Memorandum

January 28, 2019

To:	Amanda Armbruster, MDEQ	Ref. No.:	007878
From:	Matthew Rousseau, GHD/kf/178	Tel:	519-340-4316
cc:	Dave Favero, RACER; John-Eric Pardys, GHD		

Subject: **Quench Pit Area – LNAPL**
RACER Trust Saginaw Malleable Industrial Land, Saginaw Michigan

1. Introduction

This memorandum summarizes the results of LNAPL transmissivity (T_n) at RACER's Saginaw Malleable Industrial Land (Site) in Saginaw, Michigan and provides recommendations for steps moving forward. Figure 1 presents a Site Plan.

The evaluation of T_n provides a standardized science-based method to quantify the potential mobility and recoverability of LNAPL at a given site that is a primary metric in MDEQ's Remediation and Redevelopment Divisions' Resource Materials-25-2014-01 *Non-Aqueous Phase Liquid (NAPL) Characterization, Remediation, and Management for Petroleum Releases*. The results of T_n testing can be compared against the MDEQ recommended de minimis criterion of 0.5 ft^2/day to assess the technical feasibility and potential value of LNAPL mass recovery efforts. Where T_n is found to be of de minimis magnitude, LNAPL is typically considered to be largely present at residual levels and hydraulically immobile/unrecoverable.

In September 2016, GHD abandoned the Quench Pit Area monitoring wells in preparation for the installation of a 1-foot cover over the entire concrete floor slab, which was approved by the MDEQ in a September 2, 2016 email (Attachment A). A subset of the monitoring wells that were abandoned were re-installed between June and August 2017, as approved by the MDEQ (Attachment A), following the installation of the cover. Pursuant to the MDEQ approved monitoring plan (Attachment A), GHD initiated quarterly gauging in Q3 – 2017. A summary of the quarterly gauging information is provided in Table 1. Table 1 also includes the historical gauging information for reference. Figure 2 presents the Quench Pit Area monitoring well locations. All water levels/LNAPL thicknesses were below the top of screen, with the exception of one location (QPTW-13R), during the Q1-2018 gauging event.

2. Methodology - T_n Testing

Consistent with MDEQ recommendations, wells were selected for testing where in-well thickness exceeding 0.2 feet was observed. Wells having no LNAPL or in-well LNAPL thickness less than 0.2 feet are assumed to represent a de minimis LNAPL transmissivity condition by default.

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The field methodology was performed consistent with the manual skimming technique detailed in ASTM International Standard E2856-13 *Standard Guide for Estimation of LNAPL Transmissivity*. The manual skimming procedure provides a method to quantify LNAPL recoverability through the estimation of LNAPL transmissivity based on LNAPL recovery rates observed during a test. The fundamental premise of the manual skimming technique is that LNAPL is removed from a well such that a relatively consistent level of LNAPL drawdown is maintained until a stabilized/consistent removal rate is observed. The basic field procedure was as follows:

1. The test well was gauged using an oil-water interface probe and initial depths to LNAPL and water recorded. The corresponding in-well LNAPL thickness was calculated.
2. As much of the LNAPL was initially purged from the test well using a peristaltic pump, taking care to minimize the amount of water removed with the LNAPL. Record the volume of LNAPL purged and the purging start and stop times.
3. The recharge of LNAPL into the well was monitored by periodically recording depths to LNAPL and water and time of measurement.
4. LNAPL was repeatedly removed from the well to maintain in-well thickness below 25 percent of its pre-purging value. Start and stop times for each purging event and volume of LNAPL purged were also recorded.
5. The recovery rate for each purge event was estimated by dividing the volume of LNAPL recovered during the purge event (typically in gallons) by the time from the end of the previous purge event to the end of the current purge event (typically in minutes).

The LNAPL recovery rates measured in the field were then used to estimate LNAPL transmissivity according to the following equation (ASTM 2013, Eq. 16):

$$T_n = \frac{Q_n \ln\left(\frac{R_{oi}}{r_w}\right)}{2\pi s_n} \quad (1)$$

Where:

T_n = LNAPL transmissivity (ft^2/day)

Q_n = Stabilized LNAPL recovery rate (ft^3/day)

R_{oi} = Radius of influence (ft)

r_w = Well radius (ft)

s_n = LNAPL drawdown, the geometric mean of LNAPL drawdown values measured/calculated that correspond to the LNAPL recovery rate range used in the calculations (see below)

Based on available historical well gauging data, GHD assumed the LNAPL is present in an unconfined setting given the apparent indirect relationship between in-well LNAPL thickness changes and fluctuations in the potentiometric surface (i.e., in-well LNAPL thickness increases with a rising potentiometric surface and vice versa). As such, the following calculation for LNAPL in an unconfined setting was used to estimate LNAPL drawdown (ASTM 2012):

$$S_{nt} = Z_{AN*} - Z_{ANt} \quad (2)$$

Where: S_{nt} = LNAPL drawdown at time t (feet)

Z_{AN*} = Elevation of air/LNAPL interface in well for equilibrium/pre-test conditions (ft)

Z_{ANt} = Elevation of air/LNAPL interface in well at time t (ft)

It is also noted that, pursuant to ASTM E2856-13, the $\ln(R_{oi}/r_w)$ term was assumed to equal 4.6 in the calculations.

3. Results – T_n Testing

Prior to the re-installation of monitoring wells in the Quench Pit Area, eight transmissivity tests were completed on five monitoring wells. Following re-installation of monitoring wells in the Quench Pit Area, three transmissivity tests were conducted at three monitoring wells, where sufficient thickness of product was gauged. The results of the transmissivity testing were provided to MDEQ previously. Table 2 presents a summary of the transmissivity testing completed at the Site and Attachment B presents a copy of the transmissivity results.

All transmissivity testing since 2016 have been less than the MDEQ de minimis LNAPL recoverability criterion of 0.5 ft^2/day. Wells that were not tested during a given test event either had insufficient LNAPL for testing or similar in-well LNAPL thicknesses compared with previously completed tests. It is noted that wells that had no LNAPL or less than 0.2 feet LNAPL thickness are also concluded to exhibit de minimis LNAPL transmissivity by default. Based on these results, the LNAPL in this area is concluded to be predominantly present as unrecoverable residual. Consequently, the mass recovery of LNAPL would not be considered technically feasible or expected to provide any technical benefit in terms of the mitigation of risk or migration potential.

4. Recommendation

The remaining concern with LNAPL appears to be limited to the potential for residual LNAPL sheen to enter active sewers that discharge to the on-Site stormwater pond. However, it is noted that no sheen has been observed in the on-Site stormwater pond since the demolition of the Plant (2010). Further, T_n testing since 2016 has demonstrated only de minimis T_n conditions.

As such GHD recommends that no additional T_n testing be performed and quarterly gauging and observations be reduced to annually.

List of Enclosures:

Figure 1 – Site Plan

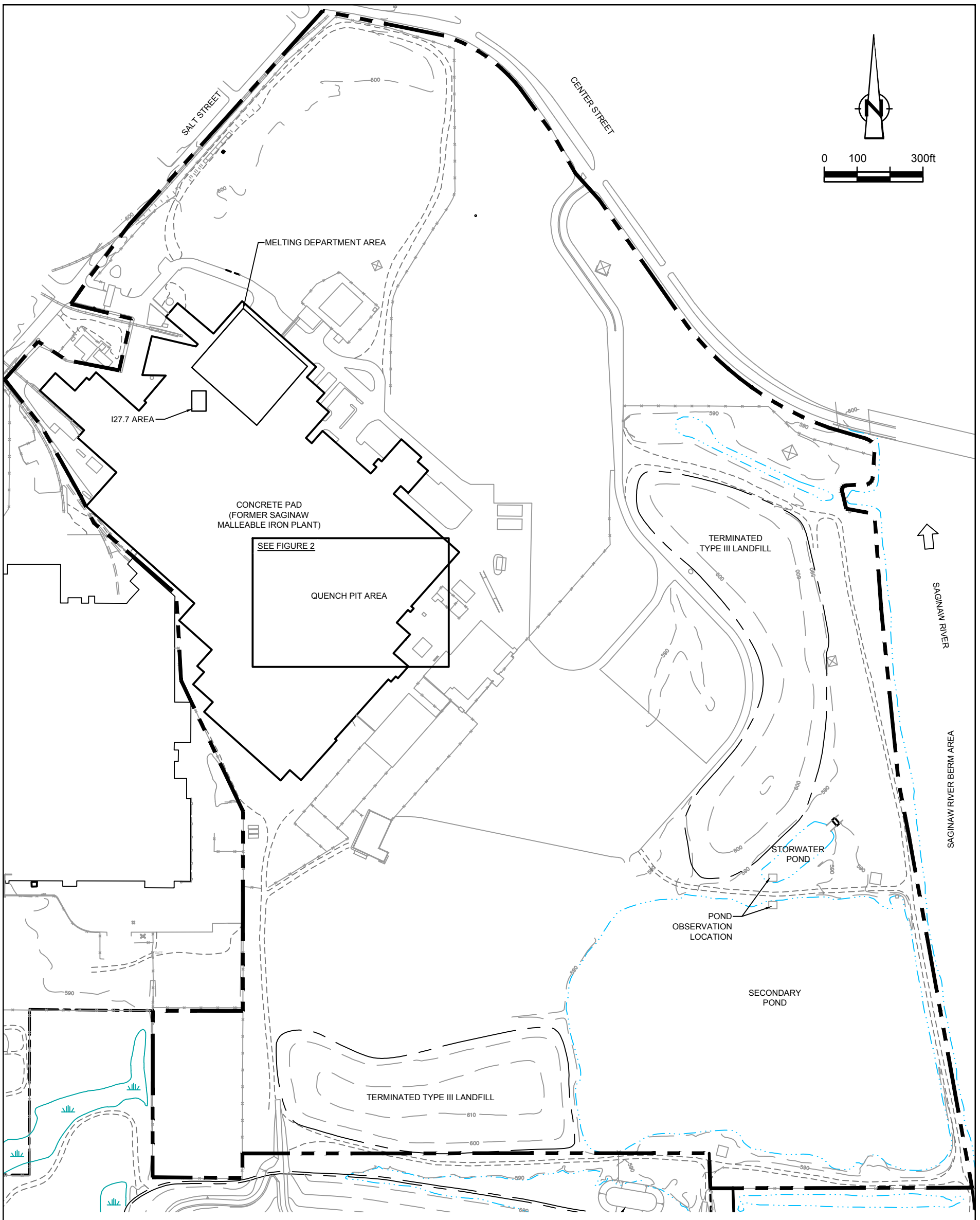
Figure 2 – Quench Pit Area – LNAPL Monitoring Program

Table 1 – Summary of Groundwater Gauging Data – Quench Pit Area

Table 2 – Summary of Transmissivity Testing – Quench Pit Area

Attachment A – MDEQ correspondence regarding Quench Pit Area Monitoring Program

Attachment B – LNAPL Transmissivity Testing Results



LEGEND

- RACER MALLEABLE IRON INDUSTRIAL LAND PROPERTY LINE (APPROX.)
- UNPAVED ROAD
- GROUND SURFACE ELEVATION CONTOUR (10 FT INTERVAL)
- FENCE LINE

NOTE:
THIS DRAWING HAS BEEN PREPARED
UTILIZING THE BEST AVAILABLE INFORMATION.

figure 1

SITE PLAN
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND
Saginaw, Michigan

P:\drawings\07000s\07878\07878-MEMO\07878-T05(MEMO178)\07878-T05(MEMO178)GN\07878-T05(MEMO178)GN-WA001.DWG Plot Date: JAN 25, 2019

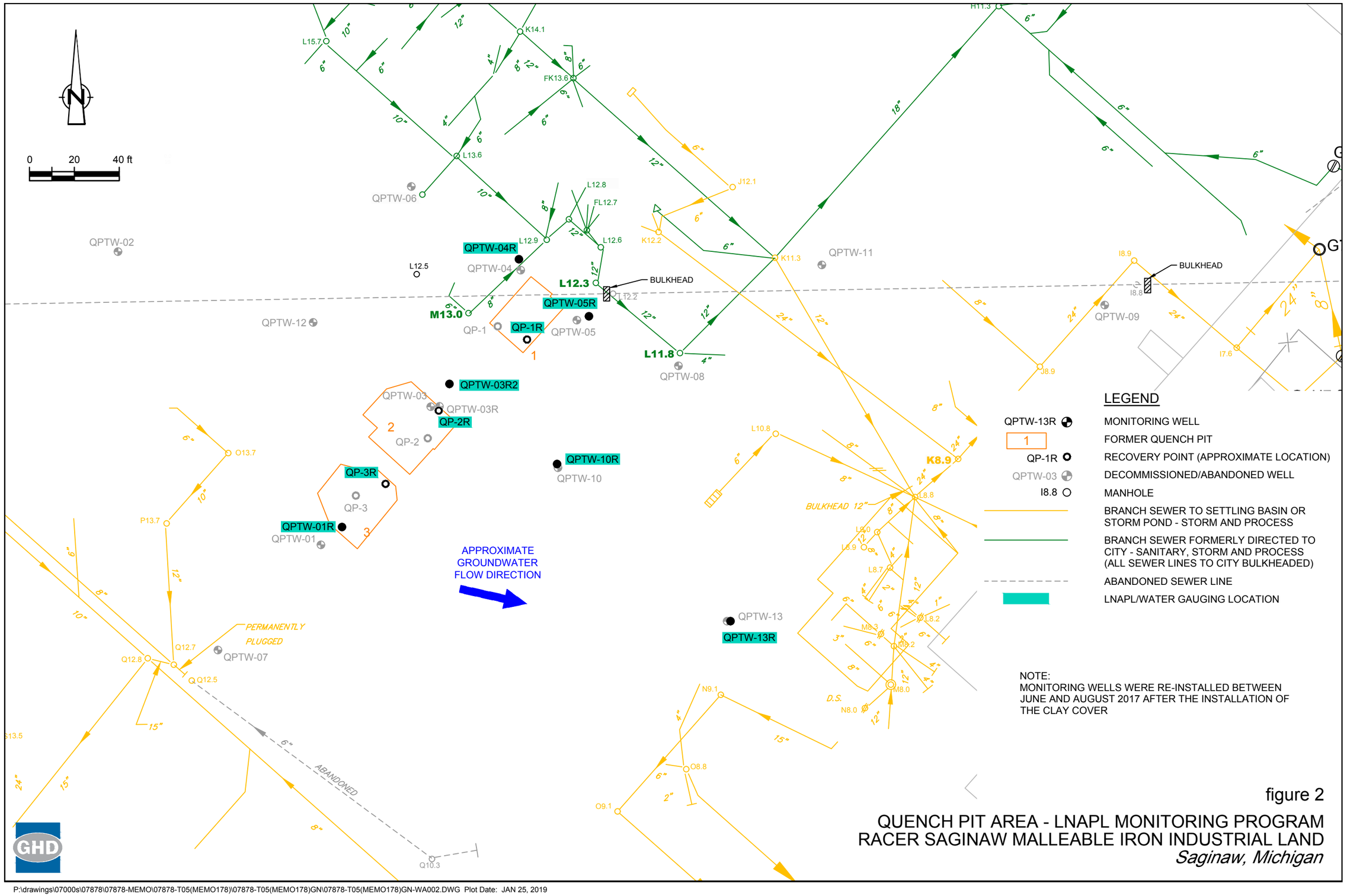


figure 2

QUENCH PIT AREA - LNAPL MONITORING PROGRAM
RACER SAGINAW MALLEABLE IRON INDUSTRIAL LAND
Saginaw, Michigan

P:\drawings\07000s\07878\07878-MEMO\07878-T05(MEMO178)\07878-T05(MEMO178)GN\07878-T05(MEMO178)GN-WA002.DWG Plot Date: JAN 25, 2019

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QPTW-01	03/17/05	592.3	591.95	2.85	12.85	10.48	7.28	3.20	584.29	7.66
	04/12/05	592.3	591.95	2.85	12.85	10.63	7.30	3.33	584.25	7.70
	05/31/05	592.3	591.95	2.85	12.85	10.69	7.36	3.33	584.19	7.76
	06/24/05	592.3	591.95	2.85	12.85	10.45	7.04	3.41	584.50	7.45
	08/12/05	592.3	591.95	2.85	12.85	10.20	6.95	3.25	584.61	7.34
	10/14/05	592.3	591.95	2.85	12.85	10.58	7.29	3.29	584.27	7.68
	11/08/05	592.3	591.95	2.85	12.85	10.82	7.44	3.38	584.10	7.85
	12/19/05	592.3	591.95	2.85	12.85	10.91	7.52	3.39	584.02	7.93
	01/31/06	592.3	591.95	2.85	12.85	10.53	7.29	3.24	584.27	7.68
	02/15/06	592.3	591.95	2.85	12.85	10.46	7.21	3.25	584.35	7.60
	03/13/06	592.3	591.95	2.85	12.85	9.71	6.93	2.78	584.69	7.26
	04/10/06	592.3	591.95	2.85	12.85	10.02	7.04	2.98	584.55	7.40
	05/22/06	592.3	591.95	2.85	12.85	10.23	7.11	3.12	584.47	7.48
	06/21/06	592.3	591.95	2.85	12.85	10.22	7.05	3.17	584.52	7.43
	07/11/06	592.3	591.95	2.85	12.85	9.67	6.82	2.85	584.79	7.16
	08/23/06	592.3	591.95	2.85	12.85	9.99	6.78	3.21	584.78	7.17
	09/26/06	592.3	591.95	2.85	12.85	9.90	6.82	3.08	584.76	7.19
	10/30/06	592.3	591.95	2.85	12.85	9.62	6.83	2.79	584.79	7.16
	11/27/06	592.3	591.95	2.85	12.85	9.79	6.91	2.88	584.69	7.26
	12/27/06	592.3	591.95	2.85	12.85	9.97	6.96	3.01	584.63	7.32
	01/15/07	592.3	591.95	2.85	12.85	9.79	6.94	2.85	584.67	7.28
	02/21/07	592.3	591.95	2.85	12.85	10.35	7.29	3.06	584.29	7.66
	03/23/07	592.3	591.95	2.85	12.85	10.18	7.27	2.91	584.33	7.62
	04/09/07	592.3	591.95	2.85	12.85	10.39	7.25	3.14	584.32	7.63
	05/15/07	592.3	591.95	2.85	12.85	10.09	7.32	2.77	584.30	7.65
	06/11/07	592.3	591.95	2.85	12.85	10.36	7.47	2.89	584.13	7.82
	07/11/07	592.3	591.95	2.85	12.85	10.36	7.43	2.93	584.17	7.78
	08/16/07	592.3	591.95	2.85	12.85	10.41	7.48	2.93	584.12	7.83
	09/17/07	592.3	591.95	2.85	12.85	10.11	7.38	2.73	584.24	7.71
	11/26/07	592.3	591.95	2.85	12.85	10.62	7.64	2.98	583.95	8.00
	12/12/07	592.3	591.95	2.85	12.85	10.79	7.77	3.02	583.82	8.13
	01/11/08	592.3	591.95	2.85	12.85	10.32	7.56	2.76	584.06	7.89
	02/05/08	592.3	591.95	2.85	12.85	9.91	7.42	2.49	584.23	7.72
	04/11/08	592.3	591.95	2.85	12.85	8.41	6.60	1.81	585.13	6.82
	05/16/08	592.3	591.95	2.85	12.85	8.65	6.56	2.09	585.14	6.81
	10/29/08	592.3	591.95	2.85	12.85	8.71	6.39	2.32	585.28	6.67
	01/21/09	592.3	591.95	2.85	12.85	8.22	6.26	1.96	585.45	6.50
	03/18/09	592.3	591.95	2.85	12.85	***8.07***	***6.16***	1.91	585.56	6.39
	10/17/09	592.3	591.95	2.85	12.85	8.46	6.39	2.07	585.31	6.64
	10/23/09	592.3	591.95	2.85	12.85	8.07	6.34	1.73	585.40	6.55
	06/24/10	592.3	591.95	2.85	12.85	8.31	5.06	3.25	586.50	5.45
	07/08/10	592.3	591.95	2.85	12.85	8.88	4.62	4.26	586.82	5.13
	07/22/10	592.3	591.95	2.85	12.85	9.86	4.81	5.05	586.53	5.42
	07/29/10	592.3	591.95	2.85	12.85	8.27	5.11	3.16	586.46	5.49
	08/06/10	592.3	591.95	2.85	12.85	8.13	5.41	2.72	586.21	5.74
	08/13/10	592.3	591.95	2.85	12.85	6.83	4.04	2.79	587.58	4.37
	08/27/10	592.3	591.95	2.85	12.85	7.40	4.42	2.98	587.17	4.78
	09/23/10	592.3	591.95	2.85	12.85	5.54	3.05	2.49	588.60	3.35
	10/15/10	592.3	591.95	2.85	12.85	7.14	4.01	3.13	587.56	4.39
	10/29/10	592.3	591.95	2.85	12.85	6.90	3.99	2.91	587.61	4.34
	12/07/10	592.3	591.95	2.85	12.85	7.61	3.87	3.74	587.63	4.32
	03/18/11	592.3	591.95	2.85	12.85	6.57	3.54	3.03	588.05	3.90
	04/08/11	592.3	591.95	2.85	12.85	6.15	2.77	3.38	588.77	3.18
	05/09/11	592.3	591.95	2.85	12.85	5.98	3.11	2.87	588.50	3.45
	06/09/11	592.3	591.95	2.85	12.85	6.31	3.16	3.15	588.41	3.54
	07/05/11	592.3	591.95	2.85	12.85	5.62	3.31	2.31	588.36	3.59
	08/23/11	592.3	591.95	2.85	12.85	4.21	2.88	1.33	588.91	3.04
	10/14/11	592.3	591.95	2.85	12.85	5.72	3.81	1.91	587.91	4.04
	01/24/12	592.3	591.95	2.85	12.85	6.28	1.66	4.62	589.74	2.21
	03/20/12	592.3	591.95	2.85	12.85	5.41	2.67	2.74	588.95	3.00
	04/23/12	592.3	591.95	2.85	12.85	5.53	2.16	3.37	589.39	2.56
	06/11/12	592.3	591.95	2.85	12.85	6.72	2.87	3.85	588.62	3.33
	07/10/12	592.3	591.95	2.85	12.85	5.41	3.69	1.72	588.05	3.90
	08/29/12	592.3	591.95	2.85	12.85	5.75	3.04	2.71	588.58	3.37
	09/12/12	592.3	591.95	2.85	12.85	4.25	2.90	1.35	588.89	3.06
	11/06/12	592.3	591.95	2.85	12.85	4.06	3.04	1.02	588.79	3.16
	12/05/12	592.3	591.95	2.85	12.85	4.41	3.26	1.15	588.55	3.40
	04/03/13	592.3	591.95	2.85	12.85	4.91	3.37	1.54	588.40	3.55
	07/18/13	592.3	591.95	2.85	12.85	3.48	2.80	0.68	589.07	2.88
	09/23/13	592.3	591.95	2.85	12.85	4.34	3.74	0.60	588.14	3.81
	06/02/14	592.3	591.95	2.85	12.85	3.06	2.36	0.70	589.51	2.44
	07/09/14	592.3	591.95	2.85	12.85	2.92	1.07	1.85	590.66	1.29

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QPTW-01 (cont'd)	07/31/14	592.3	591.95	2.85	12.85	3.17	1.99	1.18	589.82	2.13
	09/16/14	592.3	591.95	2.85	12.85	3.31	2.27	1.04	589.56	2.39
	03/24/15	592.3	591.95	2.85	12.85	4.51	3.14	1.37	588.65	3.30
	06/17/15	592.3	591.95	2.85	12.85	3.31	1.25	2.06	590.45	1.50
	09/09/15	592.3	591.95	2.85	12.85	3.81	1.11	2.70	590.52	1.43
	12/04/15	592.3	591.95	2.85	12.85	4.70	3.48	1.22	588.32	3.63
	03/15/16	592.3	591.95	2.85	12.85	5.13	1.94	3.19	589.63	2.32
	06/17/16	592.3	591.95	2.85	12.85	2.23	1.17	1.06	590.65	1.30
	09/22/16	592.3	591.95	2.85	12.85	3.82	2.86	0.96	588.97	2.98
	09/27/16	ABANDONED								
QPTW-01R	09/06/17	594.69	594.49	2.00	12.00	4.14	---	---	590.35	4.14
	11/27/17	594.69	594.49	2.00	12.00	4.17	---	---	590.32	4.17
	02/27/18	594.69	594.49	2.00	12.00	3.66	---	---	590.83	3.66
	06/04/18	594.69	594.49	2.00	12.00	3.81	---	---	590.68	3.81
	10/05/18	594.69	594.49	2.00	12.00	4.13	---	---	590.36	4.13
	12/11/18	594.69	594.49	2.00	12.00	frozen	---	---	---	---
QPTW-02	03/17/05	592.6	592.35	2.80	12.80	7.54	7.51	0.03	584.84	7.51
	04/12/05	592.6	592.35	2.80	12.80	7.64	7.58	0.06	584.76	7.59
	05/31/05	592.6	592.35	2.80	12.80	7.54	7.50	0.04	584.85	7.50
	06/24/05	592.6	592.35	2.80	12.80	7.41	7.38	0.03	584.97	7.38
	08/12/05	592.6	592.35	2.80	12.80	7.30	7.26	0.04	585.09	7.26
	10/14/05	592.6	592.35	2.80	12.80	7.50	7.44	0.06	584.90	7.45
	11/08/05	592.6	592.35	2.80	12.80	7.52	7.49	0.03	584.86	7.49
	12/19/05	592.6	592.35	2.80	12.80	7.67	7.63	0.04	584.72	7.63
	01/31/06	592.6	592.35	2.80	12.80	7.53	7.48	0.05	584.86	7.49
	02/15/06	592.6	592.35	2.80	12.80	7.50	7.47	0.03	584.88	7.47
	03/13/06	592.6	592.35	2.80	12.80	7.30	7.26	0.04	585.09	7.26
	04/10/06	592.6	592.35	2.80	12.80	7.39	7.36	0.03	584.99	7.36
	05/22/06	592.6	592.35	2.80	12.80	7.38	7.35	0.03	585.00	7.35
	06/21/06	592.6	592.35	2.80	12.80	7.33	7.29	0.04	585.06	7.29
	07/11/06	592.6	592.35	2.80	12.80	7.29	7.26	0.03	585.09	7.26
	08/23/06	592.6	592.35	2.80	12.80	7.28	7.26	0.02	585.09	7.26
	09/26/06	592.6	592.35	2.80	12.80	7.39	7.37	0.02	584.98	7.37
	10/30/06	592.6	592.35	2.80	12.80	7.38	7.35	0.03	585.00	7.35
	11/27/06	592.6	592.35	2.80	12.80	7.41	7.38	0.03	584.97	7.38
	12/27/06	592.6	592.35	2.80	12.80	7.44	7.42	0.02	584.93	7.42
	01/15/07	592.6	592.35	2.80	12.80	7.46	7.42	0.04	584.93	7.42
	02/21/07	592.6	592.35	2.80	12.80	7.47	7.46	0.01	584.89	7.46
	03/23/07	592.6	592.35	2.80	12.80	7.42	7.40	0.02	584.95	7.40
	04/09/07	592.6	592.35	2.80	12.80	7.45	7.43	0.02	584.92	7.43
	05/15/07	592.6	592.35	2.80	12.80	7.50	7.48	0.02	584.87	7.48
	08/16/07	592.6	592.35	2.80	12.80	7.65	7.62	0.03	584.73	7.62
	09/17/07	592.6	592.35	2.80	12.80	7.51	7.48	0.03	584.87	7.48
	11/26/07	592.6	592.35	2.80	12.80	7.73	7.71	0.02	584.64	7.71
	12/12/07	592.6	592.35	2.80	12.80	7.76	7.74	0.02	584.61	7.74
	01/11/08	592.6	592.35	2.80	12.80	7.15	7.14	0.01	585.21	7.14
	02/05/08	592.6	592.35	2.80	12.80	7.27	7.26	0.01	585.09	7.26
	04/11/08	592.6	592.35	2.80	12.80	6.79	---	---	585.56	6.79
	05/16/08	592.6	592.35	2.80	12.80	7.30	---	---	585.05	7.30
	10/29/08	592.6	592.35	2.80	12.80	6.99	---	---	585.36	6.99
	01/21/09	592.6	592.35	2.80	12.80	6.53	---	---	585.82	6.53
	03/18/09	592.6	592.35	2.80	12.80	6.28	---	---	586.07	6.28
	10/17/09	592.6	592.35	2.80	12.80	6.93	---	---	585.42	6.93
	10/23/09	592.6	592.35	2.80	12.80	7.08	---	---	585.27	7.08
	10/15/10	592.6	592.35	2.80	12.80	5.23	---	---	587.12	5.23
	10/29/10	592.6	592.35	2.80	12.80	5.30	---	---	587.05	5.30
	03/18/11	592.6	592.35	2.80	12.80	3.96	---	---	588.39	3.96
	04/08/11	592.6	592.35	2.80	12.80	3.19	---	---	589.16	3.19
	05/09/11	592.6	592.35	2.80	12.80	3.47	---	---	588.88	3.47
	06/09/11	592.6	592.35	2.80	12.80	3.58	---	---	588.77	3.58
	07/05/11	592.6	592.35	2.80	12.80	3.79	---	---	588.56	3.79
	08/23/11	592.6	592.35	2.80	12.80	3.11	---	---	589.24	3.11
	10/14/11	592.6	592.35	2.80	12.80	4.04	---	---	588.31	4.04
	11/23/11	592.6	592.35	2.80	12.80	3.81	---	---	588.54	3.81
	03/20/12	592.6	592.35	2.80	12.80	2.77	---	---	589.58	2.77
	04/23/12	592.6	592.35	2.80	12.80	3.02	---	---	589.33	3.02
	06/11/12	592.6	592.35	2.80	12.80	3.22	---	---	589.13	3.22
	07/10/12	592.6	592.35	2.80	12.80	3.88	---	---	588.47	3.88
	08/29/12	592.6	592.35	2.80	12.80	3.22	---	---	589.13	3.22
	09/12/12	592.6	592.35	2.80	12.80	3.01	---	---	589.34	3.01
	10/01/12	592.6	592.35	2.80	12.80	3.79	---	---	588.56	3.79
	11/06/12	592.6	592.35	2.80	12.80	2.98	---	---	589.37	2.98
	12/05/12	592.6	592.35	2.80	12.80	3.61	---	---	588.74	3.61
	04/03/13	592.6	592.35	2.80	12.80	3.25	---	---	589.10	3.25
	07/18/13	592.6	592.35	2.80	12.80	2.59	---	---	589.76	2.59

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QPTW-02 (cont'd)	09/23/13	592.6	592.35	2.80	12.80	3.94	---	---	588.41	3.94
	04/25/14	592.6	592.35	2.80	12.80	1.81	---	---	590.54	1.81
	06/02/14	592.6	592.35	2.80	12.80	2.62	---	---	589.73	2.62
	07/31/14	592.6	592.35	2.80	12.80	2.31	---	---	590.04	2.31
	09/16/14	592.6	592.35	2.80	12.80	2.36	---	---	589.99	2.36
	03/24/15	592.6	592.35	2.80	12.80	3.20	---	---	589.15	3.20
	06/17/15	592.6	592.35	2.80	12.80	under water	---	---	---	under water
	09/09/15	592.6	592.35	2.80	12.80	1.84	---	---	590.51	1.84
	12/04/15	592.6	592.35	2.80	12.80	3.85	---	---	588.50	3.85
	03/15/16	592.6	592.35	2.80	12.80	1.98	---	---	590.37	1.98
	06/17/16	592.6	592.35	2.80	12.80	1.66	---	---	590.69	1.66
	09/22/16	592.6	592.35	2.80	12.80	2.98	---	---	589.37	2.98
	09/27/16	ABANDONED								
QPTW-03R	04/25/14	592.5	592.13	2.75	12.75	2.19	1.82	0.37	590.27	1.86
	06/02/14	592.5	592.13	2.75	12.75	3.13	2.86	0.27	589.24	2.89
	07/09/14	592.5	592.13	2.75	12.75	2.10	1.98	0.12	590.14	1.99
	07/31/14	592.5	592.13	2.75	12.75	2.74	2.66	0.08	589.46	2.67
	09/16/14	592.5	592.13	2.75	12.75	3.27	---	---	588.86	3.27
	03/24/15	592.5	592.13	2.75	12.75	3.56	3.55	0.01	588.58	3.55
	06/17/15	592.5	592.13	2.75	12.75	3.36	2.72	0.64	589.33	2.80
	09/09/15	592.5	592.13	2.75	12.75	2.74	2.46	0.28	589.64	2.49
	12/04/15	592.5	592.13	2.75	12.75	4.14	---	---	587.99	4.14
	03/15/16	592.5	592.13	2.75	12.75	2.46	2.39	0.07	589.73	2.40
	06/17/16	592.5	592.13	2.75	12.75	2.30	1.77	0.53	590.30	1.83
	09/22/16	592.5	592.13	2.75	12.75	3.78	3.05	0.73	588.99	3.14
	09/27/16	ABANDONED								
QPTW-03R2	09/06/17	594.91	594.61	2.00	12.00	5.24	---	---	589.37	5.24
	11/27/17	594.91	594.61	2.00	12.00	5.07	4.85	0.22	589.73	4.88
	02/27/18	594.91	594.61	2.00	12.00	4.31	3.92	0.39	590.64	3.97
	06/04/18	594.91	594.61	2.00	12.00	4.83	4.65	0.18	589.94	4.67
	10/05/18	594.91	594.61	2.00	12.00	5.75	5.21	0.54	589.34	5.27
	12/11/18	594.91	594.61	2.00	12.00	5.13	4.52	0.61	590.02	4.59
QPTW-04	03/17/05	592.3	591.73	2.50	12.50	8.54	7.51	1.03	584.10	7.63
	04/12/05	592.3	591.73	2.50	12.50	8.53	7.54	0.99	584.07	7.66
	05/31/05	592.3	591.73	2.50	12.50	8.58	7.50	1.08	584.10	7.63
	06/24/05	592.3	591.73	2.50	12.50	8.34	7.29	1.05	584.31	7.42
	08/12/05	592.3	591.73	2.50	12.50	8.28	7.26	1.02	584.35	7.38
	10/14/05	592.3	591.73	2.50	12.50	8.61	7.68	0.93	583.94	7.79
	11/08/05	592.3	591.73	2.50	12.50	8.70	7.72	0.98	583.89	7.84
	12/19/05	592.3	591.73	2.50	12.50	8.87	7.83	1.04	583.78	7.95
	01/31/06	592.3	591.73	2.50	12.50	8.58	7.46	1.12	584.14	7.59
	02/15/06	592.3	591.73	2.50	12.50	8.45	7.33	1.12	584.27	7.46
	03/13/06	592.3	591.73	2.50	12.50	8.14	7.16	0.98	584.45	7.28
	04/10/06	592.3	591.73	2.50	12.50	8.29	7.32	0.97	584.29	7.44
	05/22/06	592.3	591.73	2.50	12.50	8.41	7.39	1.02	584.22	7.51
	06/21/06	592.3	591.73	2.50	12.50	8.34	7.41	0.93	584.21	7.52
	07/11/06	592.3	591.73	2.50	12.50	8.16	7.12	1.04	584.49	7.24
	08/23/06	592.3	591.73	2.50	12.50	8.39	7.10	1.29	584.48	7.25
	09/26/06	592.3	591.73	2.50	12.50	8.09	7.11	0.98	584.50	7.23
	10/30/06	592.3	591.73	2.50	12.50	8.05	7.08	0.97	584.53	7.20
	11/27/06	592.3	591.73	2.50	12.50	8.08	7.19	0.89	584.43	7.30
	12/27/06	592.3	591.73	2.50	12.50	8.58	7.48	1.10	584.12	7.61
	01/15/07	592.3	591.73	2.50	12.50	8.07	7.29	0.78	584.35	7.38
	02/21/07	592.3	591.73	2.50	12.50	8.45	7.57	0.88	584.05	7.68
	03/23/07	592.3	591.73	2.50	12.50	8.32	7.56	0.76	584.08	7.65
	04/09/07	592.3	591.73	2.50	12.50	8.47	7.52	0.95	584.10	7.63
	05/15/07	592.3	591.73	2.50	12.50	8.42	7.51	0.91	584.11	7.62
	06/11/07	592.3	591.73	2.50	12.50	8.61	7.64	0.97	583.97	7.76
	07/11/07	592.3	591.73	2.50	12.50	8.67	7.61	1.06	583.99	7.74
	08/16/07	592.3	591.73	2.50	12.50	8.80	7.69	1.11	583.91	7.82
	09/17/07	592.3	591.73	2.50	12.50	8.62	7.54	1.08	584.06	7.67
	11/26/07	592.3	591.73	2.50	12.50	9.05	7.99	1.06	583.61	8.12
	12/12/07	592.3	591.73	2.50	12.50	9.15	8.09	1.06	583.51	8.22
	01/11/08	592.3	591.73	2.50	12.50	8.81	7.82	0.99	583.79	7.94
	02/05/08	592.3	591.73	2.50	12.50	8.69	7.64	1.05	583.96	7.77
	04/11/08	592.3	591.73	2.50	12.50	7.75	6.68	1.07	584.92	6.81
	05/16/08	592.3	591.73	2.50	12.50	7.82	6.81	1.01	584.80	6.93
	10/29/08	592.3	591.73	2.50	12.50	7.70	6.69	1.01	584.92	6.81
	01/21/09	592.3	591.73	2.50	12.50	7.35	6.61	0.74	585.03	6.70
	03/18/09	592.3	591.73	2.50	12.50	6.86	6.12	0.74	585.52	6.21
	10/17/09	592.3	591.73	2.50	12.50	7.76	6.85	0.91	584.77	6.96
	10/23/09	592.3	591.73	2.50	12.50	7.76	6.83	0.93	584.79	6.94
	06/09/10	592.3	591.73	2.50	12.50	6.23	5.65	0.58	586.01	5.72
	08/27/10	592.3	591.73	2.50	12.50	7.06	6.17	0.89	585.45	6.28
	09/17/10	592.3	591.73	2.50	12.50	5.61	5.02	0.59	586.64	5.09

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QPTW-04	09/23/10	592.3	591.73	2.50	12.50	5.47	4.87	0.60	586.79	4.94
(cont'd)	10/15/10	592.3	591.73	2.50	12.50	6.03	5.20	0.83	586.43	5.30
	10/29/10	592.3	591.73	2.50	12.50	6.39	5.86	0.53	585.81	5.92
	03/18/11	592.3	591.73	2.50	12.50	5.16	4.20	0.96	587.41	4.32
	04/08/11	592.3	591.73	2.50	12.50	4.27	3.54	0.73	588.10	3.63
	05/09/11	592.3	591.73	2.50	12.50	4.60	3.64	0.96	587.97	3.76
	06/09/11	592.3	591.73	2.50	12.50	4.35	3.63	0.72	588.01	3.72
	07/05/11	592.3	591.73	2.50	12.50	4.84	3.87	0.97	587.74	3.99
	08/23/11	592.3	591.73	2.50	12.50	4.16	3.34	0.82	588.29	3.44
	03/20/12	592.3	591.73	2.50	12.50	5.21	2.78	2.43	588.66	3.07
	04/23/12	592.3	591.73	2.50	12.50	5.59	3.06	2.53	588.37	3.36
	06/11/12	592.3	591.73	2.50	12.50	5.85	3.16	2.69	588.25	3.48
	07/10/12	592.3	591.73	2.50	12.50	5.97	3.40	2.57	588.02	3.71
	08/29/12	592.3	591.73	2.50	12.50	5.32	2.99	2.33	588.46	3.27
	09/12/12	592.3	591.73	2.50	12.50	5.03	2.68	2.35	588.77	2.96
	10/01/12	592.3	591.73	2.50	12.50	5.80	3.31	2.49	588.12	3.61
	11/06/12	592.3	591.73	2.50	12.50	4.85	2.88	1.97	588.61	3.12
	12/05/12	592.3	591.73	2.50	12.50	5.49	3.50	1.99	587.99	3.74
	04/03/13	592.3	591.73	2.50	12.50	5.36	3.16	2.20	588.31	3.42
	07/18/13	592.3	591.73	2.50	12.50	4.74	2.48	2.26	588.98	2.75
	09/23/13	592.3	591.73	2.50	12.50	4.73	3.61	1.12	587.99	3.74
	04/25/14	592.3	591.73	2.50	12.50	3.16	1.73	1.43	589.83	1.90
	06/02/14	592.3	591.73	2.50	12.50	3.98	2.39	1.59	589.15	2.58
	07/09/14	593.3	592.73	2.50	12.50	2.74	1.61	1.13	590.98	1.75
	07/31/14	592.3	591.73	2.50	12.50	3.53	2.33	1.20	589.26	2.47
	09/16/14	591.3	590.73	2.50	12.50	4.00	2.10	1.90	588.40	2.33
	03/24/15	590.3	589.73	2.50	12.50	4.66	3.02	1.64	586.51	3.22
	06/17/15	589.3	588.73	2.50	12.50	3.51	2.05	1.46	586.50	2.23
	09/09/15	588.3	587.73	2.50	12.50	4.09	2.64	1.45	584.92	2.81
	12/04/15	587.3	586.73	2.50	12.50	5.56	3.51	2.05	582.97	3.76
	03/15/16	586.3	585.73	2.50	12.50	3.68	1.76	1.92	583.74	1.99
	06/17/16	585.3	584.73	2.50	12.50	2.27	2.16	0.11	582.56	2.17
	09/22/16	584.3	583.73	2.50	12.50	4.61	2.80	1.81	580.71	3.02
	09/27/16	ABANDONED								
QPTW-04R	09/06/17	594.96	594.46	2.00	12.00	5.61	4.75	0.86	589.61	4.85
	11/27/17	594.96	594.46	2.00	12.00	5.10	4.51	0.59	589.88	4.58
	02/27/18	594.96	594.46	2.00	12.00	3.62	3.58	0.04	590.88	3.58
	06/04/18	594.96	594.46	2.00	12.00	4.51	4.32	0.19	590.12	4.34
	10/05/18	594.96	594.46	2.00	12.00	5.01	4.85	0.16	589.59	4.87
	12/11/18	594.96	594.46	2.00	12.00	4.58	4.27	0.31	590.15	4.31
QPTW-05	03/17/05	592.4	592.13	2.70	12.70	8.94	7.67	1.27	584.31	7.82
	04/12/05	592.4	592.13	2.70	12.70	8.98	7.69	1.29	584.29	7.84
	05/31/05	592.4	592.13	2.70	12.70	9.10	7.73	1.37	584.24	7.89
	06/24/05	592.4	592.13	2.70	12.70	8.65	7.50	1.15	584.49	7.64
	08/12/05	592.4	592.13	2.70	12.70	8.76	7.68	1.08	584.32	7.81
	10/14/05	592.4	592.13	2.70	12.70	9.38	7.91	1.47	584.04	8.09
	11/08/05	592.4	592.13	2.70	12.70	9.55	7.99	1.56	583.95	8.18
	12/19/05	592.4	592.13	2.70	12.70	9.74	8.05	1.69	583.88	8.25
	01/31/06	592.4	592.13	2.70	12.70	8.84	7.68	1.16	584.31	7.82
	02/15/06	592.4	592.13	2.70	12.70	8.63	7.54	1.09	584.46	7.67
	03/13/06	592.4	592.13	2.70	12.70	8.20	7.33	0.87	584.70	7.43
	04/10/06	592.4	592.13	2.70	12.70	8.44	7.47	0.97	584.54	7.59
	05/22/06	592.4	592.13	2.70	12.70	8.65	7.58	1.07	584.42	7.71
	06/21/06	592.4	592.13	2.70	12.70	8.70	6.71	1.99	585.18	6.95
	07/11/06	592.4	592.13	2.70	12.70	8.35	7.38	0.97	584.63	7.50
	08/23/06	592.4	592.13	2.70	12.70	8.52	7.46	1.06	584.54	7.59
	09/26/06	592.4	592.13	2.70	12.70	8.46	7.45	1.01	584.56	7.57
	10/30/06	592.4	592.13	2.70	12.70	8.32	7.33	0.99	584.68	7.45
	11/27/06	592.4	592.13	2.70	12.70	8.50	7.44	1.06	584.56	7.57
	12/27/06	592.4	592.13	2.70	12.70	8.18	7.23	0.95	584.79	7.34
	01/15/07	592.4	592.13	2.70	12.70	8.55	7.49	1.06	584.51	7.62
	02/21/07	592.4	592.13	2.70	12.70	9.27	7.84	1.43	584.12	8.01
	03/23/07	592.4	592.13	2.70	12.70	9.19	7.81	1.38	584.15	7.98
	04/09/07	592.4	592.13	2.70	12.70	9.27	7.77	1.50	584.18	7.95
	05/15/07	592.4	592.13	2.70	12.70	9.11	7.74	1.37	584.23	7.90
	06/11/07	592.4	592.13	2.70	12.70	9.41	7.92	1.49	584.03	8.10
	07/11/07	592.4	592.13	2.70	12.70	9.52	7.96	1.56	583.98	8.15
	08/16/07	592.4	592.13	2.70	12.70	9.71	8.04	1.67	583.89	8.24
	09/17/07	592.4	592.13	2.70	12.70	9.25	7.82	1.43	584.14	7.99
	11/26/07	592.4	592.13	2.70	12.70	10.10	8.21	1.89	583.69	8.44
	12/12/07	592.4	592.13	2.70	12.70	10.31	8.30	2.01	583.59	8.54
	01/11/08	592.4	592.13	2.70	12.70	9.62	8.07	1.55	583.87	8.26
	02/05/08	592.4	592.13	2.70	12.70	9.05	7.90	1.15	584.09	8.04
	04/11/08	592.4	592.13	2.70	12.70	7.50	7.00	0.50	585.07	7.06
	05/16/08	592.4	592.13	2.70	12.70	7.67	7.12	0.55	584.94	7.19

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QPTW-05 (cont'd)	10/29/08	592.4	592.13	2.70	12.70	7.71	7.23	0.48	584.84	7.29
	01/21/09	592.4	592.13	2.70	12.70	7.43	6.87	0.56	585.19	6.94
	03/18/09	592.4	592.13	2.70	12.70	7.11	6.57	0.54	585.50	6.63
	10/17/09	592.4	592.13	2.70	12.70	7.98	7.18	0.80	584.85	7.28
	10/23/09	592.4	592.13	2.70	12.70	7.68	7.09	0.59	584.97	7.16
	06/09/10	592.4	592.13	2.70	12.70	7.07	6.23	0.84	585.80	6.33
	06/24/10	592.4	592.13	2.70	12.70	7.40	6.59	0.81	585.44	6.69
	07/29/10	592.4	592.13	2.70	12.70	7.34	6.14	1.20	585.85	6.28
	08/06/10	592.4	592.13	2.70	12.70	7.31	6.28	1.03	585.73	6.40
	08/13/10	592.4	592.13	2.70	12.70	6.08	5.57	0.51	586.50	5.63
	08/27/10	592.4	592.13	2.70	12.70	6.51	5.70	0.81	586.33	5.80
	09/17/10	592.4	592.13	2.70	12.70	6.36	5.83	0.53	586.24	5.89
	09/23/10	592.4	592.13	2.70	12.70	6.12	5.59	0.53	586.48	5.65
	10/15/10	592.4	592.13	2.70	12.70	6.31	6.01	0.30	586.08	6.05
	10/29/10	592.4	592.13	2.70	12.70	5.48	5.14	0.34	586.95	5.18
	12/07/10	592.4	592.13	2.70	12.70	6.46	5.72	0.74	586.32	5.81
	01/03/11	592.4	592.13	2.70	12.70	5.99	5.71	0.28	586.39	5.74
	03/18/11	592.4	592.13	2.70	12.70	5.43	5.11	0.32	586.98	5.15
	04/08/11	592.4	592.13	2.70	12.70	4.63	4.32	0.31	587.77	4.36
	05/09/11	592.4	592.13	2.70	12.70	4.55	4.31	0.24	587.79	4.34
	06/09/11	592.4	592.13	2.70	12.70	4.83	4.56	0.27	587.54	4.59
	07/05/11	592.4	592.13	2.70	12.70	5.11	4.64	0.47	587.43	4.70
	08/23/11	592.4	592.13	2.70	12.70	4.26	4.03	0.23	588.07	4.06
	10/14/11	592.4	592.13	2.70	12.70	5.28	4.94	0.34	587.15	4.98
	11/23/11	592.4	592.13	2.70	12.70	4.75	4.42	0.33	587.67	4.46
	01/24/12	592.4	592.13	2.70	12.70	3.73	3.58	0.15	588.53	3.60
	03/20/12	592.4	592.13	2.70	12.70	4.05	3.72	0.33	588.37	3.76
	04/23/12	592.4	592.13	2.70	12.70	4.10	3.74	0.36	588.35	3.78
	06/11/12	592.4	592.13	2.70	12.70	4.44	4.00	0.44	588.08	4.05
	07/10/12	592.4	592.13	2.70	12.70	5.17	4.52	0.65	587.53	4.60
	08/29/12	592.4	592.13	2.70	12.70	4.44	3.80	0.64	588.25	3.88
	09/12/12	592.4	592.13	2.70	12.70	4.39	3.63	0.76	588.41	3.72
	11/06/12	592.4	592.13	2.70	12.70	4.49	3.69	0.80	588.34	3.79
	12/05/12	592.4	592.13	2.70	12.70	5.28	4.31	0.97	587.70	4.43
	04/03/13	592.4	592.13	2.70	12.70	5.07	4.01	1.06	587.99	4.14
	07/18/13	592.4	592.13	2.70	12.70	4.80	3.10	1.70	588.83	3.30
	09/23/13	592.4	592.13	2.70	12.70	6.20	4.26	1.94	587.64	4.49
	04/25/14	592.4	592.13	2.70	12.70	4.87	2.36	2.51	589.47	2.66
	06/02/14	592.4	592.13	2.70	12.70	4.45	3.16	1.29	588.82	3.31
	07/09/14	592.4	592.13	2.70	12.70	3.66	2.19	1.47	589.76	2.37
	07/31/14	592.4	592.13	2.70	12.70	4.25	2.93	1.32	589.04	3.09
	09/16/14	592.4	592.13	2.70	12.70	4.77	2.99	1.78	588.93	3.20
	03/24/15	592.4	592.13	2.70	12.70	5.11	3.70	1.41	588.26	3.87
	06/17/15	592.4	592.13	2.70	12.70	4.77	2.59	2.18	589.28	2.85
	09/09/15	592.4	592.13	2.70	12.70	5.30	2.49	2.81	589.30	2.83
	12/04/15	592.4	592.13	2.70	12.70	6.38	4.10	2.28	587.76	4.37
	03/15/16	592.4	592.13	2.70	12.70	4.86	2.49	2.37	589.36	2.77
	06/17/16	592.4	592.13	2.70	12.70	4.14	1.99	2.15	589.88	2.25
	09/22/16	592.4	592.13	2.70	12.70	5.67	3.15	2.52	588.68	3.45
	09/27/16	ABANDONED								
QPTW-05R	09/06/17	595	594.28	2.00	12.00	5.64	4.98	0.66	589.22	5.06
	11/27/17	595	594.28	2.00	12.00	5.41	4.75	0.66	589.45	4.83
	02/27/18	595	594.28	2.00	12.00	4.21	4.07	0.14	590.19	4.09
	06/04/18	595	594.28	2.00	12.00	5.36	4.52	0.84	589.66	4.62
	10/05/18	595	594.28	2.00	12.00	5.38	5.05	0.33	589.19	5.09
	12/11/18	595	594.28	2.00	12.00	4.97	4.66	0.31	589.58	4.70
QPTW-10	03/17/05	592.4	592.15	2.60	12.60	9.83	7.58	2.25	584.30	7.85
	04/12/05	592.4	592.15	2.60	12.60	9.96	7.63	2.33	584.24	7.91
	05/31/05	592.4	592.15	2.60	12.60	10.29	7.83	2.46	584.02	8.13
	06/24/05	592.4	592.15	2.60	12.60	9.72	7.43	2.29	584.45	7.70
	08/12/05	592.4	592.15	2.60	12.60	9.79	7.58	2.21	584.30	7.85
	10/14/05	592.4	592.15	2.60	12.60	10.56	7.80	2.76	584.02	8.13
	11/08/05	592.4	592.15	2.60	12.60	10.82	7.88	2.94	583.92	8.23
	12/19/05	592.4	592.15	2.60	12.60	11.01	7.95	3.06	583.83	8.32
	01/31/06	592.4	592.15	2.60	12.60	9.79	7.54	2.25	584.34	7.81
	02/15/06	592.4	592.15	2.60	12.60	9.73	7.44	2.29	584.44	7.71
	03/13/06	592.4	592.15	2.60	12.60	9.22	7.23	1.99	584.68	7.47
	04/10/06	592.4	592.15	2.60	12.60	9.59	7.34	2.25	584.54	7.61
	05/22/06	592.4	592.15	2.60	12.60	9.95	7.43	2.52	584.42	7.73
	06/21/06	592.4	592.15	2.60	12.60	10.00	7.49	2.51	584.36	7.79
	07/11/06	592.4	592.15	2.60	12.60	9.69	7.30	2.39	584.56	7.59
	08/23/06	592.4	592.15	2.60	12.60	9.58	7.30	2.28	584.58	7.57
	09/26/06	592.4	592.15	2.60	12.60	9.85	7.33	2.52	584.52	7.63
	10/30/06	592.4	592.15	2.60	12.60	9.68	7.19	2.49	584.66	7.49
	11/27/06	592.4	592.15	2.60	12.60	9.91	7.33	2.58	584.51	7.64

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QPTW-05	12/27/06	592.4	592.15	2.60	12.60	9.99	7.34	2.65	584.49	7.66
	01/15/07	592.4	592.15	2.60	12.60	9.90	7.37	2.53	584.48	7.67
	02/21/07	592.4	592.15	2.60	12.60	10.81	7.78	3.03	584.01	8.14
	03/23/07	592.4	592.15	2.60	12.60	10.71	7.72	2.99	584.07	8.08
	04/09/07	592.4	592.15	2.60	12.60	10.63	7.64	2.99	584.15	8.00
	05/15/07	592.4	592.15	2.60	12.60	10.38	7.46	2.92	584.34	7.81
	06/11/07	592.4	592.15	2.60	12.60	10.81	7.81	3.00	583.98	8.17
	07/11/07	592.4	592.15	2.60	12.60	11.05	7.86	3.19	583.91	8.24
	08/16/07	592.4	592.15	2.60	12.60	11.27	7.95	3.32	583.80	8.35
	09/17/07	592.4	592.15	2.60	12.60	10.54	7.73	2.81	584.08	8.07
	11/26/07	592.4	592.15	2.60	12.60	11.57	8.11	3.46	583.62	8.53
	12/12/07	592.4	592.15	2.60	12.60	11.80	8.18	3.62	583.54	8.61
	01/11/08	592.4	592.15	2.60	12.60	10.96	7.95	3.01	583.84	8.31
	02/05/08	592.4	592.15	2.60	12.60	10.21	7.78	2.43	584.08	8.07
	04/11/08	592.4	592.15	2.60	12.60	8.71	6.83	1.88	585.09	7.06
	05/16/08	592.4	592.15	2.60	12.60	8.91	6.95	1.96	584.96	7.19
	10/29/08	592.4	592.15	2.60	12.60	9.12	6.94	2.18	584.95	7.20
	01/21/09	592.4	592.15	2.60	12.60	7.96	6.68	1.28	585.32	6.83
	03/18/09	592.4	592.15	2.60	12.60	8.69	6.36	2.33	585.51	6.64
	10/17/09	592.4	592.15	2.60	12.60	9.10	7.04	2.06	584.86	7.29
	10/23/09	592.4	592.15	2.60	12.60	8.67	6.97	1.70	584.98	7.17
	06/09/10	592.4	592.15	2.60	12.60	8.42	6.23	2.19	585.66	6.49
	06/24/10	592.4	592.15	2.60	12.60	8.91	6.48	2.43	585.38	6.77
	07/29/10	592.4	592.15	2.60	12.60	9.37	6.51	2.86	585.30	6.85
	08/06/10	592.4	592.15	2.60	12.60	9.22	6.71	2.51	585.14	7.01
	08/13/10	592.4	592.15	2.60	12.60	8.06	5.73	2.33	586.14	6.01
	08/27/10	592.4	592.15	2.60	12.60	8.83	6.03	2.80	585.78	6.37
	09/17/10	592.4	592.15	2.60	12.60	8.68	5.72	2.96	586.07	6.08
	09/23/10	592.4	592.15	2.60	12.60	8.54	5.64	2.90	586.16	5.99
	10/15/10	592.4	592.15	2.60	12.60	8.92	5.82	3.10	585.96	6.19
	10/29/10	592.4	592.15	2.60	12.60	8.87	5.68	3.19	586.09	6.06
	03/18/11	592.4	592.15	2.60	12.60	8.03	4.92	3.11	586.86	5.29
	04/08/11	592.4	592.15	2.60	12.60	7.75	4.06	3.69	587.65	4.50
	05/09/11	592.4	592.15	2.60	12.60	8.24	3.95	4.29	587.69	4.46
	06/09/11	592.4	592.15	2.60	12.60	8.28	4.24	4.04	587.43	4.72
	07/05/11	592.4	592.15	2.60	12.60	8.75	4.38	4.37	587.25	4.90
	08/23/11	592.4	592.15	2.60	12.60	8.50	3.67	4.83	587.90	4.25
	10/14/11	592.4	592.15	2.60	12.60	8.64	4.58	4.06	587.08	5.07
	11/23/11	592.4	592.15	2.60	12.60	8.38	3.98	4.40	587.64	4.51
	04/23/12	592.4	592.15	2.60	12.60	4.13	3.78	0.35	588.33	3.82
	07/10/12	592.4	592.15	2.60	12.60	5.65	4.51	1.14	587.50	4.65
	11/12/14	592.4	592.15	2.60	12.60	4.83	3.91	0.92	588.13	4.02
	09/09/15	592.4	592.15	2.60	12.60	2.99	2.85	0.14	589.28	2.87
	03/15/16	592.4	592.15	2.60	12.60	3.37	2.77	0.60	589.31	2.84
	06/17/16	592.4	592.15	2.60	12.60	2.84	2.41	0.43	589.69	2.46
	09/22/16	592.4	592.15	2.60	12.60	5.60	3.27	2.33	588.60	3.55
	09/27/16	ABANDONED								
QPTW-10R	09/06/17	594.82	594.20	2.00	12.00	4.99	---	---	589.21	4.99
	11/27/17	594.82	594.20	2.00	12.00	4.77	---	---	589.43	4.77
	02/27/18	594.82	594.20	2.00	12.00	4.00	---	---	590.20	4.00
	06/04/18	594.82	594.20	2.00	12.00	4.56	---	---	589.64	4.56
	10/05/18	594.82	594.20	2.00	12.00	5.05	---	---	589.15	5.05
	12/11/18	594.82	594.20	2.00	12.00	4.61	---	---	589.59	4.61
QPTW-13	10/15/10	592.7	592.36	2.76	12.76	7.17	6.65	0.52	585.65	6.71
	10/29/10	592.7	592.36	2.76	12.76	6.77	6.49	0.28	585.84	6.52
	03/18/11	592.7	592.36	2.76	12.76	4.56	4.47	0.09	587.88	4.48
	05/09/11	592.7	592.36	2.76	12.76	4.59	4.56	0.03	587.80	4.56
	06/09/11	592.7	592.36	2.76	12.76	4.88	4.85	0.03	587.51	4.85
	07/05/11	592.7	592.36	2.76	12.76	5.08	5.02	0.06	587.33	5.03
	08/23/11	592.7	592.36	2.76	12.76	4.43	4.38	0.05	587.97	4.39
	10/14/11	592.7	592.36	2.76	12.76	5.12	5.03	0.09	587.32	5.04
	03/20/12	592.7	592.36	2.76	12.76	4.12	---	---	588.24	4.12
	04/23/12	592.7	592.36	2.76	12.76	4.16	4.15	0.01	588.21	4.15
	06/11/12	592.7	592.36	2.76	12.76	4.38	---	---	587.98	4.38
	07/10/12	592.7	592.36	2.76	12.76	5.06	4.84	0.22	587.49	4.87
	08/29/12	592.7	592.36	2.76	12.76	4.30	4.24	0.06	588.11	4.25
	09/12/12	592.7	592.36	2.76	12.76	4.13	4.09	0.04	588.27	4.09
	04/15/13	592.7	592.36	2.76	12.76	2.85	---	---	589.51	2.85
	07/18/13	592.7	592.36	2.76	12.76	3.54	---	---	588.82	3.54
	09/23/13	592.7	592.36	2.76	12.76	4.74	4.71	0.03	587.65	4.71
	04/25/14	592.7	592.36	2.76	12.76	2.98	---	---	589.38	2.98
	06/02/14	592.7	592.36	2.76	12.76	3.65	---	---	588.71	3.65
	07/09/14	592.7	592.36	2.76	12.76	2.73	---	---	589.63	2.73
	07/31/14	592.7	592.36	2.76	12.76	3.41	---	---	588.95	3.41
	09/16/14	592.7	592.36	2.76	12.76	3.48	---	---	588.88	3.48

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QPTW-13 (cont'd)	03/24/15	592.7	592.36	2.76	12.76	4.12	---	---	588.24	4.12
	06/17/15	592.7	592.36	2.76	12.76	3.17	---	---	589.19	3.17
	09/09/15	592.7	592.36	2.76	12.76	3.17	---	---	589.19	3.17
	03/15/16	592.7	592.36	2.76	12.76	3.11	---	---	589.25	3.11
	06/17/16	592.7	592.36	2.76	12.76	2.53	---	---	589.83	2.53
	09/22/16	592.7	592.36	2.76	12.76	3.72	---	---	588.64	3.72
	09/27/16	ABANDONED								
QPTW-13R	09/06/17	594.8	594.04	4	14	4.83	---	---	589.21	4.83
	11/27/17	594.8	594.04	4	14	4.61	---	---	589.43	4.61
	02/27/18	594.8	594.04	4	14	3.93	---	---	590.11	3.93
	06/04/18	594.8	594.04	4	14	4.40	---	---	589.64	4.40
	10/05/18	594.8	594.04	4	14	4.88	---	---	589.16	4.88
	12/11/18	594.8	594.04	4	14	4.54	---	---	589.50	4.54
QP-1	06/24/10	---	---	5	15	9.65	9.51	0.14	---	9.53
	07/22/10	---	---	5	15	12.22	12.14	0.08	---	12.15
	08/06/10	---	---	5	15	4.40	4.21	0.19	---	4.23
	08/13/10	---	---	5	15	1.63	1.56	0.07	---	1.57
	08/27/10	---	---	5	15	9.79	---	---	---	9.79
	09/17/10	---	---	5	15	8.64	---	---	---	8.64
	09/23/10	---	---	5	15	8.45	---	---	---	8.45
	10/15/10	---	---	5	15	8.91	---	---	---	8.91
	10/29/10	---	---	5	15	8.85	---	---	---	8.85
	12/07/10	---	---	5	15	9.22	---	---	---	9.22
	01/03/11	---	---	5	15	8.73	---	---	---	8.73
	03/18/11	---	---	5	15	8.83	---	---	---	8.83
	04/08/11	---	---	5	15	8.26	---	---	---	8.26
	05/09/11	---	---	5	15	8.19	---	---	---	8.19
	06/09/11	---	---	5	15	7.72	---	---	---	7.72
	07/05/11	---	---	5	15	8.54	---	---	---	8.54
	08/23/11	---	---	5	15	7.47	---	---	---	7.47
	10/14/11	---	---	5	15	8.82	---	---	---	8.82
	11/23/11	---	---	5	15	8.21	---	---	---	8.21
	01/24/12	---	---	5	15	6.58	---	---	---	6.58
	03/20/12	---	---	5	15	7.63	---	---	---	7.63
	04/23/12	---	---	5	15	7.15	---	---	---	7.15
	06/11/12	---	---	5	15	7.91	---	---	---	7.91
	07/10/12	---	---	5	15	8.54	---	---	---	8.54
	08/29/12	---	---	5	15	7.91	---	---	---	7.91
	09/12/12	---	---	5	15	7.66	---	---	---	7.66
	10/01/12	---	---	5	15	8.47	---	---	---	8.47
	11/06/12	---	---	5	15	7.66	---	---	---	7.66
	12/05/12	---	---	5	15	7.68	---	---	---	7.68
	04/03/13	---	---	5	15	7.93	---	---	---	7.93
	07/18/13	---	---	5	15	7.37	---	---	---	7.37
	09/23/13	---	---	5	15	8.55	---	---	---	8.55
	04/25/14	---	---	5	15	6.49	---	---	---	6.49
	06/02/14	---	---	5	15	7.17	---	---	---	7.17
	07/09/14	---	---	5	15	6.16	---	---	---	6.16
	07/31/14	---	---	5	15	6.48	---	---	---	6.48
	09/16/14	---	---	5	15	6.94	---	---	---	6.94
	03/24/15	---	---	5	15	7.55	---	---	---	7.55
	06/17/15	---	---	5	15	6.51	---	---	---	6.51
	09/09/15	---	---	5	15	6.12	---	---	---	6.12
	12/04/15	---	---	5	15	8.25	---	---	---	8.25
	03/15/16	---	---	5	15	6.88	---	---	---	6.88
	06/17/16	---	---	5	15	6.12	---	---	---	6.12
	09/22/16	---	---	5	15	7.45	---	---	---	7.45
	09/27/16	ABANDONED								
QP-1R	09/06/17	594.87	594.59	1.5	12	5.20	---	---	589.39	5.20
	11/27/17	594.87	594.59	1.5	12	5.11	---	---	589.48	5.11
	02/27/18	594.87	594.59	1.5	12	4.65	---	---	589.94	4.65
	06/04/18	594.87	594.59	1.5	12	4.68	---	---	589.91	4.68
	10/05/18	594.87	594.59	1.5	12	5.29	---	---	589.30	5.29
	12/11/18	594.87	594.59	1.5	12	4.63	---	---	589.96	4.63
QP-2	06/24/10	---	---	5	15	10.27	10.25	0.02	---	10.25
	06/28/10	---	---	5	15	9.49	9.45	0.04	---	9.45
	07/08/10	---	---	5	15	8.57	8.48	0.09	---	8.49
	07/22/10	---	---	5	15	8.31	8.22	0.09	---	8.23
	07/29/10	---	---	5	15	8.55	8.46	0.09	---	8.47
	08/06/10	---	---	5	15	8.88	8.74	0.14	---	8.76
	08/13/10	---	---	5	15	6.70	6.61	0.09	---	6.62
	08/27/10	---	---	5	15	7.76	7.66	0.10	---	7.67
	09/17/10	---	---	5	15	7.44	7.28	0.16	---	7.30
	09/23/10	---	---	5	15	7.14	6.98	0.16	---	7.00

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QP-2 (cont'd)	10/15/10	---	---	5	15	7.96	7.73	0.23	---	7.76
	10/29/10	---	---	5	15	7.74	7.48	0.26	---	7.51
	12/07/10	---	---	5	15	7.71	7.40	0.31	---	7.44
	01/03/11	---	---	5	15	7.62	7.31	0.31	---	7.35
	03/18/11	---	---	5	15	7.51	7.25	0.26	---	7.28
	04/08/11	---	---	5	15	7.03	6.73	0.30	---	6.77
	05/09/11	---	---	5	15	6.97	6.61	0.36	---	6.65
	06/09/11	---	---	5	15	7.36	6.93	0.43	---	6.98
	07/05/11	---	---	5	15	7.45	6.92	0.53	---	6.98
	08/23/11	---	---	5	15	7.13	6.42	0.71	---	6.51
	10/14/11	---	---	5	15	8.31	7.34	0.97	---	7.46
	11/23/11	---	---	5	15	7.99	7.07	0.92	---	7.18
	01/24/12	---	---	5	15	6.79	5.81	0.98	---	5.93
	03/20/12	---	---	5	15	7.25	6.29	0.96	---	6.41
	04/23/12	---	---	5	15	7.21	6.18	1.03	---	6.30
	06/11/12	---	---	5	15	7.20	6.48	0.72	---	6.57
	07/10/12	---	---	5	15	8.43	7.04	1.39	---	7.21
	08/29/12	---	---	5	15	8.00	6.44	1.56	---	6.63
	09/12/12	---	---	5	15	7.75	6.17	1.58	---	6.36
	10/01/12	---	---	5	15	8.66	6.81	1.85	---	7.03
	11/06/12	---	---	5	15	7.02	6.29	0.73	---	6.38
	12/05/12	---	---	5	15	7.59	6.86	0.73	---	6.95
	04/03/13	---	---	5	15	7.12	6.40	0.72	---	6.49
	07/18/13	---	---	5	15	6.91	5.86	1.05	---	5.99
	09/23/13	---	---	5	15	7.73	6.95	0.78	---	7.04
	04/25/14	---	---	5	15	5.86	5.40	0.46	---	5.46
	06/02/14	---	---	5	15	6.24	5.74	0.50	---	5.80
	07/09/14	---	---	5	15	5.86	5.29	0.57	---	5.36
	07/31/14	---	---	5	15	6.16	5.55	0.61	---	5.62
	09/16/14	---	---	5	15	5.93	5.76	0.17	---	5.78
	03/24/15	---	---	5	15	6.51	6.30	0.21	---	6.33
	06/17/15	---	---	5	15	5.79	5.53	0.26	---	5.56
	09/09/15	---	---	5	15	5.71	5.36	0.35	---	5.40
	12/04/15	---	---	5	15	7.35	6.88	0.47	---	6.94
	03/15/16	---	---	5	15	5.77	5.51	0.26	---	5.54
	06/17/16	---	---	5	15	5.53	5.22	0.31	---	5.26
	09/22/16	---	---	5	15	6.38	5.99	0.39	---	6.04
	09/27/16	ABANDONED								
QP-2R	09/06/17	594.81	594.22	2	12	4.29	4.27	0.02	589.95	4.27
	11/27/17	594.81	594.22	2	12	4.36	4.35	0.01	589.87	4.35
	02/27/18	594.81	594.22	2	12	3.80	3.79	0.01	590.43	3.79
	06/04/18	594.81	594.22	2	12	3.86	3.85	0.01	590.37	3.85
	10/05/18	594.81	594.22	2	12	4.33	---	---	589.89	4.33
	12/11/18	594.81	594.22	2	12	3.69	---	---	590.53	3.69
QP-3	06/24/10	---	---	5	15	17.53	16.80	0.73	---	16.89
	06/28/10	---	---	5	15	12.56	12.53	0.03	---	12.53
	07/08/10	---	---	5	15	12.37	12.32	0.05	---	12.33
	07/29/10	---	---	5	15	12.47	12.35	0.12	---	12.36
	08/06/10	---	---	5	15	12.89	12.81	0.08	---	12.82
	08/13/10	---	---	5	15	11.69	11.62	0.07	---	11.63
	08/27/10	---	---	5	15	11.78	11.71	0.07	---	11.72
	09/17/10	---	---	5	15	11.78	11.69	0.09	---	11.70
	09/23/10	---	---	5	15	11.55	11.41	0.14	---	11.43
	10/15/10	---	---	5	15	8.19	8.03	0.16	---	8.05
	10/29/10	---	---	5	15	8.27	8.09	0.18	---	8.11
	12/07/10	---	---	5	15	7.92	7.82	0.10	---	7.83
	01/03/11	---	---	5	15	7.70	7.57	0.13	---	7.59
	03/18/11	---	---	5	15	7.69	7.59	0.10	---	7.60
	04/08/11	---	---	5	15	6.78	6.72	0.06	---	6.73
	05/09/11	---	---	5	15	7.08	7.02	0.06	---	7.03
	06/09/11	---	---	5	15	7.33	7.25	0.08	---	7.26
	07/05/11	---	---	5	15	7.26	7.18	0.08	---	7.19
	08/23/11	---	---	5	15	6.41	6.37	0.04	---	6.37
	10/14/11	---	---	5	15	7.44	7.35	0.09	---	7.36
	11/23/11	---	---	5	15	7.06	7.00	0.06	---	7.01
	01/24/12	---	---	5	15	5.63	5.60	0.03	---	5.60
	03/20/12	---	---	5	15	6.25	6.22	0.03	---	6.22
	04/23/12	---	---	5	15	6.02	6.00	0.02	---	6.00
	06/11/12	---	---	5	15	6.55	6.51	0.04	---	6.51
	07/10/12	---	---	5	15	7.21	7.11	0.10	---	7.12
	08/29/12	---	---	5	15	6.58	6.49	0.09	---	6.50
	09/12/12	---	---	5	15	6.16	6.10	0.06	---	6.11
	10/01/12	---	---	5	15	7.11	7.01	0.10	---	7.02
	11/06/12	---	---	5	15	7.07	7.01	0.06	---	7.02
	12/05/12	---	---	5	15	6.58	6.55	0.03	---	6.55

Table 1

Summary of Groundwater Gauging Data - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Well ID	Date	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Top of Screen (ft btoc)	Total Depth (ft btoc)	Depth to Water (ft btoc)	Depth to Product (ft btoc)	LNAPL Thickness (ft)	Corrected Groundwater Elevation [1] (ft amsl)	Corrected Water Table Depth [1] (ft btoc)
QP-3	04/03/13	---	---	5	15	6.57	6.54	0.03	---	6.54
(cont'd)	07/18/13	---	---	5	15	5.98	5.92	0.06	---	5.93
	09/23/13	---	---	5	15	7.01	6.91	0.10	---	6.92
	04/25/14	---	---	5	15	5.41	5.39	0.02	---	5.39
	06/02/14	---	---	5	15	5.74	5.71	0.03	---	5.71
	07/09/14	---	---	5	15	5.17	5.13	0.04	---	5.13
	07/31/14	---	---	5	15	5.25	5.24	0.01	---	5.24
	09/16/14	---	---	5	15	5.47	5.41	0.06	---	5.42
	03/24/15	---	---	5	15	6.36	6.34	0.02	---	6.34
	06/17/15	---	---	5	15	5.20	5.18	0.02	---	5.18
	09/09/15	---	---	5	15	5.12	5.09	0.03	---	5.09
	12/04/15	---	---	5	15	6.40	6.39	0.01	---	6.39
	03/15/16	---	---	5	15	5.40	5.39	0.01	---	5.39
	06/17/16	---	---	5	15	5.13	5.11	0.02	---	5.11
	09/22/16	---	---	5	15	5.72	5.68	0.04	---	5.68
	09/27/16	ABANDONED								
QP-3R	09/06/17	594.8	594.41	2	12	4.17	4.08	0.09	590.32	4.09
	11/27/17	594.8	594.41	2	12	4.15	4.04	0.11	590.36	4.05
	02/27/18	594.8	594.41	2	12	3.79	3.71	0.08	590.69	3.72
	06/04/18	594.8	594.41	2	12	3.87	3.76	0.11	590.64	3.77
	10/05/18	594.8	594.41	2	12	4.24	4.08	0.16	590.31	4.10
	12/11/18	594.8	594.41	2	12	3.71	3.59	0.12	590.81	3.60

Notes

LNAPL	Light Non-Aqueous Phase Liquid
ft	Feet
ft amsl	Feet Above Mean Sea Level
ft btoc	Feet Below Top of Casing
---	No LNAPL measured
[1]	A specific gravity of 0.88 (quench/hydraulic oil) was used to calculate corrected groundwater levels

Table 2

Summary of Transmissivity Testing - Quench Pit Area
RACER Trust - Saginaw Malleable Iron Industrial Land
Saginaw, Michigan

Quench Pit Well Location	Date of Last Transmissivity Test	LNAPL Transmissivity - T_n (ft^3/day)	LNAPL Thickness at Time of Transmissivity Testing (ft)	Range of LNAPL Thickness Since Well Re-Installation (ft)
QPTW-01R*				No Measurable Product
QPTW-01	5/10/2016	0.05	1.3	
QPTW-03R2*	4/27/2018	0.30	0.54	0.18 - 0.61
QPTW-03R	4/28/2016	0.11	1.3	
QPTW-04R*	9/9/2017	0.21	0.82	0.04 - 0.31
QPTW-04	5/10/2016	0.08	0.97	
QPTW-05R*	9/9/2017	de minimis	0.6	0.14 - 0.84
QPTW-05	4/29/2016	0.31	2.18	
QPTW-05	10/30/2014	0.31	1.7	
QPTW-10R*				No Measurable Product
QPTW-10	4/28/2016	0.00	0.23	
QPTW-10	9/30/2015	1.17	0.58	
QPTW-10	10/30/2014	1.58	2.56	

* Monitoring well re-installed between June and August 2017

Attachment A

John Pardys

From: Pardys, John-Eric
Sent: Friday, September 2, 2016 9:34 AM
To: Armbruster, Amanda (DEQ)
Cc: Dave Favero; Rousseau, Matthew; Klann, Rhonda (DEQ)
Subject: RE: ~COR-007878~SMI - wells proposed for abandonment and re-installation

Amanda,

Thanks for the response.

We are willing to incorporate the changes and are moving forward with the construction plans.

John-Eric Pardys P. Eng.

GHD
T: 1 519 884 0510 x3554 | F: 1 519 884 0525 | E: john-eric.pardys@ghd.com | www.ghd.com
Mailing address: 651 Colby Drive Waterloo Ontario N2V 1C2 Canada
Office address: 40 Bathurst Drive Waterloo Ontario N2V 1V6 Canada

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

From: Armbruster, Amanda (DEQ) [mailto:ARMBRUSTERA@michigan.gov]
Sent: Friday, September 02, 2016 9:13 AM
To: Pardys, John-Eric
Cc: Dave Favero; Rousseau, Matthew; Klann, Rhonda (DEQ)
Subject: RE: ~COR-007878~SMI - wells proposed for abandonment and re-installation

John-Eric,
Thank you for the detailed response. We are in agreement with the proposed work with a few exceptions. In addition to the 7 monitoring wells proposed for reinstallation, we would like QP-1 and QPTW-13 to be replaced. QP-1 had NAPL when it was installed and it is situated between two wells that exhibited greater than 2 feet of NAPL in 2015. QPTW-13 is located in the general downgradient direction of QPTW-10 and had NAPL detections as recent as 2013. The well screens are also submerged, so we believe reinstallation is warranted.

Quarterly NAPL monitoring for the replacement wells is acceptable, but only one year of monitoring cannot be approved at this time. If no NAPL is encountered at the completion of one year of monitoring a proposal can be made to discontinue or reduce monitoring. Supporting documentation will be needed to show the disappearance of NAPL was not influenced by fluctuating groundwater elevations or other factors. If NAPL is identified, recovery options need to be evaluated based on thicknesses identified and transmissivity of the wells, etc.

Our last comment is regarding the use of de minimus in relation to transmissivity levels less than 0.5 ft^2/day. For clarification, NAPL is not considered de minimus at transmissivity values of 0.5 or less. Having transmissivity values below that level is a means of showing NAPL can no longer be recovered in a cost-effective and efficient manner (which is different than de minimus). De minimus arguments are more appropriate for evaluating the volume and impact of remaining contamination.

If you are willing to incorporate our changes, feel free to move forward with your construction plans. If you have any concerns, let me know so we can discuss.

Thank you,
Amanda Armbruster, Geologist
Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Saginaw Bay District Office
989-894-6242 phone
989-894-6259 fax

From: Pardys, John-Eric [mailto:John-Eric.Pardys@ghd.com]
Sent: Monday, August 29, 2016 3:29 PM
To: Armbruster, Amanda (DEQ)
Cc: Dave Favero; Rousseau, Matthew; Klann, Rhonda (DEQ)
Subject: RE: ~COR-007878~SMI - wells proposed for abandonment and re-installation

Amanda,

We appreciate the prompt response to our request. See our responses following your comments below in **bold.**

Should you have any further questions, please do not hesitate to contact us.

Thanks

John-Eric Pardys P. Eng.

GHD
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Office address: 40 Bathurst Drive Waterloo Ontario N2V 1V6 Canada

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From: Armbruster, Amanda (DEQ) [mailto:ARMBRUSTERA@michigan.gov]
Sent: Thursday, August 25, 2016 11:24 AM
To: Pardys, John-Eric
Cc: Dave Favero; Rousseau, Matthew; Klann, Rhonda (DEQ)
Subject: RE: ~COR-007878~SMI - wells proposed for abandonment and re-installation

John-Eric,
I took a look at the wells proposed for abandonment. It looks like you are proposing to replace everything you had NAPL detections in last year, but I have a few questions:

See below for details on when or if LNAPL was observed in the wells we are not planning to re-install.

QPTW-02 – No LNAPL since '08 (and historically only had minor amounts of product)
QPTW-06 – No LNAPL historically or currently
QPTW-07 – No LNAPL historically (based on 1 reading in '97) or currently

QPTW-08 - No LNAPL currently (unable to find any historical readings)
QPTW-09 – No LNAPL historically (based on 1 reading in '97) or currently
QPTW-11 – No LNAPL historically (based on 2 readings one in '97 and one in '08) or currently
QPTW-12 – No LNAPL historically or currently
QPTW-13 – No LNAPL historically (based on 2 readings one in '97 and one in '07), evidence of product between 2010 and 2013, no LNAPL since September 23, 2013
QP-1 - At installation (June 2010) there was evidence of product, but product has not been measured in the well since August 2010.

Do all of these well currently straddle the water table?
All the monitoring wells proposed for abandonment were installed prior to or during the demolition (when the water table was lower). With the completion of the demolition the water level has come up and as such the top of screens for the Quench Pit monitoring wells proposed for abandonment are all at or below the water level (ie. screen is submerged).

What is the current construction? How will the new wells be constructed (diameter, screen length, etc.)?
The current construction of the majority of the wells is 2" diameter PVC, with the exception of the three wells installed in each of the former quench pits (QP1, QP2, QP3). Two of those wells were constructed of steel and are 16" in diameter and the other well was constructed of steel and is 4" in diameter. These wells were installed during the demolition of the quench pits and were intended to be LNAPL recovery wells.

The new wells would be constructed of PVC and be 2" diameter with 10ft screens straddling the water table with the exception of the replacement wells for QP-2 and QP-3 which would be constructed of PVC and be 4" diameter with 10ft screens straddling the water table. See below for levels of product in the QP recovery wells.
QP-1 - At installation (June 2010) there was evidence of product, but product has not been measured in the well since August 2010.
QP-2 – presence of product since installation (0.02 to 1.85 ft)
QP-3 – presence of product since installation (0.01 to 0.73 ft)

Is chemical analysis being done on any of the wells proposed for abandonment?
The current MDEQ approved monitoring program for this area does not include sampling or chemical analysis for any of these wells. We do not propose to complete sampling and chemical analysis on the wells being proposed for abandonment or the wells proposed for re-installation.

What is the plan for the treatment building/skimmer pump in QPTW-10?
The Plan is to move the treatment building/skimmer pump off of the work to allow for concrete removal and installing the soil cover. After the proposed wells are re-installed we propose to complete a transmissivity evaluation of all the re-installed wells. If the transmissivity level is less than the de minimus (0.5), we would propose no further active recovery be completed. If the transmissivity levels in one or more wells is above the de minimus, we would assess the value of continuing LNAPL recovery at that time based on the reasonably expected impact (risk reduction), of recovery on the residual LNAPL body. The building and skimmer pump will remain on-site as long as quarterly monitoring continues until MDEQ approve their complete removal from the Site.

Can the wells you are proposing to abandon be extended instead of replaced?
As the screens of the Quench Pit wells we are proposing to abandon are all at or below the water table we do not believe it is appropriate to try to extend the wells and based on experience it is very difficult to keep wells from being damaged during construction activity as is planned for the well locations.

I suspect it may take a while before NAPL starts to accumulate in any new wells. If NAPL doesn't show up right away, how long do you anticipate checking the new wells before you determine no NAPL is present?

We propose conducting quarterly level monitoring (consistent with the current program) and if no NAPL is present after 4 consecutive rounds of monitoring it can be concluded that LNAPL mobility/recoverability is de minimis by default and that no further action is needed to address the residual LNAPL and that monitoring can be discontinued.

I think what you are proposing to do is fine, but because of my lack of history with the site I'd feel better having some of the above information before we abandon the wells.

Thank you,
Amanda Armbruster, Geologist
Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Saginaw Bay District Office
989-894-6242 phone
989-894-6259 fax

From: Pardys, John-Eric [mailto:John-Eric.Pardys@ghd.com]
Sent: Monday, August 22, 2016 9:56 AM
To: Armbruster, Amanda (DEQ)
Cc: Dave Favero; Rousseau, Matthew
Subject: RE: ~COR-007878~SMI - wells proposed for abandonment and re-installation

Thank you.

JE

From: Armbruster, Amanda (DEQ) [mailto:ARMBRUSTERA@michigan.gov]
Sent: Monday, August 22, 2016 9:56 AM
To: Pardys, John-Eric
Cc: Dave Favero; Rousseau, Matthew
Subject: RE: ~COR-007878~SMI - wells proposed for abandonment and re-installation

John-Eric,
I didn't see this come through last week, so I'm glad you resent it. I'll take a look at it this week and let you know if I have any concerns.

Amanda Armbruster, Geologist
Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Saginaw Bay District Office
989-894-6242 phone
989-894-6259 fax

From: Pardys, John-Eric [mailto:John-Eric.Pardys@ghd.com]
Sent: Monday, August 22, 2016 8:39 AM
To: Armbruster, Amanda (DEQ)
Cc: Dave Favero; Rousseau, Matthew
Subject: ~COR-007878~SMI - wells proposed for abandonment and re-installation

Amanda,

GHD was having some difficulty sending emails last week, so I am sending this email again in the event you did not receive it. Thanks.

In preparation for the upcoming PCB work to be completed at RACER's Malleable Iron Industrial Land Site (former SMI facility) in Saginaw, MI, RACER/GHD is proposing to abandon monitoring wells on and nearby the concrete floor slab since the upcoming work includes the installation of- a 1-ft cover over the entire concrete floor slab. Following the installation of the cover and subject to acceptable weather, a sub-set of the monitoring wells would be re-installed to continue evaluation of LNAPL in the Quench Pit Area.

Please see the attached figure which identifies those wells proposed for abandonment (highlighted in yellow) and those monitoring wells proposed for abandonment and re-installation (highlighted in blue). The monitoring wells selected to be re-installed have had historical and/or current presence of LNAPL. At this time, we do not believe re-installation of wells for delineation or verifying no migration is necessary, since NAPL was deemed "effectively immobile, unrecoverable, and stable/non-migrating overall in the bulk of the soil matrix" (November 2014 NAPL presentation). In total there are 23 monitoring wells that would be abandoned and 7 monitoring wells that would be re-installed.

We have tentatively scheduled the abandonment of the monitoring wells for the end of the month.

Should you have any questions or require additional information, please do not hesitate to contact us.

Thanks

John-Eric Pardys P. Eng.

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Attachment B

Attachment B

LNAPL Transmissivity Testing: QPTW-03R2
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (fl oz)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
4/26/2018	8:00	0:00	3.72	4.26	6.48	11.00	0.09			
4/26/2018	8:10	0:10	3.76	3.91	1.80	3.00	0.02	3.4	0.04	0.45
4/26/2018	8:15	0:15	3.75	3.81	0.72				0.03	
4/26/2018	8:20	0:20	3.74	3.81	0.84	2.00	0.02	2.3	0.02	0.30
4/26/2018	8:25	0:25	3.74	3.77	0.36				0.02	
4/26/2018	8:30	0:30	3.74	3.77	0.36				0.02	
4/26/2018	8:35	0:35	3.74	3.78	0.48				0.02	
4/26/2018	8:40	0:40	3.74	3.79	0.60				0.02	
4/26/2018	8:45	0:45	3.74	3.79	0.60				0.02	
4/26/2018	8:50	0:50	3.74	3.79	0.60				0.02	
4/26/2018	8:55	0:55	3.74	3.79	0.60				0.02	
4/26/2018	9:00	1:00	3.74	3.79	0.60				0.02	
4/26/2018	9:10	1:10	3.74	3.79	0.60				0.02	
4/26/2018	9:20	1:20	3.74	3.79	0.60				0.02	
4/26/2018	9:30	1:30	3.74	3.79	0.60				0.02	
4/26/2018	9:40	1:40	3.74	3.79	0.60				0.02	
4/26/2018	9:50	1:50	3.74	3.79	0.60				0.02	
4/26/2018	10:00	2:00	3.74	3.80	0.72				0.02	
4/26/2018	10:15	2:15	3.74	3.80	0.72				0.02	
4/26/2018	10:30	2:30	3.74	3.80	0.72				0.02	
4/26/2018	10:45	2:45	3.74	3.80	0.72				0.02	
4/26/2018	11:00	3:00	3.73	3.80	0.84				0.01	
4/26/2018	11:15	3:15	3.73	3.80	0.84				0.01	
4/26/2018	11:30	3:30	3.73	3.80	0.84				0.01	
4/26/2018	11:45	3:45	3.73	3.80	0.84				0.01	
4/26/2018	12:00	4:00	3.73	3.80	0.84				0.01	
4/26/2018	12:20	4:20	3.73	3.80	0.84				0.01	
4/26/2018	12:40	4:40	3.74	3.80	0.72				0.02	
4/26/2018	13:00	5:00	3.74	3.80	0.72	1.5	0.01	0.06	0.02	0.01
4/26/2018	13:10	5:10	3.73	3.80	0.84				0.01	
4/26/2018	13:20	5:20	3.73	3.80	0.84				0.01	
4/26/2018	13:30	5:30	3.73	3.80	0.84				0.01	
4/26/2018	14:00	6:00	3.73	3.80	0.84				0.01	
4/26/2018	14:30	6:30	3.73	3.80	0.84				0.01	
4/26/2018	15:00	7:00	3.73	3.80	0.84				0.01	
4/26/2018	15:30	7:30	3.74	3.80	0.72				0.02	
4/26/2018	16:00	8:00	3.74	3.80	0.72				0.02	
4/27/2018	10:45	2:45	3.77	3.80	0.36				0.05	

Inputs	**0.02**	**0.01**
LNAPL Transmissivity - T_n (ft^2/day)		**0.30**

LNAPL Transmissivity Testing: QPTW-04R
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (fl oz)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	25% of Recovery Rate (gal/day)	Recovery Rate Difference (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
9/19/2017	9:45	0:00	4.98	5.80	9.84	16.00	0.13					
9/19/2017	9:55	0:10	5.05	5.15	1.20	2.00	0.02	2.3			0.07	0.30
9/19/2017	10:05	0:20	5.06	5.12	0.72						0.08	
9/19/2017	10:10	0:25	5.06	5.13	0.84						0.08	
9/19/2017	10:15	0:30	5.06	5.13	0.84						0.08	
9/19/2017	10:25	0:40	5.05	5.14	1.08	1.50	0.01	0.6	0.14		0.07	0.08
9/19/2017	10:35	0:50	5.06	5.11	0.60						0.08	
9/19/2017	10:45	1:00	5.06	5.13	0.84						0.08	
9/19/2017	10:55	1:10	5.06	5.13	0.84						0.08	
9/19/2017	11:05	1:20	5.05	5.13	0.96						0.07	
9/19/2017	11:15	1:30	5.05	5.13	0.96						0.07	
9/19/2017	11:25	1:40	5.05	5.13	0.96						0.07	
9/19/2017	11:40	1:55	5.05	5.14	1.08						0.07	
9/19/2017	11:55	2:10	5.06	5.14	0.96						0.08	
9/19/2017	12:10	2:25	5.05	5.14	1.08	1.50	0.01	0.2	0.04	0.10	0.07	0.02
9/19/2017	12:25	2:40	5.06	5.11	0.60						0.08	
9/19/2017	12:40	2:55	5.06	5.12	0.72						0.08	
9/19/2017	13:10	3:25	5.06	5.12	0.72						0.08	
9/19/2017	13:40	3:55	5.06	5.13	0.84						0.08	
9/19/2017	14:10	4:25	5.05	5.13	0.96						0.07	
9/19/2017	14:40	4:55	5.06	5.14	0.96						0.08	
9/19/2017	15:10	5:25	5.06	5.14	0.96						0.08	
9/19/2017	15:40	5:55	5.06	5.14	0.96						0.08	

Inputs	**0.08**	**0.02**

LNAPL Transmissivity - T_n (ft^2/day)	**0.21**

LNAPL Transmissivity Testing: QPTW-05R
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (fl oz)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	25% of Recovery Rate (gal/day)	Recovery Rate Difference (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
9/19/2017	8:15	0:00	5.23	5.76	6.36	12.00	0.09					
9/19/2017	8:20	0:05	5.27	5.40	1.56	4.00	0.03	9.0			0.04	1.20
9/19/2017	8:25	0:10	5.29	5.35	0.72						0.06	
9/19/2017	8:30	0:15	5.28	5.35	0.84						0.05	
9/19/2017	8:35	0:20	5.27	5.35	0.96						0.04	
9/19/2017	8:40	0:25	5.27	5.35	0.96						0.04	
9/19/2017	8:50	0:35	5.27	5.35	0.96	1.50	0.01	0.6	0.1		0.04	0.08
9/19/2017	8:55	0:40	5.28	5.31	0.36						0.05	
9/19/2017	9:00	0:45	5.28	5.32	0.48						0.05	
9/19/2017	9:10	0:55	5.28	5.32	0.48						0.05	
9/19/2017	9:40	1:25	5.28	5.32	0.48						0.05	
9/19/2017	10:00	1:45	5.28	5.32	0.48						0.05	
9/19/2017	10:20	2:05	5.28	5.32	0.48						0.05	
9/19/2017	10:50	2:35	5.28	5.32	0.48						0.05	
9/19/2017	11:20	3:05	5.28	5.32	0.48						0.05	
9/19/2017	11:50	3:35	5.28	5.32	0.48						0.05	
9/19/2017	12:30	4:15	5.28	5.32	0.48						0.05	
9/19/2017	13:15	5:00	5.28	5.32	0.48						0.05	
9/19/2017	14:00	5:45	5.28	5.32	0.48						0.05	
9/19/2017	14:45	6:30	5.28	5.33	0.60						0.05	
9/19/2017	15:30	7:15	5.28	5.33	0.60						0.05	

Inputs	de minimis	de minimis

LNAPL Transmissivity - T_n (ft^2/day)	de minimis

(based on lack of significant recharge after approximately 7 hours)

LNAPL Transmissivity Testing: QPTW-01
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (ml)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	25% of Recovery Rate (gal/day)	Recovery Rate Difference (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
5/10/2016	9:07	0:00	1.99	3.29	15.60	750	0.20					
5/10/2016	9:12	0:05	2.83	2.93	1.20						0.84	
5/10/2016	9:17	0:10	2.69	2.79	1.20						0.70	
5/10/2016	9:22	0:15	2.58	2.68	1.20						0.59	
5/10/2016	9:27	0:20	2.50	2.60	1.20						0.51	
5/10/2016	9:32	0:25	2.45	2.55	1.20						0.46	
5/10/2016	9:37	0:30	2.40	2.51	1.32						0.41	
5/10/2016	9:42	0:35	2.38	2.49	1.32						0.39	
5/10/2016	9:52	0:45	2.34	2.45	1.32						0.35	
5/10/2016	10:02	0:55	2.32	2.43	1.32						0.33	
5/10/2016	10:12	1:05	2.31	2.42	1.32						0.32	
5/10/2016	10:22	1:15	2.30	2.41	1.32						0.31	
5/10/2016	10:32	1:25	2.30	2.41	1.32						0.31	
5/10/2016	10:47	1:40	2.29	2.41	1.44	60	0.02	0.2	0.1	--	0.30	0.03
5/10/2016	11:02	1:55	2.42	2.47	0.60						0.43	
5/10/2016	11:17	2:10	2.35	2.40	0.60						0.36	
5/10/2016	11:37	2:30	2.32	2.37	0.60						0.33	
5/10/2016	11:57	2:50	2.30	2.35	0.60						0.31	
5/10/2016	12:17	3:10	2.29	2.34	0.60						0.30	
5/10/2016	12:47	3:40	2.28	2.33	0.60						0.29	
5/10/2016	13:17	4:10	2.27	2.32	0.60						0.28	
5/10/2016	14:17	5:10	2.25	2.31	0.72						0.26	
5/10/2016	15:17	6:10	2.24	2.30	0.72						0.25	
5/10/2016	16:17	7:10	2.24	2.30	0.72						0.25	

Inputs	**0.42**	**0.03**

LNAPL Transmissivity - T_n (ft^2/day) **0.05**

LNAPL Transmissivity Testing: QPTW-04
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (ml)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	25% of Recovery Rate (gal/day)	Recovery Rate Difference (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
5/10/2016	8:05	0:00	1.80	2.77	11.64	550	0.15					
5/10/2016	8:10	0:05	2.14	2.23	1.08						0.34	
5/10/2016	8:15	0:10	2.01	2.12	1.32						0.21	
5/10/2016	8:20	0:15	1.95	2.07	1.44						0.15	
5/10/2016	8:25	0:20	1.93	2.05	1.44						0.13	
5/10/2016	8:30	0:25	1.92	2.04	1.44						0.12	
5/10/2016	8:35	0:30	1.91	2.03	1.44	60	0.02	0.8	0.2		0.11	0.10
5/10/2016	8:45	0:40	1.96	2.02	0.72						0.16	
5/10/2016	8:55	0:50	1.92	1.99	0.84						0.12	
5/10/2016	9:05	1:00	1.91	1.98	0.84						0.11	
5/10/2016	9:15	1:10	1.91	1.98	0.84						0.11	
5/10/2016	9:30	1:25	1.91	1.98	0.84						0.11	
5/10/2016	9:45	1:40	1.91	1.98	0.84						0.11	
5/10/2016	10:00	1:55	1.90	1.98	0.96						0.10	
5/10/2016	10:20	2:15	1.90	1.98	0.96						0.10	
5/10/2016	10:40	2:35	1.90	1.98	0.96						0.10	
5/10/2016	11:00	2:55	1.90	1.98	0.96						0.10	
5/10/2016	11:30	3:25	1.90	1.98	0.96	40	0.01	0.09	0.02	0.2	0.10	0.01
5/10/2016	12:00	3:55	1.91	1.96	0.60						0.11	
5/10/2016	12:30	4:25	1.91	1.96	0.60						0.11	
5/10/2016	13:00	4:55	1.90	1.96	0.72						0.10	
5/10/2016	14:00	5:55	1.89	1.95	0.72						0.09	
5/10/2016	15:00	6:55	1.89	1.95	0.72						0.09	
5/10/2016	16:00	7:55	1.89	1.95	0.72						0.09	

Inputs	**0.11**	**0.01**

LNAPL Transmissivity - T_n (ft^2/day)	**0.08**

LNAPL Transmissivity Testing: QPTW-05
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (ml)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	25% of Recovery Rate (gal/day)	Recovery Rate Difference (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
4/29/2016	7:40	0:00	2.41	4.59	26.16	1400	0.37					
4/29/2016	7:45	0:05	3.78	3.96	2.16						1.37	
4/29/2016	7:50	0:10	3.35	3.57	2.64						0.94	
4/29/2016	7:55	0:15	3.08	3.45	4.44						0.67	
4/29/2016	8:00	0:20	2.93	3.29	4.32	200	0.053	4	1.0		0.52	0.51
4/29/2016	8:05	0:25	3.04	3.15	1.32						0.63	
4/29/2016	8:10	0:30	2.91	3.04	1.56						0.50	
4/29/2016	8:15	0:35	2.82	2.97	1.80						0.41	
4/29/2016	8:20	0:40	2.78	2.93	1.80						0.37	
4/29/2016	8:30	0:50	2.70	2.86	1.92						0.29	
4/29/2016	8:40	1:00	2.67	2.84	2.04						0.26	
4/29/2016	8:50	1:10	2.64	2.85	2.52						0.23	
4/29/2016	9:00	1:20	2.62	2.87	3.00	120	0.032	0.8	0.2	3	0.21	0.10
4/29/2016	9:10	1:30	2.76	2.89	1.56						0.35	
4/29/2016	9:20	1:40	2.67	2.85	2.16						0.26	
4/29/2016	9:30	1:50	2.65	2.85	2.40						0.24	
4/29/2016	9:40	2:00	2.63	2.86	2.76						0.22	
4/29/2016	9:55	2:15	2.62	2.88	3.12	135	0.036	0.9	0.2	0.2	0.21	0.12
4/29/2016	10:10	2:30	2.71	2.86	1.80						0.30	
4/29/2016	10:25	2:45	2.65	2.85	2.40						0.24	
4/29/2016	10:40	3:00	2.63	2.86	2.76						0.22	
4/29/2016	10:55	3:15	2.62	2.89	3.24	150	0.040	1	0.2	0.02	0.21	0.13
4/29/2016	11:15	3:35	2.68	2.82	1.68						0.27	
4/29/2016	11:35	3:55	2.62	2.83	2.52						0.21	
4/29/2016	11:55	4:15	2.61	2.85	2.88						0.20	
4/29/2016	12:25	4:45	2.60	2.92	3.84	175	0.046	0.7	0.2	0.2	0.19	0.10
4/29/2016	12:55	5:15	2.64	2.81	2.04						0.23	
4/29/2016	13:25	5:45	2.60	2.83	2.76						0.19	
4/29/2016	13:55	6:15	2.58	2.87	3.48						0.17	
4/29/2016	14:25	6:45	2.56	2.92	4.32						0.15	
4/29/2016	14:55	7:15	2.56	2.96	4.80						0.15	

Inputs	**0.27**	**0.11**

LNAPL Transmissivity - T_n (ft^2/day)	**0.3**

LNAPL Transmissivity Testing: QPTW-03R
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (ml)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	25% of Recovery Rate (gal/day)	Recovery Rate Difference (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
4/28/2016	11:35	0:00	1.99	3.29	15.60	1200	0.32					
4/28/2016	11:40	0:05	2.83	2.93	1.20						0.84	
4/28/2016	11:45	0:10	2.69	2.79	1.20						0.70	
4/28/2016	11:50	0:15	2.58	2.68	1.20						0.59	
4/28/2016	11:55	0:20	2.50	2.60	1.20						0.51	
4/28/2016	12:05	0:30	2.45	2.55	1.20						0.46	
4/28/2016	12:15	0:40	2.40	2.51	1.32						0.41	
4/28/2016	12:25	0:50	2.38	2.49	1.32						0.39	
4/28/2016	12:35	1:00	2.34	2.45	1.32	90	0.02	0.6	0.1		0.35	0.08
4/28/2016	12:45	1:10	2.32	2.43	1.32						0.33	
4/28/2016	12:55	1:20	2.31	2.42	1.32						0.32	
4/28/2016	13:10	1:35	2.30	2.41	1.32						0.31	
4/28/2016	13:25	1:50	2.30	2.41	1.32						0.31	
4/28/2016	13:40	2:05	2.29	2.41	1.44	60	0.02	0.4	0.1	0.2	0.30	0.05
4/28/2016	13:55	2:20	2.42	2.47	0.60						0.43	
4/28/2016	14:15	2:40	2.35	2.40	0.60						0.36	
4/28/2016	14:35	3:00	2.32	2.37	0.60						0.33	
4/28/2016	14:55	3:20	2.30	2.35	0.60						0.31	
4/28/2016	15:15	3:40	2.29	2.34	0.60						0.30	
4/28/2016	15:35	4:00	2.28	2.33	0.60						0.29	
4/28/2016	16:05	4:30	2.27	2.32	0.60						0.28	

Inputs	**0.32**	**0.05**

LNAPL Transmissivity - T_n (ft^2/day)	**0.1**

LNAPL Transmissivity Testing: QPTW-10
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (ml)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	25% of Recovery Rate (gal/day)	Recovery Rate Difference (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
4/28/2016	8:05	0:00	2.58	2.81	2.76	125	0.03					
4/28/2016	8:10	0:05	2.60	2.67	0.84	45	0.01	3.4			0.02	0.46
4/28/2016	8:15	0:10	2.59	2.64	0.60	30	0.008	2.3	0.6		0.01	0.31
4/28/2016	8:20	0:15	2.63	2.65	0.24						0.05	
4/28/2016	8:25	0:20	2.59	2.63	0.48					0.6	0.01	
4/28/2016	8:30	0:25	2.58	2.63	0.60	30	0.008	0.8	0.2		0.00	0.10
4/28/2016	8:40	0:35	2.59	2.62	0.36					0.0	0.01	
4/28/2016	8:50	0:45	2.59	2.62	0.36						0.01	
4/28/2016	9:00	0:55	2.59	2.62	0.36					0.0	0.01	
4/28/2016	9:10	1:05	2.59	2.63	0.48	25	0.007	0.2	0.1		0.01	0.03
4/28/2016	9:20	1:15	2.59	2.61	0.24						0.01	
4/28/2016	9:35	1:30	2.59	2.61	0.24					0.0	0.01	
4/28/2016	9:50	1:45	2.59	2.61	0.24						0.01	
4/28/2016	10:10	2:05	2.59	2.61	0.24						0.01	
4/28/2016	10:30	2:25	2.59	2.61	0.24					0.0	0.01	
4/28/2016	11:00	2:55	2.59	2.61	0.24						0.01	
4/28/2016	11:30	3:25	2.59	2.61	0.24					0.0	0.01	
4/28/2016	12:00	3:55	2.59	2.61	0.24						0.01	
4/28/2016	13:00	4:55	2.59	2.61	0.24					0.0	0.01	
4/28/2016	14:00	5:55	2.59	2.61	0.24						0.01	
4/28/2016	15:00	6:55	2.59	2.61	0.24					0.0	0.01	
4/28/2016	16:00	7:55	2.59	2.61	0.24						0.01	0.00[a]
										Inputs	**0.01**	**0.00**
										LNAPL Transmissivity - T_n (ft^2/day)		**0.00**

Notes:

[a]LNAPL recovery rate assumed to be zero since there was no LNAPL recharge into the well during the last 6.5 hours of test.

LNAPL Transmissivity Testing: QPTW-10
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (fl oz)	Volume Removed (gal)	LNAPL Recovery Rate - Q_n (gal/day)	25% of Recovery Rate (gal/day)	Recovery Rate Difference (gal/day)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/day)
9/30/2015	8:25	0:00	3.81	4.39	6.96	12.00	0.09					
9/30/2015	8:30	0:05	3.86	4.01	1.80	3.00	0.02	6.8			0.05	0.90
9/30/2015	8:35	0:10	3.86	4.01	1.80	2.50	0.02	5.6	1.4		0.05	0.75
9/30/2015	8:40	0:15	3.86	3.97	1.32						0.05	
9/30/2015	8:45	0:20	3.85	3.98	1.56	2.75	0.02	3.1	0.8	0.6	0.04	0.41
9/30/2015	8:50	0:25	3.86	3.96	1.20						0.05	
9/30/2015	8:55	0:30	3.85	3.98	1.56	2.75	0.02	3.1	0.8	0.0	0.04	0.41
9/30/2015	9:00	0:35	3.86	3.96	1.20						0.05	
9/30/2015	9:05	0:40	3.85	3.97	1.44	2.50	0.02	2.8	0.7	0.1	0.04	0.38
9/30/2015	9:10	0:45	3.86	3.95	1.08						0.05	
9/30/2015	9:15	0:50	3.85	3.96	1.32						0.04	
9/30/2015	9:20	0:55	3.85	3.98	1.56	2.75	0.02	2.1	0.5	0.2	0.04	0.28
9/30/2015	9:25	1:00	3.86	3.96	1.20						0.05	
9/30/2015	9:30	1:05	3.85	3.96	1.32						0.04	
9/30/2015	9:35	1:10	3.85	3.98	1.56	2.75	0.02	2.1	0.5	0.0	0.04	0.28
9/30/2015	9:45	1:20	3.85	3.96	1.32						0.04	
9/30/2015	9:55	1:30	3.85	3.98	1.56	2.75	0.02	1.5	0.4	0.1	0.04	0.21
9/30/2015	10:05	1:40	3.85	3.96	1.32						0.04	
9/30/2015	10:15	1:50	3.84	3.98	1.68	2.75	0.02	1.5	0.4	0.0	0.03	0.21
9/30/2015	10:25	2:00	3.86	3.96	1.20						0.05	
9/30/2015	10:35	2:10	3.85	3.98	1.56	2.75	0.02	1.5	0.4	0.0	0.04	0.21
9/30/2015	10:50	2:25	3.85	3.96	1.32						0.04	
9/30/2015	11:05	2:40	3.85	3.98	1.56	2.75	0.02	1.0	0.3	0.1	0.04	0.14
9/30/2015	11:20	2:55	3.86	3.97	1.32						0.05	
9/30/2015	11:35	3:10	3.85	3.98	1.56	2.75	0.02	1.0	0.3	0.0	0.04	0.14
9/30/2015	11:55	3:30	3.86	3.97	1.32						0.05	
9/30/2015	12:15	3:50	3.85	3.99	1.68	2.75	0.02	0.8	0.2	0.1	0.04	0.10
9/30/2015	12:35	4:10	3.86	3.96	1.20						0.05	
9/30/2015	12:55	4:30	3.85	3.98	1.56	2.75	0.02	0.8	0.2	0.0	0.04	0.10
9/30/2015	13:25	5:00	3.86	3.96	1.20						0.05	
9/30/2015	13:55	5:30	3.85	3.98	1.56	2.75	0.02	0.5	0.1	0.1	0.04	0.07
9/30/2015	14:25	6:00	3.85	3.94	1.08						0.04	
9/30/2015	14:55	6:30	3.85	3.96	1.32						0.04	
9/30/2015	15:25	7:00	3.85	3.98	1.56						0.04	

Inputs	**0.04**	**0.07**

LNAPL Transmissivity - T_n (ft^2/day)	**1.17**

LNAPL Transmissivity Testing: QPTW-05
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (gal)	Volume Removed (fl oz)	Volume Removed (mL)	LNAPL Recovery Rate - Q_n (mL/hr)	25% of Recovery Rate (mL/hr)	Recovery Rate Difference (mL/hr)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/hr)
10/30/2014	8:00	0:00	3.44	5.14	20.40	0.2500	32	946					
10/30/2014	8:10	0:10											
10/30/2014	8:15	0:15	4.32	4.58	3.12							0.88	
10/30/2014	8:20	0:20	3.91	4.32	4.92		8	237	710	177		0.47	0.0251
10/30/2014	8:25	0:25	4.04	4.24	2.40							0.60	
10/30/2014	8:30	0:30	3.83	4.09	3.12							0.39	
10/30/2014	8:35	0:35	3.76	4.02	3.12							0.32	
10/30/2014	8:40	0:40	3.71	3.96	3.00		6	177	532	133	177	0.27	0.0188
10/30/2014	8:45	0:45	3.81	3.98	2.04							0.37	
10/30/2014	8:50	0:50	3.74	3.93	2.28							0.30	
10/30/2014	8:55	0:55	3.70	3.90	2.40							0.26	
10/30/2014	9:00	1:00	3.68	3.88	2.40		4	118	355	89	177	0.24	0.0125
10/30/2014	9:10	1:10	3.71	3.90	2.28							0.27	
10/30/2014	9:20	1:20	3.67	3.87	2.40							0.23	
10/30/2014	9:30	1:30	3.65	3.86	2.52							0.21	
10/30/2014	9:40	1:40	3.63	3.87	2.88							0.19	
10/30/2014	9:50	1:50	3.62	3.88	3.12							0.18	
10/30/2014	10:00	2:00	3.61	3.91	3.60		6	177	177	44	177	0.17	0.0063
10/30/2014	10:15	2:15	3.65	3.90	3.00							0.21	
10/30/2014	10:30	2:30	3.61	3.91	3.60		6	177	355	89	177	0.17	0.0125
10/30/2014	11:00	3:00	3.62	3.88	3.12							0.18	
10/30/2014	11:30	3:30	3.59	3.94	4.20							0.15	
10/30/2014	11:45	3:45	3.59	3.98	4.68		8	237	189	47	166	0.15	0.0067
10/30/2014	12:30	4:30	3.59	3.94	4.20		7	207	276	69	87	0.15	0.0097
10/30/2014	13:30	5:30	3.58	3.90	3.84		6	177	177	44	99	0.14	0.0063
10/30/2014	14:30	6:30	3.60	3.83	2.76		4	118	118	30	59	0.16	0.0042
10/30/2014	15:30	7:30	3.58	3.78	2.40							0.14	
10/30/2014	16:00	8:00	3.57	3.82	3.00							0.13	

Inputs **0.23**

LNAPL Transmissivity - T_n (ft^2/day)

LNAPL Transmissivity Testing: QPTW-10
RACER Saginaw Malleable Industrial Land
Saginaw, MI

Day	Time	Elapsed Time (hours)	DTP (ft btor)	DTW (ft btor)	In-Well LNAPL Thickness (in)	Volume Removed (gal)	Volume Removed (fl oz)	Volume Removed (mL)	LNAPL Recovery Rate - Q_n (mL/hr)	25% of Recovery Rate (mL/hr)	Recovery Rate Difference (mL/hr)	LNAPL Drawdown - S_n (feet)	LNAPL Recovery Rate - Q_n (ft^3/hr)
10/30/2014	10:35	0:00	3.43	5.99	30.72	0.3750	48	1420					
10/30/2014	10:40	0:05	3.66	4.04	4.56							0.23	
10/30/2014	10:45	0:10	3.59	4.13	6.48		11	325	1952	488		0.16	
10/30/2014	10:50	0:15	3.62	3.90	3.36							0.19	
10/30/2014	10:55	0:20	3.62	3.95	3.96							0.19	
10/30/2014	11:05	0:30	3.59	4.07	5.76		9	266	1065	266	887	0.16	0.0376
10/30/2014	11:10	0:35	3.63	3.87	2.88							0.20	
10/30/2014	11:15	0:40	3.61	3.90	3.48							0.18	
10/30/2014	11:20	0:45	3.60	3.98	4.56							0.17	
10/30/2014	11:25	0:50	3.60	4.05	5.40		8	237	1420	355	355	0.17	0.0501
10/30/2014	11:35	1:00	3.61	3.92	3.72							0.18	
10/30/2014	11:40	1:05	3.60	3.97	4.44							0.17	
10/30/2014	11:50	1:15	3.59	4.09	6.00		10	296	1183	296	237	0.16	0.0418
10/30/2014	12:00	1:25	3.61	3.87	3.12							0.18	
10/30/2014	12:10	1:35	3.59	3.99	4.80							0.16	
10/30/2014	12:20	1:45	3.58	4.11	6.36		10	296	887	222	296	0.15	0.0313
10/30/2014	12:35	2:00	3.60	3.92	3.84							0.17	
10/30/2014	12:50	2:15	3.59	4.10	6.12		10	296	591	148	296	0.16	0.0209
10/30/2014	13:05	2:30	3.61	3.87	3.12							0.18	
10/30/2014	13:25	2:50	3.58	4.13	6.60		11	325	558	139	34	0.15	0.0197
10/30/2014	13:45	3:10	3.59	3.96	4.44							0.16	
10/30/2014	14:05	3:30	3.59	4.16	6.84		11	325	488	122	70	0.16	0.0172
10/30/2014	14:35	4:00	3.58	4.03	5.40							0.15	
10/30/2014	15:05	4:30	3.55	4.26	8.52		14	414	414	104	74	0.12	0.0146
10/30/2014	15:35	5:00	3.59	3.99	4.80							0.16	
10/30/2014	15:50	5:15	3.58	4.12	6.48		11	325	434	108	20	0.15	0.0153
10/30/2014	16:30	5:55	3.58	4.02	5.28							0.15	

Inputs **0.17**

LNAPL Transmissivity - T_n (ft^2/day)