

MONITORING WELL INSTALLATION REPORT COAL COMBUSTION RESIDUALS (CCR) RULE

INACTIVE BOTTOM ASH IMPOUNDMENT DTE Monroe Plant Monroe, Michigan

Prepared for:

DTE Energy
One Energy Plaza
Detroit, MI 48226

April 2019
Revision 1: August 30, 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 Impoundment 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 Impoundment 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 Inactive Bottom Ash Impoundment 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 Impoundment is located to the south of the main Monroe Plant area and encompasses an area approximately 86.4 acres in size (**Figure 1**). The Inactive Bottom Ash 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 Impoundment 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, Inactive Bottom Ash Impoundment, 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 Impoundment, 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 Impoundment 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 Impoundment 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 Impoundment. 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 Impoundment 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 Impoundment. Groundwater monitoring was performed over an 8-month period to evaluate the hydrogeology and groundwater chemistry in the vicinity of the Inactive Bottom Ash Impoundment. 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 rotasonic 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 nephelometric 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 Impoundment. 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 Impoundment. 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

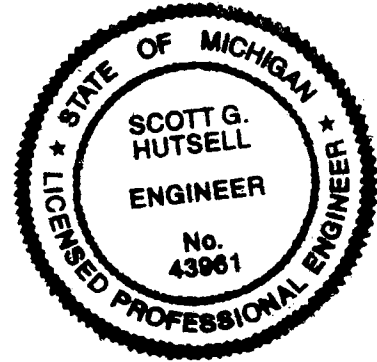
I, Scott G. Hutsell, being a Registered Professional Engineer, in accordance with the State of Michigan Professional Engineer's Registration program, possessing the technical knowledge and experience to make the specific technical certifications required under 40 Code of Federal Regulations (CFR) Part 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: Scott G. Hutsell

Date: 08/30/19

License #: 43961

License Renewal Date: 10/31/20



Revision Log

The table below provides a description of revisions to the Monitoring Well Installation Report.

REVISION #	REVISION DATE	DESCRIPTION OF REVISION
1	08/30/2019	Changed text on cover page and pages 1, 2, 3, 4, and 5, and updated Figures 1, 2, 3, 4a, and 4b.

TABLE

**TABLE 1
DTE ENERGY
MONROE POWER PLANT
MONITORING WELL CONSTRUCTION SUMMARY**

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

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

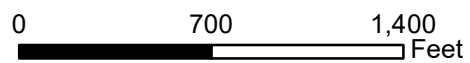
FIGURES



Aerial and Google Earth 2016 Aerial Imagery

LEGEND:

- Unit Separation Berm
- Approximate Boundary of Inactive Bottom Ash Impoundment



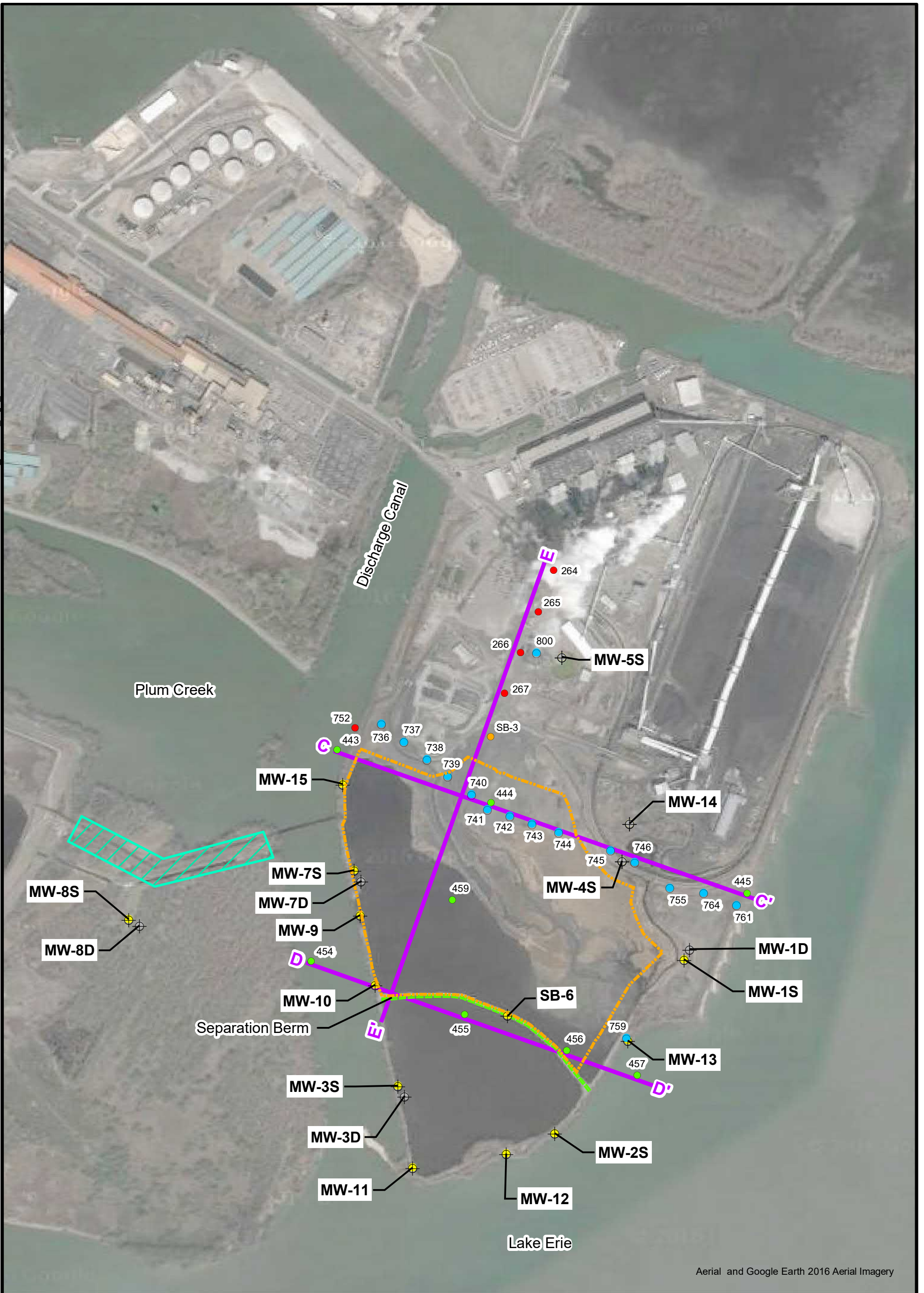
Monroe Power Plant

FIGURE 1
SITE VICINITY MAP

DATE: 8/13/2019

SCALE 1 inch = 700 feet

JOB NO. 60516675



Aerial and Google Earth 2016 Aerial Imagery

LEGEND:

	CCR Program Monitoring Well		Unit Separation Berm
	Investigation Monitoring Well (Potentiometry Only)		Cross Section Location
	Soil Borings (NTH)		Conveyance Line Boring Corridor (No Basal Sand)
	Soil Boring pre-1971		Approximate Boundary of Inactive Bottom Ash Impoundment
	Soil Boring 1971 and later		
	Soil Boring 1971 and later with ash fill		
	Soil Boring in 2015 by NTH with ash fill		

0 700 1,400 Feet

Monroe County, Michigan

Monroe Power Plant

**FIGURE 2
GEOLOGIC CROSS-SECTION
LOCATION MAP**

DATE: 8/13/2019	SCALE 1 inch = 700 feet
JOB NO. 60516675	

NORTHWEST

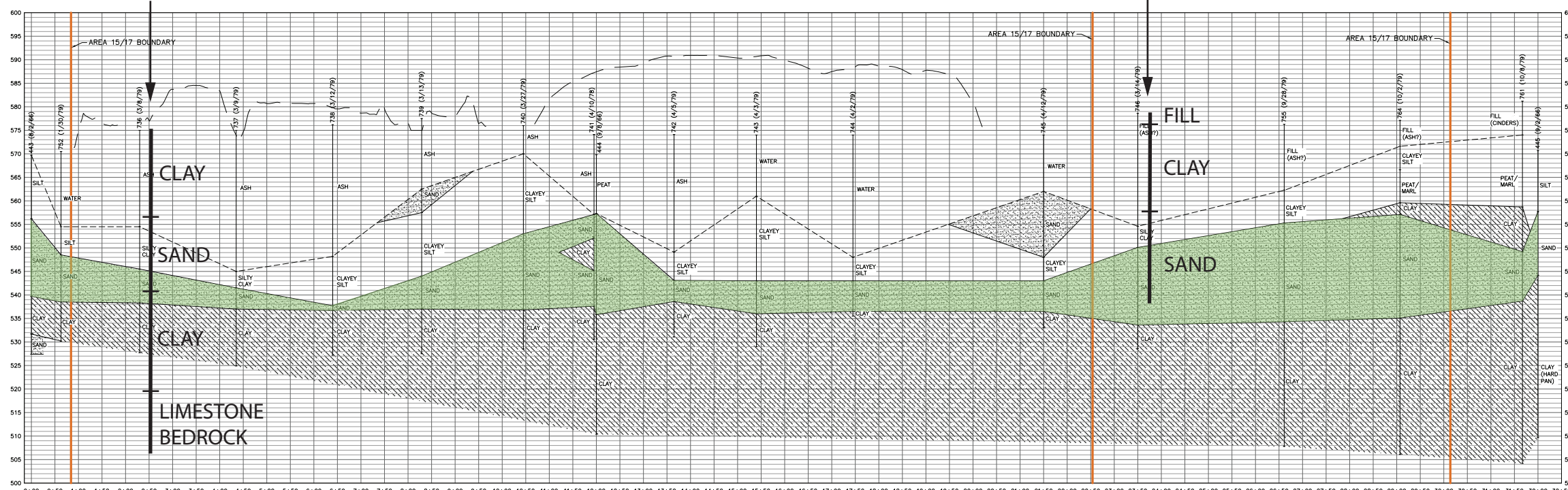
SOUTHEAST

C

MW-7D (PROJECTED)

MW-4S (PROJECTED)

C'



LEGEND

- ASH
- CLAY
- SAND
- UPPERMOST AQUIFER

PRELIMINARY
NOT FOR CONSTRUCTION

C				B				A			
PROJ. ENG.	PROJ. MGR.	DATE	TIME	PROJ. ENG.	PROJ. MGR.	DATE	TIME	PROJ. ENG.	PROJ. MGR.	DATE	TIME

DETROIT EDISON APPROVALS		DATE	OTHER DISCIPLINE APPROVALS		DATE

DESIGNED BY		DATE
DRAWN BY		DATE
CHECKED BY		DATE
APPROVED BY		DATE
PROJECT ENGINEER		DATE
PROJECT MANAGER		DATE

2
LATEST REVISION "0"
PMP NUMBER: 11107
GL/WBS2 NUMBER: I-000022-0211
PO NUMBER: 4700855696

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

NO.	DATE	ISSUED FOR	PROJ. ENG.	RESP. ENG.

Vendor:
NTH Consultants, Ltd.
Infrastructure Engineering & Environmental Services
Member of the Veolia Group

NTH PROJECT NO. 62-150238-00
The Detroit Edison Co. Engineering

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

LOCATION NAME: MONROE POWER PLANT
ORIGINATING SOURCE: NTH CONSULTANTS, LTD.
DRAWING NUMBER: 2

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

DESIGN FILE:
DATE ISSUED:
DATE PLOTTED:
OPERATOR:

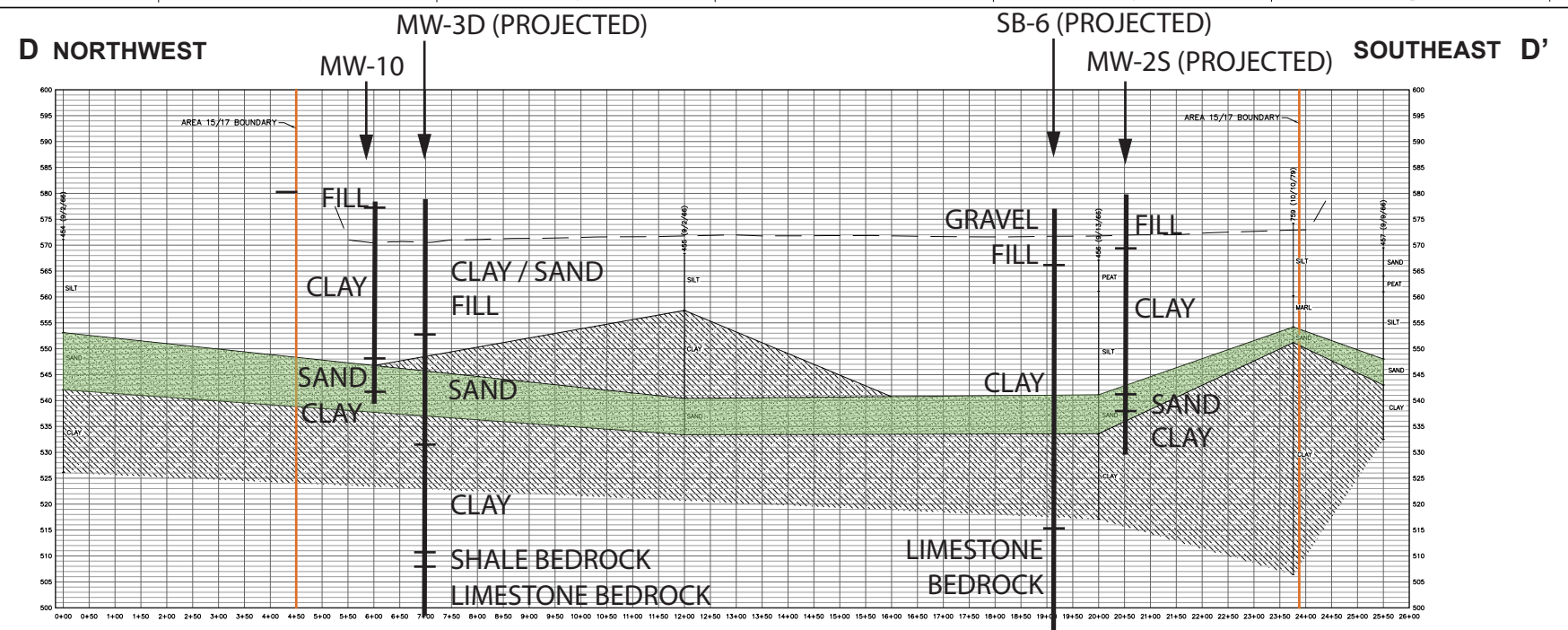


DTE Energy Monroe Power Plant

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

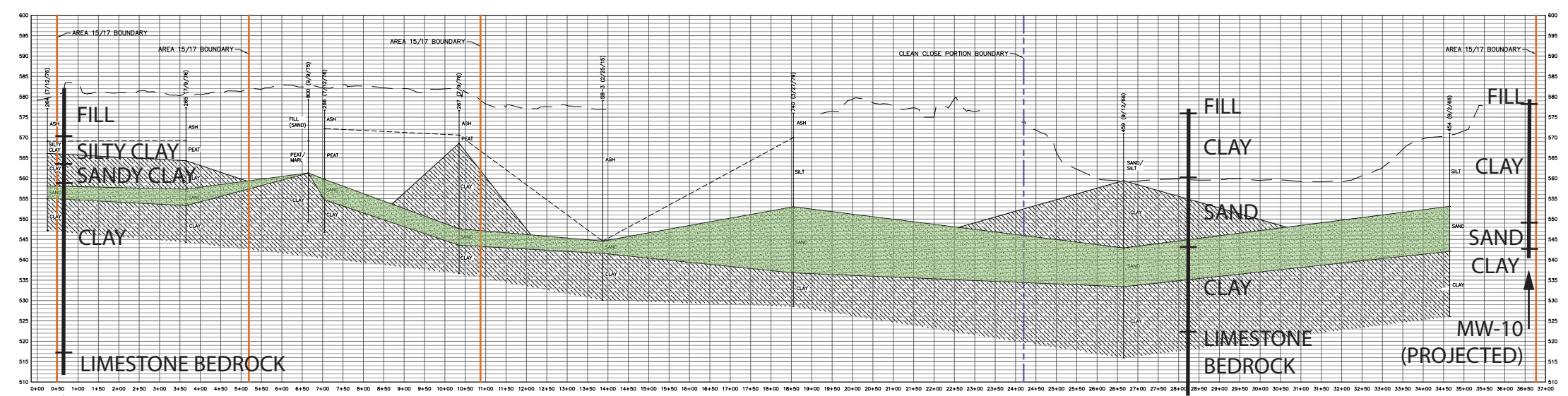
DATE	REV. NO.	DWG. BY	CHKD. BY
03/20/19	1	JMA	WBL

JOB NO. 60516675 **AECOM**



NORTHEAST E

E' SOUTHWEST



3
LATEST REVISION "O"
PMP NUMBER: 11107
GL/WBS2 NUMBER: 1-000022-0211
PG NUMBER: 470085696

NO.	DATE	ISSUED FOR	PROJ. ENG.	RESP. ENG.
PRECONSTRUCTION REVISION BLOCK - REV.				
Vendor:				
NTH Consultants, Ltd.				
NTH PROJECT NO. 60-150239-00				
The Detroit Edison Co.			Engineering	
AREA 15-17 CLOSURE CROSS SECTIONS D,E				
LOCATION NAME: MONROE POWER PLANT				
ORIGINATING SOURCE: NTH CONSULTANTS, LTD.				
SCALE: AS SHOWN				
DRAWING NUMBER: 3				

LEGEND

ASH
CLAY
SAND
UPPERMOST AQUIFER

PRELIMINARY
NOT FOR CONSTRUCTION

C				B				A				DETROIT EDISON APPROVALS				OTHER DISCIPLINE APPROVALS			
PROJ. ENGR.	PROJ. MGR.	DATE	DATE	PROJ. ENGR.	PROJ. MGR.	DATE	DATE	PROJ. ENGR.	PROJ. MGR.	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE		

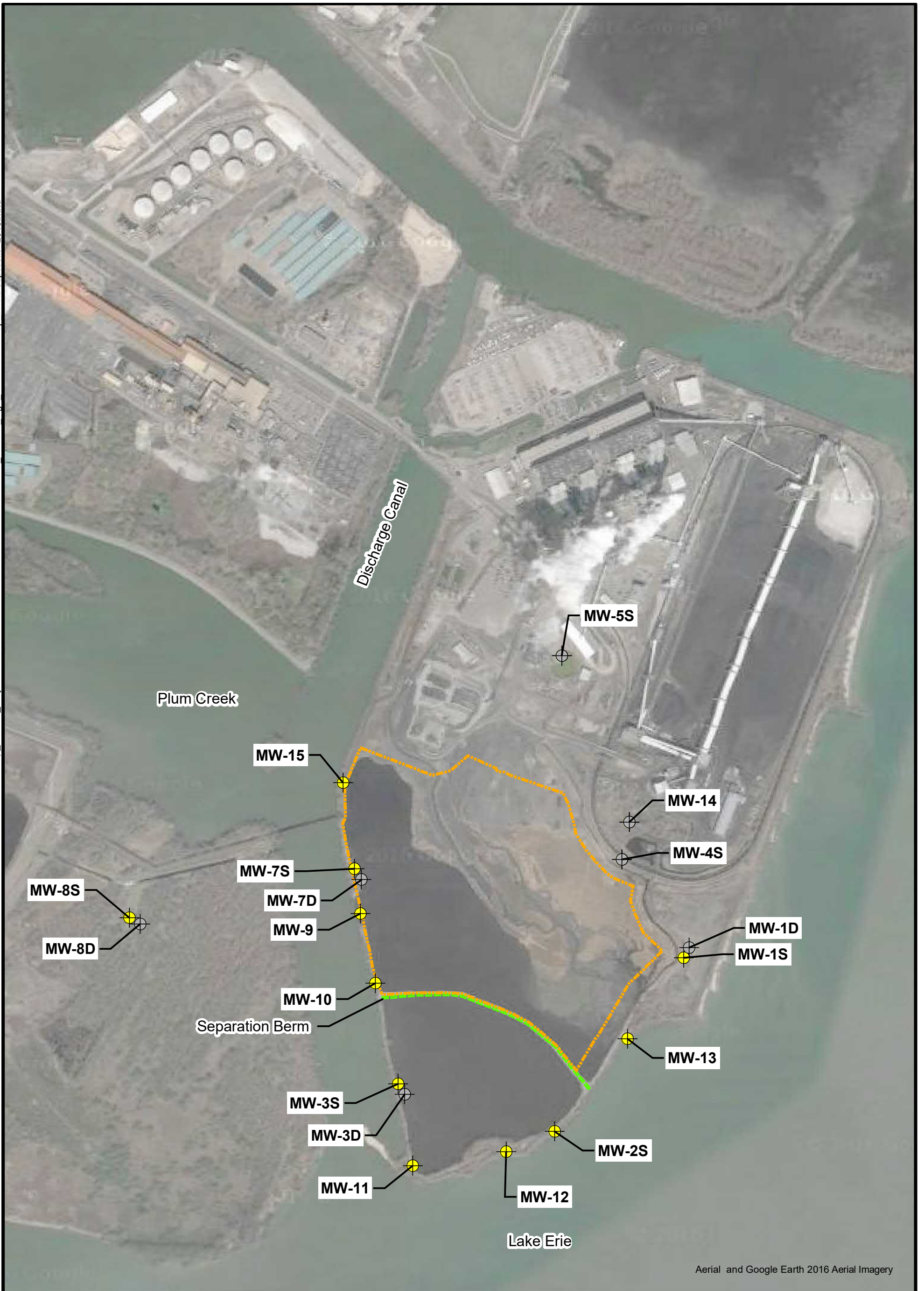


DTE Energy Monroe Power Plant

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

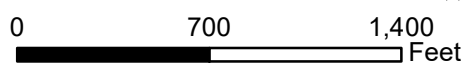
JOB NO. 60489524 **AECOM**



Aerial and Google Earth 2016 Aerial Imagery

- LEGEND:**
- CCR Program Monitoring Well
 - Investigation Monitoring Well (Potentiometry Only)

- Unit Separation Berm
- Approximate Boundary of Inactive Bottom Ash Impoundment



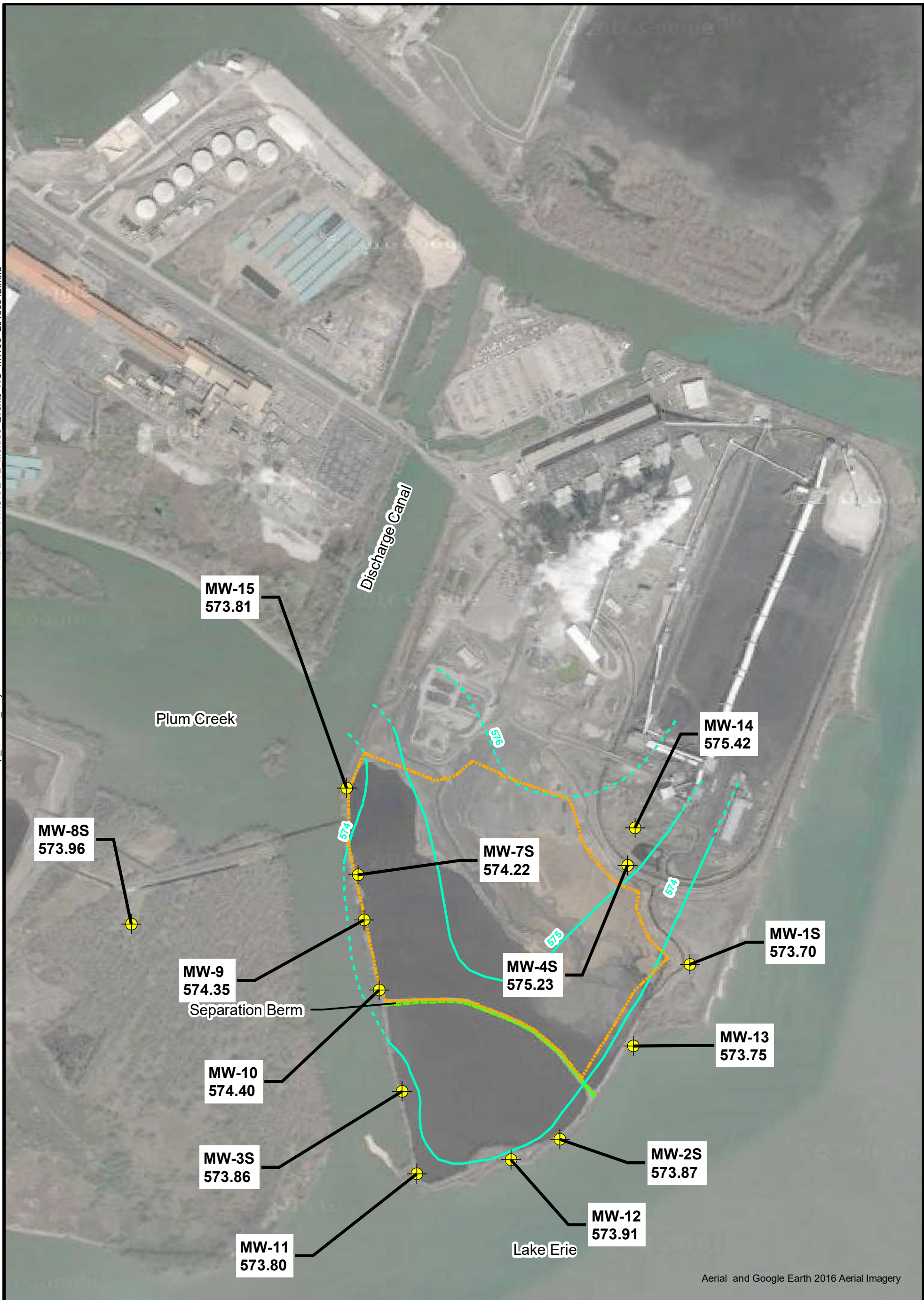
Monroe Power Plant

FIGURE 3
INACTIVE BOTTOM ASH IMPOUNDMENT
WELL LOCATION MAP
2018

DATE: 8/13/2019

SCALE 1 inch = 700 feet

JOB NO. 60516675



Aerial and Google Earth 2016 Aerial Imagery

LEGEND:

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

0 700 1,400 Feet



DTE Energy Monroe Power Plant

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

DATE: 8/13/2019	SCALE 1 inch = 700 feet
JOB NO. 60516675	



Aerial and Google Earth 2016 Aerial Imagery

LEGEND: Monitoring Well Groundwater Contour (Dashed where inferred) Unit Separation Berm Approximate Boundary of Inactive Bottom Ash Impoundment		 		Monroe Power Plant	
FIGURE 4b EVENT 6 (NO MW-5S) GROUNDWATER CONTOUR MAP 9/24/2018				DATE: 8/13/2019	SCALE 1 inch = 700 feet
				JOB NO. 60516675	

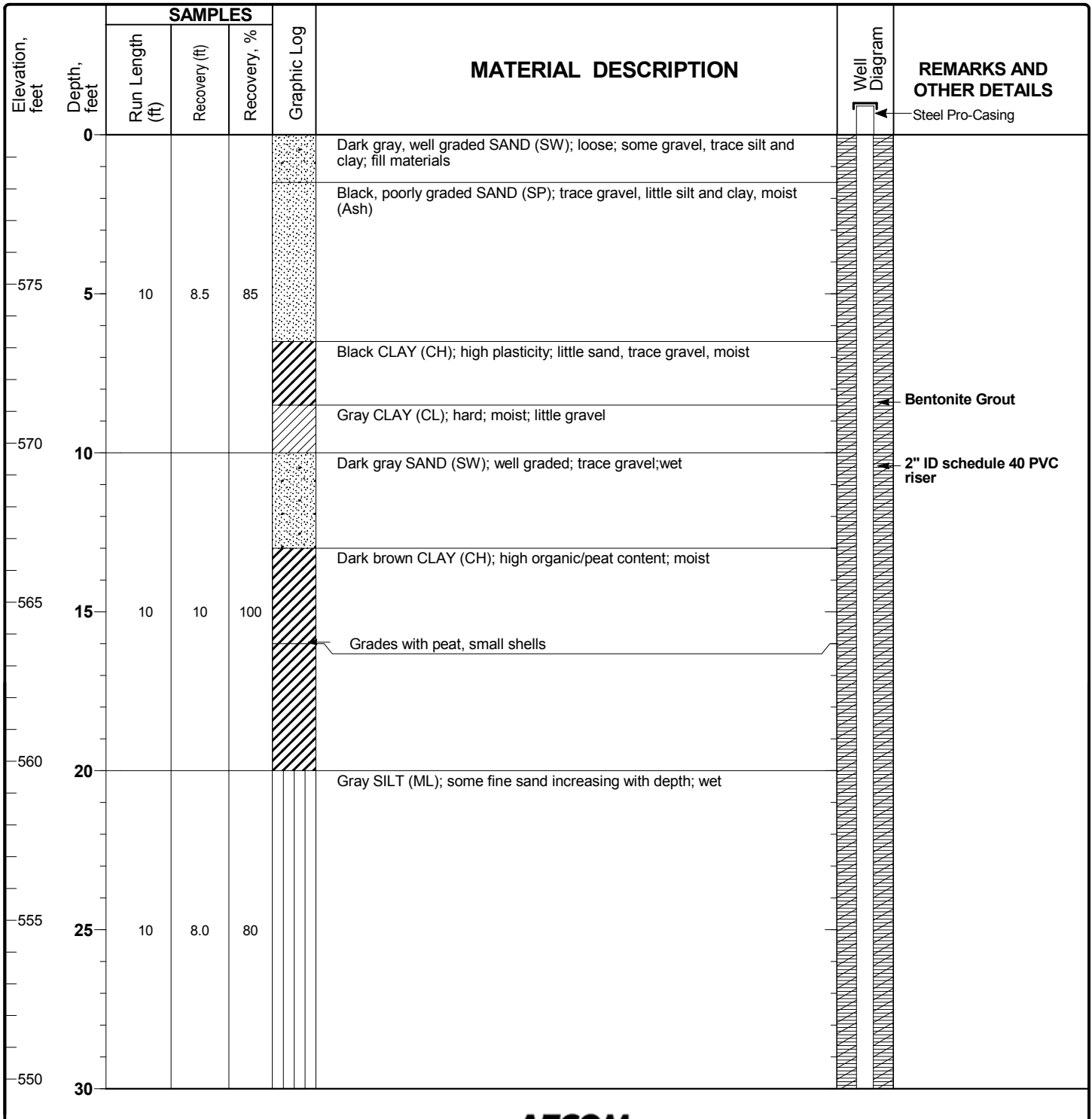
APPENDIX A
Monitoring Well Construction Logs

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

**Log of
 MW-1D**

Sheet 1 of 3

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]		



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/27/2016 4:25:06 PM

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


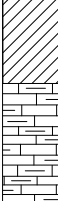

Log of
 MW-1D
 Sheet 2 of 3

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\IDTE\MONROE_GRANVILLE CLONE.GPJ; 10/27/2016 4:25:06 PM

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

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

Log of
 MW-1D
 Sheet 3 of 3

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

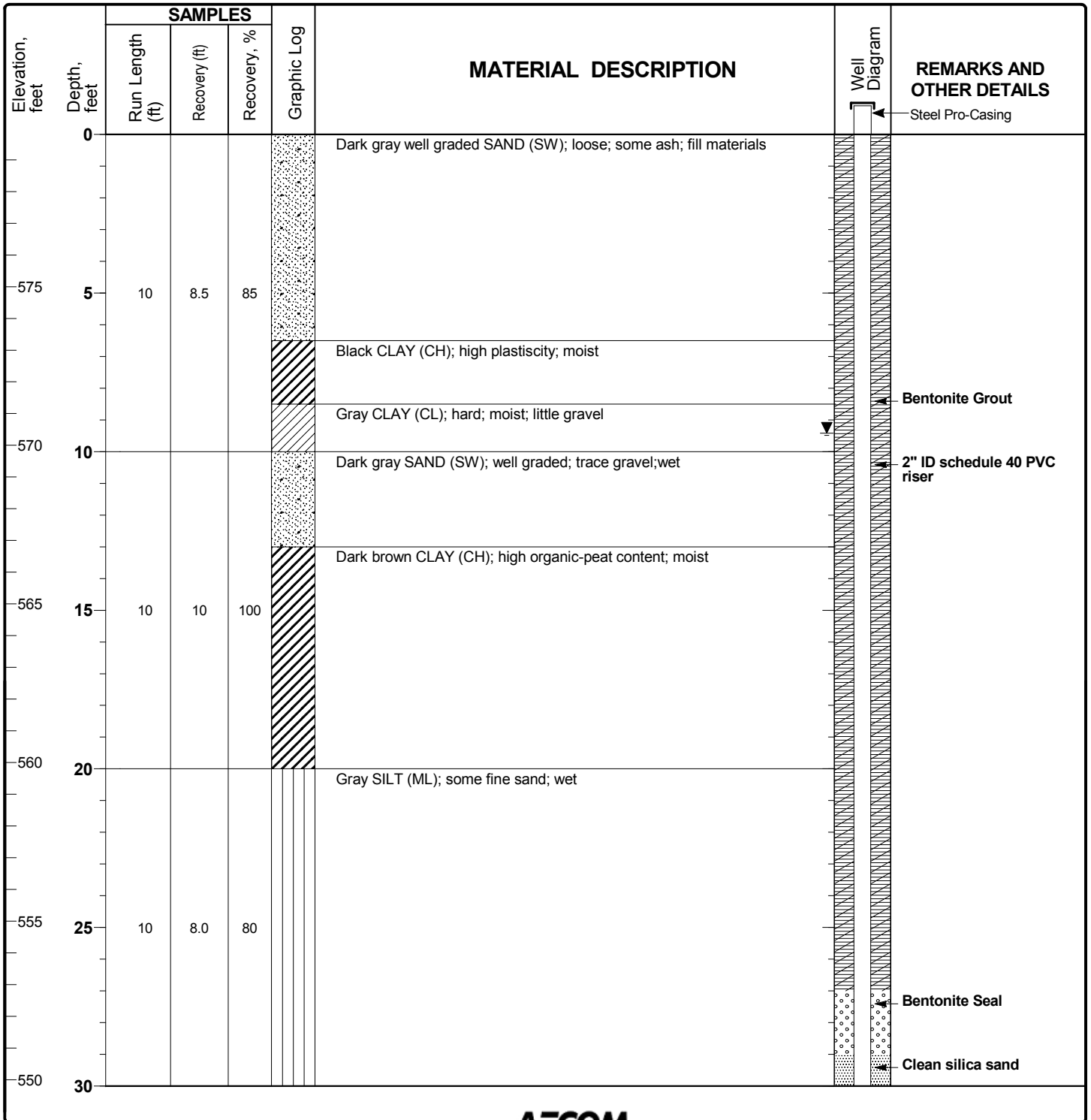
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-1S

Sheet 1 of 2

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]		



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/27/2016 4:25:11 PM

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

Log of
 MW-1S
 Sheet 2 of 2

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

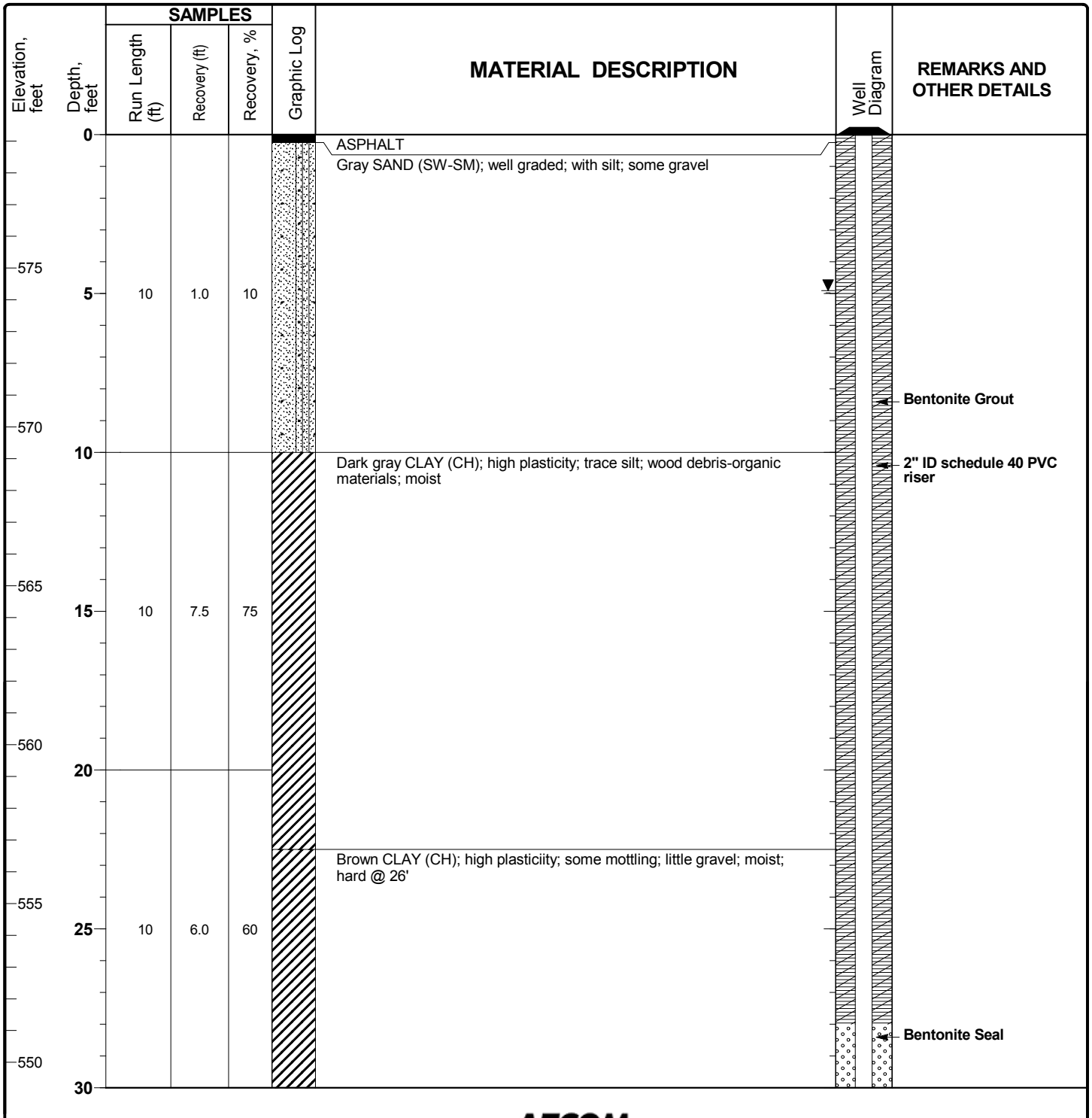
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-2S**

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]		



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

Log of
 MW-2S
 Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		Run Length (ft)	Recovery (ft)	Recovery, %			
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					Bentonite Seal	
					Dark gray SAND (SP); poorly graded; wet		
					Dark Gray CLAY (CL); glacial till; very hard, trace gravel and sand; moist		
535	45	10	8.0	80			
530	50					End of boring	
525	55						
520	60						
515	65						

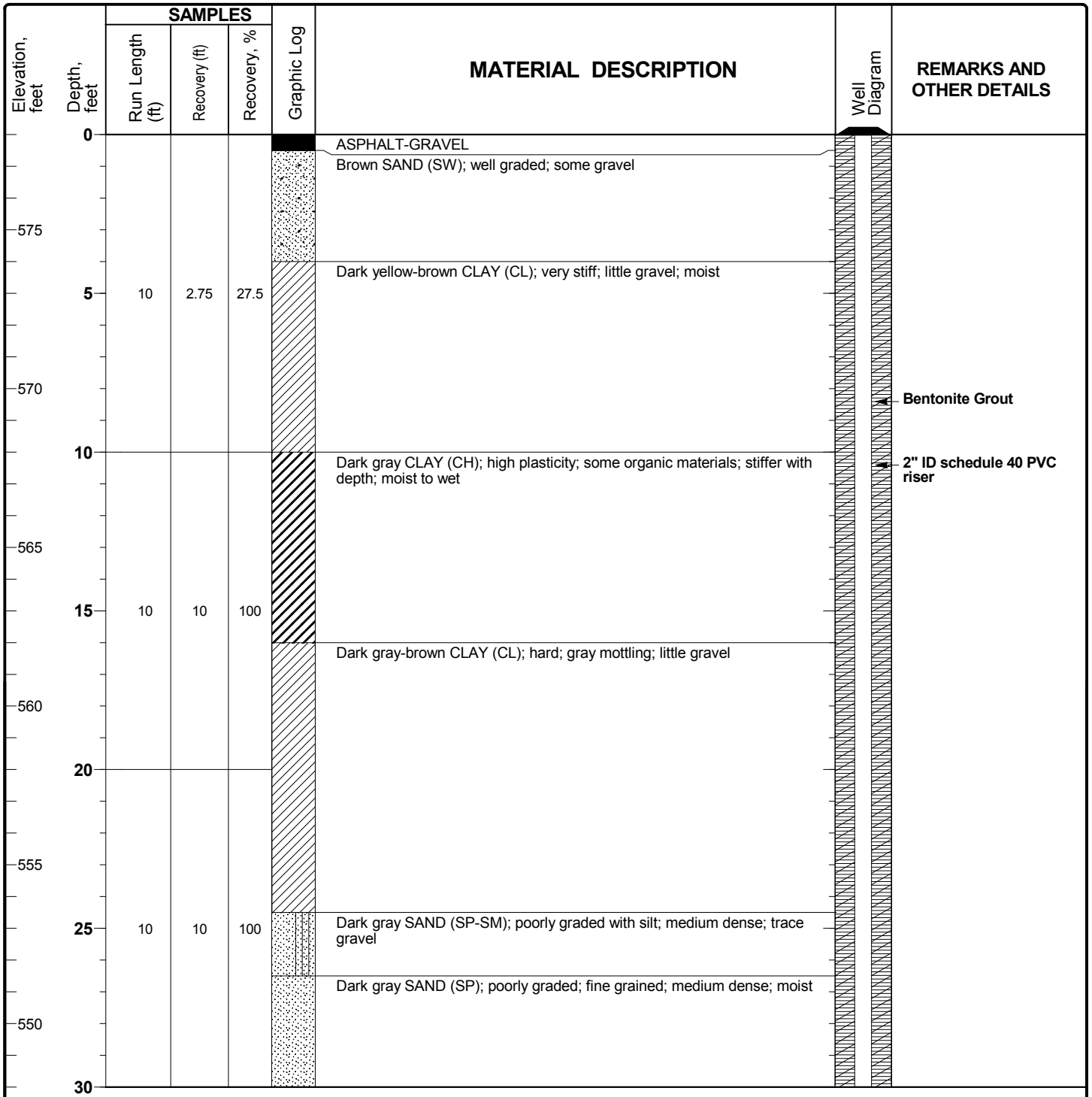
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-3D**

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]		



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/27/2016 4:25:25 PM

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



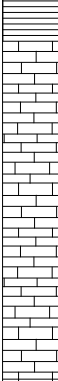

Log of
 MW-3D
 Sheet 2 of 3

Elevation, feet	Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		Run Length (ft)	Recovery (ft)	Recovery, %			
30							
545					Dark gray SAND (SP-SM); poorly graded with silt; fine grained; higher silt content at depth; wet		
35		10	9.5	95			
540					Gray SILT (ML); soft; little fine sand; wet	Bentonite Grout	
40					Dark gray CLAY (CL); glacial till; hard; trace gravel and sand; moist	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		
65					Dark gray CLAY (CL); glacial till; hard; trace gravel; moist	Bentonite Seal	

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

Log of
 MW-3D
 Sheet 3 of 3

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

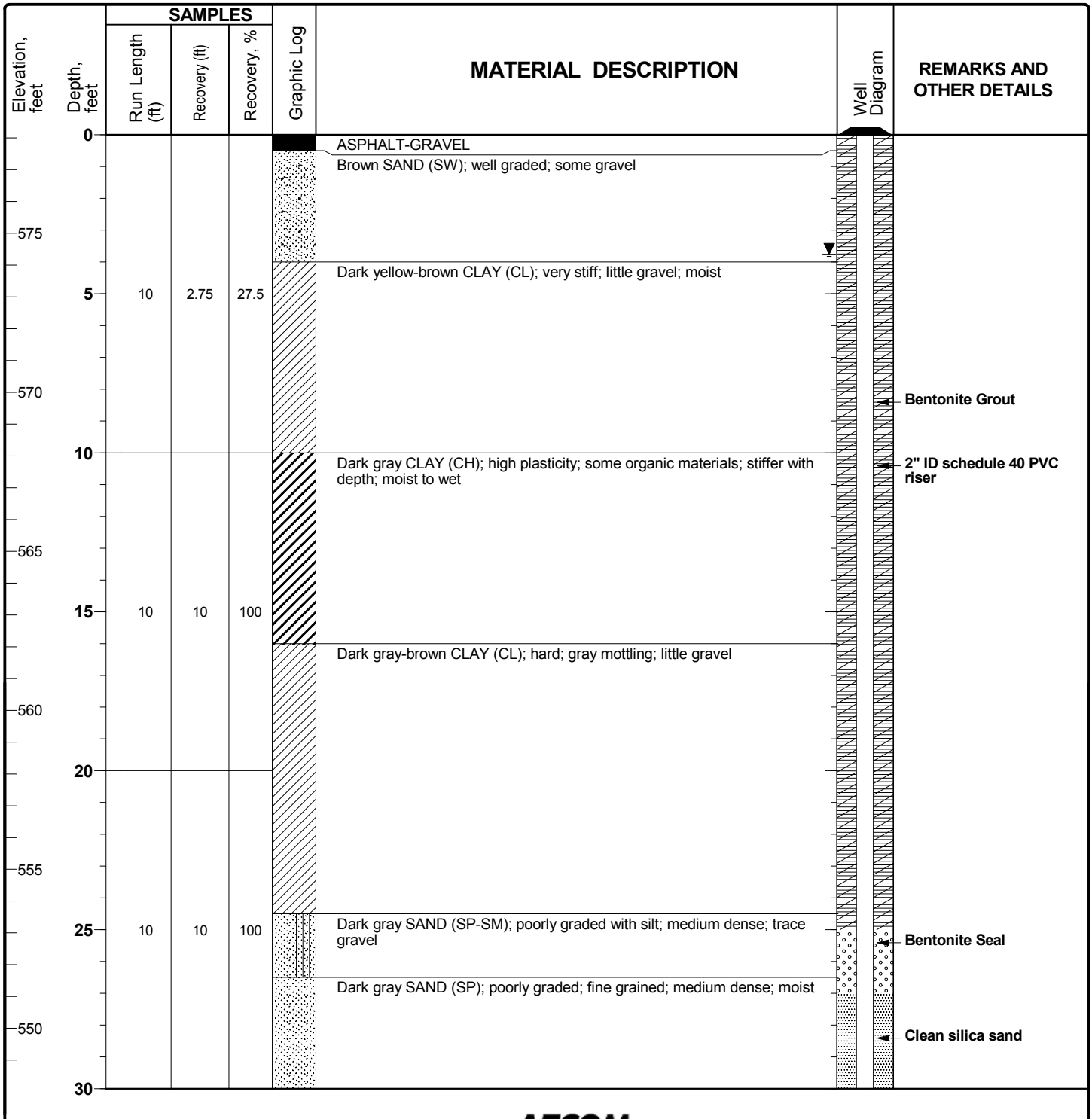
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-3S**

Sheet 1 of 2

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]		



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

Log of
 MW-3S
 Sheet 2 of 2

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

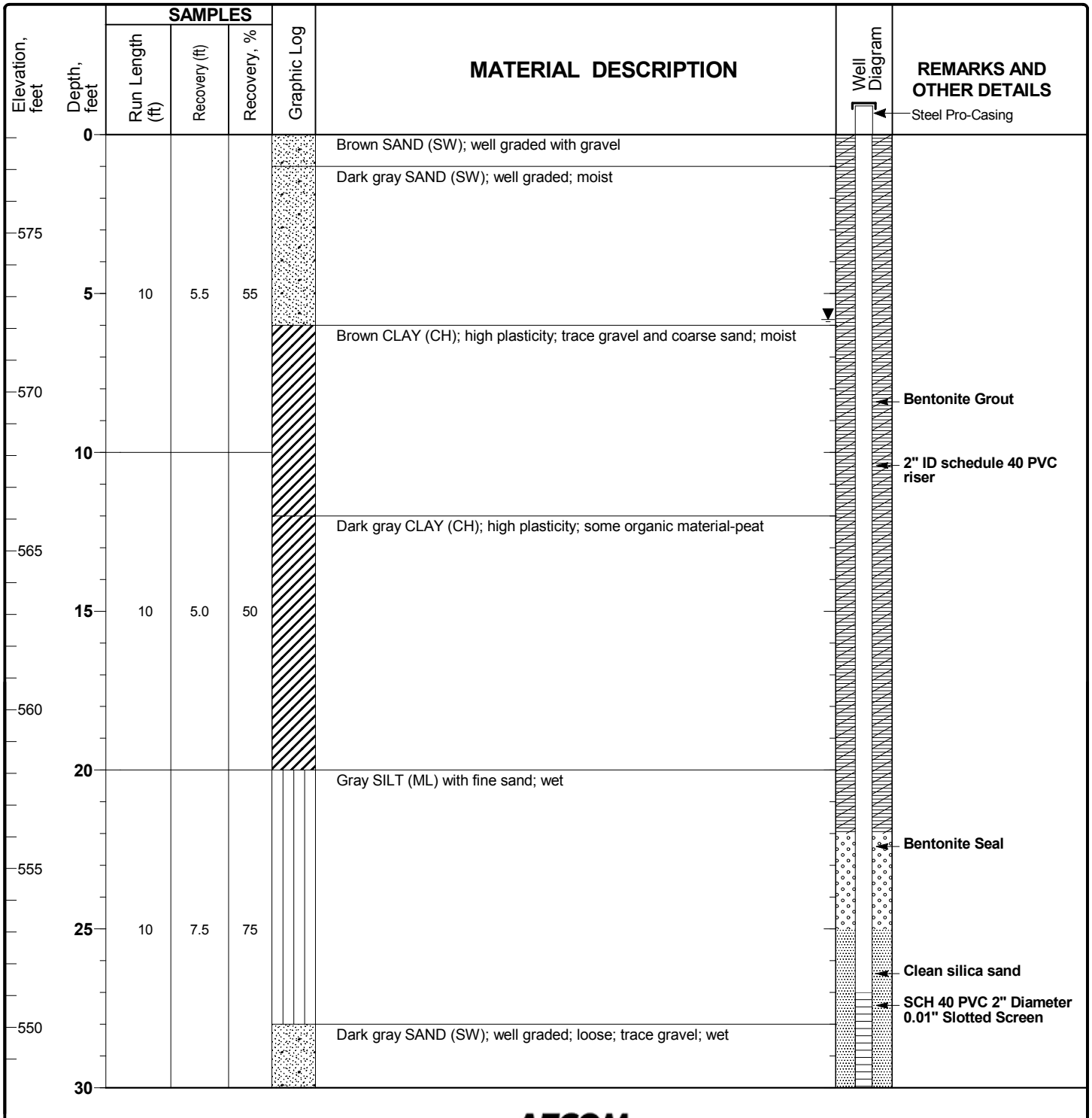
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-4S

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]		



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/27/2016 4:25:36 PM

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

Log of
 MW-4S
 Sheet 2 of 2

Elevation, feet	Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		Run Length (ft)	Recovery (ft)	Recovery, %			
30						2" ID schedule 40 PVC riser	
545						SCH 40 PVC 2" Diameter 0.01" Slotted Screen	
35		10	7.5	75		Clean silica sand	
540						Bentonite Seal	
40						End of boring	
535							
45							
530							
50							
525							
55							
520							
60							
515							
65							

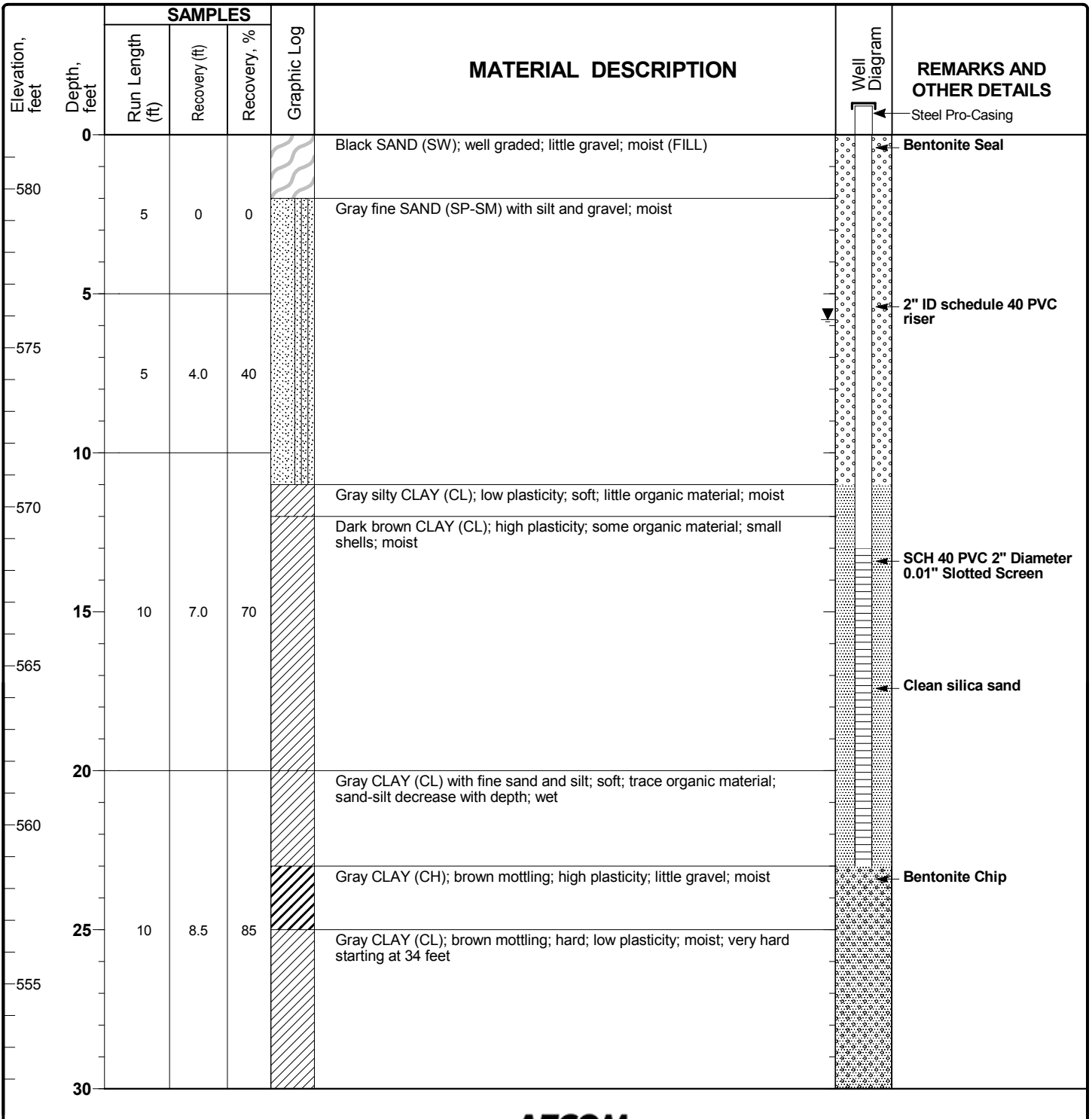
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-5S**

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]		



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

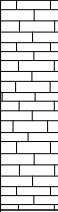

Log of
 MW-5S
 Sheet 2 of 3

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

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/27/2016 4:25:43 PM

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

Log of
 MW-5S
 Sheet 3 of 3

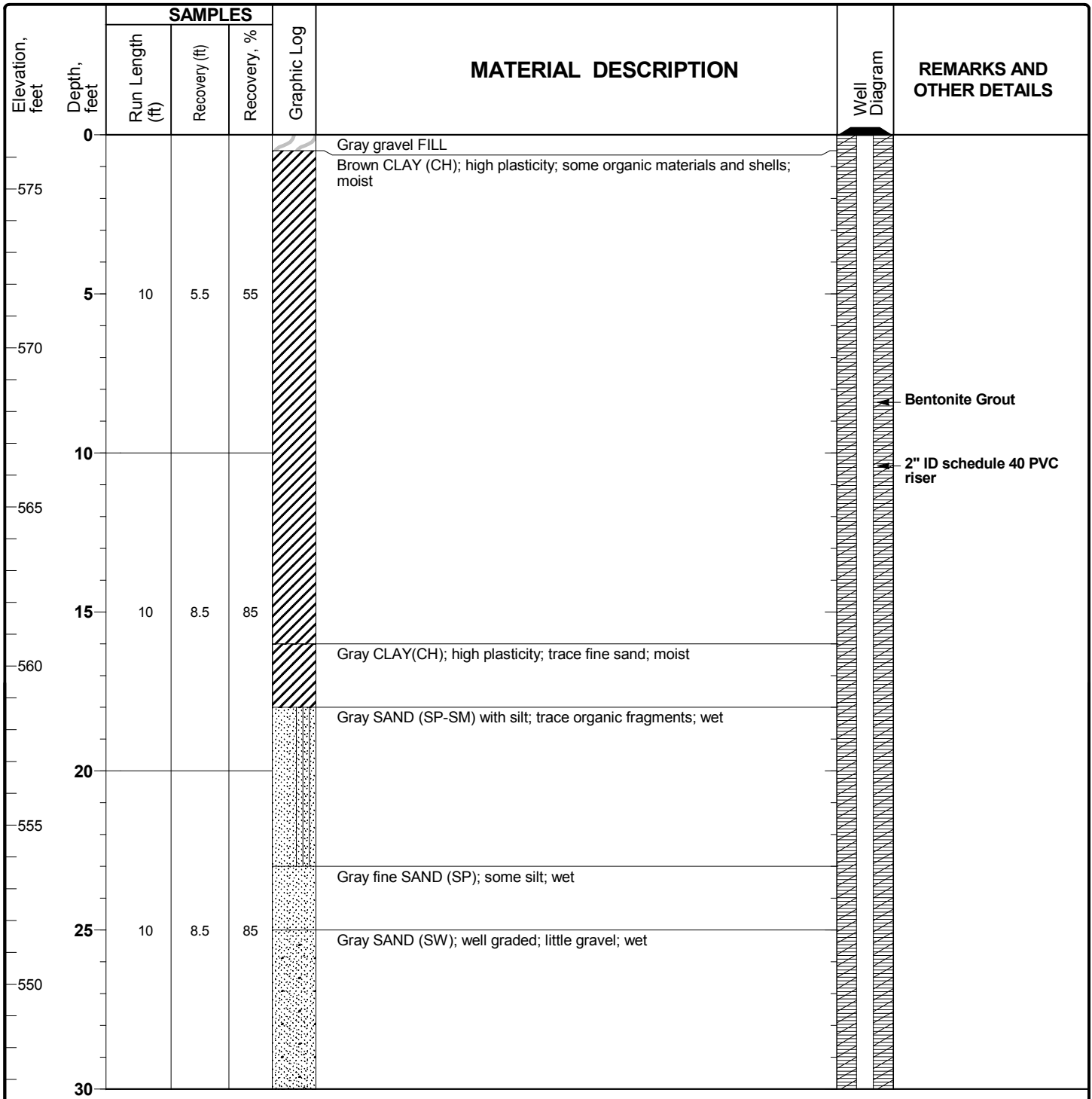
Elevation, feet	Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION		REMARKS AND OTHER DETAILS
		Run Length (ft)	Recovery (ft)	Recovery, %				
515		5	4.0	80		Gray LIMESTONE (bedrock); highly weathered; dry from drilling methods but zone produces water		Bentonite Chip
70								End of boring
510		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

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/27/2016 4:25:44 PM

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

**Log of
 MW-7D**
 Sheet 1 of 3

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]		



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

Log of
 MW-7D
 Sheet 2 of 3

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/27/2016 4:25:51 PM

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

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

Log of
 MW-7D
 Sheet 3 of 3

Elevation, feet	Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
		Run Length (ft)	Recovery (ft)	Recovery, %			
510		10	2.5	25		<ul style="list-style-type: none"> 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							

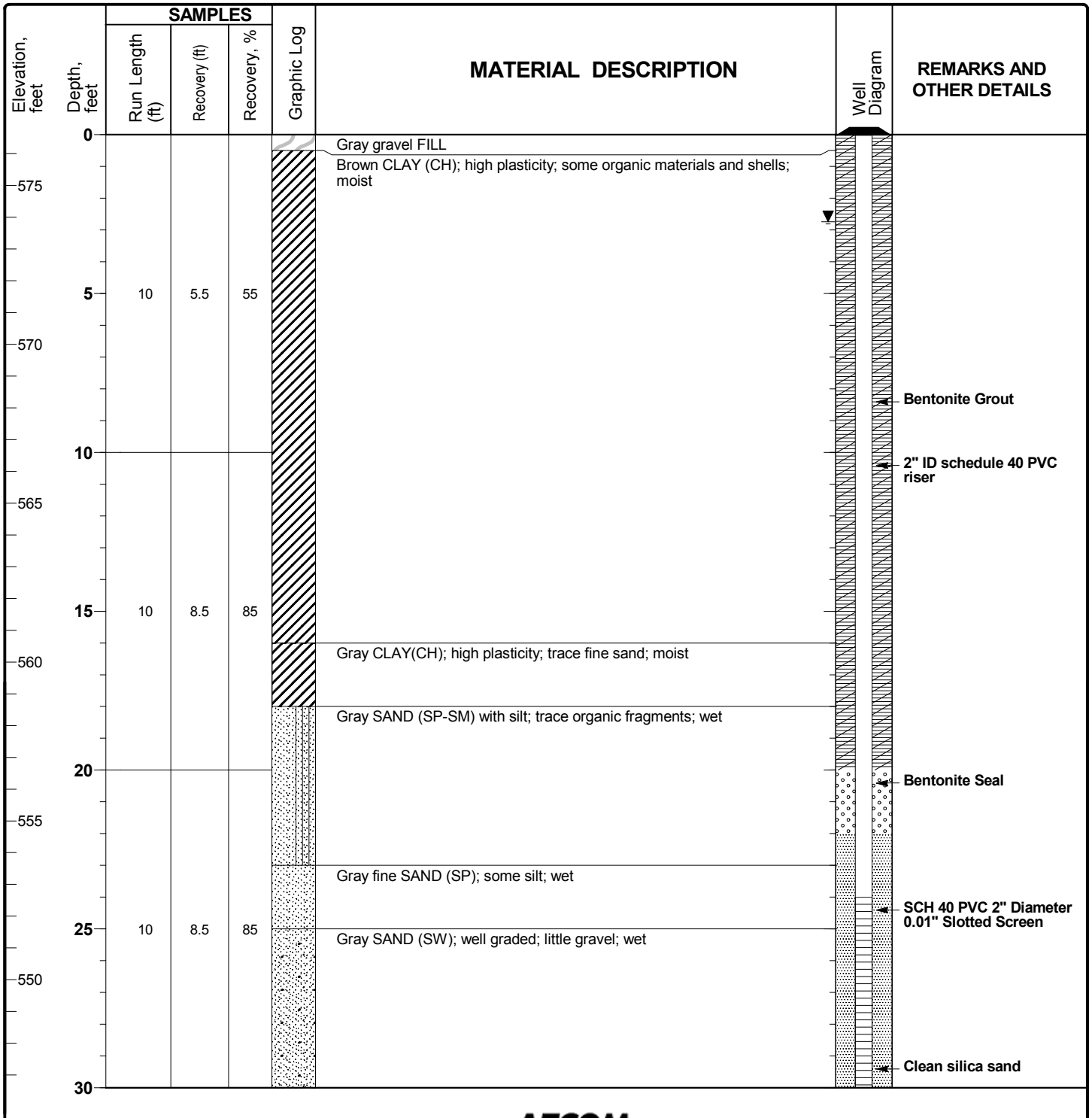
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-7S**

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]		



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/27/2016 4:25:56 PM

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

Log of
 MW-7S
 Sheet 2 of 2

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

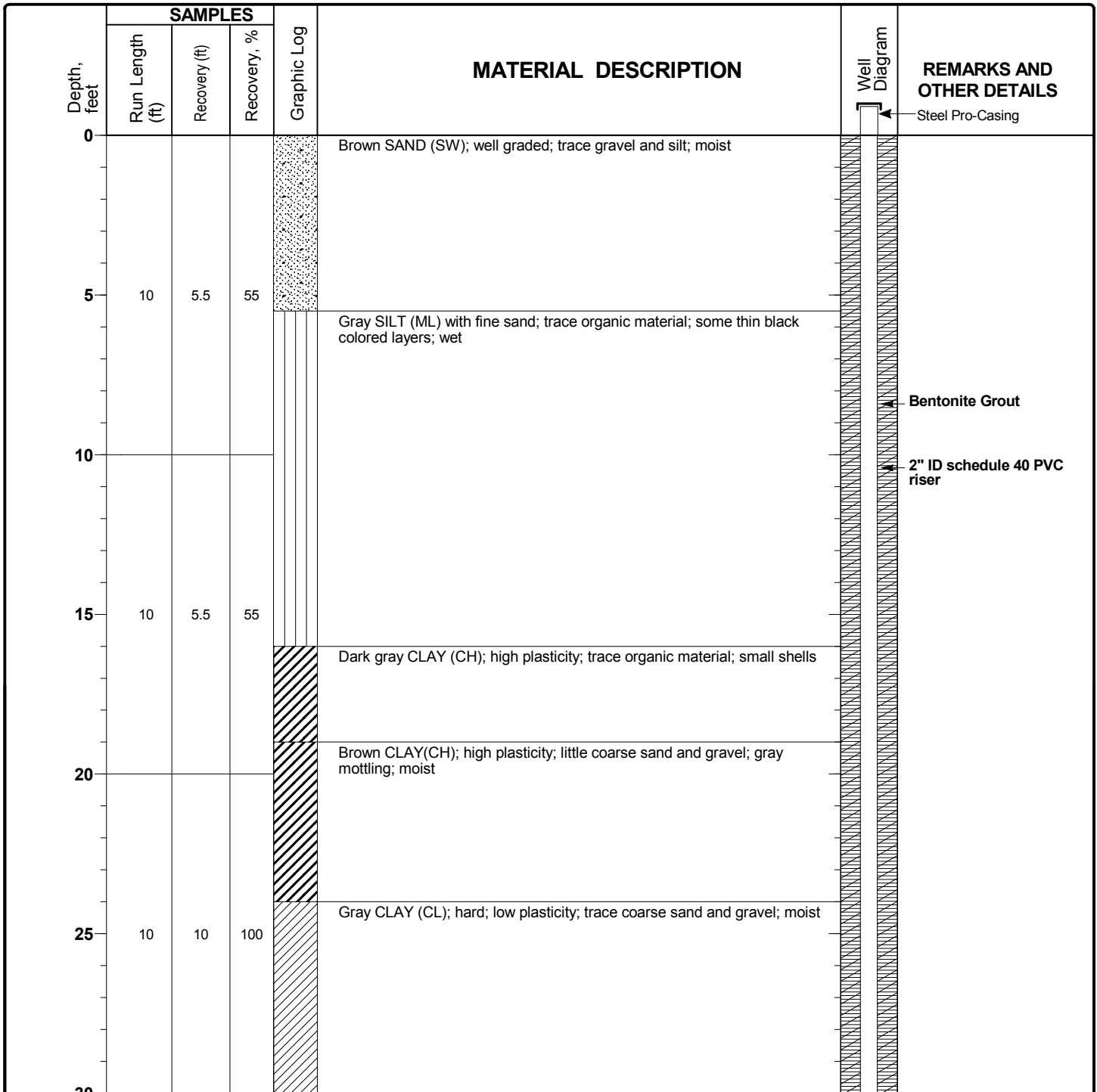
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-8D**

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]		



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/27/2016 4:26:05 PM

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

Log of
 MW-8D
 Sheet 2 of 3

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

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/27/2016 4:26:06 PM

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

Log of
 MW-8D
 Sheet 3 of 3

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

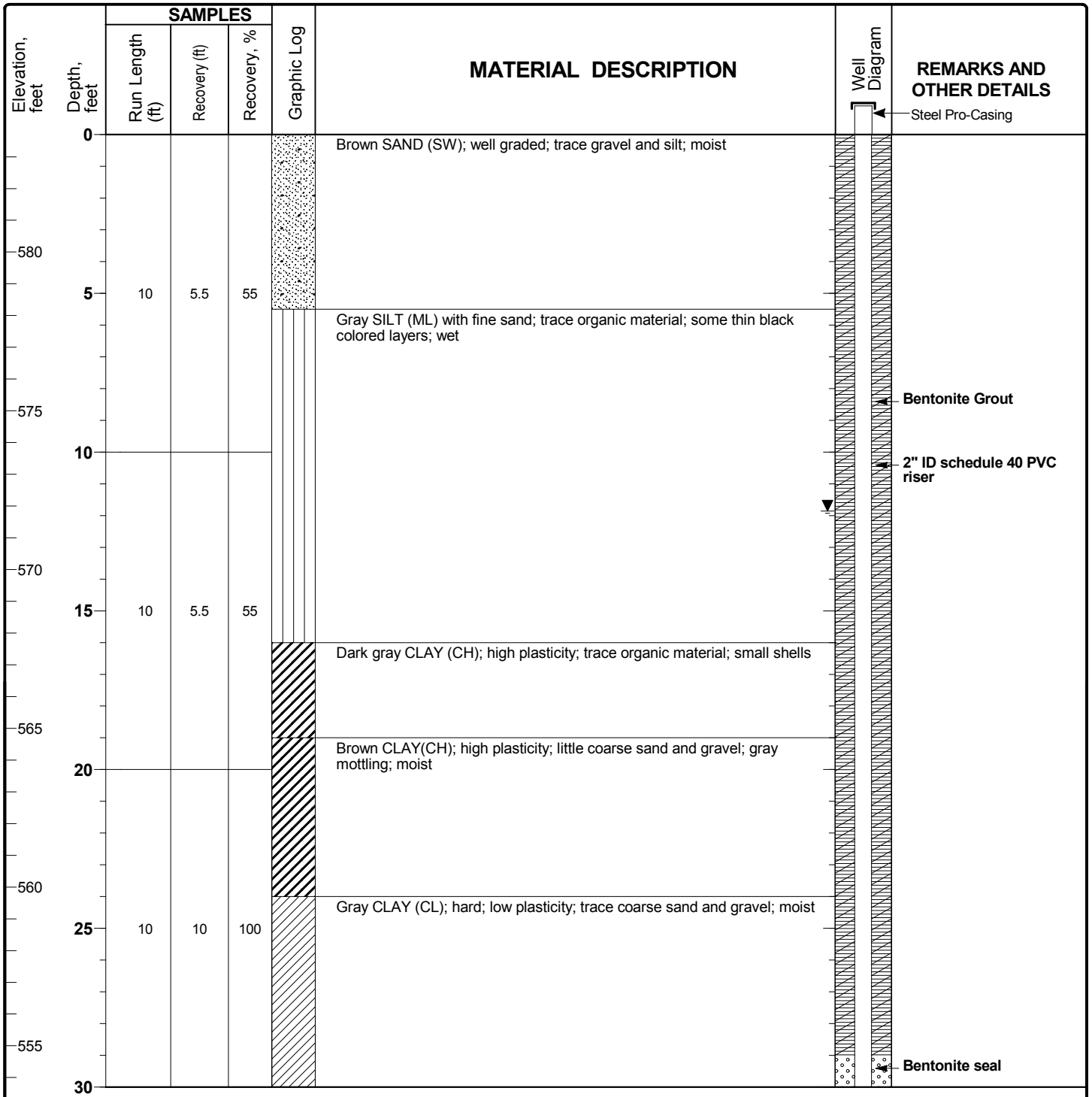
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

Log of MW-8S

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]		



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\ENV\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/27/2016 4:26:12 PM

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

Log of
 MW-8S
 Sheet 2 of 2

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

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/27/2016 4:26:12 PM

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

**Log of
 MW-9**

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

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

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

Log of
 MW-9
 Sheet 2 of 2

Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	Run Length (ft)	Recovery (ft)	Recovery, %			
30					Gray fine grained SAND with trace fines, wet	Clean silica sand
35	10	10	100%			Natural Collapse
40					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						

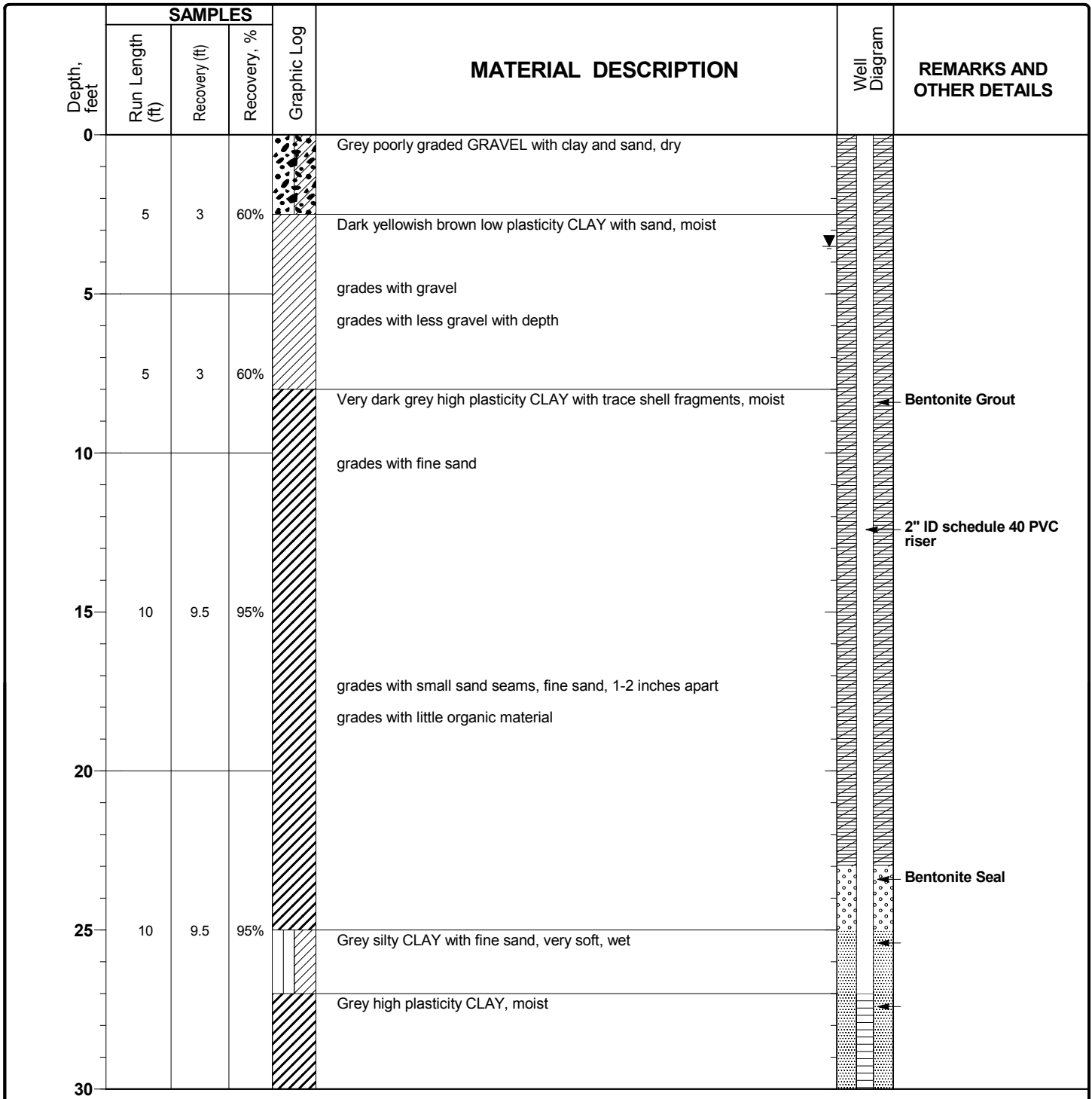
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-10**

Sheet 1 of 2



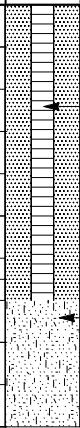



Date(s) Drilled	9/20/17 to 9/20/2017	Logged By	Ron Friend	Checked By	B Finnigan
Drilling Method	Sonic	Drill Bit Size/Type	Sonic 6"	Total Depth of Borehole	40.0 ft
Drill Rig Type	Sonic	Drilling Contractor	Cascade Drilling	Surface Elevation	ft msl
Borehole Backfill	Monitoring Well	Sampling Method(s)	Sonic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



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/16/2017 8:29:46 AM

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

Log of
 MW-10
 Sheet 2 of 2

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

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/16/2017 8:29:46 AM

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

**Log of
 MW-11**

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			Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	Run Length (ft)	Recovery (ft)	Recovery, %				
0					Pale brown poorly graded SAND (fill), loose, dry		
	5	2	40%				
5					grades with gravel		
	5	4	80%				
10					Dark brown high plasticity CLAY with grey mottling, very stiff, moist		Bentonite Grout
	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					Grey low plasticity CLAY with brown mottling, little coarse sand and gravel, hard, moist		
	5	5	100%		grades to brown		
20							
	5	5	100%		grades to grey		
25					Grey CLAY with little gravel and coarse sand, hard, moist-dry		
	5	5	100%				Bentonite Seal
30					Grey SILT with fine sand, stiff, moist - wet, slow dilatancy		

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/16/2017 8:29:51 AM

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

Log of
 MW-11
 Sheet 2 of 2

Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	Run Length (ft)	Recovery (ft)	Recovery, %			
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
45	5	5	100%			
					Terminate boring at 45 feet BGS.	End of boring
50						
55						
60						
65						

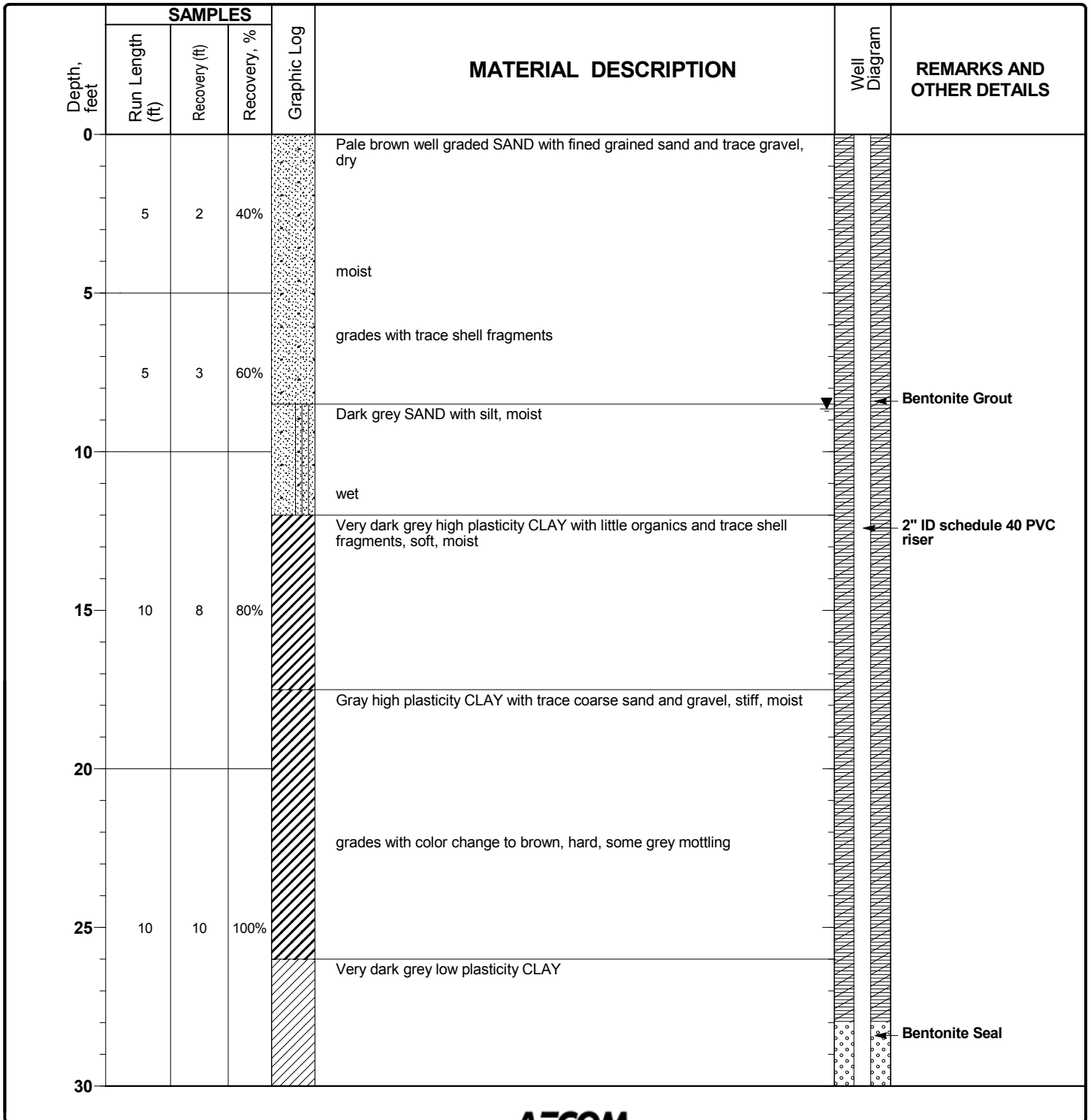
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**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)			



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\ENV\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/16/2017 8:29:54 AM

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

Log of
 MW-12
 Sheet 2 of 2

Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	Run Length (ft)	Recovery (ft)	Recovery, %			
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						
45	10	10	100%		Dark grey low plasticity CLAY (till) with little gravel and coarse sand, hard, moist	Natural Collapse
50						End of boring
55						
60						
65						

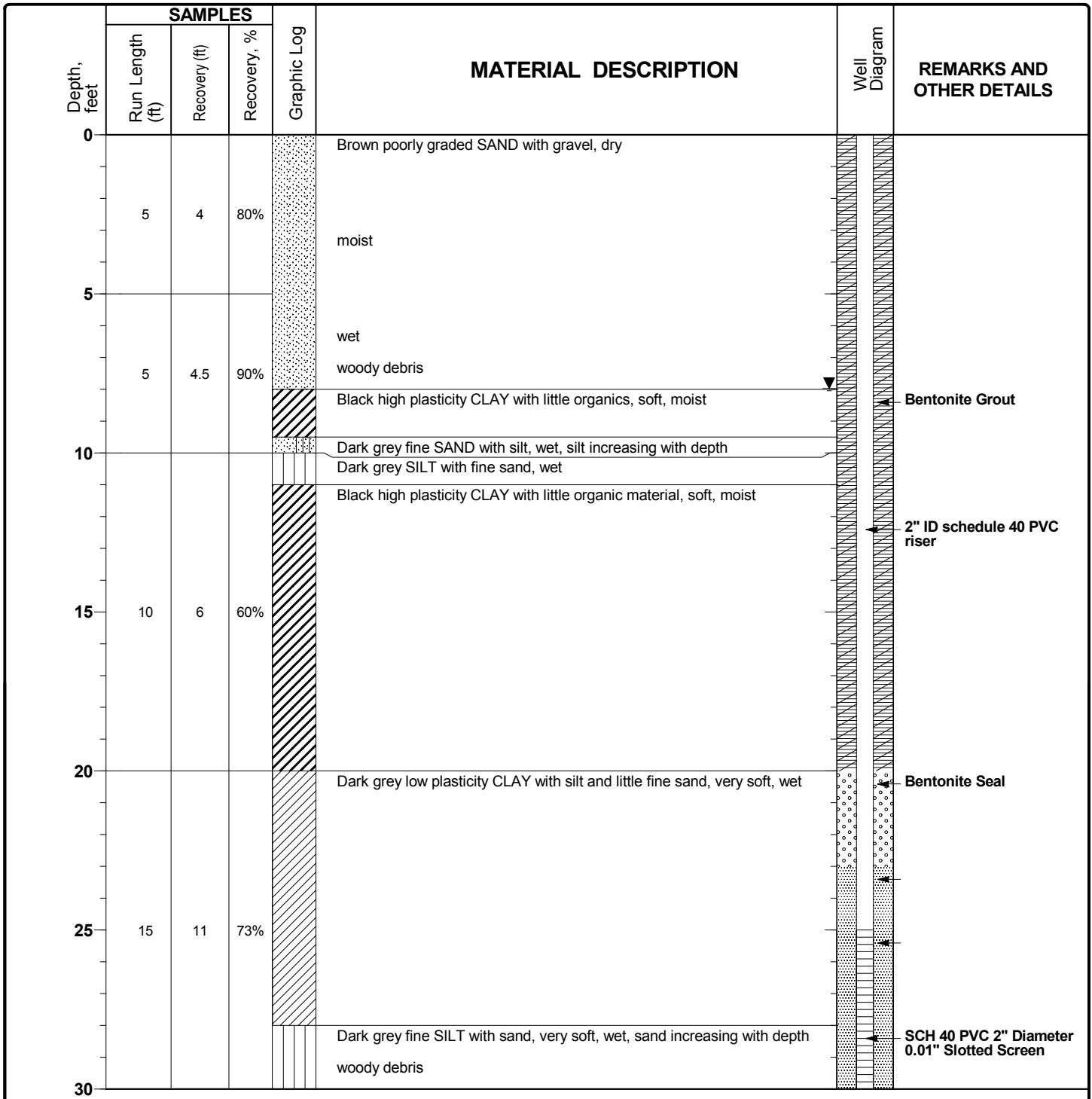
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-13**

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	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)			



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/16/2017 8:29:59 AM

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

**Log of
 MW-13**
 Sheet 2 of 2

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

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\ENV\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/16/2017 8:30:00 AM

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

**Log of
 MW-14**

Sheet 1 of 2


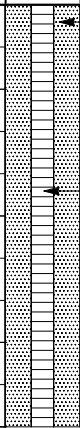


Date(s) Drilled 9/22/17 to 9/22/2017	Logged By Ron Friend	Checked By B Finnigan
Drilling Method Sonic	Drill Bit Size/Type Sonic 6"	Total Depth of Borehole 40.0 ft
Drill Rig Type Sonic	Drilling Contractor Cascade Drilling	Surface Elevation ft msl
Borehole Backfill Monitoring Well	Sampling Method(s) Sonic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

Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	Well Diagram	REMARKS AND OTHER DETAILS
	Run Length (ft)	Recovery (ft)	Recovery, %				
0					Black coal ash FILL with gravel and coal, loose, dry		
5	5	4	80%		Black coal ash FILL, coarse, sand-gravel sized, moist		
10	5	4.5	90%		Very dark grey high plasticity CLAY, soft, moist		Bentonite Grout
15	10	6	60%		grades to coarse sand and gravel, wet		2" ID schedule 40 PVC riser
20					Very dark grey fine SAND with silt and clay, wet		
25	10	0	0%		No recovery		Bentonite Seal
30							

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

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

Log of
 MW-14
 Sheet 2 of 2

Depth, feet	SAMPLES			Graphic Log	MATERIAL DESCRIPTION	REMARKS AND OTHER DETAILS
	Run Length (ft)	Recovery (ft)	Recovery, %			
30					Dark grey CLAY with sand, fine-medium grained sand. wet	 SCH 40 PVC 2" Diameter 0.01" Slotted Screen
35	10	9	90%		Dark grey poorly graded SAND with gravel, coarse grained sand, wet	
40					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						

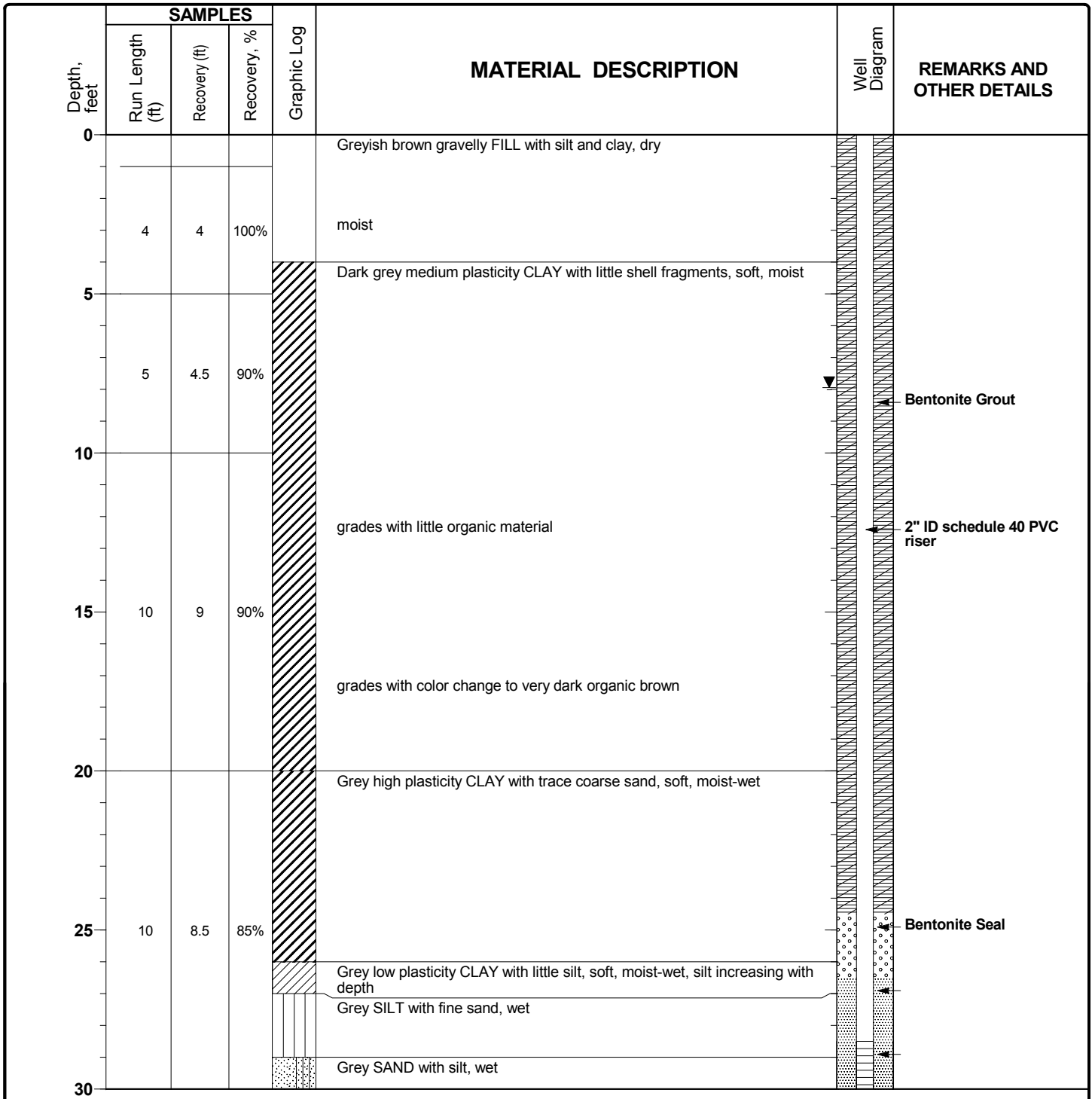
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Project: DTE Monroe Plant
Project Location: Monroe, Michigan
Project Number: 60489524

**Log of
 MW-15**

Sheet 1 of 2


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)			



Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE CLONE.GPJ; 10/16/2017 8:30:11 AM

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

Log of
 MW-15
 Sheet 2 of 2

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

Report: DTE_MONROE; File J:\RESOURCE\DISCIPLINES\GINT\PROJECTS\DTE\MONROE_GRANVILLE_CLONE.GPJ; 10/16/2017 8:30:12 AM