MONITORING WELL INSTALLATION REPORT
COAL COMBUSTION RESIDUALS (CCR) RULE

INACTIVE BOTTOM ASH BASIN
DTE Monroe Plant
Monroe, Michigan

Prepared for:

DTE Energy
One Energy Plaza
Detroit, MI 48226

April 2019

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1.0 INTRODUCTION

At the request of DTE Electric Company (DTE), AECOM Technical Services, Inc. (AECOM) has prepared this Well Installation Report to document the installation of monitoring wells at the DTE Energy Monroe Power Plant located in Monroe, Michigan (**Figure 1**). The field activities were conducted in the vicinity of the inactive Bottom Ash Basin in order to establish a groundwater monitoring system as required by the United States Environmental Protection Agency (USEPA) Final Rule 40 Code of Federal Regulations (CFR), Part 257 (Rule), Section 257.91 Sub-Part (a). The Rule was established to regulate the disposal of Coal Combustion Residuals (CCR) produced by electric generating facilities (USEPA, 2015).

1.1 Site Location

The DTE Monroe Plant (Monroe Plant) is located in Monroe County Michigan approximately 2 miles east of the city of Monroe. The Monroe Plant was built in the early 1970s and occupies a parcel of land approximately 440 acres in size. The plant buildings, coal pile, and appurtenances associated with power generation reside on the northern (approximately 274 acres) portion of the 440-acre land parcel. The southern portion of the land parcel consists of the inactive Bottom Ash Basin area plus the Process Pond area which, together cover approximately 166 acres.

The Monroe Plant is bounded to the east by the shoreline of Lake Erie; to the west by neighboring industrial facilities and the plant discharge canal; to the south by undeveloped land; and to the north by mixed residential/commercial properties as well as Plum Creek, as shown on **Figure 1**. Topography at the Bottom Ash Basin area is relatively flat with elevations ranging from 580 down to 572 feet mean sea level (msl), which is close to the mean elevation of Lake Erie.

1.2 Description of the CCR Unit

The Inactive Bottom Ash Basin is located to the south of the main Monroe Plant area and encompasses an area approximately 105 acres in size (**Figure 1**). The Inactive CCR Impoundment area was constructed in the late 1960s by building a perimeter dike to surround a low area of the adjacent Lake Erie; the area south of the plant was removed from the Waters of the United States by an Act of Congress prior to plant construction. CCR materials have been placed and allowed to drain into the pond from the north end of the pond; these materials currently form a delta that extends about 1/3 of the way into the pond. For purposes of the CCR groundwater study, the Inactive Bottom Ash Basin is considered a single CCR unit.

2.0 HYDROGEOLOGY

The following section presents information regarding the site-specific geologic and hydrogeologic conditions based on the findings from field investigation activities.

2.1 Geologic Setting

The Monroe Plant site is located on the eastern side of the Michigan Basin, which is a regional geologic structure in which the bedrock layers have warped downward towards a low spot in west-central Michigan. Accordingly, bedrock layers in the site vicinity are inclined (dip) at a very shallow angle to the west. The bedrock underlying the site is comprised of late Silurian age sedimentary rocks (predominantly dolomites and shales) from the Bass Island Group. The uppermost bedrock in the area tends to be highly weathered and is comprised of a tan, argillaceous dolomite with interbedded dark gray, firm to soft shales. The Bass Island Group is underlain by the middle to late Silurian age Salina Group, which is also comprised of alternating dolomite and shale units as well as anhydrite beds.

The bedrock in the site vicinity is overlain by approximately 40 to 50 feet of unconsolidated deposits of glacial origin. The deposits are comprised of two distinct units: a hard glacial till immediately overlying bedrock and lacustrine (lake bed or lake shore) deposits which overlay the till unit. Various thicknesses of surficial fill materials are present across the entire Monroe Plant and ash basin areas.

2.2 Local Hydrogeology

A series of cross-sections was prepared by NTH Consultants, LTD as part of a sitewide study completed in 2014. The locations of these sections are illustrated on **Figure 2**. These sections illustrate the sequence of geologic materials present under the Plant, Bottom Ash Basin, and Process Pond areas based on an assemblage of available boring logs. The lowermost unit identified in these areas is the glacial till. The till is comprised of overconsolidated (highly compacted) gray silty to sandy clay with some cobbles and boulders, and ranges from approximately 20 to 50 feet in thickness (**Figures 2a and 2b**). The overlying lacustrine deposits are composed of 10 to 30 feet of fine-grained sand and silt with some soft clay except where there is a thin, discontinuous coarse sand unit at the base of the lacustrine sequence (**Figure 2b**).

Under parts of the Plant, the Inactive Bottom Ash Basin, and Process Pond areas, this sand unit ranges in thickness from 5 to 20 feet and yields groundwater. The sand unit thins progressively to the west, having a thickness of approximately 12 feet on the east side of the discharge canal and thinning to less than a few feet within 150 feet to the west of the discharge canal. Further to the west the sand unit is not evident in soil borings for monitoring wells drilled in 2016 around the Fly Ash Basin. This is consistent with the expectation that lake-deposited materials will decrease in thickness with distance away from Lake Erie. Accordingly, it appears that this sand unit is a localized lakeshore beach deposit formed by westward aggradation with rising lake level and subsequently blanketed by finer lacustrine deposits. Groundwater in the sand unit is under semi-confined conditions with groundwater elevations ranging between approximately 572.6 and 575.6 feet above mean sea level (msl).

Lithologic information for each Inactive Bottom Ash Basin monitoring well is provided on the monitoring well construction logs included in **Appendix A**. Geologic Cross-sections are presented in **Figures 2a and 2b.**

2.2.1 Uppermost Aquifer System

The following section presents the expectations under the CCR Rule for identifying the uppermost aquifer subject to groundwater monitoring and describes the lithologic unit identified as the uppermost aquifer in the vicinity of the combined footprint of the Inactive Bottom Ash Basin at the Monroe Plant.

As described in the CCR Rule:

> *"The owner or operator of a CCR unit must install a groundwater monitoring system that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer…"*

Applicable definitions from the CCR rule (40 CFR 257.93) regarding the definition of an aquifer and the uppermost aquifer include the following:

> *"Aquifer means a geologic formation, group of formations, or portion of a formation capable of yielding usable 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 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."

Based on the hydrogeologic investigation findings, the uppermost aquifer zone occurs in the lower portion of a sequence of lacustrine deposits that is dominated by silty materials near the ground surface or under fill materials, which transitions at depth to a fine-grained sand. The shallow water-bearing zone is semi-confined by the overlying silts, with water levels generally higher than the top of the lacustrine unit. This water-bearing zone overlies a thick, hard glacial till. The glacial till unit acts as an aquitard between the unconsolidated deposits and the deeper, underlying bedrock.

2.2.2 Groundwater Flow and Hydraulic Conductivity

Water level data collected during the baseline groundwater monitoring program were used to construct potentiometric surface maps for the shallow groundwater zone. The data suggest that the direction of groundwater flow within the upper water-bearing zone is generally to the south-southwest towards Lake Erie, with an average gradient along the flow direction of approximately 0.00044 foot/foot (roughly 0.45 foot per 1000 feet). These values are within the expected range for the type of aquifer and the hydraulic setting. Potentiometric surface maps from the March 2018 and September 2018 sampling events are included in **Figures 4a and 4b**. As noted above, the aquifer unit thins to the west and the north such that there is no aquifer under areas north of the Inactive Bottom Ash Basin. Consequently, there is no representative upgradient or background monitoring position available for the unit. This directly affects the approach to the evaluation of compliance for the monitoring system as noted in the Statistical Methods Certification for this unit.

Hydraulic Conductivity

Aquifer testing (via drawdown and recovery tests using a submersible pump) was completed at monitoring wells MW-1S, MW-3S, MW-7S, and MW-8S. Testing data were evaluated on a well-by-well basis to assist in selecting the appropriate solution via the Aqtesolv™ software platform. Some key assumptions included the following: confined or leaky confined, presence of wellbore storage, and whether individual wells were considered fully or partially penetrating. The test pumping rates were low enough that the potential boundary conditions represented by the physical aquifer limits (to the north and west) were not expected to be detected in the drawdown or recovery data.

The shallow water-bearing zone wells yield groundwater at a relatively high rate. Where the zone has a component of gravel in the fine sand, the wells (MW-1S and MW-7S) produced significantly more water than monitoring wells screened in fine sand with silt (wells MW-3S and MW-8S). Calculated hydraulic conductivity values for the uppermost aquifer are summarized below:

Well ID	Transmissivity (cm^2/sec)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/day)	Hydraulic Conductivity (ft/day)
MW-1S	10.16	0.0423	36.5	119.8
MW-3S	0.68	0.0035	3.02	9.90
MW-7S	42.03	0.1274	110	360.9
MW-8S	0.57	0.0024	3.07	10.07

cm2/sec – centimeters squared per second
cm/sec – centimeters per second
m/day – meters per day
ft/day – feet per day

Horizontal Time of Travel

The horizontal time of travel for the Inactive Bottom Ash Basin area was calculated using Darcy Flux calculations and the following input values:

- Hydraulic Gradient (foot/foot) – based on average of dry and wet season potentiometric contours
- Hydraulic Conductivity (feet/day) – based on a median value estimated for the shallow aquifer system
- Effective Porosity (unit less) – based on published values for silty sands

Assuming an effective porosity of 30 percent for silty sand with some gravel, a gradient value of 0.00044 foot/foot with a median conductivity value of 119 feet/day, the horizontal time of travel is estimated to be 0.174 feet/day (or 260 feet/year).

3.0 GROUNDWATER MONITORING SYSTEM INSTALLATION

The CCR groundwater monitoring system well network was installed in two phases. The first phase of activities, conducted between September 19 and October 4, 2016, included the installation of seven (7) shallow and four (4) exploratory, deep (bedrock) monitoring wells in the vicinity of the inactive Bottom Ash Basin. Groundwater monitoring was performed over an 8-month period to evaluate the hydrogeology and groundwater chemistry in the vicinity of the inactive Bottom Ash Basin. Findings were used to select the location of seven (7) additional monitoring wells to establish the CCR groundwater monitoring system well network. The additional monitoring wells were installed between September 20 and September 26, 2017.

3.1 Borehole Advancement and Well Installation

Each monitoring well was installed by a State of Michigan licensed well driller as directly observed by an AECOM Geologist. Borings were advanced using a rotosonic drill rig and soil cores were collected in continuous sections for examination and lithologic description by the on-site geologist to the terminating depth of each borehole. Photographs of each soil core were collected. In total, 14 boreholes were advanced into the upper water-bearing zone in unconsolidated materials. Upon reaching the target depth, a monitoring well was installed in each borehole. Four (4) separate boreholes were advanced into a water-bearing zone of the bedrock that underlies the unconsolidated materials, but these wells are not included in the monitoring system because there is a strong upward hydraulic gradient between the bedrock and shallow groundwater systems that prevents downward migration of contaminants.

3.2 Well Construction

Each monitoring well was constructed using 2-inch inside diameter polyvinyl chloride (PVC) casing with a 10-foot section of 0.010-inch slotted PVC screen. The annular space (between the borehole wall and well screen/casing) was backfilled with a clean silica sand pack extending at least 2 feet above the top of the screen. A minimum 2-foot thick bentonite seal was placed on top of the sand pack and each seal was allowed to hydrate for at least 1 hour per manufacturer's specifications. After hydrating the seal, the remaining annular space was filled with a cement/bentonite grout emplaced via tremie method to within approximately 12 inches of the ground surface.

3.3 Well Development

Each monitoring well was developed no sooner than 24-hours after grout emplacement to enhance hydraulic connection between the well and the aquifer and to remove potable water introduced to the subsurface during drilling activities. A submersible pump was used to remove at least five (5) well volumes or until the water was visibly clear of sediments, turbidity was less than 10 nephalometric turbidity units (NTUs), and water quality measurements [temperature, pH, conductivity, and oxidation-reduction potential (ORP)] were stable over at least three (3) well volumes.

3.4 Well Survey

Each monitoring well was surveyed for horizontal location (North American Datum of 1983 or NAD 83) and elevation data(North American Vertical Datum of 1988 or NAVD 88). by a surveyor licensed in the State of Michigan. Top-of-casing and ground surface elevations were recorded to the nearest 0.01 foot.

4.0 CCR GROUNDWATER MONITORING SYSTEM DESCRIPTION

Based on site-specific hydrogeologic information and groundwater flow, 12 shallow monitoring wells were selected as the groundwater monitoring system for the inactive Bottom Ash Basin. The number, spacing, and depth of monitoring wells was based on a thorough characterization of the hydrogeologic factors included in § 257.91 (b)(1)&(2). As noted in Section 3.1 above, each well was installed into the uppermost water-bearing zone underlying the site. The zone is comprised primarily of sand with varying amounts of silt present between approximately 25 to 35 feet below ground surface (bgs) on site. Each well is equipped with a dedicated bladder pump system and tubing installed for sampling purposes.

Monitoring well locations are shown on **Figure 3**. **Table 1** contains information regarding well locations and construction details. Well lithologic and construction logs are included as **Attachment A**.

5.0 CCR GROUNDWATER MONITORING SYSTEM CERTIFICATION

AECOM ("Consultant") has been retained by DTE Energy to provide certification of the groundwater monitoring system as required under 40 CFR § 257.91(f) of the HAZARDOUS AND SOLID WASTE MANAGEMENT SYSTEM; DISPOSAL OF COAL COMBUSTION RESIDUALS FROM ELECTRIC UTILITIES; FINAL RULE, 80 Fed. Reg. 21302 (Apr. 17, 2015) ("CCR Rule") for the inactive CCR unit identified by DTE Energy at their Monroe Plant located in Monroe, Michigan.

Requirements

Pursuant to 40 CFR § 257.90(b)(1), by April 17, 2019, the owner or operator of an inactive CCR unit must install a groundwater monitoring system that meets the requirements of 40 CFR § 257.91. The groundwater monitoring system must meet the CCR Rule's performance standard, which requires the system to consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that accurately represent the quality of:

(1) background groundwater that has not been affected by leakage from a CCR unit; and

(2) groundwater passing the waste boundary of the CCR unit and monitoring all potential contaminant pathways.

The CCR unit identified at the site is the Inactive Bottom Ash Basin. The CCR Rule groundwater monitoring system requirement is addressed by a single system consisting of 12 monitoring wells. Information regarding the groundwater monitoring system design and construction has been provided to the qualified professional engineer as required by 40 CFR § 257.91(e)(1) and is included in the facility operating record per 40 CFR § 257.91(e)(1).

Limitations

The signature of Consultant's authorized representative on this document represents that to the best of Consultant's knowledge, information, and belief in the exercise of its professional judgment, it is Consultant's professional opinion that the aforementioned information is accurate as of the date of such signature. Any opinion or decisions by Consultant are made on the basis of Consultant's experience, qualifications, and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

6.0 CERTIFICATION

I, Scott Hutsell, being a Registered Professional Engineer, in accordance with the State of Michigan Professional Engineer's Registration program, possessing the technical knowledge and experience to make the specific technical certifications required under 40 Code of Federal Regulations (CFR) Part 257, Subpart D, Standards for the Disposal of Coal Combustion Residuals (CCRs) in Landfills and Surface Impoundments, and being licensed in the state where the CCR unit(s) is located, do hereby certify to the best of my knowledge, information, and belief, that the groundwater monitoring system that is the subject of this certification has been designed and constructed to meet the requirements of 40 CFR § 257.91.

Signature: [signature]

Date: 04/15/19

License #: 43961

License Renewal Date: 10/31/20

TABLE

TABLE 1
DTE ENERGY
MONROE POWER PLANT
MONITORING WELL CONSTRUCTION SUMMARY

<table>
<tr><th>Well ID</th><th>Easting</th><th>Northing</th><th>Well Installation Date</th><th>TOC Elevation (ft MSL)</th><th>Ground Surface Elevation (ft MSL)</th><th>Total Depth (ft BTOC)</th><th>Bottom Elevation (ft MSL)</th><th>Screen Length (feet)</th><th>Top of Screen Elevation (ft MSL)</th><th>Bottom of Screen Elevation (ft MSL)</th><th>Pump Depth (ft BTOC)</th><th>Well Casing Material</th><th>Well Screen Material and Slot Size</th><th>Groundwater Flow Location</th><th>Program Use</th></tr>
<tr><td>MW-1S</td><td>13401951.05</td><td>140176.14</td><td>9/19/2016</td><td>582.62</td><td>579.80</td><td>43.82</td><td>538.80</td><td>10</td><td>548.80</td><td>538.80</td><td>40.74</td><td rowspan="18">2-inch Schedule 40 PVC</td><td rowspan="18">2-inch Schedule 40 PVC and 0.01-inch slot</td><td rowspan="3">Downgradient</td><td rowspan="12">Detection</td></tr>
<tr><td>MW-2S</td><td>13401077.48</td><td>139070.06</td><td>9/19/2016</td><td>578.85</td><td>579.20</td><td>49.65</td><td>529.20</td><td>10</td><td>548.20</td><td>538.20</td><td>37.34</td></tr>
<tr><td>MW-3S</td><td>13399871.43</td><td>139417.18</td><td>9/20/2016</td><td>577.58</td><td>578.10</td><td>39.48</td><td>538.10</td><td>10</td><td>548.10</td><td>538.10</td><td>35.00</td></tr>
<tr><td>MW-7S</td><td>13399510.36</td><td>141102.76</td><td>9/28/2016</td><td>576.20</td><td>576.60</td><td>33.60</td><td>542.60</td><td>10</td><td>552.60</td><td>542.60</td><td>29.70</td><td>Downgradient</td></tr>
<tr><td>MW-8S</td><td>13397828.28</td><td>140560.53</td><td>9/30/2016</td><td>586.59</td><td>583.70</td><td>45.89</td><td>540.70</td><td>10</td><td>550.70</td><td>540.70</td><td>42.57</td><td>Lateral Gradient</td></tr>
<tr><td>MW-9</td><td>13399606.60</td><td>140623.10</td><td>9/19/2017</td><td>579.05</td><td>576.37</td><td>37.73</td><td>541.32</td><td>10</td><td>551.37</td><td>541.37</td><td>33.00</td><td rowspan="7">Downgradient</td></tr>
<tr><td>MW-10</td><td>13399724.80</td><td>140207.50</td><td>9/20/2017</td><td>577.46</td><td>577.79</td><td>36.58</td><td>540.88</td><td>10</td><td>550.79</td><td>540.79</td><td>31.50</td></tr>
<tr><td>MW-11</td><td>13399991.4</td><td>138811.7</td><td>9/20/2017</td><td>580.58</td><td>577.84</td><td>41.90</td><td>538.68</td><td>10</td><td>547.84</td><td>537.84</td><td>36.00</td></tr>
<tr><td>MW-12</td><td>13400748.3</td><td>138911.9</td><td>9/21/2017</td><td>582.49</td><td>579.90</td><td>44.79</td><td>537.70</td><td>10</td><td>547.90</td><td>537.90</td><td>39.00</td></tr>
<tr><td>MW-13</td><td>13401644.6</td><td>139800.4</td><td>9/21/2017</td><td>580.97</td><td>578.25</td><td>38.08</td><td>542.89</td><td>10</td><td>553.25</td><td>543.25</td><td>33.00</td></tr>
<tr><td>MW-14</td><td>13401772.2</td><td>141406.5</td><td>9/22/2017</td><td>580.76</td><td>577.87</td><td>42.67</td><td>538.09</td><td>10</td><td>547.87</td><td>537.87</td><td>37.50</td></tr>
<tr><td>MW-15</td><td>13399419.6</td><td>141789.1</td><td>9/26/2017</td><td>580.80</td><td>578.11</td><td>40.88</td><td>539.92</td><td>10</td><td>549.61</td><td>539.61</td><td>36.00</td></tr>
<tr><td>MW-4S</td><td>13401614.14</td><td>141163.06</td><td>9/26/2016</td><td>580.67</td><td>578.10</td><td>42.57</td><td>538.10</td><td>10</td><td>551.10</td><td>541.10</td><td>35.84</td><td rowspan="6">N/A</td><td rowspan="6">Potentiometry*</td></tr>
<tr><td>MW-5S</td><td>13401176.41</td><td>142564.92</td><td>10/4/2016</td><td>584.50</td><td>581.70</td><td>72.80</td><td>511.70</td><td>10</td><td>568.70</td><td>558.70</td><td>20.96</td></tr>
<tr><td>MW-1D</td><td>13401952.04</td><td>140178.92</td><td>9/19/2016</td><td>582.82</td><td>579.40</td><td>83.42</td><td>499.40</td><td>10</td><td>509.40</td><td>499.40</td><td>N/A</td></tr>
<tr><td>MW-3D</td><td>13399871.16</td><td>139422.09</td><td>9/20/2016</td><td>577.42</td><td>578.00</td><td>79.42</td><td>498.00</td><td>10</td><td>509.00</td><td>499.00</td><td>N/A</td></tr>
<tr><td>MW-7D</td><td>13399510.92</td><td>141099.21</td><td>9/28/2016</td><td>576.17</td><td>576.70</td><td>69.47</td><td>506.70</td><td>10</td><td>517.70</td><td>507.70</td><td>N/A</td></tr>
<tr><td>MW-8D</td><td>13397828.00</td><td>140561.00</td><td>9/30/2016</td><td>586.45</td><td>583.70</td><td>72.75</td><td>513.70</td><td>10</td><td>527.20</td><td>517.20</td><td>N/A</td></tr>
</table>

TOC - Top of Casing
ft MSL - feet above Mean Sea Level
ft BTOC - feet below top of casing
PVC - Polyvinyl Chloride

FIGURES

Document Path: J:\GIS\Projects\D\DTE\Monroe Plant\Fig1_Site Location Map (7-22-2016).mxd

LEGEND:

- Unit Separation Berm
- Approximate Plant Boundary
- Approximate Boundary of Inactive Bottom Ash Basin

N

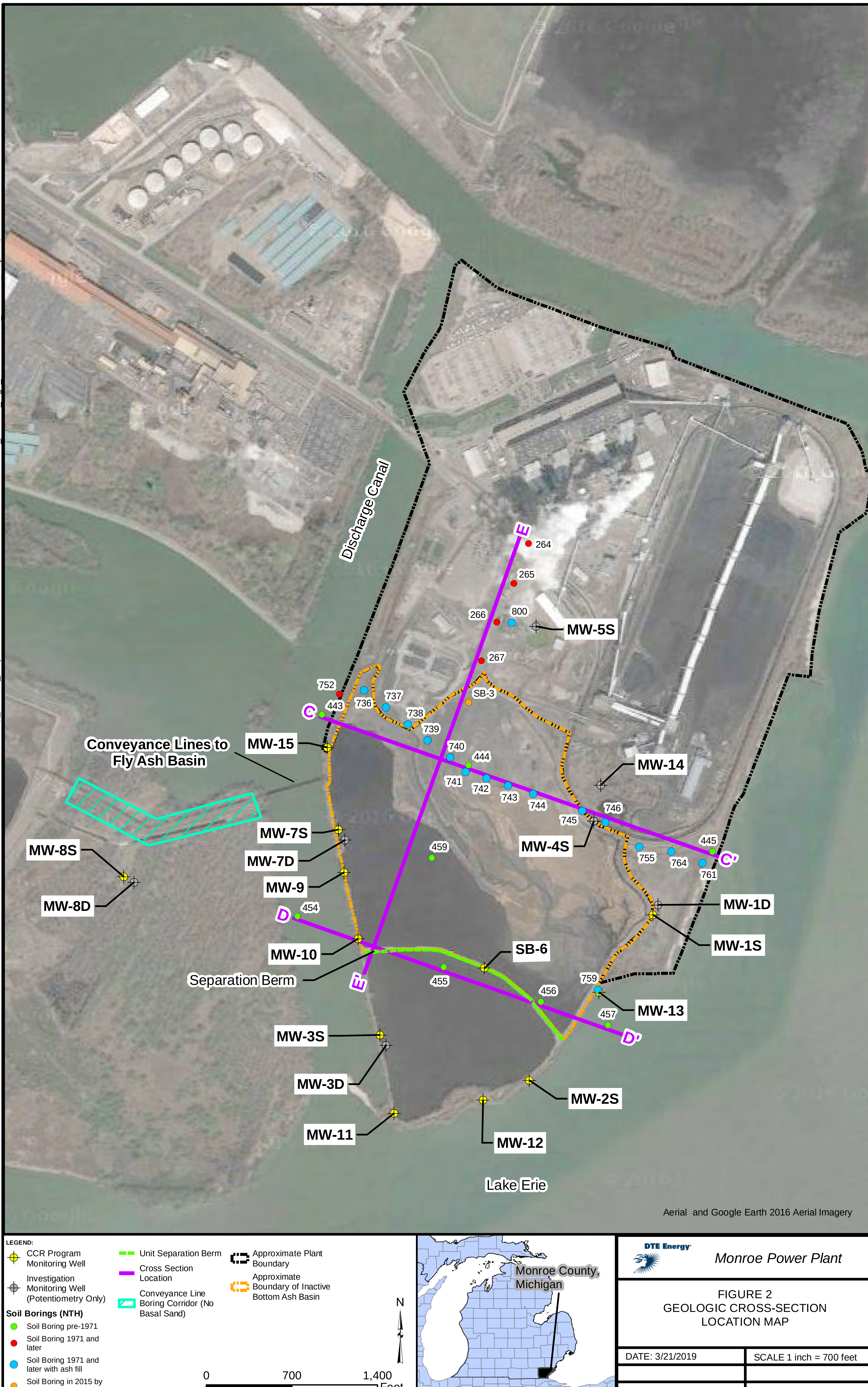
0 750 1,500 Feet

DTE Energy

Monroe Power Plant

FIGURE 1
SITE VICINITY MAP

DATE: 7/22/2016	SCALE 1 inch = 720 feet
CREATED BY: KLP	
JOB NO. 60489524	



DTE Energy

Monroe Power Plant

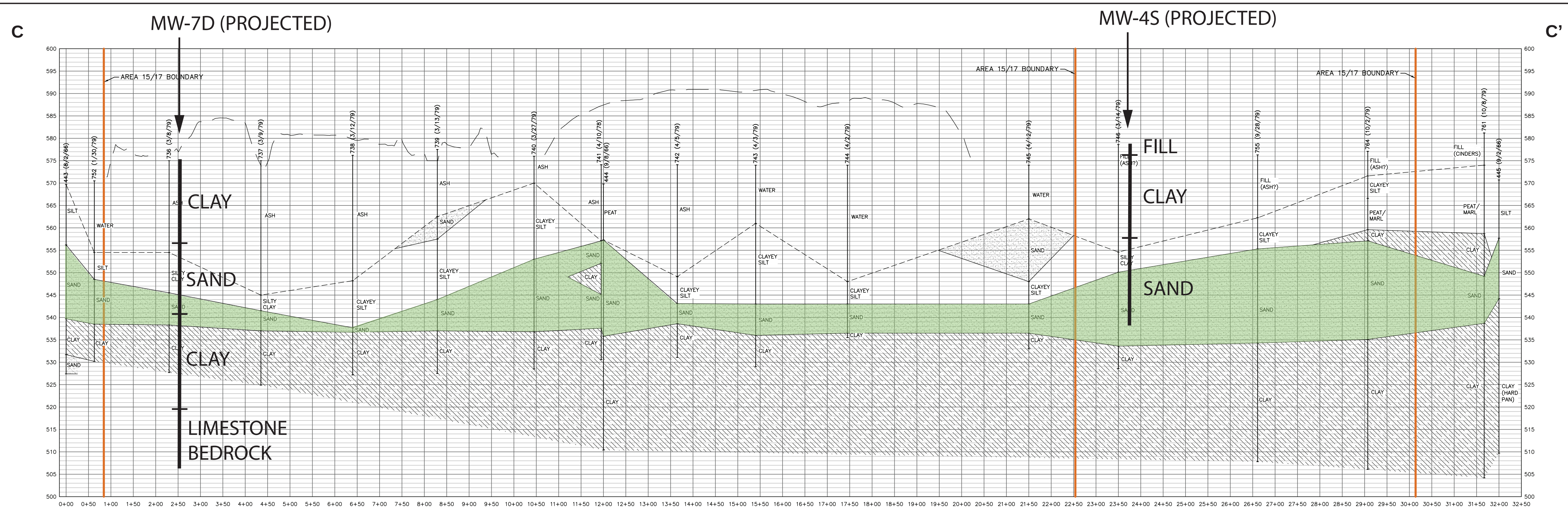
FIGURE 2
GEOLOGIC CROSS-SECTION LOCATION MAP

DATE: 3/21/2019	SCALE 1 inch = 700 feet
JOB NO. 60516675	

Document Path: G:\Cincinnati\DCS\GIS\ArcMap_GeoDB_Projects\D\DTE\DTE-Monroe Plant\Data-Tech\GIS\DTE_Monroe_Fig2_Cross-Section_Location_Map.mxd

NORTHWEST

SOUTHEAST



LEGEND

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NOT FOR CONSTRUCTION

THIS IS A CAD PRODUCED DRAWING. ANY CHANGES OR REVISIONS TO THIS DRAWING MUST BE COMPLETED USING THE CAD SYSTEM.

2

LATEST REVISION "0"

PMP NUMBER: 11107
GL/WBS2 NUMBER: I-000022-0211
PO NUMBER: 4700855696

NTH Consultants, Ltd.

NTH PROJECT NO. 62-150239-00

The Detroit Edison Co. Engineering

AREA 15-17 CLOSURE
CROSS SECTIONS A,B,C

LOCATION NAME: MONROE POWER PLANT
UNIT NUMBER: 1-4
ORIGINATING SOURCE: NTH CONSULTANTS, LTD.
SCALE: AS SHOWN
DRAWING NUMBER: 2

DESIGNED BY: ACE 7/13/2015
DRAWN BY: CWS 7/13/2015
CHECKED BY: DRL 7/13/2015

DTE Energy

Monroe Power Plant

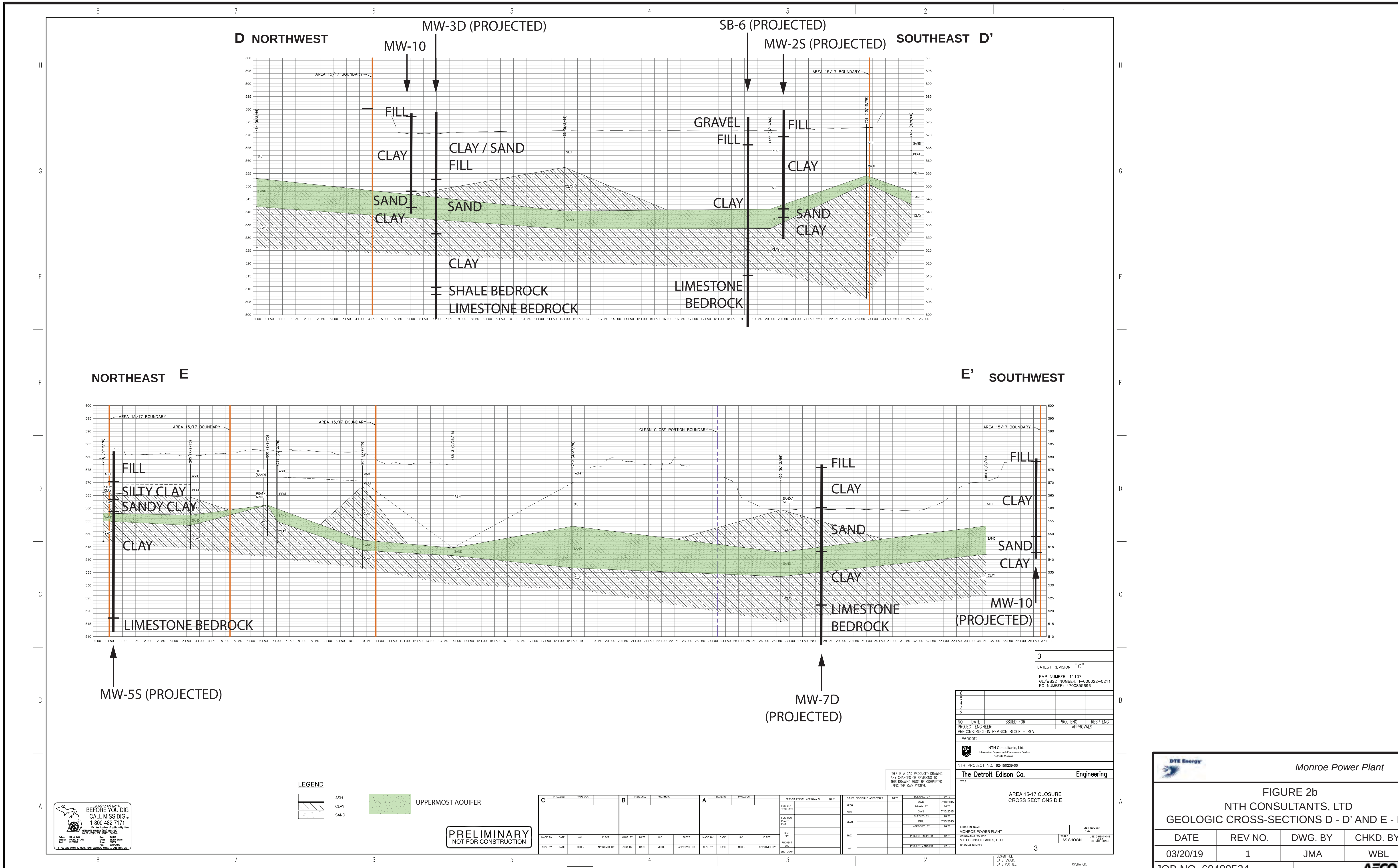
FIGURE 2a
NTH CONSULTANTS, LTD - GEOLOGIC
CROSS-SECTION C - C'

DATE	REV NO.	DWG. BY	CHKD. BY
03/20/19	1	JMA	WBL

JOB NO. 60516675

AECOM

J:\Project\D\DTE\DTE-Monroe Plant\Deliverables\Draft\Aquifer Memo\Fig2a_Geo-Xsection_CC.AI



Monroe Power Plant

FIGURE 2b
NTH CONSULTANTS, LTD
GEOLOGIC CROSS-SECTIONS D - D’ AND E - E’

DATE	REV NO.	DWG. BY	CHKD. BY
03/20/19	1	JMA	WBL

JOB NO. 60489524

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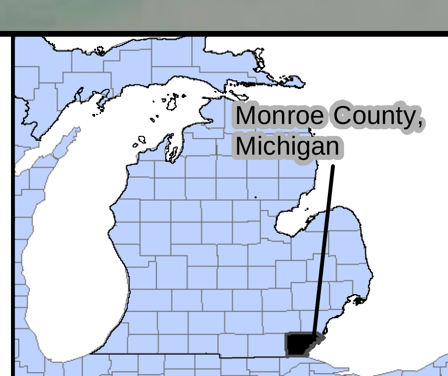
LEGEND:

- CCR Program Monitoring Well
- Investigation Monitoring Well (Potentiometry Only)
- Unit Separation Berm
- Approximate Plant Boundary
- Approximate Boundary of Inactive Bottom Ash Basin

N

0 700 1,400 Feet

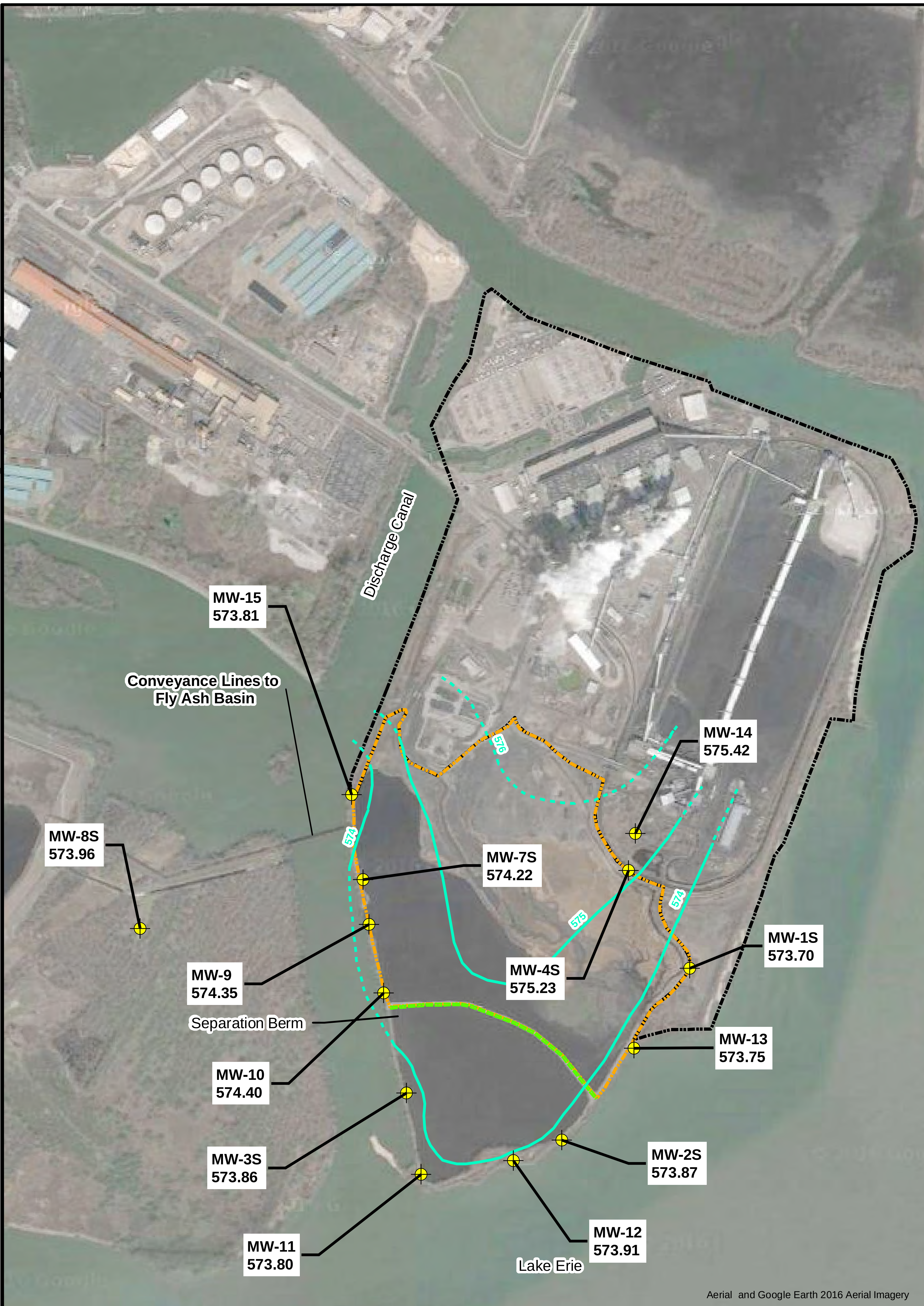


DTE Energy

Monroe Power Plant

FIGURE 3
INACTIVE BOTTOM ASH BASIN
WELL LOCATION MAP
2018

DATE: 3/20/2019	SCALE 1 inch = 720 feet
JOB NO. 60516675	



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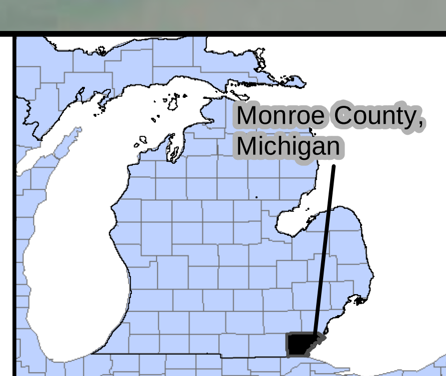
LEGEND:

- Monitoring Well
- Groundwater Contour (Dashed where inferred)
- Unit Separation Berm
- Approximate Plant Boundary
- Approximate Boundary of Inactive Bottom Ash Basin

N

0 700 1,400 Feet



DTE Energy

Monroe Power Plant

FIGURE 4a
EVENT 3 (NO MW-5S)
GROUNDWATER CONTOUR MAP
3/12/2018

DATE: 3/20/2019	SCALE 1 inch = 720 feet
JOB NO. 60516675	

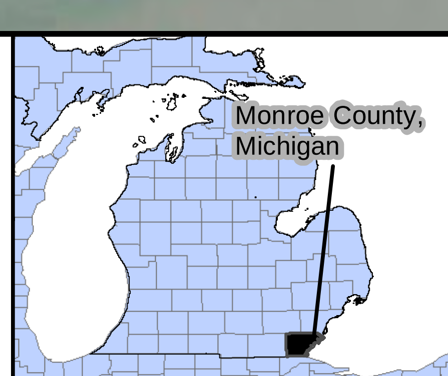
Document Path: G:\Cincinnati\DCS\GIS\ArcMap_GeoDB_Projects\D\DTE\DTE-Monroe Plant\Data-Tech\GIS\DTE_Monroe_Event6_NO_MW5S_20190226.mxd

LEGEND:

- Monitoring Well
- Goundwater Contour (Dashed where inferred)
- Unit Separation Berm
- Approximate Plant Boundary
- Approximate Boundary of Inactive Bottom Ash Basin

N

0 700 1,400 Feet



DTE Energy

Monroe Power Plant

FIGURE 4b
EVENT 6 (NO MW-5S)
GROUNDWATER CONTOUR MAP
9/24/2018

DATE: 3/20/2019	SCALE 1 inch = 720 feet
JOB NO. 60516675	

APPENDIX A

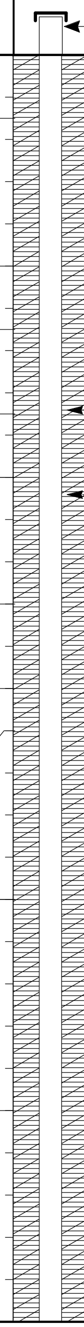
Monitoring Well Construction Logs

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-1D

Date(s) Drilled	9/15/16 to 9/19/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	80.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	579.7 ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	582.60 ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)	Artesian (flowing) [Measurement after development]		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	0				Dark gray, well graded SAND (SW); loose; some gravel, trace silt and clay; fill materials	Steel Pro-Casing
					Black, poorly graded SAND (SP); trace gravel, little silt and clay, moist (Ash)	
575	5	10	8.5	85		
					Black CLAY (CH); high plasticity; little sand, trace gravel, moist	
					Gray CLAY (CL); hard; moist; little gravel	**Bentonite Grout**
570	10				Dark gray SAND (SW); well graded; trace gravel;wet	**2" ID schedule 40 PVC riser**
					Dark brown CLAY (CH); high organic/peat content; moist	
565	15	10	10	100		
					Grades with peat, small shells	
560	20				Gray SILT (ML); some fine sand increasing with depth; wet	
555	25	10	8.0	80		
550	30					



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Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30						
						Dark gray fine SAND (SP-SM); poorly graded; some silt; wet	
545	35	10	8.5	85			
						same as above; decayed wood present	
						Gray GRAVEL (GW); rounded; well graded; trace clay; wet	Bentonite Grout
540	40						2" ID schedule 40 PVC riser
						Gray CLAY (CL); glacial till; hard; trace fine sand; moist	
535	45	10	10	100			
530	50						
		5	5.0	100			
						Highly weathered LIMESTONE-SHALE (large bedrock inclusion in till)	
525	55						
						Gray CLAY (CL); glacial till; very hard; trace medium sand; dry	
		5	5.0	100			
520	60						
		5	0.5	10			
515	65						

Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		5	2.75	55			Bentonite Grout; 2" ID schedule 40 PVC riser; Bentonite Seal
510	70						SCH 40 PVC 2" Diameter 0.01" Slotted Screen
		5	4.0	80		LIMESTONE-SHALE (bedrock); gray, highly weathered; wet; some intact 2"-3"	
505	75						Clean silica sand
		5	5.0	100		LIMESTONE (bedrock); gray, slightly weathered; breaks apart with hammer blows; moist to wet	
500	80						End of boring
495	85						
490	90						
485	95						
480	100						

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-1S

Date(s) Drilled	9/15/16 to 9/19/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	41.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	579.8 ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	582.62 ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)	9.42' BTOC [Measurement after development]		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	0				Dark gray well graded SAND (SW); loose; some ash; fill materials	Steel Pro-Casing
575	5	10	8.5	85		
					Black CLAY (CH); high plastiscity; moist	
					Gray CLAY (CL); hard; moist; little gravel	Bentonite Grout
570	10				Dark gray SAND (SW); well graded; trace gravel;wet	2" ID schedule 40 PVC riser
					Dark brown CLAY (CH); high organic-peat content; moist	
565	15	10	10	100		
560	20				Gray SILT (ML); some fine sand; wet	
555	25	10	8.0	80		
						Bentonite Seal
						Clean silica sand
550	30					

Project: DTE Monroe Plant	Log of MW-1S
Project Location: Monroe, Michigan	Sheet 2 of 2
Project Number: 60489524	

Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	30							2" ID schedule 40 PVC riser
								SCH 40 PVC 2" Diameter 0.01" Slotted Screen
						Dark gray fine SAND (SP-SM); poorly graded; some silt; wet		
545	35	10	8.5	85				
								Clean silica sand
						same as above; decayed wood present		
						Gray GRAVEL (GW); rounded; well graded; trace clay; wet		
540	40							
								End of boring
535	45	10	10	100				
530	50							
525	55							
520	60							
515	65							

AECOM

Project: DTE Monroe Plant	**Log of MW-2S**
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 2

Date(s) Drilled	**9/19/16 to 9/19/2016**	Logged By	**Ron Friend**	Checked By	**M Hawrylak**
Drilling Method	**Sonic**	Drill Bit Size/Type	**Sonic 6"**	Total Depth of Borehole	**50.0 ft**
Drill Rig Type	**Mini Sonic**	Drilling Contractor	**Cascade Drilling**	Surface Elevation	**579.2 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic Core Barrel - 4"**	Top of Casing Elevation	**578.85 ft msl**
Boring Location	**Inactive Bottom Ash Basin**	Groundwater Level(s)	**4.91' BTOC [Measurement after development]**		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0					ASPHALT		
						Gray SAND (SW-SM); well graded; with silt; some gravel		
575	5	10	1.0	10				
								Bentonite Grout
570	10					Dark gray CLAY (CH); high plasticity; trace silt; wood debris-organic materials; moist		2" ID schedule 40 PVC riser
565	15	10	7.5	75				
560	20							
						Brown CLAY (CH); high plasticiity; some mottling; little gravel; moist; hard @ 26'		
555	25	10	6.0	60				
								Bentonite Seal
550	30							

AECOM

Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well	REMARKS AND OTHER DETAILS
	30							2" ID schedule 40 PVC riser
						Dark gray CLAY (CL); trace coarse sand; little gravel; very hard; dry-moist		SCH 40 PVC 2" Diameter 0.01" Slotted Screen
545								
	35	10	8.5	85				Clean silica sand
						Dark gray SAND (SP-SM); poorly graded; fine grained; some silt; wet		
540								
	40					Dark gray SAND (SP); poorly graded; wet		
						Dark Gray CLAY (CL); glacial till; very hard, trace gravel and sand; moist		Bentonite Seal
535								
	45	10	8.0	80				
530								
	50							End of boring
525								
	55							
520								
	60							
515								
	65							

Project: DTE Monroe Plant	Log of MW-3D
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 3

Date(s) Drilled	9/20/16 to 9/20/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	80.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	578.0 ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	577.42 ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)	Artesian (flowing) [Measurement after development]		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0					ASPHALT-GRAVEL		
						Brown SAND (SW); well graded; some gravel		
575								
						Dark yellow-brown CLAY (CL); very stiff; little gravel; moist		
	5	10	2.75	27.5				
570								Bentonite Grout
	10					Dark gray CLAY (CH); high plasticity; some organic materials; stiffer with depth; moist to wet		2" ID schedule 40 PVC riser
565								
	15	10	10	100				
						Dark gray-brown CLAY (CL); hard; gray mottling; little gravel		
560								
	20							
555								
	25	10	10	100		Dark gray SAND (SP-SM); poorly graded with silt; medium dense; trace gravel		
						Dark gray SAND (SP); poorly graded; fine grained; medium dense; moist		
550								
	30							

AECOM

Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30						
545						Dark gray SAND (SP-SM); poorly graded with silt; fine grained; higher silt content at depth; wet	
	35	10	9.5	95			
						Gray SILT (ML); soft; little fine sand; wet	
540							Bentonite Grout
						Dark gray CLAY (CL); glacial till; hard; trace gravel and sand; moist	
	40						2" ID schedule 40 PVC riser
535							
	45	10	5.5	55			
530							
	50						
525							
	55	10	5.5	55			
520							
	60						
515		10	3.0	30		Gray highly weathered LIMESTONE (bedrock inclusion in till); some granite pebbles	
						Dark gray CLAY (CL); glacial till; hard; trace gravel; moist	Bentonite Seal
	65						

Elevation, feet	Depth, feet	SAMPLES Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
								Bentonite Seal
		10	3.0	30				2" ID schedule 40 PVC riser
510						Light gray SH (bedrock); highly weathered; broken from drilling process; moist to wet		
	70							SCH 40 PVC 2" Diameter 0.01" Slotted Screen
						Gray LIMESTONE (bedrock); weathered; some intact sections (< 3" long); moist to wet		
505								
	75	10	4.0	40				Clean silica sand
500								
						Pale brown LIMESTONE (bedrock); highly weathered 1-2" long pieces		
	80							End of boring
495								
	85							
490								
	90							
485								
	95							
480								
	100							

Project: DTE Monroe Plant

Project Location: Monroe, Michigan

Project Number: 60489524

Log of MW-3S

Date(s) Drilled	9/20/16 to 9/20/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	40.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	578.1 ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	577.58 ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)	3.76' BTOC [Measurement after development]		

Depth, feet (top of unit)	MATERIAL DESCRIPTION
0	ASPHALT-GRAVEL
~0.6	Brown SAND (SW); well graded; some gravel
~4	Dark yellow-brown CLAY (CL); very stiff; little gravel; moist
10	Dark gray CLAY (CH); high plasticity; some organic materials; stiffer with depth; moist to wet
~16	Dark gray-brown CLAY (CL); hard; gray mottling; little gravel
~24.5	Dark gray SAND (SP-SM); poorly graded with silt; medium dense; trace gravel
~26.5	Dark gray SAND (SP); poorly graded; fine grained; medium dense; moist

SAMPLES

Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %
5	10	2.75	27.5
15	10	10	100
25	10	10	100

Elevation scale, feet: 575, 570, 565, 560, 555, 550

Depth scale, feet: 0, 5, 10, 15, 20, 25, 30

REMARKS AND OTHER DETAILS

- Bentonite Grout
- 2" ID schedule 40 PVC riser
- Bentonite Seal
- Clean silica sand

AECOM

Elevation, feet	Depth, feet	SAMPLES Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	30							SCH 40 PVC 2" Diameter 0.01" Slotted Screen
545						Dark gray SAND (SP-SM); poorly graded with silt; fine grained; higher silt content at depth; wet		2" ID schedule 40 PVC riser
	35	10	9.5	95				Clean silica sand
						Gray SILT (ML); soft; little fine sand; wet		
540								
	40							End of boring
535								
	45	10	5.5	55				
530								
	50							
525								
	55							
520								
	60							
515								
	65							

Project: DTE Monroe Plant	Log of MW-4S
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 2

Date(s) Drilled	9/26/16 to 9/26/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	40.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	578.1 ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	580.67 ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)	5.82' BTOC [Measurement after development]		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0					Brown SAND (SW); well graded with gravel		Steel Pro-Casing
						Dark gray SAND (SW); well graded; moist		
575								
	5	10	5.5	55				
						Brown CLAY (CH); high plasticity; trace gravel and coarse sand; moist		
570								Bentonite Grout
	10							2" ID schedule 40 PVC riser
						Dark gray CLAY (CH); high plasticity; some organic material-peat		
565								
	15	10	5.0	50				
560								
	20					Gray SILT (ML) with fine sand; wet		
555								Bentonite Seal
	25	10	7.5	75				
								Clean silica sand
								SCH 40 PVC 2" Diameter 0.01" Slotted Screen
550						Dark gray SAND (SW); well graded; loose; trace gravel; wet		
	30							

Elevation, feet	Depth, feet	SAMPLES Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30						2" ID schedule 40 PVC riser
545							SCH 40 PVC 2" Diameter 0.01" Slotted Screen
	35	10	7.5	75		Dark gray SILT (ML) with fine sand; wet	Clean silica sand
540						Gray CLAY (CL); glacial till; hard'; trace gravel and coarse sand	Bentonite Seal
	40						End of boring
535							
	45						
530							
	50						
525							
	55						
520							
	60						
515							
	65						

Project: DTE Monroe Plant	**Log of MW-5S**
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 3

Date(s) Drilled	**10/4/16 to 10/4/2016**	Logged By	**Ron Friend**	Checked By	**M Hawrylak**
Drilling Method	**Sonic**	Drill Bit Size/Type	**Sonic 6"**	Total Depth of Borehole	**70.0 ft**
Drill Rig Type	**Mini Sonic**	Drilling Contractor	**Cascade Drilling**	Surface Elevation	**581.7 ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic Core Barrel - 4"**	Top of Casing Elevation	**584.50 ft msl**
Boring Location	**Inactive Bottom Ash Basin**	Groundwater Level(s)	**5.81' BTOC [Measurement after development]**		

Elevation, feet	Depth, feet	SAMPLES Run Length (ft)	SAMPLES Recovery (ft)	SAMPLES Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	0					Steel Pro-Casing
	0				Black SAND (SW); well graded; little gravel; moist (FILL)	**Bentonite Seal**
580		5	0	0	Gray fine SAND (SP-SM) with silt and gravel; moist	
	5					**2" ID schedule 40 PVC riser**
575		5	4.0	40		
	10					
570					Gray silty CLAY (CL); low plasticity; soft; little organic material; moist	
					Dark brown CLAY (CL); high plasticity; some organic material; small shells; moist	**SCH 40 PVC 2" Diameter 0.01" Slotted Screen**
	15	10	7.0	70		
565						**Clean silica sand**
	20				Gray CLAY (CL) with fine sand and silt; soft; trace organic material; sand-silt decrease with depth; wet	
560						
					Gray CLAY (CH); brown mottling; high plasticity; little gravel; moist	**Bentonite Chip**
	25	10	8.5	85	Gray CLAY (CL); brown mottling; hard; low plasticity; moist; very hard starting at 34 feet	
555						
	30					

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Elevation, feet	Depth, feet	SAMPLES Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	30							
550								
	35	10	7.5	75				
545								
	40							Bentonite Chip
540						Gray CLAY (CH); brown mottling; high plasticity; little gravel; moist		
						Gray CLAY (CL); glacial till; very hard; moist to dry		
	45	10	8.5	85				
535								
	50							
530								
	55	10	5.5	55				
525								
	60							
520								
		5	4.0	80				
	65							

Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
515		5	4.0	80		Gray LIMESTONE (bedrock); higly weathered; dry from drilling methods but zone produces water		Bentonite Chip
	70							End of boring
510								
	75							
505								
	80							
500								
	85							
495								
	90							
490								
	95							
485								
	100							

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-7D

Date(s) Drilled	9/28/16 to 9/28/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	70.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	576.7 ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	576.17 ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)	Artesian (flowing) [Measurement after development]		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	0				Gray gravel FILL	
575					Brown CLAY (CH); high plasticity; some organic materials and shells; moist	
	5	10	5.5	55		
570						Bentonite Grout
	10					2" ID schedule 40 PVC riser
565						
	15	10	8.5	85		
560					Gray CLAY(CH); high plasticity; trace fine sand; moist	
					Gray SAND (SP-SM) with silt; trace organic fragments; wet	
	20					
555					Gray fine SAND (SP); some silt; wet	
	25	10	8.5	85	Gray SAND (SW); well graded; little gravel; wet	
550						
	30					

AECOM

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-7D

Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30					
545						
					Gray GRAVEL (GW); well graded with sand; wet	
					Gray SAND (SW); well graded; little gravel; wet	
					Dark gray CLAY (CL); glacial till; hard; trace gravel and coarse sand; moist	
	35	10	8.5	85		
540						
						Bentonite Grout
	40					
						2" ID schedule 40 PVC riser
535						
	45	10	9.5	95		
530						
	50					
525						
	55	10	10	100	Light gray LIMESTONE (bedrock); highly weathered; some larger pieces; wet	Bentonite Seal
520						
						SCH 40 PVC 2" Diameter 0.01" Slotted Screen
	60				Light gray LIMESTONE (bedrock); highly weathered; some intact pieces; poor recovery overall; wet	
515						
		10	2.5	25		
						Clean silica sand
	65					

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
510		10	2.5	25				2" ID schedule 40 PVC riser; SCH 40 PVC 2" Diameter 0.01" Slotted Screen; Clean silica sand; Collapse
	70							End of boring
505								
	75							
500								
	80							
495								
	85							
490								
	90							
485								
	95							
480								
	100							

Project: DTE Monroe Plant	Log of MW-7S
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 2

Date(s) Drilled	9/28/16 to 9/28/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	34.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	576.6 ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	576.20 ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)	2.74' BTOC [Measurement after development]		

Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	0					Gray gravel FILL		
575						Brown CLAY (CH); high plasticity; some organic materials and shells; moist		
	5	10	5.5	55				
570								Bentonite Grout
	10							2" ID schedule 40 PVC riser
565								
	15	10	8.5	85				
560						Gray CLAY(CH); high plasticity; trace fine sand; moist		
						Gray SAND (SP-SM) with silt; trace organic fragments; wet		
	20							Bentonite Seal
555						Gray fine SAND (SP); some silt; wet		SCH 40 PVC 2" Diameter 0.01" Slotted Screen
	25	10	8.5	85		Gray SAND (SW); well graded; little gravel; wet		
550								Clean silica sand
	30							

AECOM

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-7S

Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30	4	3.4	85			2" ID schedule 40 PVC riser
545						Gray GRAVEL (GW); well graded with sand; wet	SCH 40 PVC 2" Diameter 0.01" Slotted Screen
						Gray SAND (SW); well graded; little gravel; wet	Clean silica sand
							End of boring
	35						
540							
	40						
535							
	45						
530							
	50						
525							
	55						
520							
	60						
515							
	65						

Project: DTE Monroe Plant	Log of MW-8D
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 3

Date(s) Drilled	9/29/16 to 9/30/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	70.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	ft msl
Boring Location	Fly Ash Basin	Groundwater Level(s)	Artesian (flowing) [Measurement after development]		

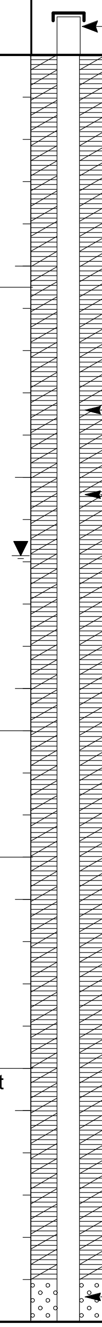
Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
0				Brown SAND (SW); well graded; trace gravel and silt; moist	Steel Pro-Casing
5	10	5.5	55		
5.5				Gray SILT (ML) with fine sand; trace organic material; some thin black colored layers; wet	
8.5					Bentonite Grout
10					2" ID schedule 40 PVC riser
15	10	5.5	55		
16				Dark gray CLAY (CH); high plasticity; trace organic material; small shells	
19				Brown CLAY(CH); high plasticity; little coarse sand and gravel; gray mottling; moist	
20					
24				Gray CLAY (CL); hard; low plasticity; trace coarse sand and gravel; moist	
25	10	10	100		
30					

Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
30–35	5	5	100		
35–40	5	2.5	50	Gray fine SAND (SP-SM) with silt; thin silt seams (<1" thick); wet	Bentonite Grout; 2" ID schedule 40 PVC riser
40–50	10	8.0	80	Gray CLAY (CL); hard; glacial till; med-low plasticity; little gravel and coarse sand; moist	
50–60	10	8.0	80	Light gray LIMESTONE (bedrock); highly weathered; soft; wet	Bentonite Seal
				Brown LIMESTONE (bedrock); weathered; wet	SCH 40 PVC 2" Diameter 0.01" Slotted Screen
60–65	10	2.0	20		Clean silica sand

Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
	10	2.0	20				2" ID schedule 40 PVC riser SCH 40 PVC 2" Diameter 0.01" Slotted Screen Clean silica sand
70							End of boring
75							
80							
85							
90							
95							
100							

Project: DTE Monroe Plant	Log of MW-8S
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 2

Date(s) Drilled	9/29/16 to 9/30/2016	Logged By	Ron Friend	Checked By	M Hawrylak
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	43.0 ft
Drill Rig Type	Mini Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	583.7 ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	586.59 ft msl
Boring Location	Fly Ash Basin	Groundwater Level(s)	11.86' BTOC [Measurement after development]		



Elevation, feet	Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	0				Brown SAND (SW); well graded; trace gravel and silt; moist	Steel Pro-Casing
580	5	10	5.5	55	Gray SILT (ML) with fine sand; trace organic material; some thin black colored layers; wet	
575	10					Bentonite Grout; 2" ID schedule 40 PVC riser
570	15	10	5.5	55	Dark gray CLAY (CH); high plasticity; trace organic material; small shells	
565	20				Brown CLAY(CH); high plasticity; little coarse sand and gravel; gray mottling; moist	
560	25	10	10	100	Gray CLAY (CL); hard; low plasticity; trace coarse sand and gravel; moist	
555	30					Bentonite seal

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Elevation, feet	Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	30	5	5	100		Bentonite seal; 2" ID schedule 40 PVC riser
550						SCH 40 PVC 2" Diameter 0.01" Slotted Screen
	35	5	2.5	50	Gray fine SAND (SP-SM) with silt; thin silt seams (<1" thick); wet	Clean silica sand
545						
	40	3	2.4	80		
540						End of boring
	45					
535						
	50					
530						
	55					
525						
	60					
520						
	65					

Project: DTE Monroe Plant	Log of MW-9
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 2

Date(s) Drilled	9/19/17 to 9/19/2017	Logged By	Ron Friend	Checked By	B Finnigan
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	40.0 ft
Drill Rig Type	Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)			

Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
0					Gravelly FILL, dry		
	2	1.5	50%				
5					Very dark gray high plasticity CLAY with some organics and shell fragments, soft, moist		
	5	5	100%		grades with fine sand		Bentonite Grout
10							
					grades with some organic material		2" ID schedule 40 PVC riser
15	10	8	80%		grades with more organics		
					Dark brown clayey PEAT, soft		
					Gray high plasticity CLAY, soft, moist		
20							Bentonite Seal
					Gray sandy SILT, soft, wet		
					grades with less sand with depth		
25	10	9	90%		Gray fine SAND with silt, loose, wet grades with less silt with depth		
					Gray poorly graded SAND with trace fines, loose, wet		SCH 40 PVC 2" Diameter 0.01" Slotted Screen
					Gray poorly graded GRAVEL with sand, loose, wet		
30							

Project: DTE Monroe Plant	Log of MW-9
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 2 of 2

Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
30							
					Gray fine grained SAND with trace fines, wet		Clean silica sand
35	10	10	100%				Natural Collapse
					Gray low plasticity CLAY with little gravel, hard, moist [TILL]		
40					Terminate boring at 40 feet BGS.		End of boring
45							
50							
55							
60							
65							

Project: DTE Monroe Plant	**Log of MW-10**
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 2

Date(s) Drilled	**9/20/17 to 9/20/2017**	Logged By	**Ron Friend**	Checked By	**B Finnigan**
Drilling Method	**Sonic**	Drill Bit Size/Type	**Sonic 6"**	Total Depth of Borehole	**40.0 ft**
Drill Rig Type	**Sonic**	Drilling Contractor	**Cascade Drilling**	Surface Elevation	**ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic Core Barrel - 4"**	Top of Casing Elevation	**ft msl**
Boring Location	**Inactive Bottom Ash Basin**	Groundwater Level(s)			

Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
0					Grey poorly graded GRAVEL with clay and sand, dry		
	5	3	60%		Dark yellowish brown low plasticity CLAY with sand, moist		
5					grades with gravel		
					grades with less gravel with depth		
	5	3	60%		Very dark grey high plasticity CLAY with trace shell fragments, moist		**Bentonite Grout**
10					grades with fine sand		
							2" ID schedule 40 PVC riser
15	10	9.5	95%				
					grades with small sand seams, fine sand, 1-2 inches apart		
					grades with little organic material		
20							
							Bentonite Seal
25	10	9.5	95%		Grey silty CLAY with fine sand, very soft, wet		
					Grey high plasticity CLAY, moist		
30							

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-10

Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
30							
					Dark grey poorly graded SAND with gravel, wet		SCH 40 PVC 2" Diameter 0.01" Slotted Screen
					Dark grey well graded SAND, with little silt, fine grained sand, wet		
35	10	9.5	95%		grades with increasing silt with depth		
					Grey SILT with little gravel, hard, moist		Natural Collapse
					Grey CLAY with little gravel, hard, moist		
40					Terminate boring at 40 feet BGS.		End of boring
45							
50							
55							
60							
65							

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Project: DTE Monroe Plant	**Log of MW-11**
Project Location: Monroe, Michigan	
Project Number: 60489524	Sheet 1 of 2

Date(s) Drilled	**9/20/17 to 9/20/2017**	Logged By	**Ron Friend**	Checked By	**B Finnigan**
Drilling Method	**Sonic**	Drill Bit Size/Type	**Sonic 6"**	Total Depth of Borehole	**45.0 ft**
Drill Rig Type	**Sonic**	Drilling Contractor	**Cascade Drilling**	Surface Elevation	**ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic Core Barrel - 4"**	Top of Casing Elevation	**ft msl**
Boring Location	**Inactive Bottom Ash Basin**	Groundwater Level(s)			

Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
0	5	2	40%		Pale brown poorly graded SAND (fill), loose, dry		
5	5	4	80%		grades with gravel		
					Dark brown high plasticity CLAY with grey mottling, very stiff, moist		**Bentonite Grout**
10	5	5	100%		Very dark grey high plasticity CLAY with little organics and trace shell fragments, soft, moist		**2" ID schedule 40 PVC riser**
15	5	5	100%		Grey low plasticity CLAY with brown mottling, little coarse sand and gravel, hard, moist		
					grades to brown		
20	5	5	100%		grades to grey		
					Grey CLAYwith little gravel and coarse sand, hard, moist-dry		
25	5	5	100%				**Bentonite Seal**
					Grey SILT with fine sand, stiff, moist - wet, slow dilatancy		
30							

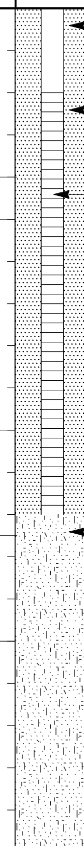
Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
30						
35	10	10	100%			SCH 40 PVC 2" Diameter 0.01" Slotted Screen
40					Grey CLAY (till) with little gravel and coarse sand, hard, friable, moist - dry	Natural Collapse
	5	5	100%			
45					Terminate boring at 45 feet BGS.	End of boring
50						
55						
60						
65						

Project: DTE Monroe Plant **Project Location: Monroe, Michigan** **Project Number: 60489524**	**Log of MW-12** Sheet 1 of 2

Date(s) Drilled	**9/21/17 to 9/21/2017**	Logged By	**Ron Friend**	Checked By	**B Finnigan**
Drilling Method	**Sonic**	Drill Bit Size/Type	**Sonic 6"**	Total Depth of Borehole	**50.0 ft**
Drill Rig Type	**Sonic**	Drilling Contractor	**Cascade Drilling**	Surface Elevation	**ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic Core Barrel - 4"**	Top of Casing Elevation	**ft msl**
Boring Location	**Inactive Bottom Ash Basin**	Groundwater Level(s)			

Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
0					Pale brown well graded SAND with fined grained sand and trace gravel, dry		
	5	2	40%				
					moist		
5					grades with trace shell fragments		
	5	3	60%				
							Bentonite Grout
					Dark grey SAND with silt, moist		
10							
					wet		
					Very dark grey high plasticity CLAY with little organics and trace shell fragments, soft, moist		2" ID schedule 40 PVC riser
15	10	8	80%				
					Gray high plasticity CLAY with trace coarse sand and gravel, stiff, moist		
20							
					grades with color change to brown, hard, some grey mottling		
25	10	10	100%				
					Very dark grey low plasticity CLAY		
							Bentonite Seal
30							

Depth, feet	Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
30					Dark grey fine SILT with sand, stiff, wet-moist	
35	10	9	90%		Dark grey fine SAND with silt, stiff, wet-moist	SCH 40 PVC 2" Diameter 0.01" Slotted Screen
40						Natural Collapse
45	10	10	100%		Dark grey low plasticity CLAY (till) with little gravel and coarse sand, hard, moist	
50						End of boring
55						
60						
65						



Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

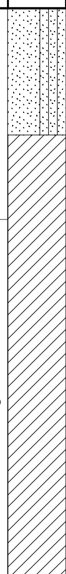
Log of MW-13

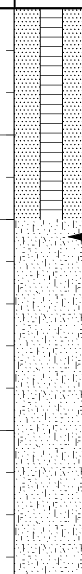
Date(s) Drilled	**9/21/17 to 9/21/2017**	Logged By	**Ron Friend**	Checked By	**B Finnigan**
Drilling Method	**Sonic**	Drill Bit Size/Type	**Sonic 6"**	Total Depth of Borehole	**43.5 ft**
Drill Rig Type	**Sonic**	Drilling Contractor	**Cascade Drilling**	Surface Elevation	**ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic Core Barrel - 4"**	Top of Casing Elevation	**ft msl**
Boring Location	**Inactive Bottom Ash Basin**	Groundwater Level(s)			

Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
0				Brown poorly graded SAND with gravel, dry	
	5	4	80%	moist	
5				wet	
	5	4.5	90%	woody debris	
				Black high plasticity CLAY with little organics, soft, moist	**Bentonite Grout**
				Dark grey fine SAND with silt, wet, silt increasing with depth	
10				Dark grey SILT with fine sand, wet	
				Black high plasticity CLAY with little organic material, soft, moist	**2" ID schedule 40 PVC riser**
15	10	6	60%		
20				Dark grey low plasticity CLAY with silt and little fine sand, very soft, wet	**Bentonite Seal**
25	15	11	73%		
				Dark grey fine SILT with sand, very soft, wet, sand increasing with depth	**SCH 40 PVC 2" Diameter 0.01" Slotted Screen**
				woody debris	
30					

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Depth, feet	SAMPLES Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
30	15	11	73%		Dark grey fine SAND with silt, wet		
					Dark grey low plasticity CLAYwith little gravel and coarse sand, hard, moist		
35	8.5	8.5	100%				Natural Collapse
40							
					Terminate boring at 43.5 feet BGS.		End of boring
45							
50							
55							
60							
65							





Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-14

Date(s) Drilled	9/22/17 to 9/22/2017	Logged By	Ron Friend	Checked By	B Finnigan
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	40.0 ft
Drill Rig Type	Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic Core Barrel - 4"	Top of Casing Elevation	ft msl
Boring Location	Inactive Bottom Ash Basin	Groundwater Level(s)			

Depth, feet	SAMPLES Run Length (ft)	Recovery (ft)	Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
0	5	4	80%	Black coal ash FILL with gravel and coal, loose, dry	
5	5	4.5	90%	Black coal ash FILL, coarse, sand-gravel sized, moist	
				Very dark grey high plasticity CLAY, soft, moist	Bentonite Grout
10	10	6	60%		2" ID schedule 40 PVC riser
				grades to coarse sand and gravel, wet	
				Very dark grey fine SAND with silt and clay, wet	
20	10	0	0%	No recovery	Bentonite Seal
30					

AECOM

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\ENV\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/16/2017 8:30:04 AM

Depth, feet	SAMPLES Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
30					Dark grey CLAY with sand, fine-medium grained sand. wet		
					Dark grey poorly graded SAND with gravel,coarse grained sand, wet		
35	10	9	90%				**SCH 40 PVC 2" Diameter 0.01" Slotted Screen**
					Dark grey CLAY (till) with little coarse sand and gravel, hard, moist		
40					Terminate boring at 40 feet BGS.		**End of boring**
45							
50							
55							
60							
65							

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-15

Date(s) Drilled	**9/26/17 to 9/26/2017**	Logged By	**Ron Friend**	Checked By	**B Finnigan**
Drilling Method	**Sonic**	Drill Bit Size/Type	**Sonic 6"**	Total Depth of Borehole	**45.0 ft**
Drill Rig Type	**Sonic**	Drilling Contractor	**Cascade Drilling**	Surface Elevation	**ft msl**
Borehole Backfill	**Monitoring Well**	Sampling Method(s)	**Sonic Core Barrel - 4"**	Top of Casing Elevation	**ft msl**
Boring Location	**Inactive Bottom Ash Basin**	Groundwater Level(s)			

Depth, feet	SAMPLES: Run Length (ft)	SAMPLES: Recovery (ft)	SAMPLES: Recovery, %	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
0				Greyish brown gravelly FILL with silt and clay, dry	
	4	4	100%	moist	
				Dark grey medium plasticity CLAY with little shell fragments, soft, moist	
5					
	5	4.5	90%		
					Bentonite Grout
10					
				grades with little organic material	**2" ID schedule 40 PVC riser**
15	10	9	90%		
				grades with color change to very dark organic brown	
20				Grey high plasticity CLAY with trace coarse sand, soft, moist-wet	
25	10	8.5	85%		**Bentonite Seal**
				Grey low plasticity CLAY with little silt, soft, moist-wet, silt increasing with depth	
				Grey SILT with fine sand, wet	
				Grey SAND with silt, wet	
30					

Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-15

Depth, feet	SAMPLES Run Length (ft)	Recovery (ft)	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
30					Grey well graded SAND, fine to coarse grained, wet	SCH 40 PVC 2" Diameter 0.01" Slotted Screen
35	10	10	100%		grades with gravel	
					Grey well graded GRAVEL with coarse sand, wet	
					Grey well graded SAND with gravel, wet	
					Grey low plasticity CLAY (till) with little coarse sand and gravel, hard, moist	Natural Collapse
40						End of boring
45					Terminate boring at 45 feet BGS.	
50						
55						
60						
65						