROWN MEDIUM 9 21	Yes <input checked="" type="checkbox"/> No Above/Below ft.		
LIMESTONE	TAN HARD 21 33	Casing Diameter	Weight	Hole Diameter
SANDSTONE	TAN HARD 33 110	2 in. to 100 ft.	2.65 lbs./ft.	7 in. to 110 ft.
		Open Hole from ft. to ft.		
		Screen YES Make JOHNSON Type stainless steel		
		Diameter	Slot/Gauze	Length Set Between
		2	10	10 100 ft. and 110 ft.
		Static Water Level 91 ft. from Land surface Date Measured 01/18/2013		
		PUMPING LEVEL (below land surface) ft. after hrs. pumping g.p.m.		
		Well Head Completion Pitless adapter manufacturer Model . <input checked="" type="checkbox"/> Casing Protection Y <input type="checkbox"/> 12 in. above grade <input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)		
REMARKS GROUT - FINE SAND 88-90'		Grouting Information Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
Located by: Minnesota Geological Survey Method: Digitization (Screen) - Map (1:24,000)		Grout Material: Bentonite from 86 to 88 ft. 1		
Unique Number Verification: Info/GPS from data source Input Date: 05/14/2013		Grout Material: Other from 88 to 90 ft. 1		
System: UTM - Nad83, Zone15, Meters X: 518079 Y: 5011532		Grout Material: Neat Cement from to 86 ft. 20 bags		
		Nearest Known Source of Contamination _feet _direction _type		
		Well disinfected upon completion? <input type="checkbox"/> Yes <input type="checkbox"/> No		
		Pump <input type="checkbox"/> Not Installed Date Installed Manufacturer's name Model number __ -HP _ Volts Length of drop Pipe ft. Capacity g.p.m. Type Material		
		Abandoned Wells Does property have any not in use and not sealed well(s)? <input type="checkbox"/>		
		Yes <input checked="" type="checkbox"/> No		
		Variance Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
First Bedrock Prairie Du Chien/Oneota Fm		Well Contractor Certification		
Last Strat Jordan Sandstone		Mark J Traut Wells, Inc. 1404 STEBBINS, N.		
Aquifer Jordan		License Business Name Lic. Or Reg. No. Name of Driller		
Depth to Bedrock 21 ft.				
County Well Index Online Report		796263		Printed 5/16/2013 HE-01205-07

Minnesota Unique Well No.

263147

County Washington
 Quad Scandia
 Quad ID 134D

Trails End

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
 Minnesota Statutes Chapter 103I

Entry Date 06/10/2009
 Update Date 01/16/2013
 Received Date

Well Name TRAIL'S END BAR & GRILL 1		Well Depth	Depth Completed	Date Well Completed
Township Range Dir Section Subsections Elevation		0 ft.	0 ft.	0
32	19 W 18 CCBCA	Elevation Method		
Elevation Method		7.5 minute topographic map (+/- 5 feet)		
Well Address		Drilling Fluid		
16297 SCANDIA TR N		-		
SCANDIA MN 55073		Well Hydrofractured? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Geological Material		From To		
Color		Hardness		
Use		Public Supply/non-comm.-transient PWS ID 5820505 Source S01		
Casing Type		Joint No Information Drive Shoe? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Above/Below		ft.		
Casing Diameter		Weight		Hole Diameter
Open Hole		from ft. to ft.		
Screen		Make Type		
Diameter		Slot/Gauze		Length Set Between
Static Water Level		ft. from Date Measured		
PUMPING LEVEL (below land surface)		ft. after hrs. pumping g.p.m.		
Well Head Completion		Pitless adapter manufacturer Model		
<input type="checkbox"/> Casing Protection		<input type="checkbox"/> 12 in. above grade		
<input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)				
REMARKS		Grouting Information Well Grouted? <input type="checkbox"/> Yes <input type="checkbox"/> No		
RESTAURANT BURNT DOWN WELL STILL THERE-PAT SARAFOLEAN-MDH. NO WELL RECORD.		Nearest Known Source of Contamination		
Located by:		0 feet direction type		
Method: GPS SA Off (averaged)		Well disinfected upon completion? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Unique Number Verification: Info/GPS from data source		Pump <input type="checkbox"/> Not Installed Date Installed		
Input Date: 06/10/2009		Manufacturer's name Model number HP Volts		
System: UTM - Nad83, Zone15, Meters		Length of drop Pipe ft. Capacity g.p.m. Type Material		
X: 517783 Y: 5011413		Abandoned Wells Does property have any not in use and not sealed well(s)? <input type="checkbox"/>		
Yes <input type="checkbox"/> No		Variance Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input type="checkbox"/> No		
First Bedrock		Well Contractor Certification		
Last Strat		License Business Name Lic. Or Reg. No. Name of Driller		
Aquifer		Depth to Bedrock ft.		
County Well Index Online Report		263147		Printed 1/17/2014 HE-01205-07

Supply well

Minnesota Unique Well No.
210498

County Washington
Quad Scandia
Quad ID 134D

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
Minnesota Statutes Chapter 103!

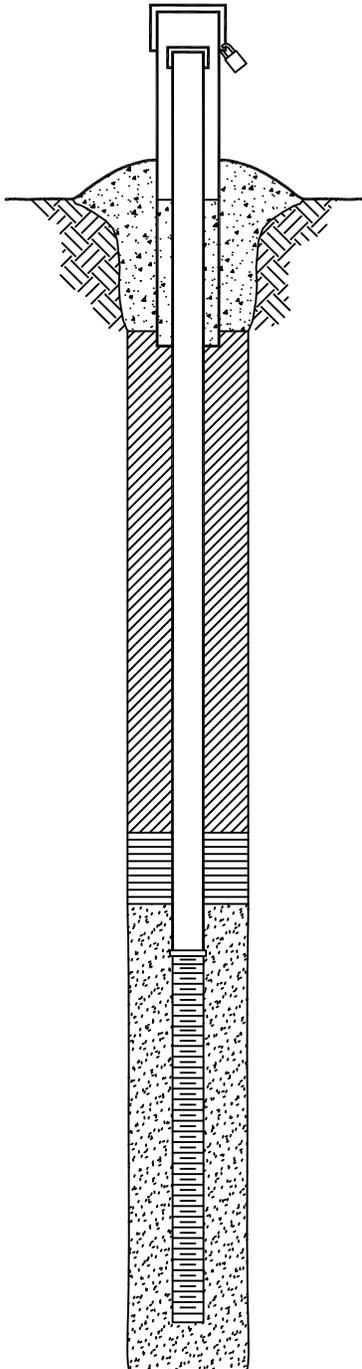
Entry Date 03/01/1989
Update Date 08/21/2012
Received Date

Well Name BARTON CONSTRUCTION CO.		Well Depth 648 ft.	Depth Completed 648 ft.	Date Well Completed 06/18/1969
Township Range Dir Section Subsections Elevation 880 ft. 32 19 W 18 CDBDDA Elevation Method 7.5 minute topographic map (+/- 5 feet)		Drilling Method Cable Tool		
Well Address CANDIA MN		Drilling Fluid -	Well Hydrofractured? <input type="checkbox"/> Yes <input type="checkbox"/> No From Ft. to Ft.	
Geological Material		Use Commercial		
DRIFT	Color	Hardness	From	To
SANDSTONE	BROWN		0	110
SHALEY SANDSTONE	GREEN		110	155
GREY SHALE - SANDSTONE			155	250
GREEN SHALE - SANDSTONE			250	280
SHALE	GRAY		280	330
SHALEY SANDSTONE	GREEN		330	360
SHALE	GREEN		360	425
COARSE SANDSTONE	GREEN		425	435
STICKY SHALE			435	500
SANDSTONE	BROWN		500	505
SANDSTONE	WHITE		505	515
SANDSTONE			515	535
SANDSTONE			535	570
RED SHALE	RED		570	590
SANDSTONE			590	595
			595	648
Casing Type Steel (black or low carbon) Joint No Information Drive Shoe? <input type="checkbox"/>		Yes <input type="checkbox"/> No Above/Below ft.		
Casing Diameter		Weight	Hole Diameter	
20 in. to 179 ft.		lbs./ft.		
16 in. to 245 ft.		lbs./ft.		
Open Hole from 245 ft. to 648 ft.				
Screen NO Make Type				
Diameter		Slot/Gauze	Length	Set Between
Static Water Level 91.3 ft. from Land surface Date Measured 06/18/1969				
PUMPING LEVEL (below land surface) ft. after hrs. pumping g.p.m.				
Well Head Completion Pitless adapter manufacturer Model <input type="checkbox"/> Casing Protection <input type="checkbox"/> 12 in. above grade <input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)				
NO REMARKS		Grouting Information Well Grouted? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Located by: Minnesota Geological Survey		Method: Digitized - scale 1:24,000 or larger (Digitizing Table)		
Unique Number		Input Date: 01/01/1990		
Verification: Information from owner				
System: UTM - Nad83, Zone15, Meters X: 518299 Y: 5011351		Nearest Known Source of Contamination _feet _direction _type		
		Well disinfected upon completion? <input type="checkbox"/> Yes <input type="checkbox"/> No		
		Pump <input type="checkbox"/> Not Installed Date Installed		
		Manufacturer's name Model number HP Volts		
		Length of drop Pipe ft. Capacity g.p.m. Type Material		
		Abandoned Wells Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input type="checkbox"/> No		
		Variance Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input type="checkbox"/> No		
First Bedrock Jordan Sandstone		Well Contractor Certification		
Last Strat Mt.Simon Sandstone		Tri-state Well Co. 27118 BENEKE, R.		
Aquifer Franconia-MtSimon		License Business Name Lic. Or Reg. No. Name of Driller		
Depth to Bedrock 110 ft.				
County Well Index Online Report		210498		Printed 1/17/2014 HE-01205-07

MONITORING WELL FIELD DATA SHEET

Client _____ Project Number _____ Location _____
 Well Number _____ Well Location _____ Date of installation _____
 B.M. Location and Elevation (±0.01') _____
 Crew _____ Geologist _____

Stick up (±0.1') _____
 Top of Riser Pipe Elevation (±0.01' Without Cap) _____
 Ground Surface Elevation (±0.1') _____
 Depth to Bottom of Surface Seal _____
 Approximate Water Level Before Installation _____
 Approximate Depth to First Water Encountered in Drilling _____
 Depth to Top of Seal _____
 Depth to Bottom of Seal _____
 Depth to Top of Screen _____
 Depth to Bottom of Screen _____
 Depth to Bottom of Boring _____



PROTECTIVE COVER:
 Type _____
 Length _____
 Lock No. _____

Concrete Surface Seal Yes No

Type of Grout Material _____

Amount of Material Used (lb.) _____

Proportions: Bentonite _____ Cement _____

RISER PIPE:
 Type _____
 Diameter _____
 Total Length _____
 Sections Used _____
 Couplings _____
 Cap Yes No

Type of Seal Material _____

Amount of Material Used (lb.) _____

Type of Filter Material _____

Amount of Material Used (lb.) _____

SCREEN:
 Type _____
 Slot Size _____
 Length _____
 Diameter _____
 Plug/Point _____

REMARKS: _____

COMPLETED BY: _____

METHOD OF ADVANCE:
 HSA _____ I.D. _____
 Casing _____ I.D. _____
 Tricone _____ O.D. _____

MONITORING WELL FIELD DATA SHEET

Client _____ Project Number _____ Location _____
 Well Number _____ Well Location _____ Date of installation _____
 B.M. Location and Elevation (±0.01') _____
 Crew _____ Geologist _____

Stick up (±0.1') _____

Top of Riser Pipe Elevation
(±0.01' Without Cap) _____

Ground Surface Elevation (±0.1') _____

Depth to Bottom of Surface Seal _____

Approximate Water Level
Before Installation _____

Approximate Depth to First
Water Encountered in
Drilling _____

Depth to Top of Seal _____

Depth to Bottom of Seal _____

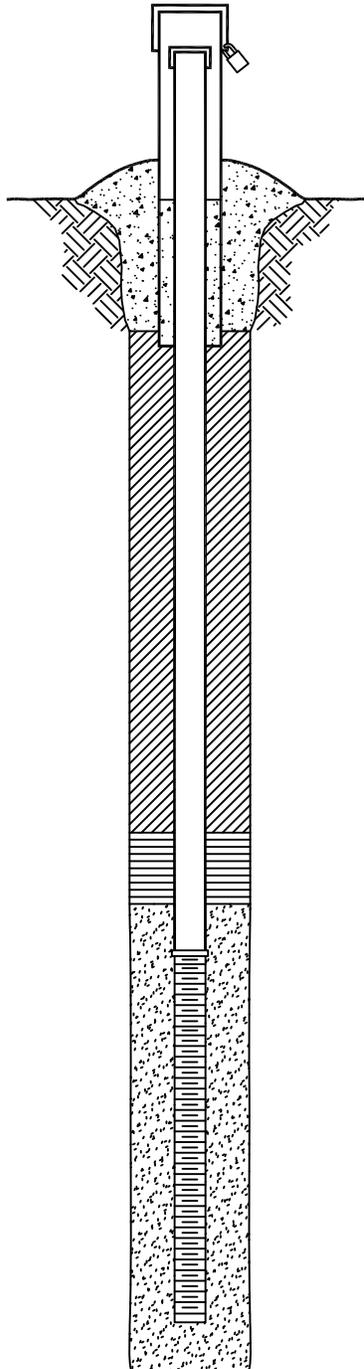
Depth to Top of Screen _____

Depth to Bottom of Screen _____

Depth to Bottom of Boring _____

METHOD OF ADVANCE:

HSA _____ I.D. _____
 Casing _____ I.D. _____
 Tricone _____ O.D. _____



PROTECTIVE COVER:

Type _____
 Length _____
 Lock No. _____

Concrete Surface Seal Yes No

Type of Grout Material _____

Amount of Material Used (lb.) _____

Proportions: Bentonite _____ Cement _____
 (100 lbs) (500 lbs)

RISER PIPE:

Type Black Iron
 Diameter _____
 Total Length _____
 Sections Used _____
 Couplings _____
 Cap Yes No

Type of Seal Material _____

Amount of Material Used (lb.) 50 lbs

Type of Filter Material _____

Amount of Material Used (lb.) 150 lbs

SCREEN:

Type _____
 Slot Size _____
 Length 15'
 Diameter _____
 Plug/Point _____

REMARKS:

COMPLETED BY: _____

Well Construction

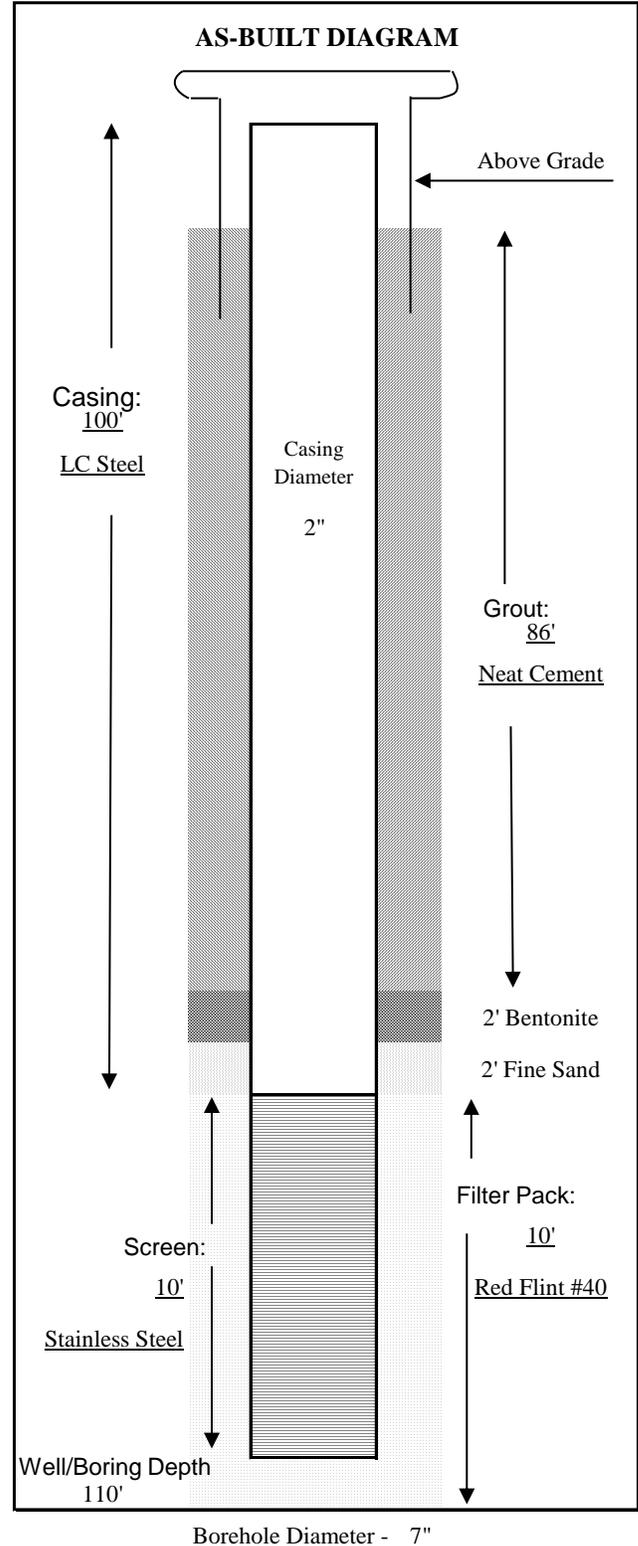
Project Name Zavoral Pit # 744
 Location HWY 95 & 97, Sandia MN
 Engineer/Client Tiller Corp.
 Date Completed 1/18/2013

Job Number 809198
 Well/Boring Name Piezometer
 Unique Number 796263
 Driller Nate S Assistant Drew & Andy

Well\Boring Depth 110'
 Drilling Method Roto Sonic
 Drilling Fluid Water
 Borehole Diameter 7"
 Static Water Level 91'
 Screen Material Stainless Steel
 Screen Length 10'
 Casing Material LC Steel
 Casing Length 100'
 Casing Diameter 2"
 Filter Pack Used Red Flint #40
 Filter Pack Interval 10'
 Grout Material Neat Cement
 Grouting Interval 86'
 Grouting Method Tremie Pipe
 Protective Pipe (if Used) 6" Pro Top

Visual Geology Classification:

Material	Color	Hardness	From	To
Top Soil	Brown	S	0	1
Sand & Gravel	Brown	S	1	9
Boulder / Sand	Brown	M	9	21
Limestone	Tan	H	21	33
Sanstone	Tan	H	33	110



ATTACHMENT 2
PACE ANALYICAL REPORT



Pace Analytical Services, Inc.
1700 Elm Street, Suite 200
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444
www.pacelabs.com

September 16, 2013

Mr. Mike Caron
Barton Sand and Gravel
P.O. Box 1480
Maple Grove, MN 55311-6480

RE: Pace Project No. 13-0754
Client Project ID: Barton Sand and Gravel- Scandia Pit 744 (Zavoral)

Dear Mr. Caron:

Enclosed are the analytical results for the sample(s) received by the laboratory on September 10, 2013 for the annual sampling and analysis at the Zavoral site (Pit 744). DRO results were ND at MW-1 (Well I.D. # 772842). Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report.

If you have any questions concerning this report please feel free to contact me.

Sincerely,

David Anderson
Project Manager
612-607-6377

State of Minnesota Laboratory No. 027-053-137



Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

September 16, 2013

Mr. David Anderson
Pace Analytical Services, Inc.
1700 Elm Street
Suite 200
Minneapolis, MN 55414

RE: Project: 13-0754 Barton Sand and Gravel
Pace Project No.: 10241461

Dear Mr. Anderson:

Enclosed are the analytical results for sample(s) received by the laboratory on September 10, 2013. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Nicole Benjamin

nicole.benjamin@pacelabs.com
Project Manager

Enclosures



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: 13-0754 Barton Sand and Gravel
Pace Project No.: 10241461

Minnesota Certification IDs

1700 Elm Street SE Suite 200, Minneapolis, MN 55414
A2LA Certification #: 2926.01
Alaska Certification #: UST-078
Alaska Certification #MN00064
Arizona Certification #: AZ-0014
Arkansas Certification #: 88-0680
California Certification #: 01155CA
Colorado Certification #Pace
Connecticut Certification #: PH-0256
EPA Region 8 Certification #: Pace
Florida/NELAP Certification #: E87605
Georgia Certification #: 959
Hawaii Certification #Pace
Idaho Certification #: MN00064
Illinois Certification #: 200011
Kansas Certification #: E-10167
Louisiana Certification #: 03086
Louisiana Certification #: LA080009
Maine Certification #: 2007029
Maryland Certification #: 322
Michigan DEQ Certification #: 9909
Minnesota Certification #: 027-053-137

Mississippi Certification #: Pace
Montana Certification #: MT CERT0092
Nebraska Certification #: Pace
Nevada Certification #: MN_00064
New Jersey Certification #: MN-002
New York Certification #: 11647
North Carolina Certification #: 530
North Dakota Certification #: R-036
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Certification #: MN200001
Oregon Certification #: MN300001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification
Tennessee Certification #: 02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Virginia/DCLS Certification #: 002521
Virginia/VELAP Certification #: 460163
Washington Certification #: C754
West Virginia Certification #: 382
Wisconsin Certification #: 999407970

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE SUMMARY

Project: 13-0754 Barton Sand and Gravel
Pace Project No.: 10241461

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10241461001	MW-1 (772842)	Water	09/10/13 09:45	09/10/13 11:46

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SAMPLE ANALYTE COUNT

Project: 13-0754 Barton Sand and Gravel
Pace Project No.: 10241461

Lab ID	Sample ID	Method	Analysts	Analytes Reported
10241461001	MW-1 (772842)	WI MOD DRO	JRH	2
		EPA 8260	SH2	7

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 13-0754 Barton Sand and Gravel
 Pace Project No.: 10241461

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
Sample: MW-1 (772842)								
Lab ID: 10241461001 Collected: 09/10/13 09:45 Received: 09/10/13 11:46 Matrix: Water								
Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO								
WIDRO GCS								
Diesel Range Organics	ND	mg/L	0.10	1	09/11/13 09:44	09/13/13 15:23		
Surrogates								
n-Triacontane (S)	83	%	50-150	1	09/11/13 09:44	09/13/13 15:23	638-68-6	
8260 MSV UST								
Analytical Method: EPA 8260								
Benzene	ND	ug/L	1.0	1		09/12/13 13:28	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		09/12/13 13:28	100-41-4	
Toluene	ND	ug/L	1.0	1		09/12/13 13:28	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		09/12/13 13:28	1330-20-7	
Surrogates								
1,2-Dichloroethane-d4 (S)	100	%	75-125	1		09/12/13 13:28	17060-07-0	
Toluene-d8 (S)	102	%	75-125	1		09/12/13 13:28	2037-26-5	
4-Bromofluorobenzene (S)	102	%	75-125	1		09/12/13 13:28	460-00-4	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 13-0754 Barton Sand and Gravel
Pace Project No.: 10241461

QC Batch: MSV/24919 Analysis Method: EPA 8260
QC Batch Method: EPA 8260 Analysis Description: 8260 MSV UST-WATER
Associated Lab Samples: 10241461001

METHOD BLANK: 1522812 Matrix: Water
Associated Lab Samples: 10241461001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	09/12/13 10:32	
Ethylbenzene	ug/L	ND	1.0	09/12/13 10:32	
Toluene	ug/L	ND	1.0	09/12/13 10:32	
Xylene (Total)	ug/L	ND	3.0	09/12/13 10:32	
1,2-Dichloroethane-d4 (S)	%	98	75-125	09/12/13 10:32	
4-Bromofluorobenzene (S)	%	103	75-125	09/12/13 10:32	
Toluene-d8 (S)	%	103	75-125	09/12/13 10:32	

LABORATORY CONTROL SAMPLE: 1522813

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	16.8	84	75-125	
Ethylbenzene	ug/L	20	17.0	85	75-125	
Toluene	ug/L	20	17.1	85	75-125	
Xylene (Total)	ug/L	60	52.0	87	75-125	
1,2-Dichloroethane-d4 (S)	%			100	75-125	
4-Bromofluorobenzene (S)	%			102	75-125	
Toluene-d8 (S)	%			103	75-125	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1522891 1522892

Parameter	Units	10241115019		1522891		1522892		% Rec	% Rec	% Rec Limits	Max RPD	Qual
		MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS Result	MSD Result					
Benzene	ug/L	ND	20	20	19.6	20.1	96	99	70-135	3	30	
Ethylbenzene	ug/L	ND	20	20	19.7	20.3	98	102	75-125	3	30	
Toluene	ug/L	ND	20	20	19.6	20.1	96	100	75-125	2	30	
Xylene (Total)	ug/L	ND	60	60	59.7	61.4	99	102	75-125	3	30	
1,2-Dichloroethane-d4 (S)	%						102	102	75-125			
4-Bromofluorobenzene (S)	%						103	102	75-125			
Toluene-d8 (S)	%						102	103	75-125			

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 13-0754 Barton Sand and Gravel
Pace Project No.: 10241461

QC Batch: OEXT/22950 Analysis Method: WI MOD DRO
QC Batch Method: WI MOD DRO Analysis Description: WIDRO GCS
Associated Lab Samples: 10241461001

METHOD BLANK: 1521580 Matrix: Water
Associated Lab Samples: 10241461001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Diesel Range Organics	mg/L	ND	0.10	09/13/13 10:10	
n-Triacontane (S)	%	89	50-150	09/13/13 10:10	

LABORATORY CONTROL SAMPLE & LCSD: 1521581

1521582

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Diesel Range Organics	mg/L	2	1.7	1.8	86	89	75-115	4	20	
n-Triacontane (S)	%				95	95	50-150			

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: 13-0754 Barton Sand and Gravel
Pace Project No.: 10241461

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PRL - Pace Reporting Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

WORKORDER QUALIFIERS

WO: 10241461

- [1] Samples were received outside of the recommended temperature range of 0-6 degrees Celsius. The samples were received from the field on ice, indicating the cool down process had begun.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 13-0754 Barton Sand and Gravel
Pace Project No.: 10241461

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10241461001	MW-1 (772842)	WI MOD DRO	OEXT/22950	WI MOD DRO	GCSV/12036
10241461001	MW-1 (772842)	EPA 8260	MSV/24919		

REPORT OF LABORATORY ANALYSIS

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Well Description and Presampling Information

Client: Barton Sand + Gravel / Project: PI+744 (Zovord) Project #: 13-0754

Monitoring Point ID MW-1 (772842) Labeled 772842

Inside Diameter 2 (inches) Key # 2106 Locked Not Locked

Casing Material: PVC Steel Stainless Steel

Depth Measurement and Elevations (from top of well casing)

Top of Casing Elevation 867.43 Feet

Well depth 92.44 Feet

Static water level measurement before purging 86.30 Feet

Static water level measurement at time of sampling 86.30 Feet

Static Water Level Elevation Before Purging 781.13 Feet

Purge Method 2" Grundfos rediflo sub pump

Date Purged 9-10-13 Water Column 6.14 Feet

Time Purged 0928-0934 One Casing Volume 1.0 Gallons

Pump Rate 0.5 GPM / LPM Volume Purged 3.0 Gallons

Field Sampling Data

Date Sampled 9-10-13

Time Sampled 0945

Sampling Equip. above pump

Analyzed by DJA

Field Parameter Measurements of Sample

pH 7.3 (units) D.O. NA (mg/l)

Spec. Cond. 500 (µmhos/cm) Turbidity NA (NTU)

Temp. 12.5 (°C) Eh NA (mV)

Other NA

Field Measurements Temp. Corrected: Yes No NA

Sample for Soluble Metals Filtered in Field: Yes No NA

Weather Conditions During Sampling: 72° + cloudy, wind E5

Sample Description: clear + odorless

Observations: DJA 9-10-13

Stabilization Test

Time	pH (units)	Specific Conductance (µmhos/cm)	Temp (°C)	D.O (mg/l)	Turbidity (NTU)	Eh (mV)	Volume Purged (cumulative gal)
0930	7.4	500	12.5	NA	NA	NA	1.0
0932	7.3	500	12.5	NA	NA	NA	2.0
0934	7.3	500	12.5	NA	NA	NA	3.0

Form Revised: 01/24/2012

Name/Affiliation of Sampler(s): David Anderson / Pace Analytical

Lead Technician Signature: David Anderson Date: 9-10-13

Client Name: Barton Sand and Gravel Project #: 13-0754

Project Description: Pit 744 (ZAVORD) Sept. 2013

pH Meter							
Date	Meter #	Technician	Calibration Buffer Results (s.u.)			Temp (°C)	Comments
9/10/13	sonde #4	DJA	4= 4.00	7= 7.00	10= 10.00	25.5	
			4=	7=	10=		
			4=	7=	10=		
4 Buffer (manufacturer / lot # / expiration date):			7 Buffer (manufacturer / lot # / expiration date):			10 Buffer (manufacturer / lot # / expiration date):	

Specific Conductance Meter					
Date	Meter #	Technician	Reference Standard (umhos/cm)	Meter Display (umhos/cm)	Comments
9/10/13	sonde #4	DJA	1000	1000	
Standard info (manufacturer / lot # / expiration date): <u>VSI / 12M100911 / EXP. 01/2014</u>					

Dissolved Oxygen Meter						
Date	Meter #	Technician	Temp (°C)	Barometric Pressure (mmHg)	D.O. Results (mg/L)	Comments

Redox Potential (Eh) Meter					
Date	Meter #	Technician	Reference Standard (mV)	Meter Display (mV)	Comments
Standard info (manufacturer / lot # / expiration date): <u>DJA 9/10/13</u>					

Temperature Probe or Thermometer					
Date	ID #	Technician	Reference Temp (°C)	Result (°C)	Comments
Performance check once per monitoring event. Reference thermometer info:					

Turbidity Meter					
Date	Meter #	Tech	Instrument Scaled to Reference Std. For Each Analysis (circle)		Comments
			Yes	No	
			Yes	No	
			Yes	No	
Standard info (manufacturer / lot # / expiration date):					

Form revised: 0211/08

Name/Affiliation of Sampler(s): David Anderson / Pace Analytical

Lead Technician Signature: David Anderson Date: 9-10-13

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CHAIN-OF-CUSTODY / Analytical Request Document

10241461



RUSH!

Section A
 Required Client Information:
 Company: Barton Sand and Gravel
 Address: E/o Pace MN Field
 E-mail To: _____
 Phone: _____ Fax: _____
 Project Name: 13-0754 Barton Sand
 Project Number: and gravel - Pi 344 (Zavara)
 Requested Date (M/D/Y): 5 Oct 17

Section B
 Invoice Information:
 Report To: David Anderson
 Copy To: _____
 Purchase Order No.: _____
 Project Name: 13-0754 Barton Sand
 Project Number: and gravel - Pi 344 (Zavara)

Section C
 Attention: C. J. Frittkie
 Company Name: _____
 Address: _____
 Pace Quote Reference: PJA
 Pace Project Manager: Nicole Benjamin
 Pace Profile #: _____

Section D
 Required Client Information:
 Matrix Codes: DW Drinking Water, WT Water, WW Waste Water, P Product, SL Soil, OL Oil, WP Wipe, AS Air, TS Tissue, OT Other.
 Matrix Code: _____
 Sample ID: MW-1 (772-842)M
 Sample IDs MUST BE UNIQUE

Section E
 Regulatory Agency: _____
 NPDES GROUND WATER DRINKING WATER
 UST RCRA OTHER

Section F
 Sub Location: _____
 State: _____

Section G
 Requested Analysis Filtered (Y/N)

ITEM #	MATRIX CODE	SAMPLE TYPE (G-GRAB G-COMP)	COLLECTED	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	RECEIVED BY / APPLICATION	DATE	TIME	RECEIVED BY / APPLICATION	DATE	TIME	Temp in °C	Received on	Custody	Sealed Cooler	Samples Intact
1	DW	G-GRAB	COMPOSITE START	9/16/09	7:22	9/16/09	11:43	9/16/09	11:43	9/16/09	11:43	David Anderson	9/16/09	11:43	David Anderson	9/16/09	11:43	8.4	Y	Y	Y	Y
2	WT	G-GRAB	COMPOSITE ENDGRAB																			
3	WW	G-GRAB																				
4	P	G-GRAB																				
5	SL	G-GRAB																				
6	OL	G-GRAB																				
7	WP	G-GRAB																				
8	AS	G-GRAB																				
9	TS	G-GRAB																				
10	OT	G-GRAB																				
11																						
12																						

Section H
 Preservatives:
 HCl: 3
 HNO₃: 3
 H₂SO₄: 3
 Unpreserved: 72
 # OF CONTAINERS: 72

Section I
 Other - (Pre-Check): NO
 Methanol: NO
 Na₂S₂O₈: NO
 NaOH: NO
 Analyte Test: NO
 Y/N: NO

Section J
 Residual Chlorine (Y/N): _____

Section K
 Page Project No./ Lab I.D.: _____

Section L
 SAMPLE CONDITIONS

Section M
 ADDITIONAL COMMENTS:
 * 5 DAY TAT on PRO. Barton Anderson Pro 9/16/09
 PATT on hold until PRO analysis is complete
 if PRO present, we will analyze for PATT. ORIGINAL

Section N
 SAMP LER NAME AND SIGNATURE
 PRINT Name of SAMPLER: David Anderson
 SIGNATURE of SAMPLER: David Anderson
 DATE Signed (MM/DD/YYYY): 9/16/09

Sample Condition Upon Receipt

Client Name: Berton Sand and Gravel **Project #:** WON 10241461

Courier: Fed Ex UPS USPS Dent
 Commercial Pace Other: _____



Tracking Number: _____

Custody Seal on Cooler/Box Present? Yes No **Seals Intact?** Yes No **Optional:** Proj. Due Date: _____ Proj. Name: _____

Packing Material: Bubble Wrap Bubble Bags None Other: _____ **Temp Blank?** Yes No

Thermom. Used: 88A912167504 80512447 72337080 **Type of Ice:** Wet Blue None Samples on ice, cooling process has begun

Cooler Temp Read (°C): 7.9 **Cooler Temp Corrected (°C):** 8.4 **Biological Tissue Frozen?** Yes No
Temp should be above freezing to 6°C **Correction Factor:** +1.5 **Date and Initials of Person Examining Contents:** 9/10/13 TN

Comments:

Chain of Custody Present?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	1.
Chain of Custody Filled Out?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	2.
Chain of Custody Relinquished?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	3.
Sampler Name and/or Signature on COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	4.
Samples Arrived within Hold Time?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	5.
Short Hold Time Analysis (<72 hr)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	6.
Rush Turn Around Time Requested?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	7.
Sufficient Volume?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	8.
Correct Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	9.
-Pace Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Containers Intact?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	10.
Filtered Volume Received for Dissolved Tests?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	11.
Sample Labels Match COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	12.
-Includes Date/Time/ID/Analysis Matrix: <u>WT</u>		
All containers needing acid/base preservation have been checked? Noncompliances are noted in 13.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO ₃ , H ₂ SO ₄ , HCl<2; NaOH>12)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Sample #
Exceptions: <u>VOA</u> Coliform, TOC, Oil and Grease, <u>WT-DRO (water)</u>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Initial when completed: <u>TN</u>
Headspace in VOA Vials (>6mm)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	Lot # of added preservative:
Trip Blank Present?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	14.
Trip Blank Custody Seals Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	15.
Pace Trip Blank Lot # (if purchased):		

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? Yes No

Person Contacted: _____ Date/Time: _____

Comments/Resolution: _____

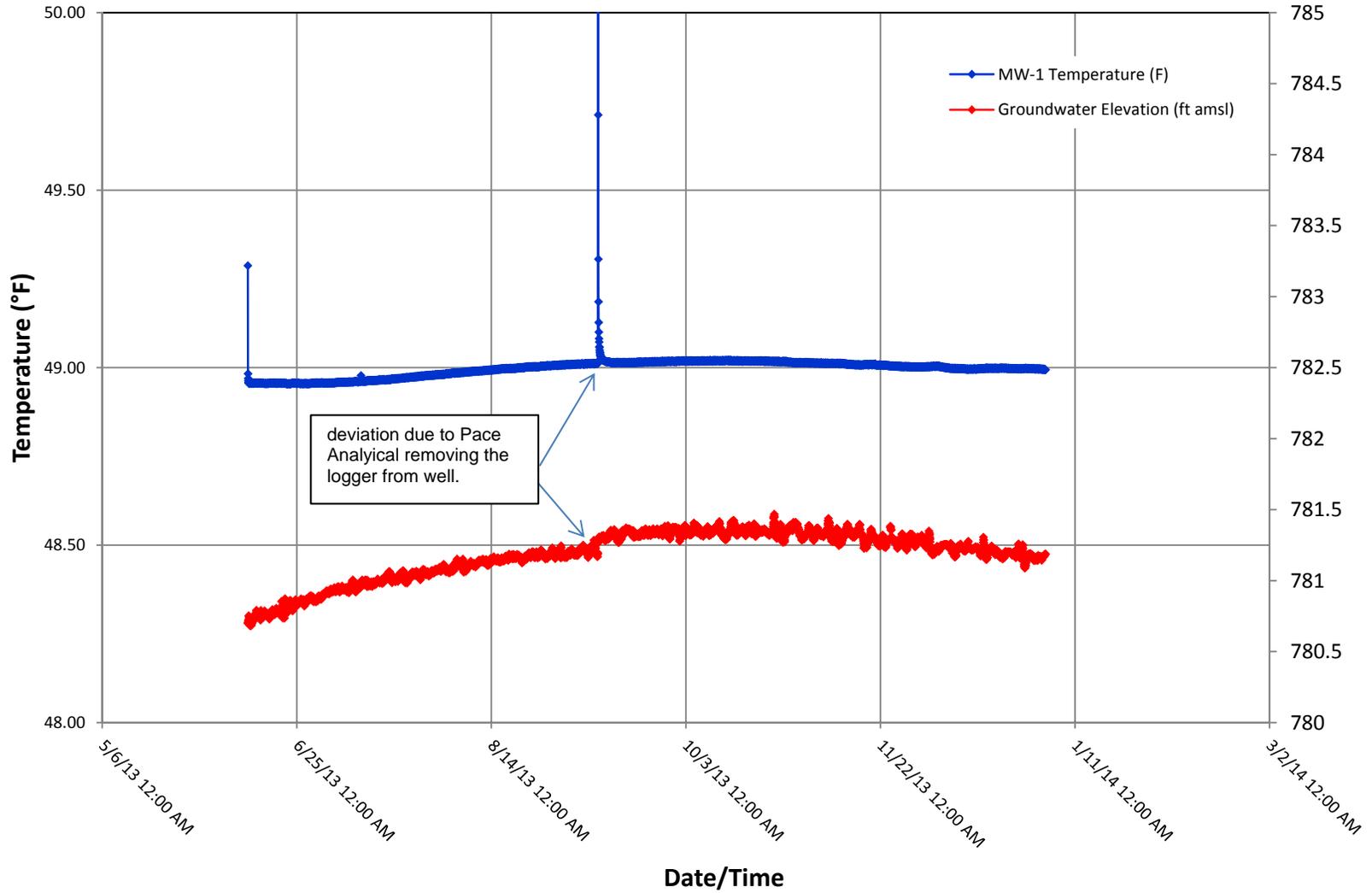
Project Manager Review:

Date: 9/11/13

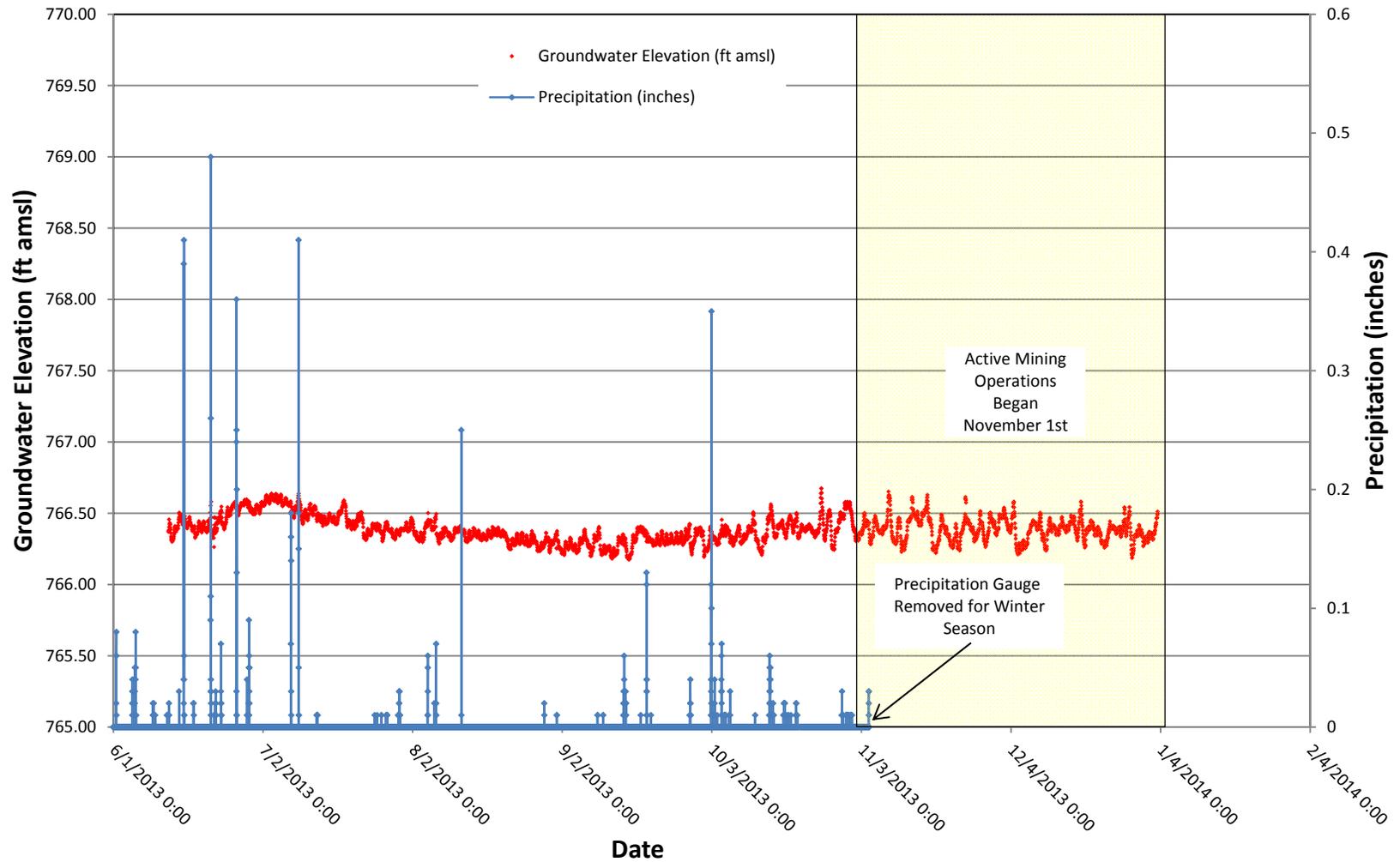
Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

ATTACHMENT 3
MONITORING WELL DATA PLOTS

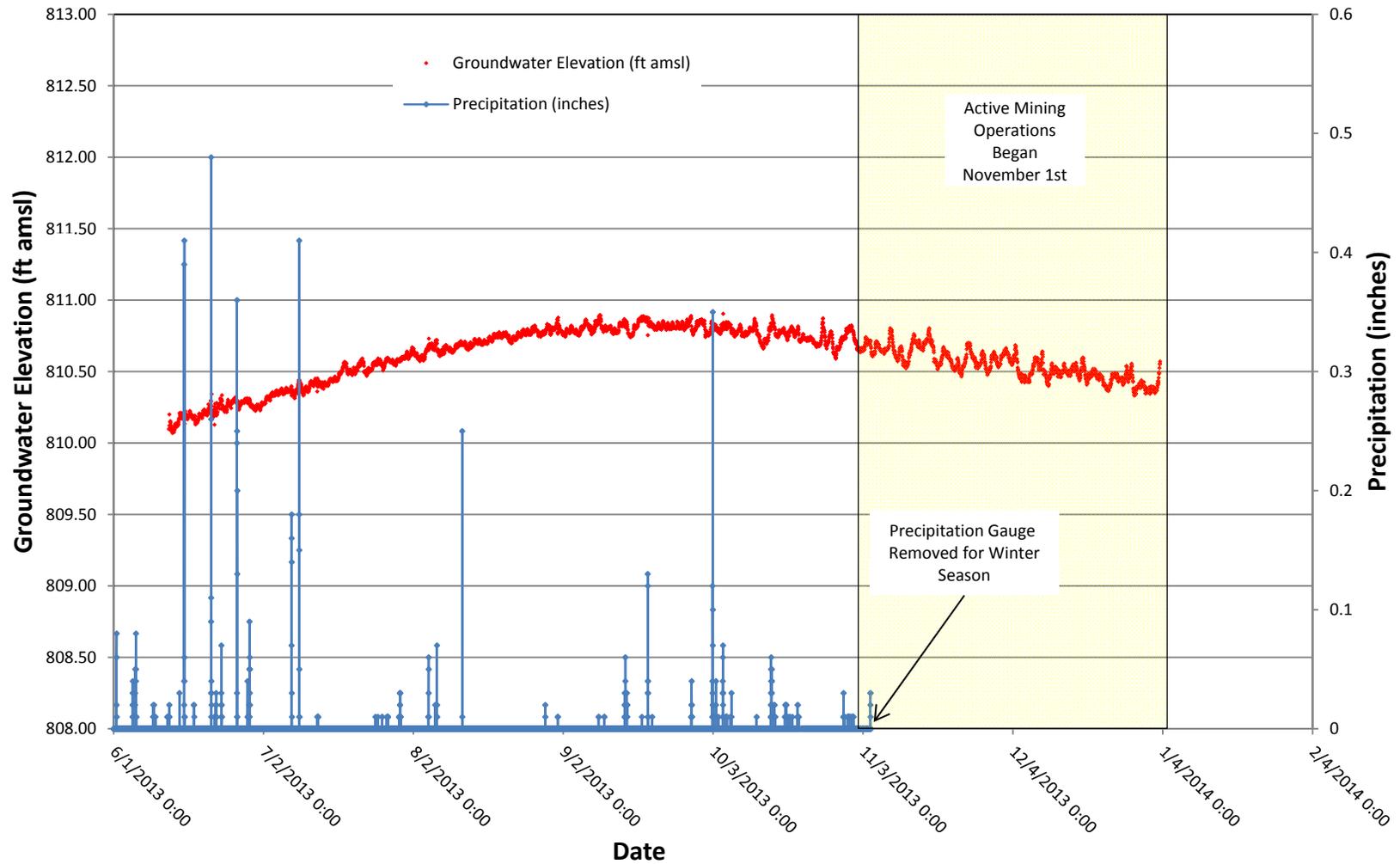
MW-1
Temperature and Groundwater Elevation vs. Time
Zavoral Aggregate Mine
Scandia, MN



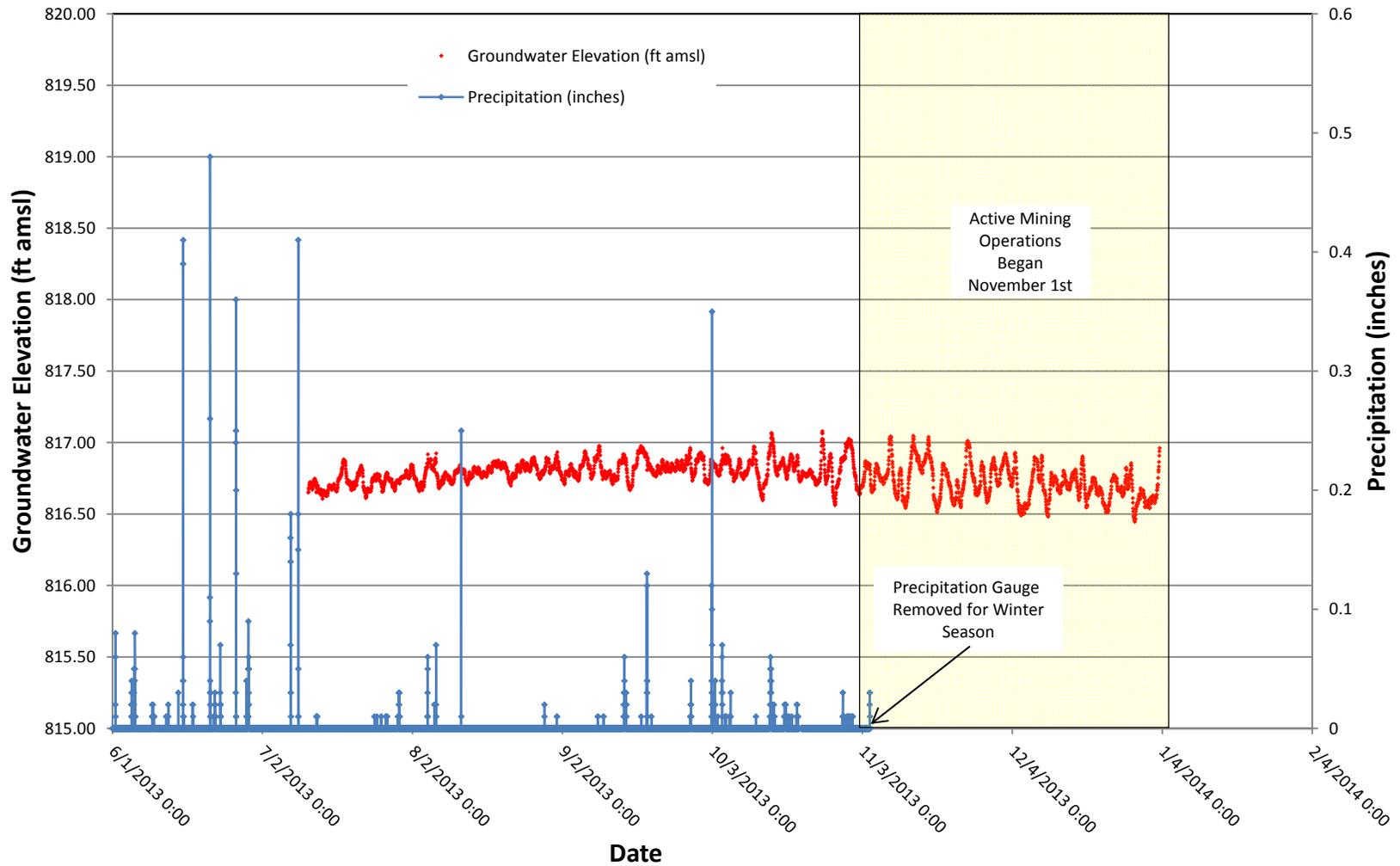
PZ-1
Groundwater Elevation (ft amsl) and Precipitation (inches) vs Time
Zavoral Mining and Reclamation Project
Scandia, MN



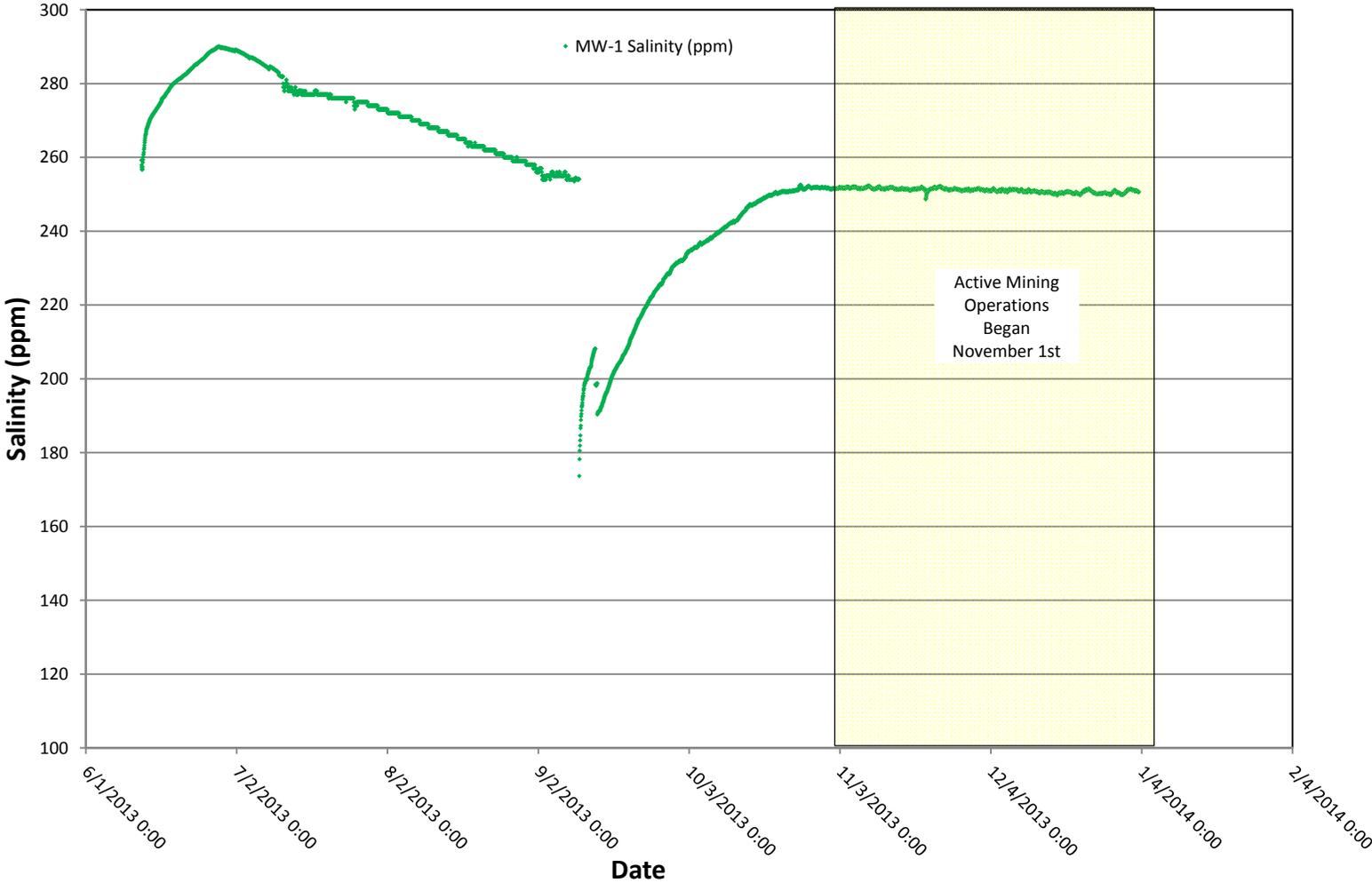
PZ-2
Groundwater Elevation (ft amsl) and Precipitation (inches) vs Time
Zavoral Mining and Reclamation Project
Scandia, MN



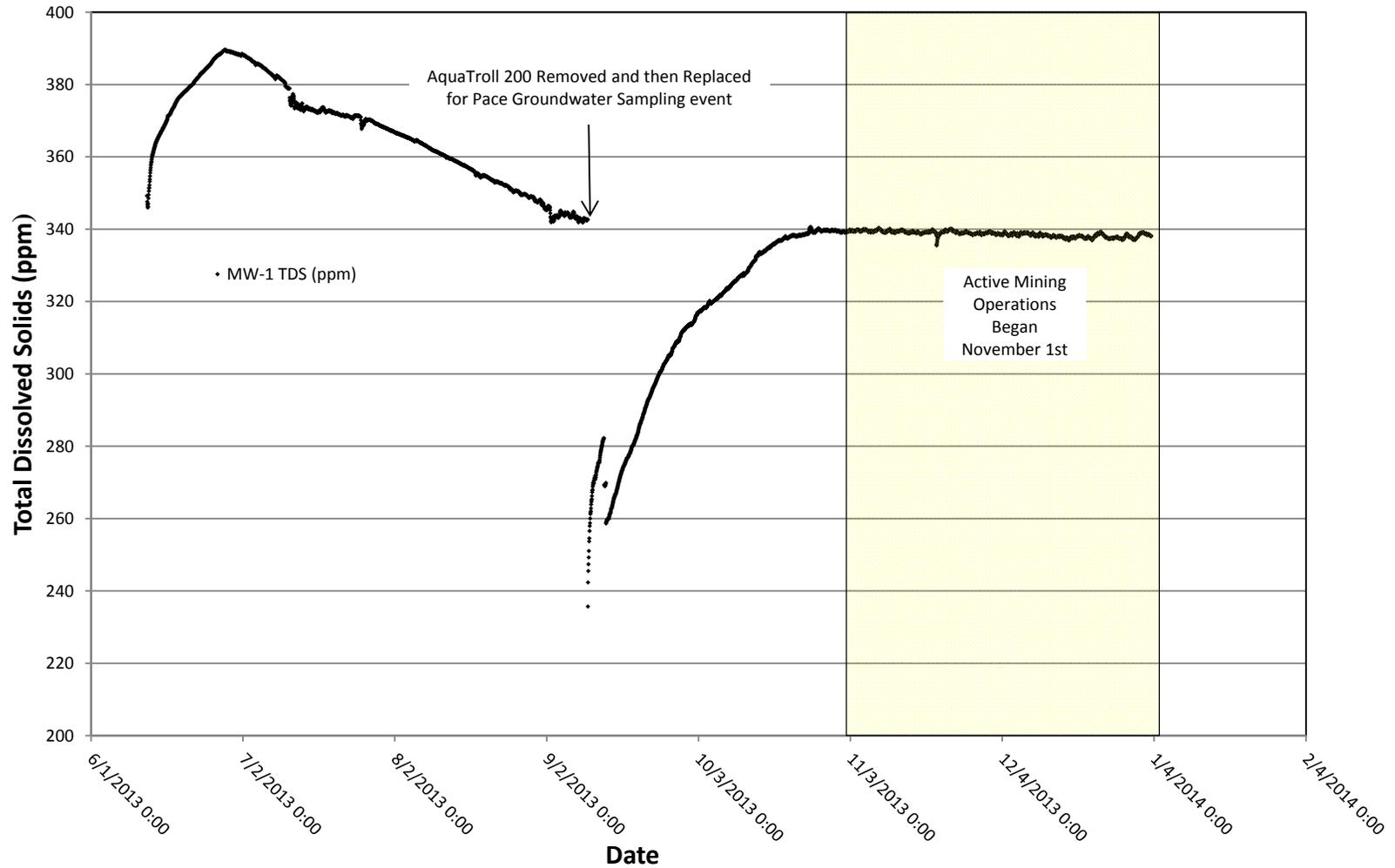
Trails End
Groundwater Elevation (ft amsl) and Precipitation (inches) vs Time
Zavoral Mining and Reclamation Project
Scandia, MN



**MW-1
Salinity (ppm) vs Time
Zavoral Mining and Reclamation Project
Scandia, MN**



MW-1
Total Dissolved Solids (ppm) vs Time
Zavoral Mining and Reclamation Project
Scandia, MN



MW-1
Conductivity (μS) and Resistivity (ohm-cm) vs Time
Zavoral Mining and Reclamation Project
Scandia, MN

