Groundwater Monitoring System
Summary Report

DTE Electric Company
River Rouge Power Plant Bottom Ash Basin
Coal Combustion Residual Unit

1 Belanger Park Drive
River Rouge, Michigan

October 2017

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Prepared For
DTE Electric Company

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Section 1
Introduction

1.1 Background and Objective

The United States Environmental Protection Agency (U.S. EPA) established a comprehensive set of requirements for management and disposal of coal combustion residuals (CCR) in landfills and surface impoundments in the Final Rule: Disposal of CCR from Electric Utilities (CCR Rule) on April 17, 2015. The DTE Electric Company (DTE Electric) River Rouge Power Plant (RRPP) CCR bottom ash basin (BAB) unit is subject to the CCR Rule.

The objective of this report is to document and certify that the CCR Groundwater Monitoring System for the RRPP CCR BAB unit has been designed and constructed to meet the requirements of Title 40 Code of Federal Regulations (CFR) §257.91 (a)(1) and (2) of the CCR Rule. TRC Engineers Michigan, Inc. (TRC) was retained by DTE Electric to provide this report documenting the construction of the CCR groundwater monitoring system for the RRPP BAB.

1.2 Site Location

The RRPP BAB is located at 1 Belanger Park Drive, within the City of River Rouge in Wayne County, Michigan (**Figures 1 and 2**). The RRPP, including the BAB CCR unit, was originally constructed in the early 1950s, just east of the DTE Electric RRPP. The power plant is located at the confluence of the Rouge River and the Detroit River.

1.3 Description of RRPP CCR Unit

The property has been used continuously as a coal fired power plant since Detroit Edison Company (now DTE Electric) began power plant operations at RRPP in 1957. The plant is constructed on reclaimed land that was formerly emergent shoreline. The BAB has been in operation with the RRPP since it began operation and has collected CCR bottom ash that is cleaned out as needed and disposed of at Sibley Quarry Landfill.

The RRPP BAB is a sedimentation basin that is an incised CCR surface impoundment (**Figure 2**). The impoundment is sheet-piled around the perimeters to approximately 30 feet below ground surface (feet-bgs) into the native soil. The BAB is located northeast of the RRPP, runs roughly from southeast to northwest parallel and adjacent to the Rouge River, and is approximately 550 feet long by 50 to 110 feet wide and widens toward the northwest (**Figure 2**). The design bottom elevation of the BAB is 569 feet relative to the North American Vertical Datum of 1988 (NAVD 88). The BAB is used for receiving sluiced bottom ash and other process flow effluent pumped from the power plant to the eastern end of the BAB. There is a sheet pile weir near the

middle of the BAB that maintains the water elevation in the eastern portion to approximately 577.5 feet through gravity flow. The water in the western portion of the BAB is maintained at an elevation of no higher than 577 feet before being recirculated back to the RRPP from the northeastern end of the BAB and/or is discharged into the Rouge River in accordance with a National Pollution Discharge Elimination System (NPDES) permit.

Section 2
Hydrogeology

2.1 Regional Hydrogeologic Setting

The Wayne County area geology is characterized by deposits of glacio-lacustrine clay and silt on top of thick strata of dolomite and limestone bedrock. The uppermost bedrock units in Wayne County consist of Paleozoic sedimentary rock strata of marine origin[1]. According to the bedrock geology map of Wayne County, the site is located in an area where the Dundee Formation (mostly limestone, with some dolostone) and the Detroit River Group (limestone, dolostone, and some sandstone) underlie the unconsolidated glacial deposits. The stratigraphic succession (from youngest to oldest) in the subject area is: Dundee Formation (Limestone), Detroit River Group, Sylvania Sandstone, Bois Blanc, followed by the Bass Island and Salina Group. The majority of wells within the county are in glacial deposits (67%) while some are installed in bedrock (27%)[2]. The general regional bedrock groundwater flow pattern in the area is generally considered to be from west to east toward the Detroit River.

2.2 RRPP Hydrogeology

The subsurface geology presented within this report is based on information from historical borings advanced during initial design and later expansion of the RRPP, in addition to the soil boring data collected from around the BABs during the groundwater monitoring system installation detailed in Section 3. Soil borings from the groundwater monitoring system are included in Appendix A and generalized geologic cross sections are provided in **Figures 3 and 4**.

This information documents that the RRPP CCR unit is underlain initially by approximately 10 feet of surficial fill of various composition (gravel, sand, silt and clay, brick and/or concrete fragments). The fill is in some places partially saturated, but is not continuously saturated across the RRPP, does not represent a significant, usable source of water and is therefore not an aquifer. An organic layer is often encountered beneath the surficial fill that is then underlain by a silt/clay-rich unit that ranges from 3 to about 8 feet thick in the area of the BAB (**Figures 3 and 4**). Beneath the silt/clay-rich unit, there is a saturated sand and gravel unit that often coarsens from sand to gravel with depth. This coarse-grained sand and gravel unit is present from as shallow as 15 feet-bgs to as deep as 25.5 feet bgs (**Figures 3 and 4**). This same coarse-grained unit is observed in most of the historical boring logs across the RRPP and appears to be a relatively

[1] Mozola, A. J., 1969, Geology for land and ground-water development in Wayne County, Michigan: Michigan Geological Survey Division Report R 3, 25 p.
[2] Beth A. Apple and Howard W. Reeves, 2007, Summary of Hydrogeologic Conditions by County for the State of Michigan. U.S. Geological Survey Open-File Report 2007-1236, 78 p.

continuous unit across the RRPP. Based on this information, this coarse-grained sand and gravel unit represents the uppermost aquifer present at the BAB CCR unit.

The coarse-grained sand and gravel unit is underlain by a more than 60-foot-thick contiguous silty clay-rich soil (till and/or lacustrine deposits) across the site, that extends to the top of the Dundee limestone bedrock (**Figures 3 and 4**). One deeper well (MW-4D) was set into the uppermost portion of the Dundee limestone (well below the uppermost aquifer) and is artesian. There is one irrigation well screened within the uppermost portion of the bedrock aquifer approximately one-mile southwest of the RRPP. There are no known water supply wells screened within the unconsolidated sediment within one-mile of the RRPP. Surface water bodies present in the area of the RRPP include the Rouge River, located immediately adjacent and northeast of the BAB CCR unit, and the Detroit River, located within 300 feet to the southeast of the BAB CCR unit (**Figure 2**).

2.2.1 Uppermost Aquifer

Definition

The 40 CFR §257.53 definitions of an aquifer and uppermost aquifer are as follows:

- *Aquifer* means a geologic formation, group of formations, or portion of a formation capable of yielding useable quantities of groundwater to wells or springs.
- *Uppermost aquifer* means the geologic formation nearest the natural ground surface that is an aquifer, as well as the lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.

Site Uppermost Aquifer

As described above, the uppermost aquifer as defined in 40 CFR §257.53 is the sand and gravel unit that ranges from as shallow as 15 feet-bgs to as deep as 25.5 feet bgs. This unit is approximately 8 to 10 feet thick in the area of the BAB (**Figures 3 and 4** and Appendix A). The uppermost aquifer sits beneath approximately 10 to 12 feet of fill/organic soil and a 3 to 8 foot thick confining silt/clay-rich unit. The uppermost aquifer is underlain by a more than 60 foot thick vertically contiguous silty clay-rich deposit that serves as a natural lower confining hydraulic barrier that isolates the Dundee limestone that represents the next aquifer (see **Figures 3 and 4** and Appendix A). There is no apparent hydraulic connection between the uppermost aquifer and the Dundee limestone.

A hydraulic conductivity of 2.3×10^{-8} centimeters per second (cm/s) was measured from a soil sample collected from the underlying confining silty clay-rich low permeability

soil during the installation of monitoring well MW-4D. Given that there is over 60 feet of silty-clay that isolates the uppermost aquifer from the underlying limestone aquifer, with a strong upward hydraulic gradient (artesian conditions observed at MW-4D exceeded static water elevations in the uppermost aquifer by at least 10 feet), there is no potential for the lower bedrock aquifer to be affected by the RRPP BAB CCR unit.

2.2.2 Groundwater Flow

Groundwater Flow Direction

TRC installed the groundwater monitoring wells included in the CCR monitoring well system which were initially completed by June 2016 with two monitoring wells added in June 2017. TRC was also retained to collect water samples and to measure groundwater level data from these wells. Groundwater flow in the vicinity of the BAB CCR unit is generally to the northeast, towards the Rouge River based on static water level data measured during the collection of the eight independent samples from the groundwater monitoring system in accordance with the CCR Rule that began in August 2016.

A representative potentiometric groundwater surface (from July 6, 2017) is displayed on **Figure 5**. As shown on **Figure 5**, CCR monitoring wells MW-16-04S, MW-17-06, and MW-17-07 are up gradient to the southwest relative to the BAB CCR unit, whereas the CCR monitoring wells MW-16-01, MW-16-02, and MW-16-03 are down gradient to the northeast of the BAB CCR unit. These potentiometric groundwater elevations indicate that groundwater flow in the area of the BAB CCR unit is generally to the northeast, towards the Rouge River, with a mean hydraulic gradient of approximately 0.00067 foot/foot based upon June through September 2017 static water level readings.

Uppermost Aquifer Hydraulic Conductivity

Hydraulic conductivities measured within the CCR monitoring wells using single well hydraulic conductivity tests (e.g., slug tests) range approximately 9.5 to 120 feet/day with a geometric mean of approximately 25.5 feet/day.

Horizontal Time of Travel

Assuming an average porosity of 0.4 for the silt/clay-rich soil within the uppermost aquifer, the low hydraulic conductivity of 9.5 feet/day, a high hydraulic conductivity of 120 feet/day, and a hydraulic gradient of 0.00067 for the uppermost aquifer proximal to the RRPP BAB, the horizontal groundwater flow rate ranges from approximately 0.016 feet/day (5.8 feet/year) to 0.2 feet/day (73 feet/year) toward the northeast.

Section 3
Groundwater Monitoring System

3.1 Groundwater Monitoring System Installation

During 2016 and 2017, TRC, on behalf of DTE Electric oversaw the installation and development of the groundwater monitoring system in accordance with the 40 CFR §257.91. Seven CCR monitoring wells (MW-16-01 through MW-16-03, MW-16-04S, MW-16-04D, MW-17-06, and MW-17-07) were installed by a Michigan-licensed well driller at the RRPP (at locations up gradient and down gradient of the BAB) to establish the groundwater monitoring system as described below:

3.1.1 Soil Boring Advancement

Initially, in 2016, five soil borings were advanced to evaluate the subsurface geology and to allow monitoring well installation to the northeast and southeast of the RRPP BAB. This work was performed using sonic drilling techniques with 4-inch and 6-inch tooling. Soil samples were collected continuously in ten-foot sections from the ground surface to the termination of the soil boring. A TRC geologist was present to log each boring and to describe the soil samples in accordance with the Unified Soil Classification System (USCS).

Four of the soil borings were advanced to depths of approximately 25 to 30 feet-bgs to install monitoring wells MW-16-01 through MW-16-03 (down gradient) and MW-16-04S (up gradient) within the uppermost aquifer sand and gravel unit present between 15 and 25 feet-bgs. In addition, a soil boring was advanced into the top of the Dundee Formation through the unconsolidated deposits, encountering the underlying limestone bedrock at a depth of 86 feet-bgs. Monitoring well MW-16-04D was installed in this boring and screened at the top of the confined, artesian limestone aquifer.

In June 2017, two additional soil borings were advanced into the uppermost aquifer to establish additional monitoring wells MW-17-06 and MW-17-07 further up gradient on the southwest side of the RRPP main building (**Figure 2**) for use as background wells. The June 2017 borings were advanced utilizing hollow stem augers to temporarily isolate the shallow fill followed by direct push drilling methods to advance to the sand and gravel aquifer and install the monitoring wells. Soil samples were collected continuously in five-foot sections from the ground surface to the termination of the soil boring, and were logged in accordance with the USCS by a TRC geologist.

3.1.2 Monitoring Well Installation

CCR monitoring wells MW-16-01 through MW-16-03 and MW-16-04S were established within the uppermost aquifer sand and gravel unit at approximately 15 to 25 feet-bgs. Three of these locations were on the northeastern side of the BAB (presumed down hydraulic gradient adjacent to the Rouge River) and one was to the southwest of the BAB (presumed up hydraulic gradient) (**Figure 2**). In addition, monitoring well MW-16-04D was screened within the uppermost portion of the limestone bedrock aquifer well below the uppermost aquifer. MW-16-04D is not utilized as a CCR monitoring well as it is not installed within the uppermost aquifer and is hydraulically isolated from the uppermost aquifer by more than 60 feet of very low hydraulic conductivity silty clay-rich soil.

Monitoring wells MW-17-06 and MW-17-07 were installed further up gradient of the BAB CCR unit to the southwest of the RRPP main building into the sand and gravel uppermost aquifer in June 2017 (**Figure 2**) to provide more representative background wells. With the additional two up gradient wells, the consistent groundwater flow direction, and the relatively small foot-print of the BAB, the horizontal spacing of the wells is adequate to detect constituents from the CCR unit.

Monitoring wells were constructed within each borehole using 2-inch-diameter, Schedule 40 PVC casing and 5-foot long screens with 0.010-inch factory cut slots. Monitoring well construction diagrams from the installed monitoring wells accompany the soil boring logs in Appendix A. Following well installation, the grout and bentonite seal materials were allowed to stabilize for more than 24-hours before monitoring well development began.

3.1.3 Monitoring Well Development and Surveying

Following installation, each CCR monitoring well was developed by air lifting methods or by utilizing a submersible pump. In addition, a Michigan-licensed surveyor horizontally located each monitoring well utilizing the Michigan State Plan South Zone-2113, North American Datum 1983 (NAD 83), International feet. Vertical elevations of the ground surface at each soil boring and monitoring well location, and the top of casing for each monitoring well were also surveyed in feet relative to the NAVD 1988. Monitoring well coordinates, elevations, screened intervals, and other monitoring well details are included in Table 1.

3.1.4 Detection Monitoring

The RRPP BAB CCR unit groundwater monitoring system uppermost aquifer monitoring wells, as shown on **Figure 2**, will serve as the detection monitoring locations pursuant to Title 40 CFR §257.93 and §257.94 of the CCR Rule. Given that groundwater flow is consistently northwest toward the Rouge River, monitoring wells MW-17-06 and

MW-17-07 are upgradient monitoring wells and MW-16-01 through MW-16-03 will be down gradient wells for the BAB CCR unit. Based on the consistent flow regime, in addition to the relatively shallow position of the uppermost aquifer relative to the BAB CCR unit, inter-well statistical approaches appear to be appropriate and, as such, will be evaluated for use during detection monitoring. A statistical evaluation plan is currently being developed to evaluate compliance in accordance with the CCR Rule.

Section 4
Groundwater Monitoring System Certification

Groundwater Monitoring System Certification per 40 CFR §257.91(f)
River Rouge Power Plant Bottom Ash Basin
River Rouge, Michigan

The U.S. EPA's Disposal of Coal Combustion Residuals from Electric Utilities Final Rule Title 40 CFR Part 257 §257.91 requires that the owner or operator of an existing CCR unit install a groundwater monitoring system. The owner or operator must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of Title 40 CFR §257.91.

CERTIFICATION

I hereby certify that the groundwater monitoring system presented within this document for the RRPP BAB CCR unit has been designed and constructed to meet the requirements of Title 40 CFR §257.91 of the Federal CCR Rule. This document is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of Title 40 CFR §257.91.

Name	Expiration Date	
David B. McKenzie, P.E.	October 31, 2017	
Company	Date	
TRC Engineers Michigan, Inc.	October 13, 2017	Stamp

Tables

Table 1
Monitoring Well Information Summary
DTE Electric Company – River Rouge Power Plant
River Rouge, Michigan

Well Location	Date Installed	Northing	Easting	Ground Surface Elevation (ft AMSL)	TOC Elevation (ft AMSL)	Geologic Unit of Screen Interval	Well Construction	Screen Interval Depth (ft BGS)	Screen Interval Elevation (ft AMSL)	Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft AMSL)
River Rouge Power Plant											
MW-16-01	6/13/2016	284822.46	13463082.55	580.46	583.02	Sand, Silty Clay, Gravel	2" PVC	18.5 to 23.5	562.0 to 557.0	26.5	554.0
MW-16-02	6/13/2016	284900.37	13462923.81	579.86	582.79	Silty Sand, Sand, Clay, Gravel	2" PVC	18.5 to 23.5	561.4 to 556.4	25.5	554.4
MW-16-03	6/10/2016	285003.95	13462772.52	579.90	582.75	Sand, Sand with Gravel	2" PVC	18.5 to 23.5	561.4 to 556.4	30.0	549.9
MW-16-04S	3/17/2016	284814.39	13462847.74	580.65	582.41	Sand, Gravel	2" PVC	19.5 to 24.5	561.2 to 556.2	25.0	555.7
MW-16-04D	2/25/2016	284811.70	13462855.24	580.28	581.83	Silty Clay, Limestone bedrock	2" PVC	85.0 to 90.0	495.3 to 490.3	97.0	483.3
MW-17-06	6/7/2017	284345.83	13462436.31	579.89	583.01	Sand, Gravel with Sand	2" PVC	20.0 to 25.0	559.9 to 554.9	25.0	554.9
MW-17-07	6/14/2017	283337.37	13461939.92	579.99	583.05	Silt with Sand, Clay	2" PVC	16.0 to 21.0	564.0 to 559.0	25.0	555.0

Notes:
Coordinates are Michigan State Plane South Zone-2113, International Feet
Elevation in feet above NAVD88.
TOC: Top of well casing.
ft AMSL: Feet above mean sea level.
ft BGS: Feet below ground surface.

Figures

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 2,000 '
1:24,000

0 2,000 4,000
FEET

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
TRC - GIS

PROJECT:
DTE ELECTRIC COMPANY
RIVER ROUGE POWER PLANT
1 BELANGER PARK DRIVE
RIVER ROUGE, MICHIGAN

TITLE:
SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S HOLMSTROM
APPROVED BY:	V. BUENING
DATE:	OCTOBER 2017
PROJ. NO.:	265996.0005
FILE:	265996-SLMMB.mxd

FIGURE 1

E:\DTE\CCR_Sites\2017_265996\265996-SLMMB.mxd -- Saved By: BDEEGAN on 10/9/2017, 14:51:49 PM

LEGEND

- MONITORING WELLS
- MONITORING POINT
- BEDROCK MONITORING WELL

NOTES

1. BASE MAP IMAGERY FROM ESRI/MICROSOFT, "WORLD IMAGERY", WEB BASEMAP SERVICE LAYER.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN JUNE 2016 & JUNE 2017.

N

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

DTE ELECTRIC COMPANY
RIVER ROUGE POWER PLANT BOTTOM ASH BASIN
1 BELANGER PARK DRIVE
RIVER ROUGE, MICHIGAN

TITLE:

SITE PLAN

DRAWN BY:	B. DEEGAN	PROJ NO.:	265996.0005.0000
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	V. BUENING		**FIGURE 2**
DATE:	OCTOBER 2017		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 265996-0005-005.mxd

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Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

LEGEND

- MONITORING WELLS
- MONITORING POINT
- BEDROCK MONITORING WELL
- CROSS SECTIONS

NOTES

1. BASE MAP IMAGERY FROM ESRI/MICROSOFT, "WORLD IMAGERY", WEB BASEMAP SERVICE LAYER.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN JUNE 2016 AND JUNE 2017.

N

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

DTE ELECTRIC COMPANY
RIVER ROUGE POWER PLANT BOTTOM ASH BASIN
1 BELANGER PARK DRIVE
RIVER ROUGE, MICHIGAN

TITLE:

CROSS-SECTION LOCATOR MAP

DRAWN BY:	B. DEEGAN	PROJ NO.:	265996.0005
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	V. BUENING		**FIGURE 3**
DATE:	OCTOBER 2017		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
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FILE NO.: 265996-0005-006.mxd

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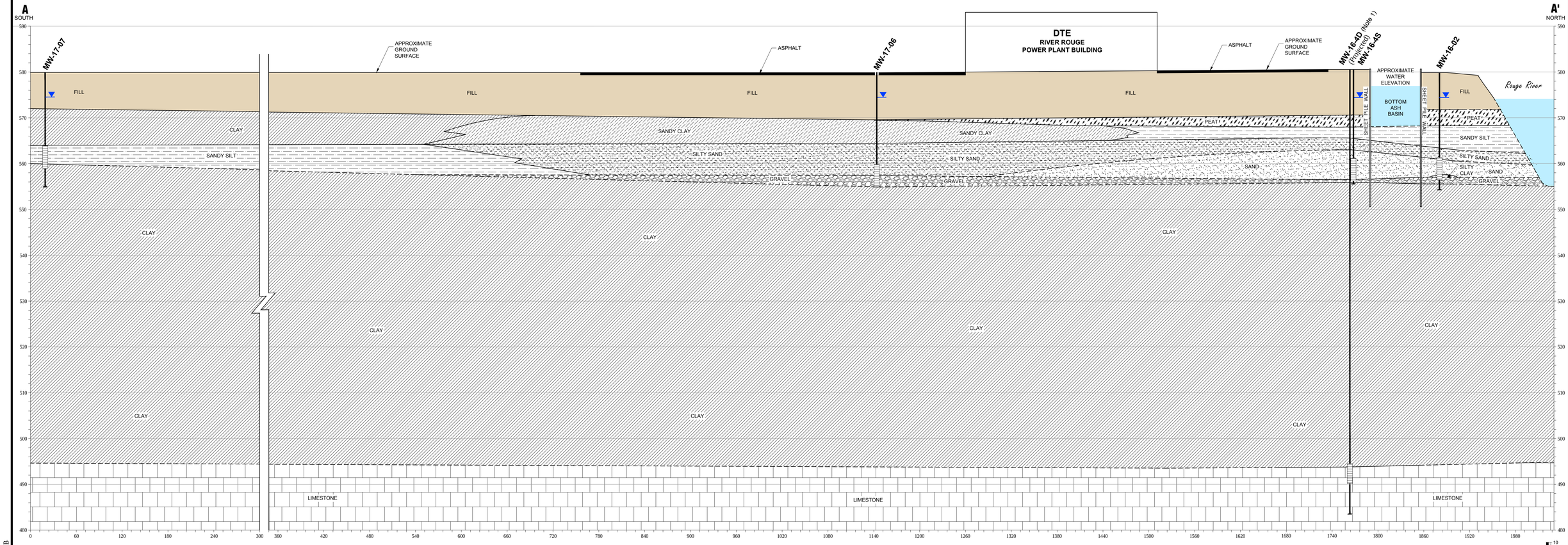
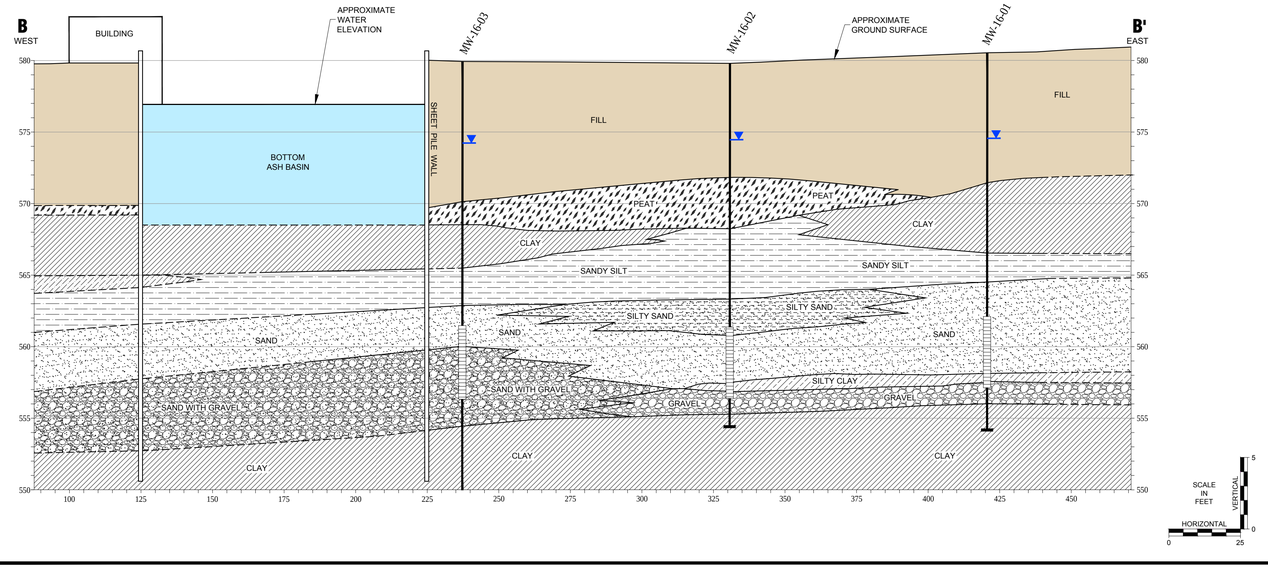
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

GENERALIZED GEOLOGIC CROSS-SECTION A-A'



GENERALIZED GEOLOGIC CROSS-SECTION B-B'



LEGEND

- STRATEGRAPHIC BOUNDARY (DASHED WHERE INFERRED)
- GROUNDWATER ELEVATION (COLLECTED 03/10/2017)
- SOIL BORING
- WELL SCREEN INTERVAL
- END OF BORING

Lithology Key

- CLAY
- FILL
- GRAVEL
- LIMESTONE
- PEAT
- SAND
- SANDY CLAY
- SANDY SILT
- SILTY CLAY
- SILTY SAND

NOTE

1. ARTESIAN MONITORING WELL.

PROJECT:	DTE ELECTRIC COMPANY RIVER ROUGE POWER PLANT RIVER ROUGE, MICHIGAN
TITLE:	GENERALIZED GEOLOGIC CROSS-SECTIONS A-A' AND B-B'
DRAWN BY: D.STEHLE	PROJ. NO.: 265996.0005.01
CHECKED BY: S.HOLMSTROM	FIGURE 4
APPROVED BY: V.BUENING	
DATE: SEPTEMBER 2017	

TRC
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Ann Arbor, MI 48108
Phone: 734.971.7080
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FILE NO.: 265996.0005.01.04_CCR.dwg

LEGEND

- MONITORING POINT
- UPPERMOST AQUIFER MONITORING WELLS
- BEDROCK MONITORING WELL
- GROUNDWATER CONTOUR (.25' INTERVAL, DASHED WHERE INFERRED)
- FLOW DIRECTION
- (575.25) ELEVATION FT (NGVD 88)

NOTES

1. BASE MAP IMAGERY FROM ESRI/MICROSOFT, "WORLD IMAGERY", WEB BASEMAP SERVICE LAYER.
2. WELL LOCATIONS SURVEYED BY BMJ ENGINEERS AND SURVEYORS INC. IN JUNE 2016 & JUNE 2017.
3. NU = NOT UTILIZED

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:
DTE ELECTRIC COMPANY
RIVER ROUGE POWER PLANT BOTTOM ASH BASIN
1 BELANGER PARK DRIVE
RIVER ROUGE, MICHIGAN

TITLE:
GROUNDWATER POTENTIOMETRIC SURFACE MAP
JULY 6, 2017

DRAWN BY:	B DEEGAN	PROJ NO.:	265996.0005.0000
CHECKED BY:	S. HOLMSTROM		
APPROVED BY:	V. BUENING		**FIGURE 5**
DATE:	OCTOBER 2017		

TRC
1540 Eisenhower Place
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FILE NO.: 265996-0005-004.mxd

Plot Date: 10/9/2017, 15:46:42 PM by BDEEGAN – LAYOUT: ANSI B(11"x17")
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Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

Appendix A
Soil Boring and Monitoring Well Installation Logs

WELL CONSTRUCTION LOG

WELL NO. MW-16-01

Page 1 of 1

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE Electric Company River Rouge Power Plant	6/13/16	6/13/16	231828.0005.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Sonic	580.46	583.02	26.5	6/4

Boring Location: N of bottom ash basin, farthest well to the E.

N: 284822.46 E: 13463082.55

Personnel
Logged By - C. Scieszka
Driller - A. Goldsmith

Drilling Equipment: TSi 150cc

Civil Town/City/or Village:	County:	State:
River Rouge	Wayne	Michigan

Water Level Observations:
While Drilling: Date/Time — Depth (ft bgs)
After Drilling: Date/Time 6/14/16 10:45 — Depth (ft bgs) 5.38

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 CS	100		0	**SILTY SAND WITH GRAVEL** mostly fine to medium sand, little fine to coarse gravel, little silt, dark gray (10YR 4/1) to brown (10YR 5/3), no odor, dry, loose.	SM			<1	Continuous sampling with 4-inch diameter casing from ground surface to terminus of soil boring, over-drilled with 6-inch diameter casing to install monitoring well.
				GRAVEL WITH SAND mostly fine to coarse gravel, little fine to coarse sand, trace to few silt, gray (10YR 5/1), no odor, dry, loose.	GW			<1	
			5	**SILTY CLAY WITH GRAVEL** mostly clay, little silt, little fine to coarse gravel, low plasticity, black (10YR 2/1), no odor, dry, stiff, trace slag fragments. Change to slight odor at 5.5 feet.	CL-ML			<1	
2 CS	100			**SILTY SAND WITH GRAVEL** mostly fine to medium sand, little fine to coarse gravel, little silt, dark gray (10YR 4/1) to brown (10YR 5/3), no odor, dry, loose, trace brick fragments present. Change to black (10YR 2/1), strong odor, saturated, metallic sheen on soil grains at 8.5 feet.	SM			<1	
			10	**CLAY** mostly clay, trace silt, high plasticity, dark gray (10YR 4/1), slight hydrocarbon odor, moist, soft. Change to no odor at 10.0 feet.	CL				
3 ST	100								
4 CS	100		15	**SANDY SILT** mostly silt, some fine to medium sand, trace clay, very low plasticity, dark gray (10YR 4/1), no odor, saturated, stiff.	ML				
				SAND mostly fine to medium sand, trace to few silt, dark gray (10YR 4/1), no odor, saturated, dense.	SP				
			20						
5 CS	100			**SILTY CLAY** mostly clay, little silt, low to medium plasticity, dark gray (10YR 4/1), no odor, moist, stiff to very stiff.	CL-ML				
					GW				
			25	**GRAVEL** mostly fine to coarse gravel, few fine to coarse sand, trace silt, dark gray (10YR 5/1), no odor, saturated, loose.	CL				
				CLAY mostly clay, trace silt, high plasticity, brown (10YR 5/3), no odor, moist, very soft. End of boring at 26.5 feet below ground surface.					

SOIL BORING WELL CONSTRUCTION LOG 231828.0005.0000.GPJ TRC_CORP.GDT 231828.0005.0000 7/13/16

Signature: [signature]

Checked By: M. Powers

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, Michigan
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION LOG

WELL NO. MW-16-02

Page 1 of 1

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE Electric Company River Rouge Power Plant	6/10/16	6/13/16	231828.0005.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Sonic	579.86	582.79	25.5	6/4

Boring Location: N of bottom ash basin, middle well.	Personnel	Drilling Equipment:
N: 284900.37 E: 13462923.81	Logged By - C. Scieszka Driller - A. Goldsmith	TSi 150cc

Civil Town/City/or Village:	County:	State:	Water Level Observations:
River Rouge	Wayne	Michigan	While Drilling: Date/Time After Drilling: Date/Time 6/14/16 10:50 ▼ Depth (ft bgs) 4.87

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 CS	100		0	**GRAVEL WITH SAND** mostly fine to coarse gravel, few to little fine to coarse sand, trace silt, dark grayish brown (10YR 4/2), no odor, dry, loose. Change to few silt, trace clay, trace slag fragments present at 2.0 feet.	GW			<1	Continuous sampling with 4-inch diameter casing from ground surface to terminus of soil boring, over-drilled with 6-inch diameter casing to install monitoring well.
			5 ▼	**SILTY SAND WITH GRAVEL** mostly fine sand, few to little silt, few to little fine to coarse gravel, dark gray (10YR 4/1), no odor, dry, loose. Change to moist, brick fragments present at 5.5 to 6.0 feet.	SM			<1	
2 CS	90			**SAND** mostly fine to coarse sand, trace to few silt, trace fine to coarse gravel, gray (10YR 5/1), no odor, saturated, medium dense.	SW			15.3	
			10	**PEAT** black (10YR 2/1), no odor, moist, soft, wood chip fragments present.					
3 ST	75			**SANDY SILT** mostly silt, little fine sand, trace to few clay, low plasticity, very dark gray (10YR 3/1), no odor, moist, stiff.	ML				
4 CS	100		15	**SILTY SAND** mostly fine sand, little silt, dark gray (10YR 4/1), no odor, saturated, dense.	SM				
				SAND mostly fine to medium sand, dark gray (10YR 4/1), no odor, saturated, loose. Change to mostly fine to coarse sand at 20.0 feet.	SP				
5 CS	100		20	Change to wood fragment present, approximately 1-inch thick interval at 21.5 feet.	CL				
				Change to few shells present at 22.0 feet. **CLAY** mostly clay, trace silt, high plasticity, gray (10YR 5/1), no odor, moist, stiff.	GW				
			25	**GRAVEL** mostly fine to coarse gravel, few fine to coarse sand, color varies with grain, no odor, saturated, loose.	CL				
				CLAY mostly clay, trace silt, high plasticity, brown (10YR 5/3), no odor, moist, very soft. End of boring at 25.5 feet below ground surface.					

SOIL BORING WELL CONSTRUCTION LOG 231828.0005.0000.GPJ TRC_CORP.GDT 231828.0005.0000 7/13/16

Signature: Chris Scieszka

Firm: TRC Environmental Corporation
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734-971-7080
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Checked By: M. Powers

WELL CONSTRUCTION LOG

WELL NO. MW-16-03

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE Electric Company River Rouge Power Plant	6/10/16	6/10/16	231828.0005.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Sonic	579.90	582.75	30.0	6/4

Boring Location: N of bottom ash basin, farthest well to the W.

N: 285003.95 E: 13462772.52

Personnel
Logged By - C. Scieszka
Driller - A. Goldsmith

Drilling Equipment: TSi 150cc

Civil Town/City/or Village:	County:	State:
River Rouge	Wayne	Michigan

Water Level Observations:
While Drilling: Date/Time
After Drilling: Date/Time 6/14/16 10:55 ▼ Depth (ft bgs) 5.14

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 CS	95		0	**GRAVEL** mostly coarse gravel, light gray (10YR 7/1), no odor, moist, very loose.	GP			<1	Continuous sampling with 4-inch diameter casing from ground surface to terminus of soil boring, over-drilled with 6-inch diameter casing to install monitoring well.
				SILTY CLAY mostly clay, some silt, low plasticity, brown (10YR 4/3), no odor, dry, stiff.					
			5 ▼		CL-ML			<1	
2 CS	50							1.1	
								27.5	
			10	**SAND** mostly medium to coarse sand, trace silt, trace fine to coarse gravel, black (10YR 2/1), moderate to strong odor, moist, loose.	SP			129.6	
3 ST	80			**PEAT** black (10YR 2/1), moderate to strong odor, moist, soft. Change to wood and high organic content present at 10.5 feet.	CL				
			15	**CLAY** mostly clay, trace silt, trace fine sand, high plasticity, black (10YR 2/1), to dark gray (10YR 4/1), moderate odor, soft to medium stiff.	ML				
4 CS	100			**SANDY SILT** mostly silt, little fine sand, non plastic, dark gray (10YR 4/1), slight odor, saturated, stiff. Change to no odor at 16.0 feet.	SP				
				SAND mostly medium to coarse sand, trace silt, dark gray (10YR 5/1), no odor, saturated, loose. Change to trace to few silt at 17.5 feet. Change to no silt at 19.5 feet.					
			20	**SAND WITH GRAVEL** mostly medium to coarse sand, little fine to coarse gravel, trace silt, dark gray (10YR 4/1), no odor, saturated, loose.	SP				
5 CS	100		25	**CLAY** mostly clay, trace silt, trace coarse sand, high plasticity, gray (10YR 5/1), no odor, moist, very soft to soft.	CL				
			30	End of boring at 30.0 feet below ground surface.					

SOIL BORING WELL CONSTRUCTION LOG 231828.0005.0000.GPJ TRC_CORP.GDT 231828.0005.0000 7/13/16

Signature: Alan A. Wagner

Firm: TRC Environmental Corporation
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Fax 734-971-9022

Checked By: M. Powers

WELL CONSTRUCTION LOG

WELL NO. MW-16-04S

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE Electric Company River Rouge Power Plant	4/6/16	4/6/16	231828.0005.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Sonic	580.65	582.41	25.0	6/4

Boring Location: 10 feet west of MW-16-04.	Personnel	Drilling Equipment:
N: 284814.39 E: 13462847.74	Logged By - A. Knutson Driller - A. Goldsmith	TSi 150cc

Civil Town/City/or Village:	County:	State:	Water Level Observations:
River Rouge	Wayne	Michigan	While Drilling: Date/Time — Depth (ft bgs) After Drilling: Date/Time 6/14/16 11:04 ▼ Depth (ft bgs) 4.10

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
			0	**SAND** mostly fine to coarse sand, few fine to coarse gravel, trace silt, dark gray (10YR 4/1), no odor, dry, loose.	SW				Continuous sampling with 4-inch diameter casing from ground surface to terminus of soil boring, over-drilled with 6-inch diameter casing to install monitoring well.
				GRAVEL WITH SAND mostly coarse gravel, some fine to coarse sand, trace silt, dark gray (10YR 4/1), no odor, saturated. ▼	GP			<1.0	
1 CS	90		5	**SAND** mostly fine to coarse sand, yellowish brown (10YR 5/8), no odor, saturated.	SW				
				SILT mostly silt, few fine to coarse sand, dark gray (10YR 4/1), no odor, saturated, brick fragments present.	ML			<1.0	
				CLAY mostly clay, few silt, trace fine to coarse gravel, medium plasticity, no odor, moist.	CL				
2 CS	90		10	**PEAT** high organic content, dark brown (10YR 2/2), natural organic odor, moist, soft, wood fragments present.				<1.0	
3 ST	100			**SANDY SILT** mostly silt, few to little sand, nonplastic, dark gray, no odor, moist, medium stiff.	ML				
4 CS	100		15	**SILTY SAND** mostly fine sand, few to little silt, dark gray (10YR 4/1), no odor, moist to saturated.	SP			<1.0	
				SAND mostly fine to coarse sand, dark gray (10YR 4/1), no odor, saturated.					
5 CS	100		20	Change to shells present at 23.0 feet.	SW			<1.0	
				GRAVEL mostly fine to coarse gravel, few fine to coarse sand, dark gray (10YR 4/1), no odor, saturated, loose.	GW				
			25	**CLAY** mostly clay, trace silt, high plasticity, brown (10YR 5/3), no odor, moist, soft.	CL				
				End of boring at 25.0 feet below ground surface.					

SOIL BORING WELL CONSTRUCTION LOG 231828.0005.0000.GPJ TRC_CORP.GDT 231828.0005.0000 7/13/16

Signature:

Checked By: M. Powers

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, Michigan
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION LOG

WELL NO. MW-16-04D

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE Electric Company River Rouge Power Plant	2/23/16	2/25/16	231828.0005.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Sonic	580.28	581.83	97.0	6

Boring Location: 100 feet east of basin bridge, 25 feet south of basin.	Personnel	Drilling Equipment:
N: 284811.70 E: 13462855.24	Logged By - C. Scieszka Driller - A. Goldsmith	TSi 150cc

Civil Town/City/or Village:	County:	State:	Water Level Observations:
River Rouge	Wayne	Michigan	While Drilling: Date/Time Depth (ft bgs) After Drilling: Date/Time Depth (ft bgs)

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 CS	55		5	**SAND** mostly fine to coarse sand, trace to few silt, trace fine gravel, dark gray (10YR 4/1), no odor, dry, loose.	SW			Continuous sampling with 4-inch diameter casing from ground surface to terminus of soil boring, over-drilled with 6-inch diameter casing to install monitoring well.
				SAND WITH SILT mostly fine to coarse sand, few to little silt, dark gray (10YR 4/1), no odor, moist, medium dense.	SW-SM			
2 CS	90		10	**SILTY CLAY** mostly clay, little to some silt, trace to few fine to coarse gravel, medium plasticity, dark gray (10YR 4/1), no odor, moist, soft to medium stiff.	CL-ML			
				PEAT high organic content, very dark brown (10YR 2/2), natural organic odor, moist, soft to medium stiff.	ML			
			15	**SANDY SILT** mostly silt, little to some fine sand, nonplastic, dark gray (10YR 4/1), no odor, moist, medium stiff.				
				SILTY SAND mostly fine sand, little silt, dark gray (10YR 4/1), no odor, moist, medium dense.	SM			
3 CS	100		20	**SAND** mostly fine sand, trace silt, dark gray (10YR 4/1), no odor, saturated, loose.	SP			
				Change to wood fragment present at 21.0 feet.				
				GRAVEL WITH SAND mostly fine to coarse gravel, little to some sand, dark gray (10YR 4/1), no odor, saturated, loose.	GW			
			25	**CLAY** mostly clay, trace silt, high plasticity, brown (10YR 5/3), no odor, moist, very soft.				
4 CS	90		30	Change to trace fine gravel, trace coarse sand at 30.0 feet.	CL			
			35					
			40					

SOIL BORING WELL CONSTRUCTION LOG 231828.0005.0000.GPJ TRC_CORP.GDT 231828.0005.0000 7/13/16

Signature: _____ Firm: TRC Environmental Corporation 734-971-7080
1540 Eisenhower Place Ann Arbor, Michigan Fax 734-971-9022

Checked By: M. Powers

WELL CONSTRUCTION LOG

WELL NO. MW-16-04D

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
5 CS	90		45					
6 ST	90		50					
7 CS	100		55					
8 CS	100		60		CL			
9 CS	75		65					
			70					
			75	Change to gray (10YR 5/1) at 79.0 feet.				
10 CS	80		80	**SILTY CLAY** mostly clay, little to some silt, trace to few fine to coarse gravel, trace to few fine to coarse sand, low plasticity, dark gray (10YR 4/1), no odor, dry, hard.	CL-ML			
			85	**LIMESTONE** white (10YR 8/1), dry, slight to moderate sulfur odor. Change to wet at 88.0 feet.				
11 CS	50		90	Change to dark gray (10YR 4/1) at 90.0 feet.				
			95	Change to white (10YR 8/1) at 96.0 feet.				
				End of boring at 97.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 231828.0005.0000.GPJ TRC_CORP.GDT 231828.0005.0000 7/13/16

WELL CONSTRUCTION LOG

TRC

WELL NO. MW-17-06

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE Electric Company River Rouge Power Plant	6/6/17	6/7/17	277472.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push	579.9	583.01	25.0	3.75

Boring Location: E side of grassy berm located N of parking lot SW of power plant building.
N: 284345.83 E: 13462436.31

Personnel
Logged By - C. Scieszka
Driller - G. Geerligs

Drilling Equipment: Geoprobe 7822DT

Civil Town/City/or Village:	County:	State:
River Rouge	Wayne	Michigan

Water Level Observations:
While Drilling: Date/Time 6/6/17 00:00 ▽ Depth (ft bgs) 15.5
After Drilling: Date/Time 6/7/17 09:00 ▼ Depth (ft bgs) 3.99

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 GP	70		0	**GRAVEL WITH SAND** mostly fine to coarse gravel, little fine to coarse sand, trace silt, dark grayish brown (10YR 4/2), no odor, dry, dense.				<1	
				SANDY CLAY mostly clay, little to some fine to medium sand, trace silt, trace fine gravel, low plasticity, very dark gray (10YR 3/1), no odor, moist, stiff to very stiff, fill.				<1	
			5	0.5-inch thick interval of brick at 4.5 feet.					
2 GP	50							<1	
								<1	
			10	**SILTY GRAVEL WITH SAND** mostly fine to coarse gravel, some silt, little fine to coarse sand, trace clay, black (10YR 2/1), no odor, hard, dry, trace fine slag and coal fragments present.	GM				
3 GP	50			**PEAT** 2-inch thick interval of peat, black (10YR 2/1), slight natural odor, moist, soft.	CL			<1	
				CLAY WITH SAND mostly clay, few to little fine to medium sand, low to medium plasticity, dark gray (10YR 4/1), no odor, moist, medium stiff.	CL			<1	
			15	Grades to **SANDY CLAY** mostly clay, little to some fine to medium sand, low plasticity, light olive gray (5Y 7/2), no odor, moist, medium stiff.					
4 GP	60			**SILTY SAND** mostly fine sand, little silt, dark gray (10YR 4/1) with yellowish brown (10YR 5/6) mottles, no odor, saturated, dense.	SM				
			20	Change to trace fine to coarse gravel at 20.0 feet.					
5 GP	70			**GRAVEL WITH SAND** mostly fine to coarse subrounded gravel, little medium to coarse sand, dark gray (10YR 4/1), no odor, saturated, dense.	GW				
			25	**CLAY** mostly clay, trace fine to medium sand, trace silt, medium plasticity, dark grayish brown (10YR 4/2), no odor, moist, medium stiff.	CL				
				End of boring at 25.0 feet below ground surface.					

SOIL BORING WELL CONSTRUCTION LOG 277472 (2017 MWS).GPJ TRC_CORP.GDT 8/28/17

Signature: [signature]

Checked By: T. Hess

Firm: TRC Environmental Corporation
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WELL CONSTRUCTION LOG

WELL NO. MW-17-07

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE Electric Company River Rouge Power Plant	6/14/17	6/14/17	277472.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Direct Push/Hollow Stem Auger	580.0	583.05	25.0	8/3.75/2

Boring Location: N of entrance road, near Belanger Park entrance, adjacent to S property boundary.
N: 283337.37 E: 13461939.92

Personnel
Logged By - C. Scieszka
Driller - G. Geerligs

Drilling Equipment: Geoprobe 7822DT

Civil Town/City/or Village:	County:	State:
River Rouge	Wayne	Michigan

Water Level Observations:
While Drilling: Date/Time 6/14/17 00:00 ▽ Depth (ft bgs) 2.5
After Drilling: Date/Time 6/15/17 11:45 ▼ Depth (ft bgs) 3.44

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	PID (PPM)	COMMENTS
1 GP	90		0	**SILTY SAND** mostly fine to medium sand, little to some silt, trace to few fine gravel, brown (10YR 5/3), no odor, dry, loose.	SM			<1	Soil sample and duplicate sample collected (0-2') at 1100.
				SILTY CLAY WITH SAND AND GRAVEL mostly clay, some silt, few to little fine to coarse sand, few to little fine to coarse gravel, no to low plasticity, very dark brown (10YR 3/3), no odor, dry, stiff, trace to few slag, cinder, and wood fragments present.	CL-ML				
2 GP	100		5	**COAL WITH SLAG FILL** mostly fine to medium sand sized coal fragments, few to little slag fragments, trace silt, black (10YR 2/1), no odor, saturated, medium dense. Change to slight hydrocarbon odor, very slight sheen on pore water at 5.0 feet.					
				CLAY mostly clay, trace silt, medium plasticity, dark gray (10YR 4/1), no odor, moist, soft.	CL				
3 GP	80		10	**PEAT** high organic content, woody, very dark brown (10YR 3/3), no odor, dry to moist, spongy.					Hollow stem augers set at 10.0 feet below ground surface prior to drilling through confining clay unit.
				CLAY mostly clay, trace to few silt, medium plasticity, black (10YR 2/1), no odor, moist, soft. Change to no silt, greenish gray (GLEY1 5/1), medium stiff at 11.0 feet.	CL				
4 GP	85		15	Change to dark gray (10YR 4/1) at 15.0 feet.					
				SILT WITH SAND mostly silt, few to little fine to medium sand, no plasticity, gray (10YR 5/1), no odor, moist to saturated, stiff. Change to brown (10YR 5/3) at 18.5 feet.	ML				
5 GP	90		20	**CLAY** mostly clay, trace silt, medium plasticity, gray (10YR 5/1), no odor, moist, medium stiff. 0.25-inch thick sand with gravel seam, mostly fine to coarse sand, few to little fine gravel, yellowish brown (10YR 5/6), no odor, saturated, dense at 20.5 feet. Change to trace coarse sand to fine gravel, gray (10YR 5/1) with light reddish brown (5YR 6/4) mottles, dry to moist, very stiff at 21.0 feet.	CL				
			25	Change to moist, medium stiff at 24.0 feet. End of boring at 25.0 feet below ground surface.					

SOIL BORING WELL CONSTRUCTION LOG 277472 (2017 MWS).GPJ TRC_CORP.GDT 8/28/17

Signature: [signature]

Firm: TRC Environmental Corporation
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Checked By: T. Hess

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: DTE Electric Company River Rouge Power Plant		WELL ID:	**MW-16-01**
PROJ. NO: 231828.0005	DATE INSTALLED: 6/13/2016 INSTALLED BY: C. Scieszka	CHECKED BY:	M. Powers

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
583.02	2.6	TOP OF CASING
580.46	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
21.5		RISER PIPE LENGTH
	14.0	GROUT
		BENTONITE SEAL MATERIAL: TIME RELEASE PELLETS
	16.0	BENTONITE SEAL
561.5	18.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
556.5	23.5	BOTTOM OF SCREEN
	23.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
554.0	26.5	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 23.5 FT.
4 IN. FROM 23.5 TO 26.5 FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 1 HOURS

WATER REMOVED: 75 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: VERY TURBID

COLOR BEFORE: BROWNISH GREY

CLARITY AFTER: CLEAR

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	26.68	T/PVC	6/13/2016	15:10
DTB AFTER DEVELOPING:	26.67	T/PVC	6/14/2016	10:45
SWL BEFORE DEVELOPING:	7.95	T/PVC	6/13/2016	15:10
SWL AFTER DEVELOPING:	8.03	T/PVC	6/14/2016	10:45
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: DTE Electric Company River Rouge Power Plant		WELL ID:	**MW-16-02**
PROJ. NO: 231828.0005	DATE INSTALLED: 6/13/2016 INSTALLED BY: C. Scieszka		CHECKED BY: M. Powers

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
582.79	2.9	TOP OF CASING
579.86	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
21.5		RISER PIPE LENGTH
	14.0	GROUT
		BENTONITE SEAL MATERIAL: TIME RELEASE PELLETS
	17.0	BENTONITE SEAL
561.3	18.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
556.3	23.5	BOTTOM OF SCREEN
	23.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
554.4	25.5	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 23.5 FT.
4 IN. FROM 23.5 TO 25.5 FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.75 HOURS

WATER REMOVED: 75 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: VERY TURBID

COLOR BEFORE: BROWNISH GREY

CLARITY AFTER: CLEAR

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	26.68	T/PVC	6/13/2016	13:20
DTB AFTER DEVELOPING:	26.68	T/PVC	6/14/2016	10:50
SWL BEFORE DEVELOPING:	7.73	T/PVC	6/13/2016	13:20
SWL AFTER DEVELOPING:	7.87	T/PVC	6/14/2013	10:50
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: DTE Electric Company River Rouge Power Plant		WELL ID:	**MW-16-03**
PROJ. NO: 231828.0005	DATE INSTALLED: 6/10/2016 INSTALLED BY: C. Scieszka	CHECKED BY:	M. Powers

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
582.75	2.9	TOP OF CASING
579.90	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
21.5		RISER PIPE LENGTH
	12.0	GROUT
		BENTONITE SEAL MATERIAL: TIME RELEASE PELLETS
	17.0	BENTONITE SEAL
561.2	18.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
556.2	23.5	BOTTOM OF SCREEN
	23.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
549.9	30.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 23.5 FT.
4 IN. FROM 23.5 TO 30 FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.67 HOURS

WATER REMOVED: 75 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: VERY TURBID

COLOR BEFORE: BROWNISH GREY

CLARITY AFTER: CLEAR

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	26.70	T/PVC	6/13/2016	13:15
DTB AFTER DEVELOPING:	26.70	T/PVC	6/14/2016	10:55
SWL BEFORE DEVELOPING:	7.85	T/PVC	6/13/2016	13:15
SWL AFTER DEVELOPING:	8.14	T/PVC	6/14/2016	10:55
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

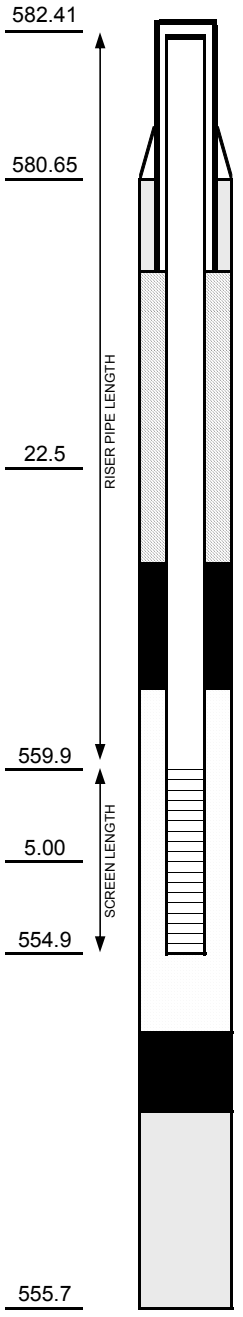
PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: DTE Electric Company River Rouge Power Plant			WELL ID: **MW-16-04S**
PROJ. NO: 231828.0005	DATE INSTALLED: 3/17/2016	INSTALLED BY: A. Knutson	CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
582.41	1.8	TOP OF CASING
580.65	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
		GROUT/BACKFILL METHOD: NA
22.5		RISER PIPE LENGTH
	NA	GROUT
		BENTONITE SEAL MATERIAL: TIME RELEASE PELLETS
	18.0	BENTONITE SEAL
559.9	19.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
554.9	24.5	BOTTOM OF SCREEN
	24.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
555.7	25.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 25 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 2 HOURS

WATER REMOVED: 200 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: TURBID

COLOR BEFORE: GREY

CLARITY AFTER: CLEAR

COLOR AFTER: NONE

ODOR (IF PRESENT): SULFUR

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	--	T/PVC	--	--
DTB AFTER DEVELOPING:	27.82	T/PVC	6/23/2016	9:06
SWL BEFORE DEVELOPING:	--	T/PVC	--	--
SWL AFTER DEVELOPING:	6.55	T/PVC	4/7/2016	11:30
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: DTE Electric Company River Rouge Power Plant		WELL ID:	**MW-16-04D**
PROJ. NO: 231828.0005	DATE INSTALLED: 2/25/2016 INSTALLED BY: A. Knutson		CHECKED BY: C. Scieszka

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)
581.83	1.6 TOP OF CASING
580.28	0.0 GROUND SURFACE
	1.0 CEMENT SURFACE PLUG
	GROUT/BACKFILL MATERIAL: BENTONITE/CEMENT SLURRY
	GROUT/BACKFILL METHOD: TREMIE
88.0	77.0 GROUT
	BENTONITE SEAL MATERIAL: TIME RELEASE PELLETS
	80.0 BENTONITE SEAL
493.8	85.0 TOP OF SCREEN
	FILTER PACK MATERIAL: MEDIUM, WASHED SAND
488.8	90.0 BOTTOM OF SCREEN
	97.0 BOTTOM OF FILTER PACK
	NA BENTONITE PLUG
	BACKFILL MATERIAL: NATURAL COLLAPSE
483.3	97.0 HOLE BOTTOM

RISER PIPE LENGTH: 493.8 − 88.0 = 405.8

SCREEN LENGTH: 5.00

NOTES:
ARTESIAN CONDITIONS PRESENT, UNABLE TO COLLECT SWL AT TIME OF INSTALLATION.

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 90 FT.
4 IN. FROM 90 TO 97 FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 2.5 HOURS

WATER REMOVED: 100 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: VERY TURBID

COLOR BEFORE: VERY DARK GRAY TO BLACK

CLARITY AFTER: CLEAR

COLOR AFTER: NONE

ODOR (IF PRESENT): STRONG SULFUR

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	93.14	T/PVC	2/25/2016	1120
DTB AFTER DEVELOPING:	93.14	T/PVC	2/25/2016	1410
SWL BEFORE DEVELOPING:	--	T/PVC	--	--
SWL AFTER DEVELOPING:	--	T/PVC	--	--
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: DTE Electric Company River Rouge Power Plant			WELL ID: **MW-17-06**
PROJ. NO: 277472.0000	DATE INSTALLED: 6/7/2017	INSTALLED BY: C. Scieszka	CHECKED BY: T. Hess

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
583.01	3.0	TOP OF CASING
579.9	0.0	GROUND SURFACE
	1.5	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
		GROUT/BACKFILL METHOD: NA
22.7		RISER PIPE LENGTH
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	8.5	BENTONITE SEAL
560.3	20.0	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: PRE PACKED MEDIUM, WASHED SAND
555.3	25.0	BOTTOM OF SCREEN
	25.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
555.3	25.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 3.75 IN. FROM 0 TO 25 FT.
_____ IN. FROM _____ TO _____ FT.

SURF. CASING DIAMETER: _____ IN. FROM _____ TO _____ FT.
_____ IN. FROM _____ TO _____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.75 HOURS

WATER REMOVED: 75 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: VERY TURBID

COLOR BEFORE: DARK GRAYISH BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	28.17	T/PVC	6/7/2017	0900
DTB AFTER DEVELOPING:	28.13	T/PVC	6/20/2017	1045
SWL BEFORE DEVELOPING:	7.03	T/PVC	6/7/2017	0900
SWL AFTER DEVELOPING:	6.93	T/PVC	6/20/2017	1045
OTHER SWL:	6.85	T/PVC	6/15/2017	1645
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: DTE Electric Company River Rouge Power Plant			WELL ID: **MW-17-07**
PROJ. NO: 277472.0000	DATE INSTALLED: 6/14/2017	INSTALLED BY: C. Scieszka	CHECKED BY: T. Hess

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
583.05	3.0	TOP OF CASING
580.0	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
		GROUT/BACKFILL METHOD: NA
19.3		RISER PIPE LENGTH
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	14.0	BENTONITE SEAL
563.8	16.0	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: PRE PACKED MEDIUM, WASHED SAND
558.8	21.0	BOTTOM OF SCREEN
	21.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
554.8	25.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER:
8 IN. FROM 0 TO 10 FT.
3.75 IN. FROM 10 TO 21 FT.
2 IN. FROM 21 TO 25 FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 1.5 HOURS

WATER REMOVED: 20 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: VERY TURBID

COLOR BEFORE: DARK GRAYISH BROWN

CLARITY AFTER: SLIGHTLY TURBID

COLOR AFTER: BROWN/CLOUDY

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	24.30	T/PVC	6/15/2017	1145
DTB AFTER DEVELOPING:	24.27	T/PVC	6/15/2017	1400
SWL BEFORE DEVELOPING:	6.44	T/PVC	6/15/2017	1145
SWL AFTER DEVELOPING:	8.11	T/PVC	6/15/2017	1400
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120