Location Restrictions Demonstrations

DTE Electric Company
Sibley Quarry Landfill Coal Combustion Residual Unit

801 Fort Street
Trenton, Michigan

October 2018

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Trenton, Michigan

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Prepared For
DTE Electric Company

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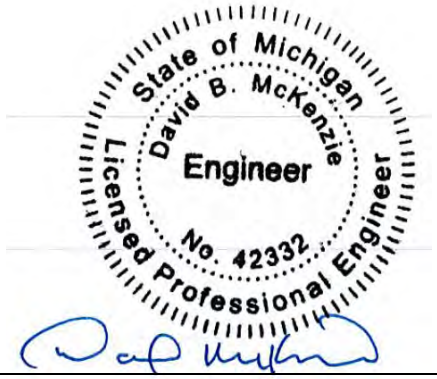
Certification

I, the undersigned Michigan Professional Engineer, hereby certify that I am familiar with the technical requirements of Title 40 Code of Federal Regulations Part 257 Subpart D (§257). I also certify that it is my professional opinion that, to the best of my knowledge, information, and belief, that the information in this demonstration is in accordance with current good and accepted engineering practice(s) and standard(s) and meets the requirements of §257.60 through §257.64.

For the purpose of this document, "certify" and "certification" shall be interpreted and construed to be a "statement of professional opinion." The certification is understood and intended to be an expression of my professional opinion as a Michigan Licensed Professional Engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be a guarantee or a warranty of the analysis herein.



Seal/Date 10/15/18

David B McKenzie, P.E.

License No: 6201042332

Section 1
Background

The purpose of this document is to determine whether the Coal Combustion Residual (CCR) landfill at the Sibley Quarry Landfill (SQLF) is in compliance with the location restrictions outlined in the Environmental Protection Agency's (EPA) final CCR rule [Title 40 Code of Federal Regulations (CFR) Parts 257 and 261] Subpart D – "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" (§257.60 through §257.64, federal rule). The SQLF is considered an existing CCR landfill according to the federal rule (§257.53).

This document includes information from a desktop study and well installation activities to demonstrate that the landfill is in compliance with locational criteria as defined in §257.60 through §257.64 of the federal rule.

Supporting documents are provided in appendices to this demonstration.

1.1 Facility and CCR Unit Information

The SQLF is located in Section 7, Township 4 South, Range 11 East, at 801 Fort Street (a.k.a. 502 Quarry Road) in Trenton, Wayne County, Michigan. The SQLF is located about two miles north of the DTE Electric Trenton Power Plant. The SQLF is bounded by Fort Street to the west, Sibley Road to the north, the former Detroit and Toledo Shore Line Railroad and West Jefferson Avenue to the east, and the former Vulcan Mold & Iron Company (now owned by Danou Enterprises) and the DTE Electric Jefferson Substation to the south.

The SQLF is a licensed Type III solid waste disposal facility owned and operated by DTE Electric. The disposal facility currently receives the majority of CCR from the Trenton Channel and River Rouge Power Plants. In addition, a small amount of CCR is also received from the Monroe Power Plant. The SQLF is operated under the current operating license number 9394 in accordance with Michigan Part 115 of the Natural Resources and Environmental Protection Act (NREPA), PA 451 of 1994, as amended.

1.2 Site Setting

The SQLF CCR unit is located approximately one-half mile west of the Detroit River. A groundwater monitoring system has been established for the SQLF CCR unit as detailed in the *Groundwater Monitoring System Summary Report – DTE Electric Company Sibley Quarry Coal Combustion Residual Landfill* (GWMS Report) (TRC, October 2017). The detection monitoring

well network for the SQLF CCR unit currently consists of eight monitoring wells that are screened in the uppermost aquifer. Monitoring well boring logs are included in Appendix A.

The Sibley Quarry was originally developed to mine limestone beginning in the mid-1800s and was mined to over 300 feet below ground surface (ft bgs) in some areas before becoming inactive. In 1951, Detroit Edison (now DTE Electric) acquired Sibley Quarry and began to manage CCR in the SQLF. As part of normal operations, beginning in 1951, the SQLF has been continuously dewatered to approximately 300 ft bgs maintaining a water level in the bottom of the quarry by pumping an average of approximately 1.5 million gallons per day.

The SQLF resides in an area characterized by near surface deposits of glacio-lacustrine clay and silt units on top of thick strata of dolomite and limestone bedrock. The SQLF is located in an area where the Dundee Formation (mostly limestone) and the Detroit River Group (limestone, dolostone and some sandstone) underlie the unconsolidated glacial drift and are the uppermost aquifer. At SQLF, the Dundee Formation is overlain by anywhere from less than 15 feet to more than 70 feet of unconsolidated material, most of which is clay-rich soil with some fill. The top of the Dundee Formation limestone/dolostone bedrock was encountered at depths ranging from 16.5 to 74.5 ft bgs and, including the underlying Detroit River Group limestone/dolostone/ sandstone, extends to depths ranging from 235 to over 310 ft bgs. The underlying Sylvania Sandstone was encountered at depths ranging from 235 to 300 ft bgs in some locations at the SQLF.

As expected, data show that groundwater levels are significantly lower within the bedrock in monitoring wells that are the closest to the quarry where significant pumping is occurring, with water levels ranging from 120 to more than 210 ft bgs. Groundwater flow is consistently inward toward the base of the quarry due to continuous pumping at the quarry that hydraulically controls groundwater flow. The pumped water from the quarry is managed in accordance with a National Pollution Discharge Elimination System (NPDES) permit. Quarry dewatering results in all the perimeter uppermost aquifer CCR monitoring wells being upgradient of the SQLF CCR unit.

Because the uppermost aquifer is in an area where pumping has been performed continuously before CCR disposal began, and will be continued to be dewatered, a continuous inward hydraulic gradient is maintained. As a result, the uppermost aquifer perimeter monitoring wells cannot have been affected by the SQLF CCR unit operations to date, nor could they be in the future under current pumping conditions.

Section 2
Location Restrictions

The location restrictions designated in the federal CCR rule are presented below with a corresponding demonstration to show compliance with each restriction. The location restrictions include placement above the uppermost aquifer, within wetlands, near fault areas, within seismic impact zones, and in unstable areas based on geologic and geomorphologic information. Supporting information for the demonstrations is included in the appendices to this report.

2.1 §257.60 – Placement above the Uppermost Aquifer

Per §257.60(a), the requirements of §257.60 apply to new or existing surface impoundments, new landfills, and all lateral expansions of CCR units. The SQLF is classified as an existing landfill according to the federal rule; therefore, the requirements of §257.60 do not apply.

2.2 §257.61 – Wetlands

Per §257.61(a), the requirements of §257.61 apply to new or existing surface impoundments, new landfills, and all lateral expansions of CCR units. The SQLF is classified as an existing landfill according to the federal rule; therefore, the requirements of §257.61 do not apply.

2.3 §257.62 – Fault areas

Per §257.62(a), the requirements of §257.62 apply to new or existing surface impoundments, new landfills, and all lateral expansions of CCR units. The SQLF is classified as an existing landfill according to the federal rule; therefore, the requirements of §257.62 do not apply.

2.4 §257.63 – Seismic Impact Zones

Per §257.63(a), the requirements of §257.63 apply to new or existing surface impoundments, new landfills, and all lateral expansions of CCR units. The SQLF is classified as an existing landfill according to the federal rule; therefore, the requirements of §257.63 do not apply.

2.5 §257.64 – Unstable Areas

The federal CCR rule requires that CCR units not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted. Factors associated with soil conditions resulting in significant differential settlement, geologic or geomorphologic features,

and human-made features or events must be evaluated to determine compliance. This demonstration was performed by reviewing geotechnical data, local geology, topography, and evaluating human-made features at the SQLF.

Geotechnical explorations performed at the SQLF area identified deposits of low permeability clay and silty clay above dolomite and limestone bedrock. Topography in the vicinity of the SQLF is relatively flat with no areas of significant elevation change that would be prone to instability due to erosional forces. The sheer quarry sidewalls have been exposed to erosional forces and weathering for more than 150 years since quarrying operations were initiated, however, these walls remain stable. The United States Geological Survey's (USGS) National Seismic Hazard Maps indicate that SE Michigan is a low hazard area for seismic impacts, and the State of Michigan in general has had very few recorded incidents of seismic disturbance with sufficient intensity to cause potential significant structural damage (Bricker, 1977).

Existing soil or bedrock conditions, geologic or geomorphologic features, or human-made features or events resulting in significant differential settling or other forms of unstable condition is not supported by this determination; therefore, it is TRC's opinion that the SQLF is not located in an unstable area, and is in compliance with the requirements of §257.64.

Section 3
Conclusions

Based on the evaluation provided in this demonstration, the SQLF is in compliance with the location restrictions provided in §257.60 through §257.64 of the CCR rule. No additional action, justification, or demonstration is required to document compliance with the location restrictions provided in the CCR rule after this demonstration has been placed into the operating record, posted to the publicly-accessible website, and government notifications provided.

Section 4
References

Bricker, D. Michael. 1977. Circular 14—Seismic Disturbances in Michigan. https://www.michigan.gov/documents/deq/GIMDL-CR14_216127_7.PDF. Lansing, MI.

TRC. October 2017. Groundwater Monitoring System Summary Report – DTE Electric Company Sibley Quarry Coal Combustion Residual Landfill.

TRC. January 2018. Annual Groundwater Monitoring Report – DTE Electric Company Sibley Quarry Coal Combustion Residual Landfill.

United States Geological Survey (USGS). 2015. U.S. Seismic Design Maps: 2015 National Earthquake Hazards Reduction Program Provisions. Available Online at http://earthquake.usgs.gov/designmaps/beta/us/. Accessed [8/16/2018].

Appendix A
Monitoring Well Boring Logs

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 2832.20 E: 2587.40

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-101

DRILLING DATE: 7/14/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

SHEET 1 OF 7

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	FLUSH / % RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
			Grass/Gravel		615.23												
0	TH-55 Rotary Rig	Air and Water Rotary (Casing:5";)	**(SC)** CLAYEY SAND, Heterogeneous, sub angular, trace to some GRAVEL, poorly graded (0-10'), well graded (10-58')		0.00												
5																	
10																	
15																	
20																	
25																	5" Black steel casing
30																	
35																	
40																	
45																	
50			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE
PROJECT: Sibley Quarry Closure
LOCATION: Sibley Quarry
N: 2832.20 E: 2587.40
Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-101

DRILLING DATE: 7/14/2015
DRILLING CONTRACTOR: Pearson Drilling Co.

SHEET 2 OF 7
DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
50			**(SC)** CLAYEY SAND, Heterogeneous, sub angular, trace to some GRAVEL, poorly graded (0-10'), well graded (10-58') *(continued)*														
55																	
					557.23												
			(CL) SILTY CLAY		58.00												
					555.23												
60			LIMESTONE, Homogeneous, angular, calcareous		60.00												5" Black steel casing
65																	
70																	
75	TH-55 Rotary Rig	Air and Water Rotary (Casing:5",)															
80																	
85																	4.75"
90																	
95																	
100			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage
Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular
Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough
Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Si-Silt, Su-Sulphide, Oth-Other, Qfsp-Quartz Feldspar

DEPTH SCALE
1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:
LOGGED: Stephen Tatum
CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 2832.20 E: 2587.40

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-101

DRILLING DATE: 7/14/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN	FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
100	TH-55 Rotary Rig	Air and Water Rotary (Casing:5" ;)	LIMESTONE, Homogeneous, angular, calcareous *(continued)*															
105																		
110																		
115																		
120																		
125																		4.75"
130																		
135																		
140																		
145																		
150			*CONTINUED NEXT PAGE*															

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 2832.20 E: 2587.40

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-101

DRILLING DATE: 7/14/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	FLUSH COLOUR / % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
150	TH-55 Rotary Rig	Air and Water Rotary (Casing:5")	LIMESTONE, Homogeneous, angular, calcareous *(continued)*														
155																	
160																	
165																	
170																	
175																	4.75"
180																	
185																	
190																	
195																	
200			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 2832.20 E: 2587.40

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-101

DRILLING DATE: 7/14/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
200			LIMESTONE, Homogeneous, angular, calcareous *(continued)*														
205																	
210																	
215																	
220					395.23												
			DOLOSTONE, Homogeneous, angular, calcareous		220.00												
225	TH-55 Rotary Rig	Air and Water Rotary (Casing:5",)															4.75"
230																	
235																	
240																	
245																	
250			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

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CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 2832.20 E: 2587.40

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-101

DRILLING DATE: 7/14/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
250	TH-55 Rotary Rig	Air and Water Rotary (Casing:5")	DOLOSTONE, Homogeneous, angular, calcareous *(continued)*														
255																	
260																	
265																	
270																	
275																	4.75"
280																	
285																	
290																	
295																	
300			*CONTINUED NEXT PAGE*		315.23												

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 2832.20 E: 2587.40

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-101

DRILLING DATE: 7/14/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	FLUSH / % RETURN / COLOUR	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
300	TH-55 Rotary Rig	Air and Water Rotary (Casing 5",)	SANDSTONE, fine grained, well sorted		300.00												4.75"
305																	
310																	
315																	
320			End of Borehole.		295.23 320.00												
325																	
330																	
335																	
340																	
345																	
350																	

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE
PROJECT: Sibley Quarry Closure
LOCATION: Sibley Quarry
N: 3821.60 E: 2394.30
Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-102

DRILLING DATE: 7/16/2015
DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	FLUSH COLOUR / % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
			Ground Surface	612.62												
0	Track Mounted Sonic Drill	Sonic (Casing:4 in. Casing;)	**(CL)** CLAY, Gravely CLAY, brown, coarse gravel, stiff, w<pl, non-plastic.	0.00	1											
5																
10					2											5" Black steel casing
15																
				596.12												
			LIMESTONE, fossiliferous, light gray, multiple stylolites.	16.50												
20					3											
					4											
25					5											
30	Track Mounted Sonic Drill	PQ Coring														4.75"
35					6											
40																
45					7											
50			*CONTINUED NEXT PAGE*													

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE
1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 3821.60 E: 2394.30

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-102

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	FLUSH	COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
50	Track Mounted Sonic Drill	PQ Coring	LIMESTONE, fossiliferous, light gray, multiple stylolites. *(continued)*															
55						8												
					554.12													
			LIMESTONE, brownish gray, many large round fossils		58.50													
60																		
					549.72													
			LIMESTONE, gray, angular bedding		63.30													
			LIMESTONE, brownish gray, horizontal bedding															
65						9												
70						10												
					538.42													
			LIMESTONE, brown, thin-very thin horizontal beddding		74.20													4.75"
75						11												
					534.02													
			LIMESTONE, gray, deformed bedding, synclinal folding		78.60													
80																		
					530.42													
			LIMESTONE, gray, brecciated		529.72													
			LIMESTONE, brownish gray, thin horizontal bedding		82.90													
85						12												
90																		
95						13												
					515.92													
			LIMESTONE, light gray, non-laminar bedding		96.70													
					514.82													
			LIMESTONE, gray to brownish gray, horizontal wavy bedding		97.80													
100																		
			CONTINUED NEXT PAGE															

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 3821.60 E: 2394.30

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-102

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
100	Track Mounted Sonic Drill	PQ Coring	LIMESTONE, gray to brownish gray, horizontal wavy bedding *(continued)*		508.52												
105			LIMESTONE, gray, thicker (~0.5") bedding , wavy, non-laminar		104.10 507.32	14											
			LIMESTONE, light gray, thick (0.5-5") bedding		506.42												
			LIMESTONE, thin bedding, brownish gray and black layering		106.60												
			LIMESTONE, thick bedding with cross cutting		503.02												
110			LIMESTONE, brownish gray with thin horizontal layers		109.60 501.92												
			LIMESTONE, large wavy stylolite marks change in color to gray		110.70 500.22												
			LIMESTONE, brownish gray, thin mostly horizontal bedding		112.40 497.72												
115			LIMESTONE, gray, thick bedding		496.82	15											
			LIMESTONE, brown, thinly bedded		115.80 494.02												
			LIMESTONE, sharp contact at 118.6, goes from brown to gray		493.22												
120			LIMESTONE, light gray, friable, thinly bedded (~1mm)		119.40 491.72	16											
			LIMESTONE, brown-brownish gray, fractured, thinly bedded		120.90												
125						17											4.75"
130																	
135			LIMESTONE, gray fragments in a light gray cement. Breccia		477.52 476.82	18											
			LIMESTONE, brown-brownish gray, fractured, thinly bedded		135.80 474.42												
			LIMESTONE, light gray, thin wavy bedding, stylolites		138.20 472.62												
140			LIMESTONE, brown-brownish gray, thin horizontal bedding		140.00 471.12												
			LIMESTONE, gray, thin horizontal bedding		141.50 467.62	19											
145			LIMESTONE, brownish gray, deformed wavy bedding		466.62												
			LIMESTONE, brownish gray, thin horizontal bedding. Broken into many small pieces 148.5-150ft		146.00	20											
150			*CONTINUED NEXT PAGE*		462.62												

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 3821.60 E: 2394.30

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-102

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
150	Track Mounted Sonic Drill	PQ Coring	deformed wavy bedding, many small voids		461.92 / 150.70												
			thin horizontal bedding, many small voids seam of mostly void spaces in gray Limestone completely crushed, fine sand - large gravel size pieces of Limestone			21											
155																	
						22											
160					452.02												
			LIMESTONE, gray, thinly bedded, small voids with crystals		160.60 / 448.62												
			LIMESTONE, light gray, deformed bedding, many small voids throughout, some filled with crystals		164.00 / 447.22	23											
165			LIMESTONE, gray-dark gray, thin horizontal bedding		165.40 / 443.52												
			LIMESTONE, thick bedding, large voids, many brown crystals		169.50												
170			LIMESTONE, gray-dark gray, thin horizontal bedding														
175					436.42	24											4.75"
			LIMESTONE, gray- dark gray, thin horizontal bedding, many voids, brittle		176.20 / 434.42												
			LIMESTONE, brown, thin horizontal bedding, friable, appears fine grained instead of crystalline.		178.20 / 432.62												
180			LIMESTONE, light brown, fine grain, no bedding, calcite filled vertical fractures graying in color		180.00 / 427.92												
			LIMESTONE, light brown-white, some horizontal cracking		185.20	25											
185			LIMESTONE gray- dark gray, thin slightly deformed horizontal bedding, stylolites		422.62												
			LIMESTONE, gray, thin horizontal bedding, large crystal filled voids, many small voids throughout		190.00												
190																	
195						26											
200			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 3821.60 E: 2394.30

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-102

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
200	Track Mounted Sonic Drill	PQ Coring	LIMESTONE, gray, thin horizontal bedding, large crystal filled voids, many small voids throughout *(continued)*														
205						27											
210					401.62												
			LIMESTONE, gray-light gray, thicker (up to 0.5") wavy bedding		211.00												
					398.82												
			LIMESTONE, grayish brown, thin horizontal bedding		213.80												
215						28											
220																	
225						29											4.75"
					386.12												
			LIMESTONE, light gray, thick (~0.5") wavy bedding		226.50												
			black seam with fracture at base		384.82												
			LIMESTONE, gray, thin horizontal bedding		227.90												
230					382.62												
			LIMESTONE, light gray, many small black crystals, evidence of bioturbation.		381.92												
			LIMESTONE, gray, thin mostly horizontal bedding		380.92												
			LIMESTONE, no layering, single bed, small black crystals		231.70												
235			LIMESTONE, gray, thin mostly horizontal bedding, many small black crystals			30											
					372.62												
240			LIMESTONE, gray-blue, angular bedding until a stylolite at 240.6 where bedding becomes wavy and deformed		240.00												
			LIMESTONE, gray, thin horizontal bedding		370.72												
			LIMESTONE, gray, deformed bedding		369.72												
			LIMESTONE, gray, thin horizontal bedding		368.62												
245			LIMESTONE, gray, deformed wavy bedding, many stylolites		244.00												
			LIMESTONE, gray, thin horizontal bedding, many small voids throughout, some large crystals		367.32	31											
					245.30												
250					362.62												
			CONTINUED NEXT PAGE														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 3821.60 E: 2394.30

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-102

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
250	Track Mounted Sonic Drill	PQ Coring	LIMESTONE, brownish gray- gray, thick (1-6") deformed bedding, many large crystals that do not react to HCl, harder than 2 on Mohs hardness scale.		250.00												
255						32											
260			many small white crystals easily scratched with fingernail														4.75"
265						33											
270			End of Borehole.		342.62 270.00												
275																	
280																	
285																	
290																	
295																	
300																	

Type: JN-Joint; FLT-Fault; SH-Shear; VN-Vein; FR-Fracture; BD-Bedding; FO-Foliation; CO-Contact; OR-Orthogonal; CL-Cleavage

Shape: PL-Planar; CU-Curved; UN-Undulating; ST-Stepped; IR-Irregular

Roughness: PO-Polished; K-Slickensided; SM-Smooth; Ro-Rough; VR-Very Rough

Infilling: Br-Brocken Rock; Bt-Biotite; Cl-Clay; Ch-Chlorite; Ca-Calcite; Ep-Epidote; Fe-Iron; Go-Gouge; Gr-Gravel; He-Hematite; Py-Pyrite; Qz-Quartz; Sa-Sand; Se-Sericite; Qfsp-Quartz Feldspar; Si-Silt; Su-Sulphide; Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 4635.40 E: 83.10

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-103

DRILLING DATE: 7/15/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

SHEET 1 OF 7

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	FLUSH / % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
			Grass		604.67												
0	TH-55 Rotary Rig	Air and Water Rotary (Casing:5",)	**(SC)** CLAYEY SAND, Heterogeneous, sub angular, medium gravels in a FLY ASH SANDY CLAY matrix, well sorted		0.00												
					601.67												
			ASH, Homogeneous, very fine grained, FLY ASH, well sorted		3.00												
5																	
					598.67												
			(SC) CLAYEY SAND, Heterogeneous, sub-angular, medium gravel, poorly sorted		6.00												
					595.67												
			(CL) SILTY CLAY, Heterogeneous, sub-angular, fine to medium to coarse, trace to some FLY ASH (9-15'), poorly sorted		9.00												
10																	
15																	
20																	
25																	5" Black steel casing
30																	
35																	
40																	
45																	
50			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 4635.40 E: 83.10

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-103

DRILLING DATE: 7/15/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	FLUSH / % RETURN / COLOUR	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
50	TH-55 Rotary Rig	Air and Water Rotary (Casing:5",)	**(CL)** SILTY CLAY, Heterogeneous, sub-angular, fine to medium to coarse, trace to some FLY ASH (9-15'), poorly sorted *(continued)*														
					551.67 / 53.00												
55			Homogeneous, angular, coarse grained, calcareous, LIMESTONE, poorly sorted, evidence of fossils (85'), darker grain colors (130-170')														5" Black steel casing
60																	
65																	
70																	
75																	
80																	4.75"
85																	
90																	
95																	
100			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 4635.40 E: 83.10

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-103

DRILLING DATE: 7/15/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
100	TH-55 Rotary Rig	Air and Water Rotary (Casing:5",)	Homogeneous, angular, coarse grained, calcareous, LIMESTONE, poorly sorted, evidence of fossils (85'), darker grain colors (130-170') *(continued)*														
105																	
110																	
115																	
120																	
125																	4.75"
130																	
135																	
140																	
145																	
150			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 4635.40 E: 83.10

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-103

DRILLING DATE: 7/15/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
150	TH-55 Rotary Rig	Air and Water Rotary (Casing:5" ;)	Homogeneous, angular, coarse grained, calcareous, LIMESTONE, poorly sorted, evidence of fossils (85'), darker grain colors (130-170') *(continued)*														
155																	
160																	
165																	
170					434.67 / 170.00												
			Homogeneous, angular, medium to coarse, DOLOSTONE														
175																	4.75"
180																	
185																	
190					414.67 / 190.00												
			Heterogeneous, fine to coarse grained, abundant calcite crystals, LIMESTONE														
195																	
200			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 4635.40 E: 83.10

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-103

DRILLING DATE: 7/15/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
200	TH-55 Rotary Rig	Air and Water Rotary (Casing:5" ;)	Heterogeneous, fine to coarse grained, abundant calcite crystals, LIMESTONE *(continued)*														
205																	
210					394.67 / 210.00												
			Homogeneous, angular, fine grained matrix, LIMESTONE														
215																	
220																	
225																	4.75"
230																	
235																	
240																	
245																	
250			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 4635.40 E: 83.10

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-103

DRILLING DATE: 7/15/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
250	TH-55 Rotary Rig	Air and Water Rotary (Casing:5" ;)	Homogeneous, angular, fine grained matrix, LIMESTONE *(continued)*														
255																	
260																	
265																	
270																	
275																	4.75"
280																	
285																	
290					314.67 / 290.00												
			Homogeneous, angular, DOLOSTONE														
295																	
300			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 4635.40 E: 83.10

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-103

DRILLING DATE: 7/15/2015

DRILLING CONTRACTOR: Pearson Drilling Co.

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
300	TH-55 Rotary Rig	Air and Water Rotary (Casing 5",)	Homogeneous, angular, DOLOSTONE *(continued)*														
305																	4.75"
310					294.67												
			End of Borehole.		310.00												
315																	
320																	
325																	
330																	
335																	
340																	
345																	
350																	

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Stephen Tatum

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 1949.90 E: 221.90

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-104

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN	FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0			Ground Surface		605.98													
			Topsoil		604.98													
			CLAY with gravel, brown-dark brown, firm, w<pl, dry, becomes stiff at 3ft		1.00	1												
5					600.98													
			Gravelly CLAY, dark brown-dark gray, friable, noncohesive, non-plastic, dry		5.00													
					598.98													
			Gravelly CLAY, dark brown-gray, cohesive, w>pl, small to large gravel		7.00													
10						2												
15			6" seam of small angular gravel with clay at 15ft															
20						3												
25	Track Mounted Sonic Drill	Sonic (Casing:4 in. Casing:)																5" Black steel casing
30						4												
35																		
40						5												
45																		
					556.98	6												
50					49.00													
			CONTINUED NEXT PAGE															

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

RECORD OF MONITORING WELL: MW-104

SHEET 2 OF 7

CLIENT: DTE
PROJECT: Sibley Quarry Closure
LOCATION: Sibley Quarry
N: 1949.90 E: 221.90
Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

DRILLING DATE: 7/16/2015
DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
50	Track Mounted Sonic Drill	Sonic	LIMESTONE, gray-dark gray, crystalline, some shell fragments, thin horizontal bedding *(continued)*			6											5" Black steel casing
55						7											
60			abundant white shells			8											
65						9											
70			antiform folded bedding 68-69ft														
					534.38												
			LIMESTONE, thick horizontal bedding, weathered, many small voids, reacts strongly to HCl Highly reactive to HCL.		71.60												
					532.28												
75	Track Mounted Sonic Drill	PQ Coring	LIMESTONE, brownish gray-gray, thin horizontal bedding, many fractures along bedding plane, mild reaction to HCl Medium reaction to HCL.		73.70	10											4.75"
					529.58												
			No recovery. Driller reported that interval felt like void		76.40												
					527.58												
			LIMESTONE, gray-brown, thin angular bedding, reacts well to HCl Highly reactive to HCL.		78.40												
80																	
					522.48												
			SANDSTONE, brown, fine grain, massive layering, porous, very slight reaction to HCl Low to no reaction to HCL.		83.50												
85					520.38	11											
			SANDSTONE, light brown-gray, fine grain, thin bedding, very porous, slight to no reaction to HCl Low to no reaction to HCL.		85.60												
90																	
95						12											
					507.33												
			LIMESTONE, gray, thin horizontal bed, stylolites		98.65												
100			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture, BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage
Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular
Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough
Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE
1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:
LOGGED: Brian Eustice
CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 1949.90 E: 221.90

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-104

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
100	Track Mounted Sonic Drill	PQ Coring			505.08												
			Interbedded layers of brown SANDSTONE and gray LIMESTONE, 1-5mm thick horizontal layers, many fractures		100.90												
105					499.38	13											
			LIMESTONE, gray-light brown, thin horizontal layers brecciated limestone from 107.9-108.1 ft		106.60												
110					494.98												
			LIMESTONE, gray, thick bedding, wavy stylolites		111.00												
					493.28												
			LIMESTONE, gray-light brown, thin horizontal bedding		112.70												
115					490.68	14											
			LIMESTONE, gray-brown, very porous, many voids, large crystals		115.30												
					487.78												
			Interbedded SANDSTONE and LIMESTONE		118.20												
120					485.68												
			LIMESTONE, gray-brown, thin horizontal bedding		120.30												
					484.18												
			SANDSTONE, brown, porous, thick bedding, weathered, little to no reaction to HCl Low to no reaction to HCL.		121.80												
					481.73												
			BRECCIA, limestone fragments		480.88												
125			Interbedded SANDSTONE and LIMESTONE, brown-gray, porous, angled bedding to 127.2ft horizontal to 130ft		125.10	15											4.75"
					475.98												
130			LIMESTONE, light brown, fine grain, porous, thick bedding, reacts to HCl Medium reaction to HCL.		130.00												
135						16											
140																	
					462.88												
			BRECCIA, limestone, brittle		143.10												
					461.38												
145			LIMESTONE, light brown-gray, thin bedding, many sinuous stylolites		144.60	17											
					459.98												
			LIMESTONE, crystalline, light gray, thick bedding, reacts well to HCl Highly reactive to HCL.		146.00												
150					455.98												

CONTINUED NEXT PAGE

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 1949.90 E: 221.90

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-104

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
150	Track Mounted Sonic Drill	PQ Coring	DOLOSTONE, light gray-whitish, thin horizontal-wavy bedding, reacts to HCl when scratched Low to no reaction to HCL.		150.00												
155					450.58	18											
			LIMESTONE, dark gray, very weathered/crumbly, many voids and fractures, abundant mineralization		449.88												
			LIMESTONE, gray-light brown, thin horizontal bedding		156.10												
160																	
					442.58												
			DOLOSTONE, light gray with light brown and black swirling, reacts to HCl when scratched Low to no reaction to HCL.		163.40	19											
165																	
170					435.58												
			LIMESTONE, light gray, thin horizontal - wavy bedding, weathered, voids		170.40												
					430.88												
175			LIMESTONE, brownish gray, thin horizontal bedding, some small voids, reacts to HCl Highly reactive to HCL.		175.10	20											4.75"
180																	
185						21											
					416.98												
			LIMESTONE, gray, crystalline, thin horizontal bedding, many stylolites becomes more fine grain than crystalline		189.00												
190																	
195						22											
200			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 1949.90 E: 221.90

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-104

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
200	Track Mounted Sonic Drill	PQ Coring	LIMESTONE, gray, crystalline, thin horizontal bedding, many stylolites *(continued)* weak to no reaction to HCl Low to no reaction to HCL. fractured zone, many broken/crushed pieces		403.48 / 202.50												
205			LIMESTONE, light gray, thin-thick bedding, some stylolites, reacts to HCl Highly reactive to HCL.			23											
210			LIMESTONE, crystalline, light gray-blue layered, thin horizontal bedding		395.08 / 394.28 / 211.70												
			LIMESTONE, dark gray-brown, thick-thin wavy deformed bedding, reacts when scratched. Low to no reaction to HCL.		391.28 / 214.70	24											
215			LIMESTONE, light gray-gray, thin horizontal bedding, many small thin voids, likely crystals that were dissolved.														
220						25											
			LIMESTONE, thin wavy bedding, thickening with depth		381.58 / 224.40												
225			LIMESTONE, brecciated		380.08												4.75"
			LIMESTONE, solid gray layer		226.50												
			Stylolite ~0.5" thick with fractures on either side			26											
230			LIMESTONE, light gray-gray, thin-thick horizontal-wavy bedding														
235						27											
240																	
245					360.38	28											
			LIMESTONE, fine grain, light brown, thin horizontal bedding, porous, many voids, abundant white non reactive crystals		245.60												
250			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 1949.90 E: 221.90

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-104

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN / FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
250	Track Mounted Sonic Drill	PQ Coring	LIMESTONE, fine grain, light brown, thin horizontal bedding, porous, many voids, abundant white non reactive crystals *(continued)*														
255						29											
260																	
265						30											
270																	
275						31											4.75"
280																	
285						32											
290																	
295						33											
300			*CONTINUED NEXT PAGE*														

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

Golder Associates

PROJECT No.: 1530539 / 0002

CLIENT: DTE

PROJECT: Sibley Quarry Closure

LOCATION: Sibley Quarry

N: 1949.90 E: 221.90

Survey Provided by: DTE Energy's Surveying Service, Dated 8/26/2015

RECORD OF MONITORING WELL: MW-104

DRILLING DATE: 7/16/2015

DRILLING CONTRACTOR: Cascade Drilling

DATUM: Local

INCLINATION: -90°

DEPTH SCALE FEET	DRILLING RIG	DRILLING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	No.	PENETRATION RATE (m/min)	COLOUR % RETURN	FLUSH	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	RQD %	FRACT. INDEX PER 0.3	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
300	Track Mounted Sonic Drill	PQ Coring	LIMESTONE, fine grain, light brown, thin horizontal bedding, porous, many voids, abundant white non reactive crystals *(continued)*															
305						34												4.75"
310					295.98													
			End of Borehole.		310.00													
315																		
320																		
325																		
330																		
335																		
340																		
345																		
350																		

Type: JN-Joint, FLT-Fault, SH-Shear, VN-Vein, FR-Fracture; BD-Bedding, FO-Foliation, CO-Contact, OR-Orthogonal, CL-Cleavage

Shape: PL-Planar, CU-Curved, UN-Undulating, ST-Stepped, IR-Irregular

Roughness: PO-Polished, K-Slickensided, SM-Smooth, Ro-Rough, VR-Very Rough

Infilling: Br-Brocken Rock, Bt-Biotite, Cl-Clay, Ch-Chlorite, Ca-Calcite, Ep-Epidote, Fe-Iron, Go-Gouge, Gr-Gravel, He-Hematite, Py-Pyrite, Qz-Quartz, Sa-Sand, Se-Sericite, Qfsp-Quartz Feldspar, Si-Silt, Su-Sulphide, Oth-Other

DEPTH SCALE

1 in to 6 ft

Golder Associates

SOIL CLASSIFICATION SYSTEM:

LOGGED: Brian Eustice

CHECKED: B. Johnson

WELL CONSTRUCTION LOG

WELL NO. MW-105

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE: Sibley Quarry CCR	3/22/16	3/30/16	231828.0002.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Mud/Water Rotary	590.71	593.28	300.0	8"/4.75"

Boring Location: Near pump house, E of quarry.	Personnel	Drilling Equipment:
N: 1469.07 E: 3370.82	Logged By - C. Scieszka Driller - J. Bacome	CME 750X

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Trenton	Wayne	MI	While Drilling: Date/Time After Drilling: Date/Time 4/19/16 18:45 ▼ Depth (ft bgs) 23.20

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 AU			10	**GRAVEL** mostly coarse gravel, trace to few sand, trace clay, gray (10YR 5/1), no odor, dry, loose. **SILTY CLAY WITH SAND** mostly clay, little to some silt, little medium to coarse sand, trace to few fine to coarse gravel, brown (10YR 4/3), mottled with black (10YR 2/1), no odor, moist, stiff.	CL-ML			
2 AU			20	**LIMESTONE** gray to white, high reaction to HCL.				
3 AU				▼				Surface casing set at 20 feet below ground surface.
4 AU			30	**SANDSTONE** coarse grained, brown, brittle, high reaction to HCL.				
5 AU			40	**LIMESTONE** dark gray to gray, trace to few black fragments present, medium reaction to HCL.				
6 AU			50	**SANDSTONE** coarse grained, brown, brittle, high reaction to HCL. **LIMESTONE** dark gray to gray, trace to few black fragments present, slight reaction to HCL.				
7 AU			60	**SANDSTONE** fine grained, brown, brittle, very slight reaction to HCL.				
8 AU			70	**LIMESTONE** gray, little calcite crystals, medium to high reaction to HCL. **SANDSTONE** fine grained, brown, brittle, slight reaction to HCL.				
9 AU			80	**LIMESTONE** gray to dark gray, no calcite crystals, medium to high reaction to HCL. **SANDSTONE** fine grained, brown, brittle, medium reaction to HCL.				

SOIL BORING WELL CONSTRUCTION LOG 231828.0002.GPJ TRC_CORP.GDT 5/23/16

Signature: [signature]

Checked By: R. Pulliam

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, Michigan
734.971.7080
Fax 734.971.9022

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
10 AU			90	Change to trace to few limestone cuttings mixed with sandstone cuttings, slight reaction to HCL at 85 feet.				
				Change to no limestone cuttings at 92 feet.				
11 AU			100					
12 AU				**LIMESTONE** grayish brown to bluish gray, flat angular cuttings, medium reaction to HCL.				
			110	Change to grayish brown, slight reaction to HCL at 112 feet.				
13 AU			120					
14 AU			130					
15 AU			140					
				Change to medium reaction to HCL at 142 feet.				
16 AU			150					
17 AU			160					
18 AU			170	**FRACTURE** 170 to 171 feet.				
				LIMESTONE grayish brown, slight reaction to HCL.				
19 AU			180					
				Change to high reaction to HCL at 182 feet.				
20 AU			190					
				Change to gray at 190 feet. Change to medium reaction to HCL at 192 feet.				
21								

WELL CONSTRUCTION LOG

WELL NO. MW-105

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
AU			200	Change to few to little black fragments present, slight to medium reaction to HCL at 202 feet.				
22 AU				**SANDSTONE** brown to yellowish brown, fine grained, calcite crystals present, slight to medium reaction to HCL.				
			210	Change to dark brown to black at 212 feet.				
23 AU			220					
24 AU				**LIMESTONE** dark gray to dark grayish brown, angular cuttings, trace to few crystals, slight to medium reaction to HCL.				
			230					
25 AU			240					
26 AU			250					
27 AU			260					
28 AU			270					
29 AU			280					
30 AU			290	**SANDSTONE** white, fine grained.				No recovery from 290 to 300 feet. Cuttings in mud-pan likely sandstone too fine for sieve.
31 AU			300	End of boring at 300 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 231828.0002.GPJ TRC_CORP.GDT 5/23/16

WELL CONSTRUCTION LOG

WELL NO. MW-106

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE: Sibley Quarry CCR	3/23/16	3/28/16	231828.0002.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Mud/Water Rotary	603.99	606.75	300.0	8"/4.75"

Boring Location: W of quarry, approximately 50 feet E of Fort Street.	Personnel	Drilling Equipment:
N: 3343.60 E: 71.70	Logged By - C. Scieszka Driller - J. Bacome	CME 750X

Civil Town/City/or Village:	County:	State:	Water Level Observations:		
Trenton	Wayne	MI	While Drilling: Date/Time		Depth (ft bgs)
			After Drilling: Date/Time	4/19/16 10:50	Depth (ft bgs) 189.37

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 AU			0	**TOPSOIL** dark brown (10YR 3/3), no odor, moist, dense.				
				SILTY CLAY mostly clay, little to some silt, low plasticity, dark grayish brown (10YR 4/2), no odor, moist, very stiff.	CL-ML			
				COAL ASH WITH COAL mostly coal ash, little coal fragments, black (10YR 2/1), white flecks, soft.				
			10	Change to no coal fragments at 5.0 feet.				
2 AU				**SILTY CLAY** mostly clay, little to some silt, low plasticity, brown (10YR 4/3), no odor, very stiff.				
			20					
3 AU				Change to trace to few medium to coarse sand at 25 feet.	CL-ML			
			30					
4 AU								
				LIMESTONE gray, low reaction to HCL.				
5 AU			40					Surface casing set at 42 feet.
6 AU								
			50					
7 AU				Change to dark gray, medium reaction to HCL at 55 feet.				
			60					
8 AU				Change to evidence of fossils present at 65 feet.				
			70					
9 AU				Change to gray, high reaction to HCL, no evidence of fossils at 77 feet.				
			80					

SOIL BORING WELL CONSTRUCTION LOG 231828.0002.GPJ TRC_CORP.GDT 6/3/16

Signature:

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, Michigan

734.971.7080
Fax 734.971.9022

Checked By: R. Pulliam

WELL CONSTRUCTION LOG

WELL NO. MW-106

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
10 AU			90	**LIMESTONE** gray, high reaction to HCL.				
11 AU			100	Change to grayish brown, low to medium reaction to HCL at 95 feet.				
12 AU			110					
13 AU			120					
14 AU			130	Change to trace to few calcite crystals present, medium to strong reaction to HCL at 122 feet.				
15 AU			140	Change to no calcite crystals, brown, no to low reaction to HCL at 132 feet.				
16 AU			150					
17 AU			160					
18 AU			170	**DOLOSTONE** dark gray, no reaction to HCL.				
19 AU			180					
20 AU			190	**LIMESTONE** little to some calcite crystals, gray to white, low reaction to HCL.				
21								

SOIL BORING WELL CONSTRUCTION LOG 231828.0002.GPJ TRC_CORP.GDT 6/3/16

WELL CONSTRUCTION LOG

WELL NO. MW-106

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
AU			200	**LIMESTONE** little to some calcite crystals, gray to white, low reaction to HCL. Change to few calcite crystals at 202 feet.				
22 AU			210					
23 AU			220					
24 AU			230					
25 AU			240					
26 AU			250					
27 AU			260					
28 AU			270					
29 AU			280					
30 AU			290					
31 AU			300	End of boring at 300 feet below ground surface.				

WELL CONSTRUCTION LOG

TRC

WELL NO. MW-107

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE: Sibley Quarry CCR	3/23/16	4/6/16	231828.0002.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Mud/Water Rotary	607.51	610.03	270.0	8"/4.75"/3.875"

Boring Location: Near Sibley Road gate, N of quarry.	Personnel	Drilling Equipment:
N: 5193.15 E: 1841.68	Logged By - C. Scieszka Driller - J. Bacome	CME 750X

Civil Town/City/or Village:	County:	State:	Water Level Observations:		
Trenton	Wayne	MI	While Drilling:	Date/Time	Depth (ft bgs)
			After Drilling:	Date/Time 4/19/16 07:51	Depth (ft bgs) 153.12

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 AU			0	**TOPSOIL** very dark grayish brown (10YR 3/2), no odor, dry, dense.				
				SILTY CLAY mostly clay, some silt, trace medium to coarse sand, medium plasticity, brown (10YR 4/3), no odor, dry, very stiff.	CL-ML			
2 AU			10	Change to few medium to coarse sand, few fine to coarse gravel at 5 feet.				
				SILTY CLAY WITH SAND AND GRAVEL mostly clay, little to some silt, little medium to coarse sand, little fine to coarse gravel, low to medium plasticity, brown (10YR 5/3), no odor, stiff.	CL-ML			
3 AU			20					
				SANDY CLAY mostly clay, little to some medium to coarse sand, dark grayish brown (10YR 4/2), no odor, stiff.	CL			
4 AU			30					
5 AU			40					
6 AU			50	**LIMESTONE** grayish brown to white, medium to high reaction to HCL.				
7 AU			60					Surface casing set at 60 feet.
8 AU			70	Change to brown at 72 feet.				
9 AU			80	Change to slight to medium reaction to HCL at 82 feet.				

SOIL BORING WELL CONSTRUCTION LOG 231828.0002.GPJ TRC_CORP.GDT 6/3/16

Signature: [signature]

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, Michigan

734.971.7080
Fax 734.971.9022

Checked By: R. Pulliam

WELL CONSTRUCTION LOG

WELL NO. MW-107

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
10 AU			90	**LIMESTONE** brown, slight to medium reaction to HCL.				
				Change to gray, high reaction to HCL at 92 feet.				
11 AU			100					
12 AU			110					Fractured zone at 105 feet, lost return.
13 AU			120					
14 AU								
15 AU			130	Change to grayish brown, medium to high reaction to HCL at 125 feet.				Advanced 4.5 inch casing to 127 feet, to case off fractured zone.
16 AU				Change to dark gray to gray, styolites present, low to medium reaction to HCL.				
17 AU			140	Change to no styolites at 137.5 feet.				Advanced 4.5 inch casing to 135 feet, to case off fractured zone. Continue drilling with 3 7/8" tri-cone drill bit at 135 feet.
18 AU			150	Change to slight reaction to HCL at 142 feet.				
19 AU				▼ Change to slight to medium reaction to HCL at 152 feet.				
20 AU			160	**SANDSTONE** fine grained, grayish brown, low reaction to HCL.				
21 AU			170	**DOLOSTONE** gray to dark gray to grayish brown, no reaction to HCL.				
22 AU			180	**LIMESTONE** dark gray, little to some calcite crystals present, low to medium reaction to HCL. Change to gray to grayish brown, trace to few calcite crystals present at 177 feet. Change to no calcite crystals present at 181 feet.				
23 AU			190					Temporarily lost return, likely smaller fractured zone at approximately 187 feet.

WELL CONSTRUCTION LOG

WELL NO. MW-107

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
			200	**LIMESTONE** gray to grayish brown, low to medium reaction to HCL.				
24 AU								
			210	Change to mostly gray to grayish brown, some dark gray, medium reaction to HCL.				
25 AU								
			220	Change to gray to grayish brown at 221 feet.				
26 AU				**SANDSTONE** fine grained, grayish brown. **LIMESTONE** gray to brownish gray, slight reaction to HCL.				
			230					
27 AU								
			240					
28 AU				Change to gray to brown slight reaction to HCL at 243.5 feet. Change to gray to grayish brown, very slight reaction to HCL.				
			250					
29 AU								
			260	**FRACTURE** 258 to 259 feet. **LIMESTONE** brown to dark brown, very slight reaction to HCL.				
30 AU				Change to medium reaction to HCL at 265 feet.				
			270	End of boring at 271.0 feet below ground surface.				Ended boring due to smaller diameter tooling locking up.
			280					
			290					
			300					

WELL CONSTRUCTION LOG

TRC

WELL NO. MW-108

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE: Sibley Quarry CCR	3/21/16	3/29/16	231828.0002.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stock Drilling	Mud/Water Rotary	600.22	602.96	300.0	8"/4.75"

Boring Location: S of quarry.	Personnel	Drilling Equipment:
N: 961.12 E: 2446.71	Logged By - C. Scieszka Driller - J. Bacome	CME 750X

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Trenton	Wayne	MI	While Drilling: Date/Time After Drilling: Date/Time 4/19/16 13:16 ▼ Depth (ft bgs) 82.15

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 AU			0	**GRAVEL** mostly fine to coarse gravel, trace to few silt, gray (10YR 4/1), no odor, moist, loose.				
				SAND FILL mostly fine to coarse sand, trace to few slag, trace to few cinders, black (10YR 2/1), moist, no odor, loose.	SW			
2 AU			10	**SAND** mostly fine to coarse sand, trace silt, very dark gray (10YR 3/1), mothball odor, loose, some wood fragments present.				
				CLAYEY SAND mostly fine to coarse sand, little to some clay, trace to few fine gravel, dark grayish brown (10YR 4/2), no odor, loose.				
3 AU			20	Change to brown (10YR 4/3) at 15 feet.	SC			
4 AU			30	**SANDY CLAY WITH SILT** mostly clay, little to some fine to coarse sand, few to little silt, medium plasticity, brown (10YR 4/3), no odor, soft.	CL-ML			
5 AU			40	**SILTY CLAY** mostly clay, little to some silt, low plasticity, brown (10YR 4/3), no odor, stiff.				
6 AU			50		CL-ML			
7 AU			60					
8 AU			70					
9 AU			80	**LIMESTONE** gray to dark gray, 1 foot thick soft interval from 76 to 77 feet.				
				▼ Change to dark gray , low to medium HCL reaction, darker grained fragments present.				

SOIL BORING WELL CONSTRUCTION LOG 231828.0002.GPJ TRC_CORP.GDT 5/3/16

Signature: _____

Checked By: R. Pulliam

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, Michigan
734.971.7080
Fax 734.971.9022

WELL CONSTRUCTION LOG

WELL NO. MW-108

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
10 AU			90	Change to dark gray to grayish brown, no dark grained fragments present, high HCL reaction.				
11 AU			100					
12 AU			110					
13 AU			120	**SANDSTONE** fine grained, brown, very slight HCL reaction.				
14 AU			130	**LIMESTONE** dark gray to grayish brown, no dark grained fragments present, high HCL reaction.				
15 AU			140	**DOLOSTONE** dark gray, no HCL reaction.				
16 AU			150	**LIMESTONE** gray to grayish brown, slight HCL reaction.				
17 AU			160	Change to brown at 152 feet.				
18 AU			170	Change to gray, medium reaction to HCL at 162 feet.				
19 AU			180	Change to slight reaction to HCL at 172 feet.				
20 AU			190	Change to medium reaction to HCL at 182 feet.				
21				Change to slight reaction to HCL at 192 feet.				

WELL CONSTRUCTION LOG

WELL NO. MW-108

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
AU			200	**LIMESTONE** gray, slight reaction to HCL.				
22 AU			210	Change to medium reaction to HCL at 212 feet.				
23 AU			220					
24 AU			230					
25 AU			240					
26 AU			250	Change to high HCL reaction at 252 feet.				
27 AU			260	Change to dark gray to gray, few dark grained fragments, medium reaction to HCL at 262 feet.				
28 AU			270	Change to slight reaction to HCL at 272 feet.				
29 AU			280					
30 AU			290					
31 AU			300	End of boring at 300.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG 231828.0002.GPJ TRC_CORP.GDT 6/3/16

WELL CONSTRUCTION LOG

TRC

WELL NO. MW-108A

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
DTE: Sibley Quarry CCR	1/23/17	1/24/17	265513.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Pearson Drilling	Mud/Air Rotary	590.5	594.06	300.0	10.625"/5.625"

Boring Location: N of King Road Approximatley 20 feet W of E access drive to substation, 10 feet S of substation fence.
N: 174.17 E: 1821.55

Personnel
Logged By - J. Krenz
Driller - B. Pearson

Drilling Equipment: GEFCO 30K

Civil Town/City/or Village:	County:	State:
Trenton	Wayne	MI

Water Level Observations:
While Drilling: Date/Time 1/24/17 00:00 ▽ Depth (ft bgs) 50.00
After Drilling: Date/Time 1/25/17 10:00 ▼ Depth (ft bgs) 49.16

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 CS	100		0	**CLAY** mostly clay, trace to few sand, medium to high plasticity, brown (10YR 5/3), no odor. Change to few fine to coarse sand at 2.5 feet.				
				Change to few fine to medium sand, trace gravel, low to med plasticity, stiff at 6.5 feet.	CL			
			10	Change to gray (10YR 5/1) at 10.0 feet.				
2 CS	100			**CLAY WITH SAND** mostly clay, little medium to coarse sand, low plasticity, gray (10YR 5/1), no odor, soft.				
			20	Change to trace fine gravel at 20.0 feet.	CL			
			30					
3 CS	100			**CLAY** mostly clay, trace to few fine to medium sand, gray (10YR 5/1), medium to high plasticity, no odor, low density.	CL			
				LIMESTONE gray to white, low reaction to HCl.				
			40	Change to medium reaction to HCl at 40.0 feet.				
				SANDSTONE medium grained, grayish brown (10YR 5/2), no reaction to HCl.				
			50 ▼					Suface casing set at 47.0 feet below ground surface. Open hole beneath surface casing.
4 CS	100			**LIMESTONE** dark gray (10YR 4/1), low reaction with HCl.				
			60	Change to light gray (10YR 7/2) at 60.0 feet.				
5 CS	100			**SANDSTONE** fine to medium grained, light brownish gray (10YR 6/2), no reaction to HCl.				
			70					

SOIL BORING WELL CONSTRUCTION LOG 231828.0002.GPJ TRC_CORP.GDT 265513.0000.0000 4/14/17

Signature: [signature] 4-13-17 Firm: TRC Environmental Fax

Checked By: C. Scieszka

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
			80	**SANDSTONE**				
6 CS	100		90	Change to gray (10YR 5/1) at 88.0 feet.				
				Change to grayish brown (10YR 5/2) at 95.0 feet.				
7 CS	100		100	Change to medium grained, pale brown (10YR 6/3), no reaction to HCl at 100.0 feet.				
			110					
				Change to grayish brown (10YR 5/2) at 166.0 feet.				
8 CS	100		120	**DOLOSTONE** gray (10YR 5/1), no reaction to HCl.				
			130					
			140	**LIMESTONE** grayish brown (10YR 5/2), slight reaction to HCl.				
9 CS	100			Change to light gray (10YR 7/1), no reaction to HCl at 146.0 feet.				
			150					
				Change to gray (10YR 6/1) at 156.0 feet.				
10 CS	100		160					

WELL CONSTRUCTION LOG

TRC

WELL NO. MW-108A

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
			170	**SANDSTONE** fine to medium grained, pale brown (10YR 6/3), no reaction to HCl.				
11 CS	100		180	**LIMESTONE** gray (10YR 5/1), slight reaction to HCl.				
			190					
12 CS	100		200	**SANDSTONE** medium grained, brown (10 YR 5/3), no reaction to HCl.				
			210					
13 CS	100		220	**DOLOSTONE** brown (10YR 4/3), slight reaction to HCl.				
			230					
14 CS	100		240	**SANDSTONE** fine grained, light gray (10YR 7/1), no reaction to HCl.				
			250					
			260					

TRC

WELL CONSTRUCTION LOG

WELL NO. MW-108A

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
15 CS	100		270	**SANDSTONE** Change to medium grained, gray (10YR 5/1) at 273.0 feet.				
16 CS	100		280 290					
17 CS	100		300	End of Boring at 300.0 feet below ground surface.				
			310 320 330 340 350					