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Date: October 17, 2017

To: Operating Record

From: Harold D. Register, Jr., P.E.

RE: Groundwater Monitoring System Certification, §257.91(f)
J.H. Campbell Generating Complex, JH Campbell Unit 1&2 Bottom Ash Pond

Introduction

According to Title 40 Code of Federal Regulations (40 CFR) Part 257, Subpart D, §257.91(f); the owner or operator of a Coal Combustion Residual (CCR) management unit must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system at the CCR management unit has been designed and constructed to meet the requirements of §257.91. Additionally, §257.91(a) details a performance standard requiring the system monitor the uppermost aquifer and include a minimum of at least one upgradient and three downgradient monitoring wells, and that if the uppermost aquifer monitoring system includes the minimum number of wells, the basis supporting use of only the minimum.

Groundwater Monitoring System

A groundwater monitoring system has been established for the JHC Unit 1&2 Bottom Ash Pond, which established the following locations for determining background groundwater quality and detection monitoring.

Background:

JHC MW-15023	JHC MW-15024	JHC MW-15025
JHC MW-15026	JHC MW-15027	JHC MW-15028

Downgradient:

JHC MW-15001	JHC MW-15002	JHC MW-15003
JHC MW-15004	JHC MW-15005	

Provided herein, as required by §257.91(f), is certification from a qualified professional engineer that the groundwater monitoring system at Consumers Energy JH Campbell Unit 1&2 Bottom Ash Pond meets the requirements of §257.91.

CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.91]

I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.91 (40 CFR Part 257.91), I attest that this Groundwater Monitoring System has been designed and constructed to meet the requirements of 40 CFR 257.91. The report is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.91.

Harold D. Register Jr.

Signature

October 17, 2017

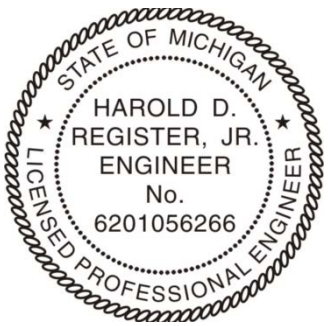
Date of Certification

Harold D. Register, Jr., P.E.

Name

6201056266

Professional Engineer Certification Number



10/17/2017

ENCLOSURES

ARCADIS (2016). "*Summary of Monitoring Well Design, Installation, and Development – Bottom Ash Pond Unit 1-2N/1-2S*"

ARCADIS Design & Consultancy for natural and built assets

Consumers Energy Company

SUMMARY OF MONITORING WELL DESIGN, INSTALLATION, AND DEVELOPMENT – BOTTOM ASH POND UNIT 1-2N/1-2S

J.H. Campbell Electric Generation Facility – West Olive, Michigan

May 13, 2016

Gregory E. Zellmer, P.G.

Certified Project Manager/Senior Geologist

Mark Robert Klemmer, PE

Printed Name of Registered Professional Engineer

Signature of Registered Professional Engineer

Registration Number: 62010-49167 State: MI

Date: 5/13/16

Summary of Monitoring Well Design, Installation, and Development – Bottom Ash Pond Unit 1-2N/1-2S

J.H. Campbell Electric Generation Facility – West Olive, MI

Prepared for:

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Date:

May 13, 2016

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1 INTRODUCTION

ARCADIS has prepared this Summary of Monitoring Well Design, Installation, and Development (Report) to summarize monitoring well installation activities for Unit 1-2N/1-2S at the J.H. Campbell electric generation facility (JHC), located in West Olive, Michigan (Site). The groundwater monitoring system for unit consists of eight background wells (JHC MW-15023 through JHC MW-15030) and five downgradient wells (JHC MW-15001 through JHC MW-15005) as depicted on Figure 1. Monitoring wells were installed to achieve compliance under the recently published 40 CFR Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities (specifically Section 257.91(e)(1)). This Report summarizes the groundwater monitoring well installation activities, including drilling procedures, well locations, well construction details, development activities, and hydraulic testing results. The methodology used in the field activities conforms to federal and state guidance and industry standards.

2 OBJECTIVES

The objectives of this report are to document the work completed at the Site, including:

- Advancement of soil borings
- Monitoring well installation
- Monitoring well development
- Hydraulic testing

The following section describes each of these elements in more detail.

3 FIELD ACTIVITIES

3.1 Soil Borings

Thirteen (13) soil borings (JHC MW-15001 through JHC MW-15005 and JHC MW-15023 through JHC MW-15030) were completed using rotosonic-drilling methods operated by Mateco Drilling Company of Grand Rapids, Michigan with oversight provided by an ARCADIS geologist. Rotosonic drilling uses powered equipment to collect subsurface-soil samples. The rotosonic drill rig advances a length of pipe into the ground through a combination of hydraulic force and high-frequency vibration. The high-frequency vibrations allow the pipe to advance through various types of soil and bedrock producing a high-quality, continuous soil core within the pipe. Each length of pipe was extracted from the ground and emptied into a clear plastic liner for logging. This process was repeated until the total depth of the boring was reached.

Continuous soil cores were collected during drilling to provide detailed lithological and stratigraphic data. An on-site geologist inspected each core, classified the contents, and recorded the observations on an ARCADIS boring log field sheet (**Appendix A**). A photographic log showing the general soil types observed at the Site is included as **Appendix B**. All soil borings were completed as monitoring wells, and details of monitoring well installation are provided in the following section.

3.2 Monitoring Well Installation

Once the total depth of the soil boring was reached, a permanent monitoring well was installed in the uppermost aquifer unit for completion of monitoring wells. Monitoring wells were installed through the rotosonic drill rig piping allowing the driller to construct the monitoring well, while simultaneously removing the drill piping. Monitoring wells were constructed with 2-inch inside diameter Schedule 40, polyvinyl chloride (PVC) screens and PVC risers. The well screens have a slot size of 0.010 inch and are 5 to 10 feet in length. A medium-grained sand pack was placed around each well screen to a height 1 to 2 feet above the top of the well screen. A 0.5 to 7 foot thick bentonite grout seal was placed on top of the sand pack. Where possible, the remainder of the annular space was sealed with a cement-bentonite grout to a depth approximately 1 to 23-foot below ground surface.

The wells were finished at the surface using a 3-foot long, locking, stickup well cover set in a 24 inch by 24 inch concrete pad. Well construction logs are included in **Appendix A**; well construction is summarized in **Table 1**; well locations are shown on **Drawing SG-22345**. Wells were labeled according to Consumers Energy's site-specific nomenclature provided to ARCADIS. The CE construction manager supplied keyed-alike locks for each well that match the existing well keys.

3.3 Monitoring Well Development

Newly installed monitoring wells were allowed to set for a minimum of 48 hours, after which the wells were developed. Well development consisted of the gentle swabbing of the entire screened interval with a surge block. After surging the well screen, water was evacuated using a submersible pump. A "flow-thru cell" and a turbidity meter were utilized to monitor indicator parameters (turbidity, pH, temperature, oxidation-reduction potential (ORP), and conductivity) to determine if groundwater parameters had appropriately stabilized during the development activities at each monitoring well. The stabilization parameters are provided below in **Table 2**. Indicator parameters were recorded in field notes and the development process continued until development water was free of visible sediment, stabilization of the field parameters, and below 10 Nephelometric Turbidity Units (NTUs). The volume of groundwater removed during development and its appearance was recorded in the field logbook. If drilling fluids were utilized during well installation, the volume of fluids used was recorded in the field logbook. This volume was removed in addition to the volume required for standard development. Monitoring well development details are included in **Table 1**.

Table 2. Groundwater Parameter Stabilization Criteria

Groundwater Parameter	Stabilization Criteria
pH	3 readings within +/- 0.1 Standard Units
Specific Conductance (SpC)	3 readings within +/- 3% mS/cms
Temperature	3 readings within +/- 3%
Oxidation-Reduction Potential (ORP)	3 readings within +/- 10 mV
Turbidity	3 readings within +/- 10% or <1 when < 10 NTU
Dissolved Oxygen (DO)	3 readings within +/- 0.3 mg/L

3.4 Hydraulic Testing

On November 10, 2015, Arcadis conducted hydraulic tests (slug tests) at nine monitoring wells (JHC MW-15005, JHC MW-15007, JHC MW-15015, JHC MW-15018, JHC MW-15024, JHC MW-15028, JHC MW-15030, JHC MW-15033, and JHC MW-15036) at the Site. Well construction logs are included in **Appendix A**; well construction details are summarized in **Table 1.**

During the slug testing activities, three tests were completed at each of the monitoring wells. The slug tests at these wells were completed to estimate hydraulic conductivity (K) by introducing a water table displacement by removing a known volume of water or depressing the water level by compressed air and measuring the rate of recovery. With the exception of the tests competed at JHC MW-15015, the tests at all wells were completed using a disposable bailer to remove a known volume of water. The bailer used at all wells was 1.5-inches in diameter and 36-inches long. At all the wells where the bail-down slug was used, the first two tests were competed using half the bailer size and the last test was completed using the full size bailer. The tests at JHC MW-15015 were completed using the pneumatic slug test method where a manifold and pump was used to depress the water level. All wells have casing and screen diameters of 2-inches and filter pack diameter of 8-inches. All wells, with the exception of JHC MW-15015 were screened across the water table at the time of well development and hydraulic testing. JHC MW-15015 was screened 2.57 feet below the water table at the time of hydraulic testing. At all wells, a pressure transducer was set to record at 0.5 second intervals to measure static head, displacement and recovery data.

The slug tests at the nine monitoring wells reached full recovery within approximately 7 to 35 seconds. Recovery data collected from the wells were analyzed using the applicable analytical solution with AQTESOLV® for Windows©. Based on diagnostic analyses, the solution utilized at most of the recovery data was the unconfined KGS model (1994) that accounts for partial penetration effects. The unconfined Bouwer and Rice (1976 and 1989) solution was utilized for recovery data at JHC MW-15030. The results indicated an estimated hydraulic conductivity range from 21 to 139 feet per day (ft/d) with an average of 73 ft/d and a geometric mean of 62 ft/d. The results of this test seem to be a reasonable fit with the sandy formation of the unconfined aquifer where the wells are screened. The monitoring well locations where slug tests were conducted are shown on **Drawing SG-22345** and the results of the hydraulic conductivity tests are presented in **Table 3** and **Appendix C**.

TABLES

Table 1
Monitoring Well Construction and Development Summary
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

ARCADIS Design & Consultancy for natural and built assets

MW ID	Former MW ID	Site Coordinates				Date Installed	Geologic Unit of Screen Interval	Well Construction	Well Screen Length (ft)	Screen Interval (ft bgs)	Development Details				
		Northing	Easting	TOC	Ground Elevation						Static DTW (ft below TOC)	Total Depth	Pumping DTW (ft below TOC)	Gallons Removed	Final Turbity (NTU)
Downgradient MW															
JHC MW-15001	---	518586.88	12633422.01	607.02	609.53	9/16/2015	Sand	2" PVC, 10 slot	5	3.5 - 8.5	9.31	11.72	NR	25	3.22
JHC MW-15002	---	518378.92	12633974.82	625.97	628.87	9/16/2015	Sand	2" PVC, 10 slot	10	28 - 38	24.51	41.05	24.75	120	1.69
JHC MW-15003	---	518069.86	12633990.37	628.31	630.63	9/17/2015	Sand	2" PVC, 10 slot	10	28 - 38	30.57	40.12	30.84	90	4.40
JHC MW-15004	---	517864.56	12633547.12	624.92	628.44	9/17/2015	Sand	2" PVC, 10 slot	10	24 - 34	31.67	37.48	31.86	70	3.60
JHC MW-15005	---	517781.42	12633905.01	624.37	627.30	9/18/2015	Sand	2" PVC, 10 slot	10	27 - 37	33.26	40.10	33.51	45	2.11
Background MW															
JHC MW-15023	---	521927.21	12638205.16	617.01	619.98	10/1/2015	Sand	2" PVC, 10 slot	10	14 - 24	18.91	27.68	NR	130	7.94
JHC MW-15024	---	522366.01	12637322.68	613.79	616.62	10/1/2015	Sand	2" PVC, 10 slot	10	7 - 17	14.12	19.93	14.49	135	3.31
JHC MW-15025	---	522702.98	12636668.15	614.14	617.17	10/1/2015	Sand	2" PVC, 10 slot	10	7 - 17	13.50	19.94	14.42	90	2.32
JHC MW-15026	---	522495.09	12635971.82	615.09	618.04	10/2/2015	Sand	2" PVC, 10 slot	10	8 - 18	15.34	21.02	15.97	180	8.88
JHC MW-15027	---	522394.86	12635097.51	614.77	617.30	10/2/2015	Sand	2" PVC, 10 slot	10	10 - 20	15.85	22.99	16.36	90	4.31
JHC MW-15028	---	521646.20	12634105.34	611.02	613.80	10/2/2015	Sand	2" PVC, 10 slot	10	8 - 18	14.38	20.82	14.62	220	9.80
JHC MW-15029	---	520503.52	12633774.30	608.08	610.95	10/5/2015	Sand	2" PVC, 10 slot	10	8 - 18	10.03	20.96	10.26	105	4.21
JHC MW-15030	---	519760.83	12633044.37	604.05	607.17	10/5/2015	Sand	2" PVC, 10 slot	10	4 - 14	7.99	16.93	8.30	NR	8.81
Hydraulic Testing MW															
JHC MW-15005	---	517781.42	12633905.01	624.37	627.30	9/18/2015	Sand	2" PVC, 10 slot	10	27 - 37	33.26	40.10	33.51	45	2.11
JHC MW-15007	---	517540.50	12635742.72	624.82	627.70	9/21/2015	Sand	2" PVC, 10 slot	10	22 - 32	29.28	34.75	29.36	55	2.64
JHC MW-15015	---	519715.11	12634186.63	632.46	635.20	9/28/2015	Sand	2" PVC, 10 slot	10	28 - 38	28.57	41.28	29.48	90	5.09
JHC MW-15018	---	521075.54	12635979.61	614.26	617.02	9/28/2015	Sand	2" PVC, 10 slot	10	10 - 20	16.23	22.95	NR	80	3.99
JHC MW-15024	---	522366.01	12637322.68	613.79	616.62	10/1/2015	Sand	2" PVC, 10 slot	10	7 - 17	14.12	19.93	14.49	135	3.31
JHC MW-15028	---	521646.20	12634105.34	611.02	613.80	10/2/2015	Sand	2" PVC, 10 slot	10	8 - 18	14.38	20.82	14.62	220	9.80
JHC MW-15030	---	519760.83	12633044.37	604.05	607.17	10/5/2015	Sand	2" PVC, 10 slot	10	4 - 14	7.99	16.93	8.30	NR	8.81
JHC MW-15033	---	521075.81	12638598.12	618.08	620.99	10/6/2015	Sand	2" PVC, 10 slot	10	16 - 26	22.93	28.78	23.2	120	5.47
JHC MW-15036	MW-B6	520099.80	12638094.34	617.94	618.34	3/13/2001	Sand	2" PVC, 10 slot	10	20 - 30	NA	NA	NA	NA	NA

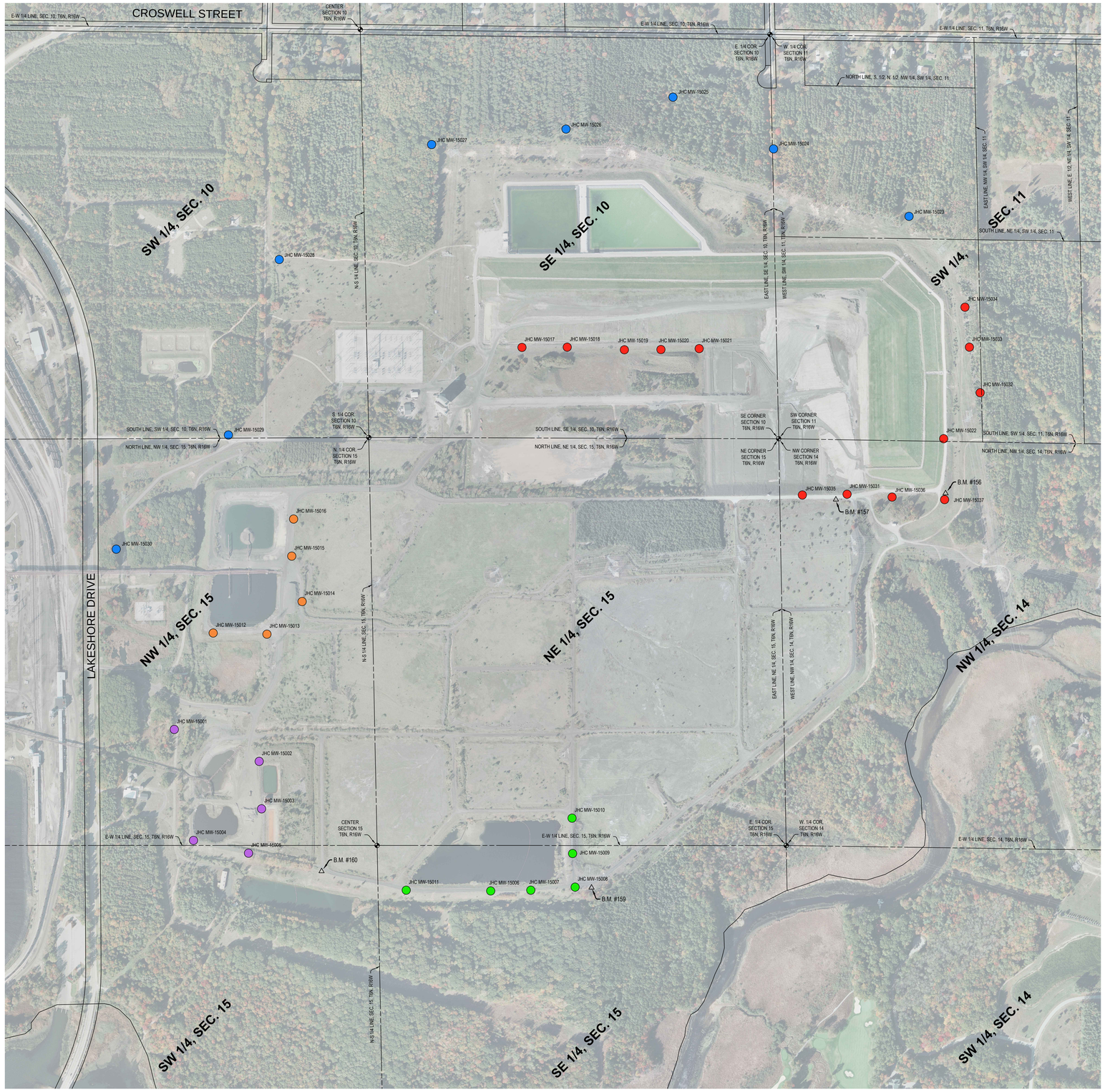
Notes:
ft = feet
bgs = below ground surface
TOC = top of casing
NR = Not recorded
NA = Not applicable

Table 3
Estimated Hydraulic Conductivity (K) Values
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Well ID	Test	H^0 (ft)	H^* (ft)	K (ft/d)	K (cm/sec)	Slug Test Solution
JHC MW-15005	2	0.738	0.844	61	2.15E-02	KGS Model (Hyder et. al, 1994)
	3	1.422	1.69	58	2.05E-02	KGS Model (Hyder et. al, 1994)
	Average			*60*	*2.10E-02*	
JHC MW-15036	2	0.777	0.844	118	4.16E-02	KGS Model (Hyder et. al, 1994)
	3	1.219	1.69	139	4.90E-02	KGS Model (Hyder et. al, 1994)
	Average			*129*	*4.53E-02*	
JHC MW-15007	1	0.629	0.844	130	4.59E-02	KGS Model (Hyder et. al, 1994)
JHC MW-15015	2	0.879	1.15	22	7.76E-03	KGS Model (Hyder et. al, 1994)
	3	1.98	2.31	21	7.41E-03	KGS Model (Hyder et. al, 1994)
	Average			*22*	*7.59E-03*	
JHC MW-15024	2	0.801	0.844	49	1.73E-02	KGS Model (Hyder et. al, 1994)
	3	1.534	1.69	45	1.59E-02	KGS Model (Hyder et. al, 1994)
	Average			*47*	1.66E-02	
JHC MW-15028	1	0.704	0.844	104	3.67E-02	KGS Model (Hyder et. al, 1994)
	3	1.515	1.69	86	3.03E-02	KGS Model (Hyder et. al, 1994)
	Average			*95*	*3.35E-02*	
JHC MW-15033	2	0.669	0.844	*74*	*2.61E-02*	KGS Model (Hyder et. al, 1994)
JHC MW-15030	2	0.701	0.844	*100*	*3.53E-02*	Bouwer-Rice (1976)
	3	1.194	1.69	*87*	*3.07E-02*	Bouwer-Rice (1976)
	Average			*94*	*3.30E-02*	
JHC MW-15018	1	0.732	0.844	*34*	*1.20E-02*	KGS Model (Hyder et. al, 1994)
	3	1.486	1.69	*33*	*1.16E-02*	KGS Model (Hyder et. al, 1994)
	Average			*34*	*1.18E-02*	
Over all Average				***73***	***2.56E-02***	
Over all Geometric mean				***62***	***2.19E-02***	
Minimum				***21***	***7.41E-03***	
Maximum				***139***	***4.90E-02***	

Note:
H^0 = initial displacement
H^* = expected (calculated) displacement
cm/sec = centimeters per second
ft = feet
ft/d = feet per day

FIGURES



BENCHMARKS

BENCHMARK #150 ELEV. = 611.72 (NAVD88)
Set railroad spike in West side of power pole 32'± East of centerline of old Hiawatha Drive, 1000'± North of Polk Street.

BENCHMARK #151 ELEV. = 612.77 (NAVD88)
Set on top of top bolt on West side of Northwest tower leg of middle tower of three running North-South.

BENCHMARK #152 ELEV. = 620.75 (NAVD88)
Set on top of top bolt on Southwest side of South tower leg of North-most tower.

BENCHMARK #153 ELEV. = 618.84 (NAVD88)
Set on top of top bolt on North side of Northwest tower leg.

BENCHMARK #154 ELEV. = 614.44 (NAVD88)
Set on top of top bolt on North side of Northwest tower leg, 50'± East of two-track to North extended.

BENCHMARK #155 ELEV. = 619.32 (NAVD88)
JHC Control Point #33 monument, 100'± South and 100'± West of woods line in Northeast corner of site.

BENCHMARK #156 ELEV. = 617.12 (NAVD88)
JHC Control Point #34 monument, approximately at top of bank, Southeast part of site, 60'± Southeast of gravel drive, approximately at Southeast corner of grassy mound.

BENCHMARK #157 ELEV. = 630.91 (NAVD88)
JHC Control Point #35 monument, 7'± South of South edge of gravel drive, 120'± West of centerline of gravel to South, approximately at Southwest corner of grassy mound.

BENCHMARK #158 ELEV. = 631.45 (NAVD88)
JHC Control Point monument, no #, on top of bank approximately at point of intersection of gravel road to North and Southwest , 22'± South of centerline of gravel road at Southeast corner of site.

BENCHMARK #159 ELEV. = 632.77 (NAVD88)
JHC Control Point monument, no #, 0.5' above ground level, approximately at point of intersection of centerline of gravel road to Northeast and West 30'± South of centerline of gravel road on top of bank.

BENCHMARK #160 ELEV. = 631.70 (NAVD88)
JHC Control Point monument, 0.25'± above ground level, at top of bank 22'± South of centerline "T" intersection of gravel drive roads going East, West and North, approximately at centerline point of intersection of centerline to North and East.

BENCHMARK #161 ELEV. = 628.67 (NAVD88)
Set railroad spike in Northwest side of light pole, 5' West of fence, 100'± South of Northwest corner of fence surrounding a pond and a metal building, approximate Southwest part of site.

BENCHMARK #162 ELEV. = 633.81 (NAVD88)
Set on top of bolt on East side on East side of Southeast tower leg, North-most tower of three, North and East of Monitor Well 15013 (Tower #6810).

BENCHMARK #163 ELEV. = 635.03 (NAVD88)
Set on top of steel post holding bird house #150, across gravel road from Northeast corner of ash pond.

TYPICAL INSTRUMENTATION STRUCTURE

JHC MW-15012

JHC MW-15014

JHC MW-15018

JHC MW-15029

Randal J. Vugteveen
Professional Surveyor No. 28429
Nederveld, Inc.
rvugteveen@nederveld.com

SURVEY POINT NUMBER	INSTRUMENTATION STRUCTURE	NORTHING NAD83 ADJ.2011	EASTING INTERNATIONAL FT.	GROUND ELEVATION (TOP OF CONCRETE) (NAVD88)	TOP OF CASING ELEVATION (NAVD88)	LATITUDE (DECIMAL DEGREES)	LONGITUDE
70035	JHC MW-15001	518586.883	12633422.010	607.02	609.53	42.908415	-86.195653
70034	JHC MW-15002	518378.917	12633974.821	625.97	628.87	42.907878	-86.193573
70033	JHC MW-15003	518069.863	12633990.368	628.31	630.63	42.907031	-86.193490
70032	JHC MW-15004	517864.558	12633547.120	624.92	628.44	42.906441	-86.195127
70031	JHC MW-15005	517781.423	12633905.007	624.37	627.30	42.906234	-86.193785
70028	JHC MW-15006	517535.735	12635481.661	624.74	627.58	42.905654	-86.187881
70027	JHC MW-15007	517540.502	12635742.724	624.82	627.70	42.905683	-86.186908
70025	JHC MW-15008	517560.390	12636031.246	632.43	635.30	42.905754	-86.185833
70024	JHC MW-15009	517779.126	12636014.800	632.33	635.32	42.906353	-86.185912
70023	JHC MW-15010	518009.361	12636011.459	632.55	635.57	42.906985	-86.185943
70029	JHC MW-15011	517540.496	12634931.588	627.71	630.83	42.905635	-86.189935
70045	JHC MW-15012	519214.841	12633675.278	632.59	635.66	42.910153	-86.194759
70046	JHC MW-15013	519207.188	12634025.153	632.40	635.25	42.910153	-86.193452
70044	JHC MW-15014	519419.850	12634254.118	635.13	638.18	42.910750	-86.192615
70043	JHC MW-15015	519715.111	12634186.634	632.46	635.20	42.911556	-86.192891
70042	JHC MW-15016	519956.792	12634198.522	631.81	634.64	42.912220	-86.192866
70037	JHC MW-15017	521074.309	12635685.320	613.69	616.61	42.915374	-86.187407
70038	JHC MW-15018	521075.536	12635979.612	614.26	617.02	42.915394	-86.186309
70039	JHC MW-15019	521058.673	12636351.996	609.81	612.86	42.915370	-86.184918
70040	JHC MW-15020	521059.974	12636589.953	609.04	611.90	42.915388	-86.184030
70041	JHC MW-15021	521065.933	12636839.055	610.70	613.65	42.915419	-86.183100
70014	JHC MW-15022	520479.719	12638430.236	620.92	623.79	42.913905	-86.177114
70010	JHC MW-15023	521927.205	12638205.162	617.01	619.98	42.917863	-86.178071
70056	JHC MW-15024	522366.013	12637322.677	613.79	616.62	42.919014	-86.181400
70007	JHC MW-15025	522702.978	12636668.146	614.14	617.17	42.919900	-86.183870
70006	JHC MW-15026	522495.091	12635971.882	615.09	618.04	42.919288	-86.186452
70057	JHC MW-15027	522394.860	12635097.509	614.77	617.30	42.918961	-86.189708
70002	JHC MW-15028	521646.198	12634105.336	611.03	613.80	42.916849	-86.193350
70000	JHC MW-15029	520503.524	12633774.295	608.08	610.95	42.913694	-86.194493
70036	JHC MW-15030	519760.827	12633044.373	604.05	607.17	42.911613	-86.197157
70020	JHC MW-15031	520118.003	12637801.509	632.94	635.87	42.912876	-86.179432
70013	JHC MW-15032	520779.281	12638667.931	611.32	614.29	42.914741	-86.176251
70012	JHC MW-15033	521075.809	12638598.117	618.08	620.99	42.915550	-86.176536
70011	JHC MW-15034	521335.834	12638568.896	612.90	615.97	42.916262	-86.176666
70022	JHC MW-15035	520112.933	12637510.259	632.53	634.28	42.912844	-86.180518
70019	JHC MW-15036	520099.800	12638094.344	617.94	618.34	42.912843	-86.178337
70017	JHC MW-15037	520083.044	12638436.693	614.28	616.06	42.912817	-86.177058

STATION	DESCRIPTION	WITNESSES	NORTHING (PLANT DATUM)	EASTING (PLANT DATUM)	NORTHING (UNIT 1 & 2)	EASTING (UNIT 1 & 2)	ELEVATION (PLANT DATUM)	ELEVATION (NAVD88 DATUM)
NED 1	SET 3-1/4" DOMED ALUMINUM CAP ON 3/4" ALUMINUM TOP SECURITY ROD MONUMENT		16259.8663	12360.7163	-----	-----	607.357	606.862
	DEPTH = 43' TO REFUSAL							
	SET MAG IN EAST SIDE OF POWER POLE	N26°W 90.83'						
	SET MAG IN NORTH SIDE OF POWER POLE	S63°W 185.96'						
	SOUTHWEST FACE OF S.B.C. RISER	N54°E 39.19'						
NED 2	SET 3-1/4" DOMED ALUMINUM CAP ON 3/4" ALUMINUM TOP SECURITY ROD MONUMENT		16584.3789	12791.7633	-----	-----	608.150	607.655
	DEPTH = 43' TO REFUSAL							
	SET "X" ON SOUTH LEG OF TRANSMISSION LINE TOWER	N25°E 82.25'						
	WEST FACE OF FENCE POST AT SOUTWEST CORNER OF FENCE AROUND SUBSTATION	N90°E 89.54'						
	SET MAG NAIL IN NORTH SIDE OF 10" PINE	S52°E 59.82'						
NED 3	SET 3-1/4" DOMED ALUMINUM CAP ON 3/4" ALUMINUM TOP SECURITY ROD MONUMENT		16566.3834	13451.8335	-----	-----	609.457	608.962
	DEPTH = 47' TO REFUSAL							
	SOUTHEAST CORNER OF METAL GARAGE BUILDING	S28°W 93.60'						
	NORTHEAST CORNER OF METAL GARAGE BUILDING	S41°W 69.22'						
	MAG NAIL IN SOUTHEAST SIDE OF POWER POLE	N33°E 33.86'						
	FACE OF FENCE POST AT SOUTHEAST CORNER OF FENCE AROUND SUBSTATION	N49°W 11.34'						

SURVEY REPORT

Horizontal: State Plane Coordinates were obtained on the monitor wells using RTK GPS using the CORS network. The horizontal datum is Michigan State Plane Coordinates, Michigan South Zone, NAD83 (2011 Adjustment, Epoch 2010.00).

Vertical: Elevations are on NAVD 88 datum. All elevations were established on the monitor wells using closed and adjusted level loops from known JHC plant benchmarks.

SURVEYOR'S NOTES

1) Utility locations are derived from actual measurements or available records. They should not be interpreted to be exact locations nor should it be assumed that they are the only utilities in this area.
2) NOTE TO CONTRACTORS: 3 (THREE) WORKING DAYS BEFORE YOU DIG, CALL MISS DIG AT TOLL FREE 1-800-482-7171 FOR UTILITY LOCATIONS ON THE GROUND .
3) 2012 aerial imagery provided by Consuemers Energy.

LEGEND

- = EXISTING MONITORING WELL
- = DOWNGRADIENT LANDFILL MONITORING WELL
- = DOWNGRADIENT BOTTOM ASH POND 1/2 N/S MONITORING WELL
- = DOWNGRADIENT BOTTOM ASH POND 3 N/S MONITORING WELL
- = POND A MONITORING WELL
- = BACKGROUND MONITORING WELL

BASIS OF BEARING
STATE PLANE COORDINATES

BASIS OF ELEVATION
NEDI BM (NAVD88)

DATUM CONVERSION
Plant Datum (NGVD29) to NAVD88 = -0.495'

811 Know what's below. CALL before you dig.

UTILITY LOCATIONS ARE DERIVED FROM ACTUAL MEASUREMENTS OR AVAILABLE RECORDS. THEY SHOULD NOT BE INTERPRETED TO BE EXACT LOCATIONS NOR SHOULD IT BE ASSUMED THAT THEY ARE THE ONLY UTILITIES IN THIS AREA.

NOTE:
EXISTING UTILITIES AND SERVICE LINES IDENTIFIED AS "PLANS" WERE OBTAINED FROM AVAILABLE CITY AS-BUILT RECORD DRAWINGS. THE CONTRACTOR SHALL VERIFY THE LOCATION, DEPTH AND STATUS OF ALL UTILITIES AND SERVICE LINES PRIOR TO NEW CONNECTIONS.

DRAWING NO.	REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	BY	APP
A	11.25.15	REVISIONS PER CONSUMERS ENERGY REVIEW	MJL	MN

DATE
DR.
FLD. PV 10.27.15
CK. MN 11.25.15
APP.
APP.

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CAMPBELL PLANT MONITORING WELLS CCR MONITORING

22345base.DWG — UNITS 1 & 2

SCALE	DRAWING NO.	SHEET	REV.
1" = 300'	SG-22345	1	A

JOB 583-009-441

APPENDIX A

Soil Boring and Monitoring Well Construction Logs

Date Start: 9/15/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): 9.31

Northing: 158586.883
Easting: 12633422.01
Casing Elevation: 609.532

Borehole Depth (ft. bgs.): 15.0
Surface Elevation: 607.017

Descriptions By: A. Westhuis

Well/Boring ID: JHC MW-15001

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgl.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
610									TOC = 609.532 (ft. above msl)
0 / 605							(0.0 - 0.3') Grass, Topsoil. (0.3 - 10.0') SAND, fine to medium, subrounded; trace silt; well sorted.		2" PVC Well Casing (-3.0-3.5' bgs) Concrete (0.0-1.0' bgs) Bentonite Pellets (1.0-2.5' bgs)
5 / 600	1	0.0-10.0'	10	NA					Sand Pack K&E WP1 (2.5-15' bgs) 2" PVC 10 Slot Well Screen (3.5-8.5' bgs)
10 / 595	2	10.0-15.0'	3	NA			(10.0 - 15.0') SAND, fine to medium, subrounded; trace silt; well sorted; wet; brown (10YR 4/3) to yellowish brown (10YR 5/4).		
15 / 590							End of boring 15.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air Knife to 6.0' bgs.
Groundwater encountered at 10.0' bgs during drilling.
Water level at development was 9.31' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 600.28 feet

Date Start: 9/16/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 11.0
Water Level Finish (ft. btoc.): 24.51

Northing: 518378.917
Easting: 12633974.82
Casing Elevation: 628.867

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 625.967

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15002**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0 / 625							(0.0 - 0.3') Grass, Topsoil.		TOC = 625.967 (ft. above msl)
							(0.3 - 11.0') ASH; trace fine sand, subrounded; well sorted; moist to wet; dark gray (10YR 4/1). NOTE: Fill material.		Concrete (0.0-1.0' bgs)
5 / 620	1	0.0-10.0'	10	NA					
10 / 615							(11.0 - 24.0') ASH; well sorted; soft; wet; light gray (10YR 7/1) to dark gray (10YR 4/1). NOTE: Fill material.		Bentonite/Cement Grout (0.0-24.0' bgs)
15 / 610	2	10.0-20.0'	1.8	NA					2" PVC Well Casing (-3.0-28.0' bgs)

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 24.0' bgs during drilling.
Water level at development was 24.51' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 604.04 feet

ARCADIS Design & Consultancy for natural and built assets

Date Start: 9/16/15
Date Finish: 9/16/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mouver
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 11.0
Water Level Finish (ft. btoc.): 24.51

Northing: 518378.917
Easting: 12633974.82
Casing Elevation: 628.867

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 625.967

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15002**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
20 / 605									
25 / 600	3	20.0-30.0'	8	NA			(24.0 - 25.0') SAND, fine, little very fine sand, subrounded; trace silt; well sorted; wet; yellowish brown (10YR 5/6). (25.0 - 38.0') SAND, fine, little very fine, subrounded; trace silt; well sorted; wet; very pale brown (10YR 7/4).		Bentonite Pellets (24.0-26.0' bgs)
30 / 595	4	30.0-38.0'	6	NA					Sand Pack K&E WP1 (26.0-38.0' bgs) 2" PVC 10 Slot Well Screen (28.0-38.0 bgs)
35 / 590							End of boring 38.0' bgs.		
40									

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 24.0' bgs during drilling.
Water level at development was 24.51' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 604.04 feet

Date Start: 9/16/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 28.0
Water Level Finish (ft. btoc.): 30.57

Northing: 518069.863
Easting: 12633990.37
Casing Elevation: 630.632

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 628.307

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15003**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
630									TOC = 628.307 (ft. above msl)
0							(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
							(0.3 - 12.0') ASH; trace fine sand, subrounded; well sorted; moist to wet; dark gray (10YR 4/1). NOTE: Fill material.		
625									
5	1	0.0-10.0'	10	NA					
620									
10							(12.0 - 20.0') ASH; well sorted; soft; moist to wet; light gray (10YR 7/1) to dark gray (10YR 4/1). NOTE: Fill material.		Bentonite/Cement Grout (1.0-24.0' bgs)
615									2" PVC Well Casing (-3.0-28.0' bgs)
15	2	10.0-20.0'	9	NA					

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 28.0' bgs during drilling.
Water level at development was 30.57' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.48 feet

Date Start: 9/16/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 28.0
Water Level Finish (ft. btoc.): 30.57

Northing: 518069.863
Easting: 12633990.37
Casing Elevation: 630.632

Borehole Depth (ft. bgs.): 38.0
Surface Elevation: 628.307

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15003**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
610									
20							(20.0 - 21.0') SAND, fine, subrounded; trace silt; well sorted; moist; brownish yellow (10YR 6/8). NOTE: Trace small roots at this depth.		
							(21.0 - 28.0') SAND, fine, subrounded; trace silt; well sorted; moist; very pale brown (10YR 7/4).		
605									
25	3	20.0-30.0'	5	NA					Bentonite Pellets (24.0-26.0' bgs)
600							(28.0 - 38.0') SAND, fine, little medium; trace granules, subrounded; trace silt; well sorted; wet; brownish yellow (10YR 6/6).		
30									
595									Sand Pack K&E WP1 (26.0-38.0' bgs)
									2" PVC 10 Slot Well Screen (28.0-38.0' bgs)
35	4	30.0-38.0'	8	NA					
590							End of boring at 38.0' bgs.		
40									

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 28.0' bgs during drilling.
Water level at development was 30.57' btoc
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.48 feet

Date Start: 9/17/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 27.0
Water Level Finish (ft. btoc.): 31.67

Northing: 517864.558
Easting: 12633547.12
Casing Elevation: 628.422

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.917

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15004**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0	625									TOC = 628.442 (ft. above msl)
								(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
								(0.3 - 10.0') ASH and SAND, fine to medium, subrounded; stiff; dry to moist; dark grayish brown (10YR 4/2). NOTE: Fill material.		
5	620	1	0.0-10'	10	NA					
10	615							(10.0 - 19.0') ASH and SAND, fine to medium, subrounded; soft; moist to wet; dark grayish brown (10YR 4/2). NOTE: Fill material.		Bentonite/Cement Grout (1.0-20.0' bgs)
		2	10.0-15.0'	4	NA			NOTE: Trace small pebbles from 12.0 to 13.0' bgs.		2" PVC Well Casing (-3.0-24.0' bgs)
15	610									
		3	15.0-20.0'	4	NA					

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 27.0' bgs during drilling.
Water level at development was 31.67' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 598.77 feet

Date Start: 9/17/15
Date Finish: 9/17/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 27.0
Water Level Finish (ft. btoc.): 31.67

Northing: 517864.558
Easting: 12633547.12
Casing Elevation: 628.422

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.917

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15004**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
								(19.0 - 20.0') SAND, fine; trace medium sand, subrounded; trace silt; well sorted; dry to moist; brownish yellow (10YR 6/8).		
20	605							(20.0 - 30.0') SAND, fine, trace medium, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		
25	600	4	20.0-30.0'	4	NA			NOTE: Wet at 27.0' bgs.		
30	595							(30.0 - 40.0') SAND, fine to medium; trace coarse sand; trace granules; subrounded; well sorted; wet; pale brown (10YR 6/3).		
35	590	5	30.0-40.0'	8	NA					
40	585							End of boring at 40.0' bgs.		

Bentonite Pellets (20.0-22.0' bgs)
Sand Pack K&E WP1 (22.0-40.0' bgs)
2" PVC 10 Slot Well Screen (24.0-34.0 bgs)

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 27.0' bgs during drilling.
Water level at development was 31.67' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 598.77 feet

Date Start: 9/18/15
Date Finish: 9/18/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 29.0
Water Level Finish (ft. btoc.): 33.26

Northing: 517781.423
Easting: 12633905.01
Casing Elevation: 627.297

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.367

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15005**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 70 F Cloudy

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
625									TOC = 627.297 (ft. above msl)
0							(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
							(0.3 - 10.0') ASH and SAND, fine to medium; trace granules, subrounded; moist; soft to stiff; poorly sorted; brown (10YR 5/3) to dark grayish brown (10YR 4/2). NOTE: Fill material.		
620									
5	1	0.0-10.0'	10	NA					
615									
10							(10.0 - 11.0') ASH; well sorted; medium stiff to stiff; moist; dark gray (10YR 4/1). NOTE: Fill material.		
							(11.0 - 13.0') SAND, medium, little to some fine sand, subrounded; trace silt; well sorted; dry; brown (10YR 5/3) to yellowish brown (10YR 5/4).		Bentonite/Cement Grout (1.0-23.0' bgs)
							(13.0 - 16.0') SAND, medium; little fine sand, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		2" PVC Well Casing (-3.0-27.0' bgs)
610									
15	2	10.0-20.0'	6	NA					
							(16.0 - 19.5') SAND, medium; trace fine, subrounded; trace silt; dry; light yellowish brown (10YR 6/4).		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 29.0' bgs during drilling.
Water level at development encountered at 33.26' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 595.77 feet

Date Start: 9/18/15
Date Finish: 9/18/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 29.0
Water Level Finish (ft. btoc.): 33.26

Northing: 517781.423
Easting: 12633905.01
Casing Elevation: 627.297

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.367

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15005**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 70 F Cloudy

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
605							(19.5 - 19.8') SAND, medium; trace fine, subrounded; little to some silt; moist, brown (10YR 4/3).		
20							(19.8 - 29.0') SAND, medium, trace fine, subrounded; trace silt; well sorted; dry; very pale brown (10YR 7/4).		
600	3	20.0-30.0'	6	NA					Bentonite Pellets (23.0-25.0' bgs)
25									
595							(29.0 - 31.0') SAND, medium, little fine, trace coarse, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3).		
30							(31.0 - 33.0') SAND, medium to coarse, little fine, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3).		Sand Pack K&E WP1 (25.0-40.0' bgs)
590	4	30.0-40.0'	9	NA			(33.0 - 40.0') SAND, fine, some medium, subrounded; well sorted; wet; pale brown (10YR 6/3).		2" PVC 10 Slot Well Screen (27.0-37.0 bgs)
35									
585									
40							End of boring at 40.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 29.0' bgs during drilling.
Water level at development encountered at 33.26' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 595.77 feet

Date Start: 9/21/15
Date Finish: 9/21/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 21.0
Water Level Finish (ft. btoc.): 29.28

Northing: 517540.502
Easting: 12635742.72
Casing Elevation: 627.697

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.817

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15007**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0 / 0							(0.0 - 0.3') Grass, Topsoil.		TOC = 627.697 (ft. above msl)
							(0.3 - 10.0') SAND, fine to medium, subrounded; trace silt; well sorted; dry to moist; light brownish gray (10YR 6/2).		Concrete (0.0-1.0' bgs)
5 / -5	1	0.0-10.0'	10	NA					
10 / -10							(10.0 - 17.0') SAND, fine, trace to little medium, subrounded; little silt; well sorted; dry; light yellowish brown (10YR 6/4).		Bentonite/Cement Grout (1.0-18.0' bgs)
									2" PVC Well Casing (~3-25.0' bgs)
15 / -15	2	10.0-20.0'	8	NA			(17.0 - 17.5') SAND, very fine to fine, subrounded; little to some silt; well sorted; dry; very pale brown (10YR 7/3).		
							(17.5 - 40.0') SAND, fine to medium, subrounded; trace silt; well sorted; dry to moist; brownish yellow (10YR 6/6).		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 21.0' bgs during drilling.
Water level at development was 29.28' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 599.22 feet

Date Start: 9/21/15
Date Finish: 9/21/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 21.0
Water Level Finish (ft. btoc.): 29.28

Northing: 517540.502
Easting: 12635742.72
Casing Elevation: 627.697

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 624.817

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15007**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
20 -20							NOTE: Wet at 21.0' bgs.		Bentonite Pellets (18.0-20.0' bgs)
25 -25	3	20.0-30.0'	5	NA					Sand Pack K&E WP1 (20.0-40.0' bgs)
30 -30									2" PVC 10 Slot Well Screen (22.0-32.0' bgs)
35 -35	4	30.0-40.0'	5	NA					
40 -40							End of boring at 40.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 21.0' bgs during drilling.
Water level at development was 29.28' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 599.22 feet

Date Start: 9/25/15
Date Finish: 9/28/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 23.92
Water Level Finish (ft. btoc.): 28.57

Northing: 519715.111
Easting: 12634186.63
Casing Elevation: 635.202

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 632.462

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15015**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
635									TOC = 635.202 (ft. above msl)
0							(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
630							(0.3 - 10.0') ASH; some sand, very fine to fine, trace medium, subrounded; well sorted; moist; medium stiff; gray (10YR 5/1). NOTE: Fill material.		
5	1	0.0-10.0'	5.0	NA					
625									
10							(10.0 - 15.0') SAND, fine, little medium; subrounded; trace to little silt; well sorted; moist to wet; light brownish gray (10YR 6/2).		Bentonite/Cement Grout (1.0-24.0' bgs)
620									2" PVC Well Casing (-3-28.0' bgs)
15	2	10.0-20.0'	7.0	NA			(15.0 - 35.0') SAND, fine, little medium, subrounded; trace silt; well sorted; moist to wet; very pale brown (10YR 7/4).		
615									

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 23.92' bgs.
Water level at development was 28.57' btoc.
No odor or staining observed.
Groundwater elevation measured on December 3, 2015 was 607.68 feet

Date Start: 9/25/15
Date Finish: 9/28/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 23.92
Water Level Finish (ft. btoc.): 28.57

Northing: 519715.111
Easting: 12634186.63
Casing Elevation: 635.202

Borehole Depth (ft. bgs.): 40.0
Surface Elevation: 632.462

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15015**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 75 F Sunny

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
20 / 610							NOTE: Wet at 23.92' bgs.		
25 / 605	3	20.0-30.0'	8.0	NA					Bentonite Pellets (24.0-26.0' bgs)
30 / 600									Sand Pack K&E WP1 (26.0-40.0' bgs)
35 / 595	4	30.0-40.0'	8.0	NA			(35.0 - 40.0') SAND, very fine to fine, subrounded; trace silt; well sorted; wet; pale brown (10YR 6/3).		2" PVC 10 Slot Well Screen (28.0-38.0 bgs)
40							End of boring at 40.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 23.92' bgs.
Water level at development was 28.57' btoc.
No odor or staining observed.
Groundwater elevation measured on December 3, 2015 was 607.68 feet

Date Start: 9/29/15
Date Finish: 9/29/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 12.0
Water Level Finish (ft. btoc.): 16.29

Northing: 521075.536
Easting: 12635979.61
Casing Elevation: 617.022

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 614.262

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15018**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: 60 F Cloudy

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
615									TOC Elevation = 617.022 (ft. above msl)
0							(0.0 - 0.3') Grass, Topsoil.		Concrete (0.0-1.0' bgs)
							(0.3 - 1.0') ASH and SAND, very fine to fine, well sorted; dry; light gray (10YR 7/2). NOTE: Fill material.		
							(1.0 - 10.0') SAND, fine, subrounded; well sorted; dry; brownish yellow (10YR 6/6).		Bentonite/Cement Grout (1.0-6.0' bgs)
610									2" PVC Well Casing (-3-10.0' bgs)
5	1	0.0-10.0'	3.0	NA					Bentonite Pellets (6.0-8.0' bgs)
605									
10							(10.0 - 17.0') SAND, fine, subrounded; trace silt; well sorted; moist to wet; very pale brown (10YR 7/3). NOTE: Wet at 12.0' bgs.	▼	
600									Sand Pack K&E WP1 (8.0-20.0' bgs)
15	2	10.0-20.0'	7.0	NA					2" PVC 10 Slot Well Screen (10.0-20.0 bgs)
595							(17.0 - 20.0') SAND, medium, little fine, subrounded; trace granules; subrounded; trace silt; well sorted; wet; very pale brown (10YR 7/4).		
20							End of boring at 20.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 12.0' bgs during drilling.
Water level at development was 16.29' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 600.45 feet

Date Start: 10/1/15
Date Finish: 10/1/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 18.0
Water Level Finish (ft. btoc.): 18.91

Northing: 521927.205
Easting: 12638205.16
Casing Elevation: 619.977

Borehole Depth (ft. bgs.): 25.0
Surface Elevation: 617.012

Descriptions By: A. Westhuis

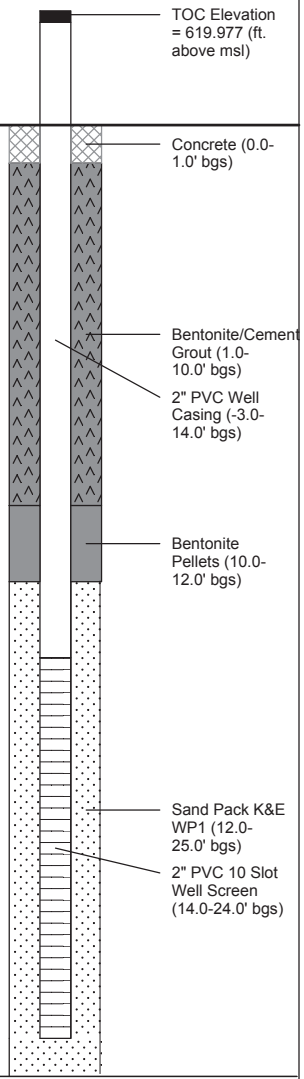
Well/Boring ID: **JHC MW-15023**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Sunny, 60F.

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
620								
0							(0.0 - 0.3') TOPSOIL; grass.	
615							(0.3 - 10.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; brown (10 YR 4/3). Note: Trace wood fragments from 7.0 to 10.0' bgs.	
5	1	0-10'	10	NA				
610								
10							(10.0 - 16.0') SAND, very fine to fine, subrounded; trace to little silt; well sorted; dry to moist; brownish yellow (10 YR 6/8).	
605								
15	2	10-20'	8	NA			(16.0 - 17.0') SAND, very fine to fine, subrounded; trace silt; well sorted; moist; yellow (10 YR 7/6).	
600							(17.0 - 18.0') SAND, fine, subrounded; trace silt; well sorted; moist; brownish yellow (10 YR 6/6).	
20							(18.0 - 21.0') SAND, very fine; little fine sand, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3).	
595	3	20-25'	4	NA			(21.0 - 25.0') SAND, medium; trace fine sand, subangular; trace granules, subangular; poorly sorted; wet; pale brown (10 YR 6/3).	
25							End of boring at 25.0' bgs.	
590								



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Remarks: bgs= below ground surface
btoc = below top of casing

Hand auger to 10.0' bgs.
Groundwater encountered at 18.0' bgs during drilling.
Water level at development was 18.91' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 592.53 feet

Date Start: 10/1/15
Date Finish: 10/1/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air Knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 10.0
Water Level Finish (ft. btoc.): 14.12

Northing: 522366.013
Easting: 12637322.68
Casing Elevation: 616.617

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 613.787

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15024**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Sunny, 60F.

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
615									TOC Elevation = 616.617 (ft. above msl)
0							(0.0 - 0.3') TOPSOIL; grass.		Concrete (0.0-1.0' bgs)
							(0.3 - 10.0') SAND, fine, subrounded; trace silt; well sorted; dry to moist; brownish yellow (10 YR 6/6).		2" PVC Well Casing (-3.0-7.0' bgs)
610									Bentonite Pellets (1.0-6.0' bgs)
5	1	0-10'	4	NA					
605							NOTE: Wet at 10.0' bgs.		
10							(10.0 - 20.0') SAND, fine to medium, subrounded; trace to little very fine sand; trace silt; well sorted; wet; pale brown (10 YR 6/3).		Sand Pack K&E WP1 (6.0-20.0' bgs)
600									2" PVC 10 Slot Well Screen (7.0-17.0' bgs)
15	2	10-20'	9	NA					
595									
20							End of boring at 20.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs= below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 10.0' bgs during drilling.
Water level at development was 14.12' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.24 feet

Date Start: 10/1/15
Date Finish: 10/1/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 12.0
Water Level Finish (ft. btoc.): 13.50

Northing: 522702.978
Easting: 12636668.15
Casing Elevation: 617.167

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 614.137

Descriptions By: A. Westhuis

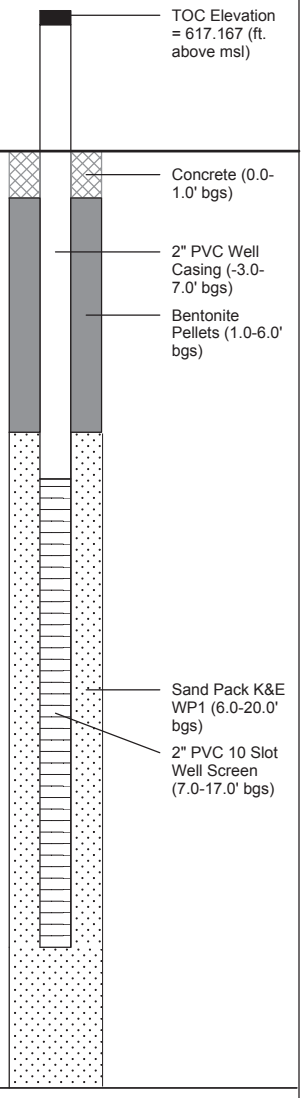
Well/Boring ID: **JHC MW-15025**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Sunny, 60F.

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
615								
0							(0.0 - 0.3') TOPSOIL; grass.	
							(0.3 - 5.0') SAND, fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3).	
610								
5	1	0-10'	10	NA			(5.0 - 12.0') SAND, fine, subrounded; trace silt; well sorted; dry; brownish yellow (10 YR 6/6). Note: Color change to brownish yellow (10YR 6/8) at 6.0' bgs.	
605								
10								
600							(12.0 - 15.0') SAND, fine, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3).	
15	2	10-20'	8	NA			(15.0 - 16.0') SAND, fine to medium, subrounded; trace coarse sand, subrounded; trace granules, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3).	
							(16.0 - 20.0') SAND, very fine to fine, subrounded; little silt; well sorted; wet; pale brown (10 YR 6/3).	
595								
20							End of boring at 20.0' bgs.	



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs= below ground surface
btoc = below top of casing

Hand auger to 10.0' bgs.
Groundwater encountered at 12.0' bgs during drilling.
Water level at development was 13.50' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 603.36 feet

Date Start: 10/2/15
Date Finish: 10/2/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 12.0
Water Level Finish (ft. btoc.): 15.34

Northing: 522495.091
Easting: 12635971.82
Casing Elevation: 618.042

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 615.087

Descriptions By: A. Westhuis

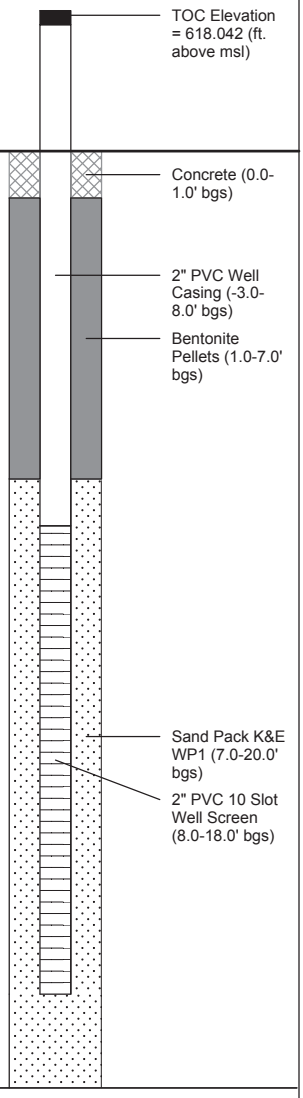
Well/Boring ID: **JHC MW-15026**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Sunny, 45F.

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0	615							(0.0 - 0.3') TOPSOIL; grass.	
								(0.3 - 3.0') SAND, fine, subrounded; trace medium sand, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3).	
5	610	1	0-10'	10	NA			(3.0 - 8.0') SAND, fine, subrounded; trace silt; well sorted; dry; brownish yellow (10 YR 6/6).	
								(8.0 - 12.0') SAND, fine, subrounded; little very fine sand, subrounded; trace silt; well sorted; dry; pale brown (10 YR 6/3) to brownish yellow (10YR 6/6).	
10	605							(12.0 - 20.0') SAND, very fine to fine, subrounded; trace silt; well sorted; moist to wet; pale brown (10 YR 6/3).	▽
15	600	2	10-20'	6	NA				
20	595							End of boring at 20.0' bgs.	



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs= below ground surface
btoc = below top of casing

Hand auger to 10.0' bgs.
Groundwater encountered at 12.0' bgs during drilling.
Water level at development was 15.34' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 602.32 feet

Date Start: 10/2/15
Date Finish: 10/2/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 13.0
Water Level Finish (ft. btoc.): 15.85

Northing: 522394.86
Easting: 1235097.51
Casing Elevation: 617.302

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 614.767

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15027**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Sunny, 50F.

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
0 / 615									TOC Elevation = 617.302 (ft. above msl)
0							(0.0 - 0.3') TOPSOIL; grass.		Concrete (0.0-1.0' bgs)
							(0.3 - 2.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; dark yellowish brown (10 YR 4/6).		
							(2.0 - 6.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3).		2" PVC Well Casing (-3.0-10.0' bgs)
5 / 610	1	0-10'	10	NA					Bentonite Pellets (1.0-8.0' bgs)
							(6.0 - 16.0') SAND, fine, subrounded; trace silt; well sorted; dry; yellow (10YR 7/6).		
10 / 605									
							Note: Wet at 13.0' bgs.	▼	Sand Pack K&E WP1 (8.0-20.0' bgs)
15 / 600	2	10-20'	8	NA					2" PVC 10 Slot Well Screen (10.0-20.0' bgs)
							(16.0 - 20.0') SAND, fine; trace medium sand, subrounded; well sorted; wet; pale brown (10 YR 6/3).		
20 / 595							End of boring at 20.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs= below ground surface
btoc = below top of casing

Hand auger to 10.0' bgs.
Groundwater encountered at 13.0' bgs during drilling.
Water level at development was 15.85' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 601.04 feet

Date Start: 10/2/15
Date Finish: 10/2/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 9.0
Water Level Finish (ft. btoc.): 14.38

Northing: 521646.198
Easting: 12634105.34
Casing Elevation: 613.8

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 611.025

Descriptions By: A. Westhuis

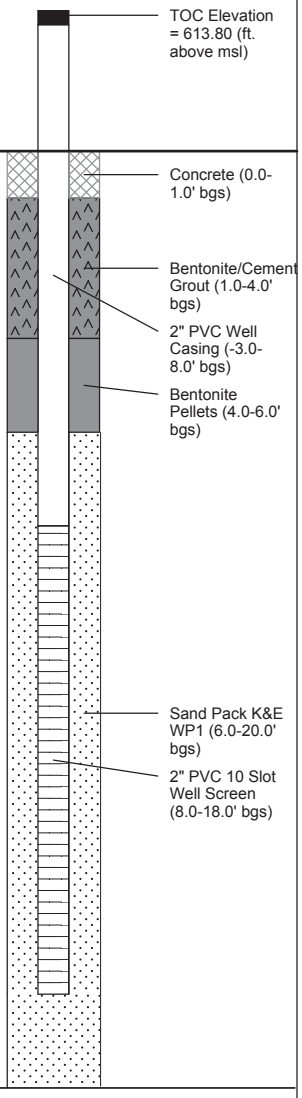
Well/Boring ID: **JHC MW-15028**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Sunny, 60F.

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0 / 610							(0.0 - 0.3') TOPSOIL; grass.	
							(0.3 - 5.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry; yellowish (10 YR 7/8).	
5 / 605	1	0-10'	10	NA			(5.0 - 9.0') SAND, fine, subrounded; trace silt; well sorted; dry to moist; pale brown (10 YR 6/3).	
							(9.0 - 20.0') SAND, medium; trace to little very fine to fine sand, subrounded; trace silt; poorly sorted; moist to wet; pale brown (10 YR 6/3).	
10 / 600								
15 / 595	2	10-20'	9	NA				
20 / 590							End of boring at 20.0' bgs.	



Well/Boring Construction

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs= below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 9.0' bgs during drilling.
Water level at development was 14.38' btoc.
No odor or staining observed.
Groundwater elevation measured on December 3, 2015 was 599.00 feet

Date Start: 10/5/15
Date Finish: 10/5/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 12.0
Water Level Finish (ft. btoc.): 10.03

Northing: 520503.524
Easting: 12633774.3
Casing Elevation: 610.952

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 608.082

Descriptions By: A. Westhuis

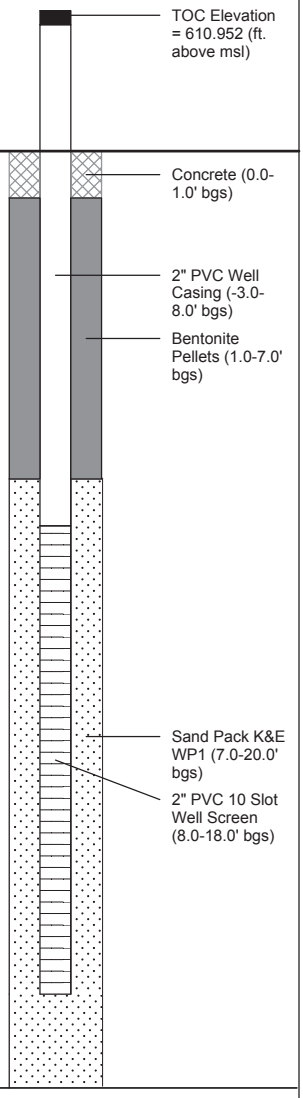
Well/Boring ID: **JHC MW-15029**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Cloudy, Light Rain, 65F.

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
610								
0							(0.0 - 0.3') TOPSOIL; grass.	
							(0.3 - 10.0') SAND, fine, subrounded; trace silt; well sorted; dry; yellowish brown (10 YR 5/4).	
605								
5	1	0-10'	3	NA				
600								
10							(10.0 - 12.0') SAND, very fine to fine, subrounded; trace silt; well sorted; dry to moist; pale brown (10 YR 6/3).	
595							(12.0 - 15.0') SAND, medium; trace fine sand, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/3).	
15	2	10-20'	6	NA			(15.0 - 20.0') SAND, medium; little coarse sand; trace granules, subrounded; trace silt; well sorted; wet; pale brown (10 YR 6/4).	
590								
20							End of boring at 20.0' bgs.	



ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 12.0' bgs during drilling.
Water level at development was 10.03' btoc.
No odor or staining observed.
Groundwater elevation measured on December 3, 2015 was 601.18 feet

Date Start: 10/5/15
Date Finish: 10/5/15
Drilling Company: Mateco Drilling
Driller's Name: Dan Mourer
Drilling Method: Air knife/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 5.0
Water Level Finish (ft. btoc.): 7.99

Northing: 519760.827
Easting: 12633044.37
Casing Elevation: 607.167

Borehole Depth (ft. bgs.): 20.0
Surface Elevation: 604.047

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15030**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Cloudy, Light Rain, 65F.

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
605									TOC Elevation = 607.167 (ft. above msl)
0							(0.0 - 0.3') TOPSOIL; grass.		Concrete (0.0-1.0' bgs)
							(0.3 - 10.0') SAND, fine, subrounded; trace silt; well sorted; dry to moist; dark brown (10 YR 3/3) to very pale brown (10YR 7/3).		2" PVC Well Casing (-3.0-4.0' bgs)
600									Bentonite Pellets (1.0-3.0' bgs)
5	1	0-10'	3	NA			NOTE: Wet at 5.0' bgs.	▼	
595									Sand Pack K&E WP1 (3.0-20.0' bgs)
10									2" PVC 10 Slot Well Screen (4.0-14.0' bgs)
590							(10.0 - 20.0') SAND, fine, subrounded; little medium sand, subrounded; trace silt; well sorted; wet; very pale brown (10 YR 7/3) to light gray (10YR 7/2).		
15	2	10-20'	6	NA					
585									
20							End of boring at 20.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Air knife to 10.0' bgs.
Groundwater encountered at 5.0' bgs during drilling.
Water level at development was 7.99' btoc.
No odor or staining observed.
Groundwater elevation measured on December 3, 2015 was 599.65 feet

Date Start: 10/6/15
Date Finish: 10/6/15
Drilling Company: Mateco Drilling
Driller's Name: John Pitsch
Drilling Method: Hand Auger/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 19.0
Water Level Finish (ft. btoc.): 22.93

Northing: 521075.809
Easting: 12638598.12
Casing Elevation: 620.987

Borehole Depth (ft. bgs.): 30.0
Surface Elevation: 618.082

Descriptions By: A. Westhuis

Well/Boring ID: **JHC MW-15033**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: Cloudy, 60F.

DEPTH (feet bgs.)	ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
	620									TOC Elevation = 620.987 (ft. above msl)
0								(0.0 - 0.3') TOPSOIL; grass.		Concrete (0.0-1.0' bgs)
	615							(0.3 - 0.8') SAND, fine, subrounded; trace silt; well sorted; dry; brown (10 YR 4/3).		
								(0.8 - 2.0') SAND, fine, subrounded; trace silt; well sorted; dry; yellowish brown (10 YR 5/6).		
5		1	0-10'	10	NA			(2.0 - 10.0') SAND, fine, subrounded; trace silt; well sorted; dry; very pale brown (10 YR 7/3).		Bentonite/Cement Grout (1.0-12.0' bgs)
	610									2" PVC Well Casing (-3.0-16.0' bgs)
10								(10.0 - 20.0') SAND, very fine to fine, subrounded; trace silt; well sorted; moist; yellowish brown (10 YR 5/4).		
	605									Bentonite Pellets (12.0-14.0' bgs)
15		2	10-20'	6	NA					
	600									
20								NOTE: Wet at 19.0' bgs.		Sand Pack K&E WP1 (14.0-30.0' bgs)
								(20.0 - 30.0') SAND, fine; little medium sand, subrounded; trace silt; well sorted; moist to wet; very pale brown (10 YR 6/3).		2" PVC 10 Slot Well Screen (16.0-26.0' bgs)
	595									
25		3	20-30'	6	NA					
	590									
30								End of boring at 30.0' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

Hand auger to 10.0' bgs.
Groundwater encountered at 19.0' bgs during drilling.
Water level at development was 22.93' btoc.
No odor or staining observed.
Groundwater elevation measured on December 2, 2015 was 598.05 feet

Date Start: 3/13/01
Date Finish: 3/13/01
Drilling Company: EDC, Inc.
Driller's Name: Sean Smith
Drilling Method: Hollow Stem Auger
Sampling Method: Split Spoon
Rig Type: Hollow Stem Auger
Water Level Start (ft. bgs.): NA
Water Level Finish (ft. btoc.): NA

Northing: NA
Easting: NA
Casing Elevation: 615.90

Borehole Depth (ft. bgs.): 30.5
Surface Elevation: NA

Descriptions By: Rebecca J. Koepke

Well/Boring ID: **JHC MW-15036**

Client: Consumers Energy

Location: JH Campbell Facility
1700 Crosswell Street Site A
West Olive, MI 49460

Weather Conditions: NA

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)	Well/Boring Construction
625 / 0									TOC = 615.90 (ft. above msl)
0							(0.0 - 0.5') SANDY ORGANIC SOIl, very dark brown, very fine to fine, loose, moist.		Concrete (0.0-1.0' bgs)
							(0.5 - 30.5') SAND, very pale brown (10YR 7/4), poorly graded, fine, trace silt, round, loose, slightly moist.		
620 / 5	1	5.0-7.0'	0.9	NA					
									2" PVC Well Casing (-3.0-20.0' bgs)
615 / 10	2	10.0-12.0'	1.6	NA			NOTE: Very fine.		Bentonite Chips (1.0-18.0' bgs)
610 / 15	3	15.0-17.0'	1.6	NA			NOTE: Very pale brown (10YR 8/3), fine.		
605 / 20	4	20.0-22.0'	1.8	NA			NOTE: Fine to medium, moist.		
600 / 25	5	25.0-27.0'	1.8	NA					Sand Pack Flat Rock #30 (18.0-30.5' bgs)
									2" PVC 10 Slot Well Screen (20.0-30.0 bgs)
595 / 30									
							End of boring at 30.5' bgs.		

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface
btoc = below top of casing

No odor or staining observed.

SOIL DESCRIPTION

Udden-Wenworth Scale Modified ARCADIS, 2008			
Size Class	Millimeters	Inches	Standard Sieve #
Boulder	256 – 4096	10.08+	
Large cobble	128 - 256	5.04 -10.08	
Small cobble	64 - 128	2.52 – 5.04	
Very large pebble	32 – 64	0.16 - 2.52	
Large pebble	16 – 32	0.63 – 1.26	
Medium pebble	8 – 16	0.31 – 0.63	
Small pebble	4 – 8	0.16 – 0.31	No. 5 +
Granule	2 – 4	0.08 – 0.16	No.5 – No.10
Very coarse sand	1 -2	0.04 – 0.08	No.10 – No.18
Coarse sand	½ - 1	0.02 – 0.04	No.18 - No.35
Medium sand	¼ - ½	0.01 – 0.02	No.35 - No.60
Fine sand	1/8 -¼	0.005 – 0.1	No.60 - No.120
Very fine sand	1/16 – 1/8	0.002 – 0.005	No. 120 – No. 230
Silt (subgroups not included)	1/256 – 1/16	0.0002 – 0.002	Not applicable (analyze by pipette or hydrometer)
Clay (subgroups not included	1/2048 – 1/256	.00002 – 0.0002	

Modifier	Percent of Total Sample (by volume)
and	36 - 50
some	21 - 35
little	10 - 20
trace	<10

Description	Criteria
Nonplastic	A $^1/_8$ inch (3 mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

Description	Criteria
Dry	Absence of moisture, dry to touch, dusty.
Moist	Damp but no visible water.
Wet (Saturated)	Visible free water, soil is usually below the water table.

Fine-grained soil – Consistency

Description	Criteria
Very soft	N-value < 2 or easily penetrated several inches by thumb.
Soft	N-value 2-4 or easily penetrated one inch by thumb.
Medium stiff	N-value 9-15 or indented about ¼ inch by thumb with great effort.
Very stiff	N-value 16-30 or readily indented by thumb nail.
Hard	N-value > than 30 or indented by thumbnail with difficulty

Description	Criteria
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

Coarse-grained soil – Density

Description	Criteria
Very loose	N-value 1- 4
Loose	N-value 5-10
Medium dense	N-value 11-30
Dense	N-value 31- 50
Very dense	N-value >50

APPENDIX B

Photographic Log

Photograph #1

Description of Photograph:
View of the various soil types encountered during the monitoring well installation activities at the Site.

Site Location:
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Photograph Taken By:
Austin Westhuis

Date of Photograph:
September 17, 2015

Photograph #2

Description of Photograph:
View of the various soil types encountered during the monitoring well installation activities at the Site.

Site Location:
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Photograph Taken By:
Austin Westhuis

Date of Photograph:
September 23, 2015

Photograph #3

Description of Photograph:
View of the various soil types encountered during the monitoring well installation activities at the Site.

Site Location:
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Photograph Taken By:
Austin Westhuis

Date of Photograph:
September 25, 2015

Photograph #4

Description of Photograph:
View of the typical sand layer encountered at the Site where monitoring well screens were installed.

Site Location:
Consumers Energy Co.
J.H. Campbell Generating Facility
West Olive, Michigan

Photograph Taken By:
Austin Westhuis

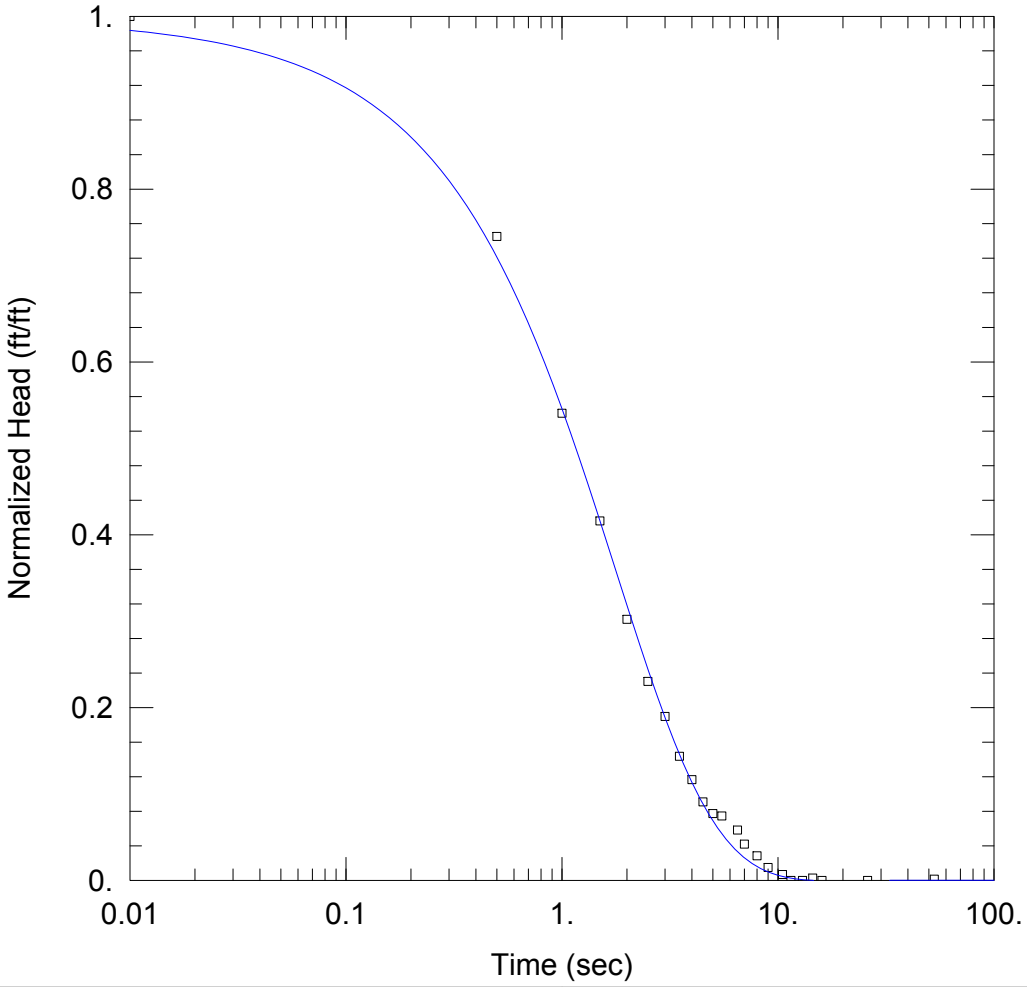
Date of Photograph:
September 18, 2015

APPENDIX C

Hydraulic Test Logs

Slug Test Analysis Result for JHC MW-15005 - Test 2

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 61. ft/day Ss = 3.7E-5 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 19.82 ft

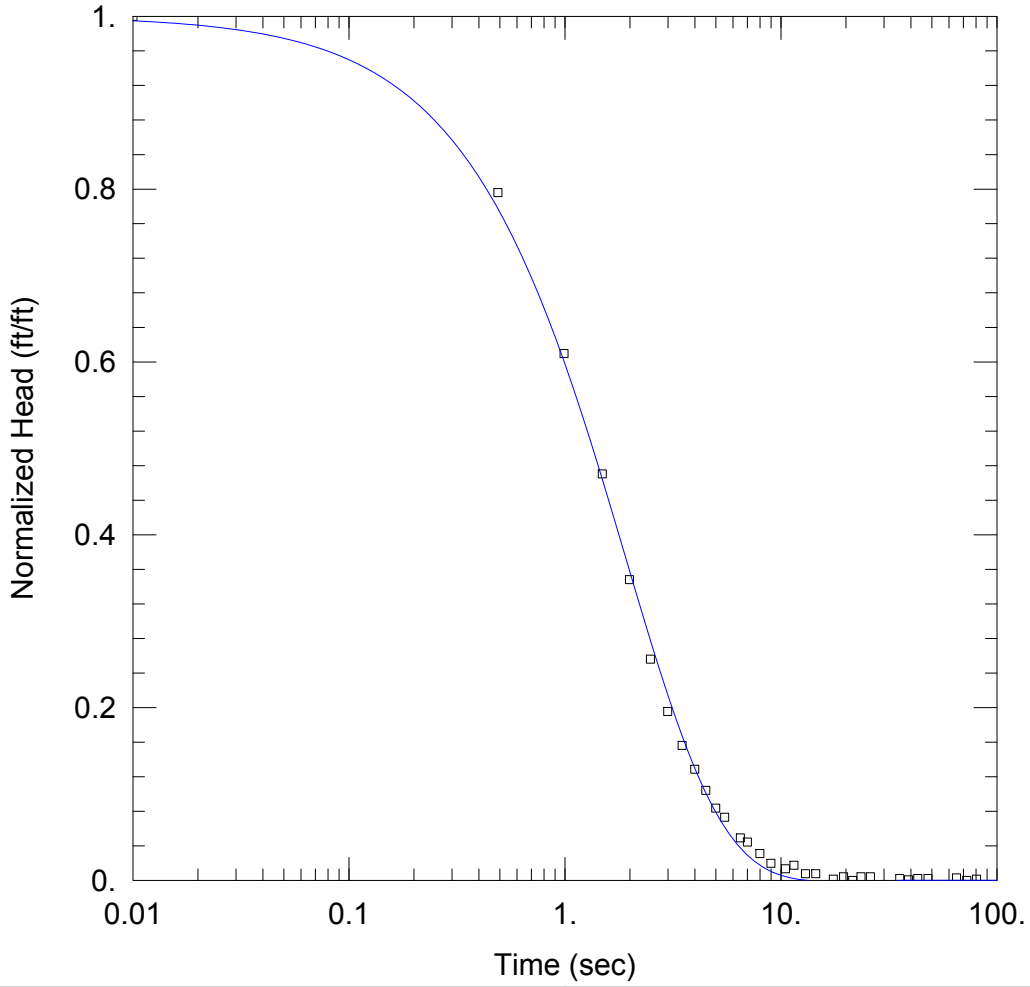
WELL DATA (JHC MW-15005)

Initial Displacement: 0.738 ft
Static Water Column Height: 6.82 ft
Total Well Penetration Depth: 6.82 ft
Screen Length: 6.82 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15005 - Test 3

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 58. ft/day Ss = 5.05E-12 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 19.82 ft

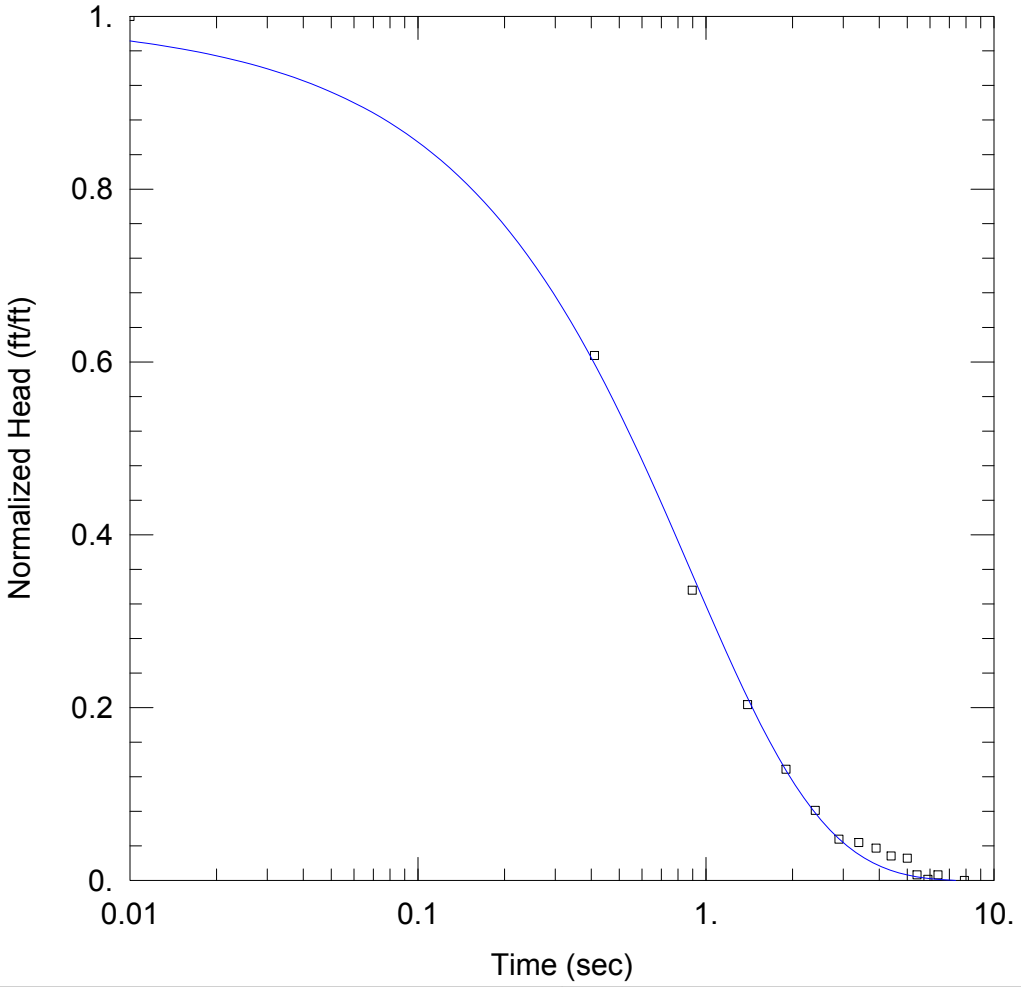
WELL DATA (JHC MW-15005)

Initial Displacement: 1.422 ft
Static Water Column Height: 6.82 ft
Total Well Penetration Depth: 6.82 ft
Screen Length: 6.82 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-B6 - Test 2

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 118. ft/day Ss = 6.03E-5 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 25.71 ft

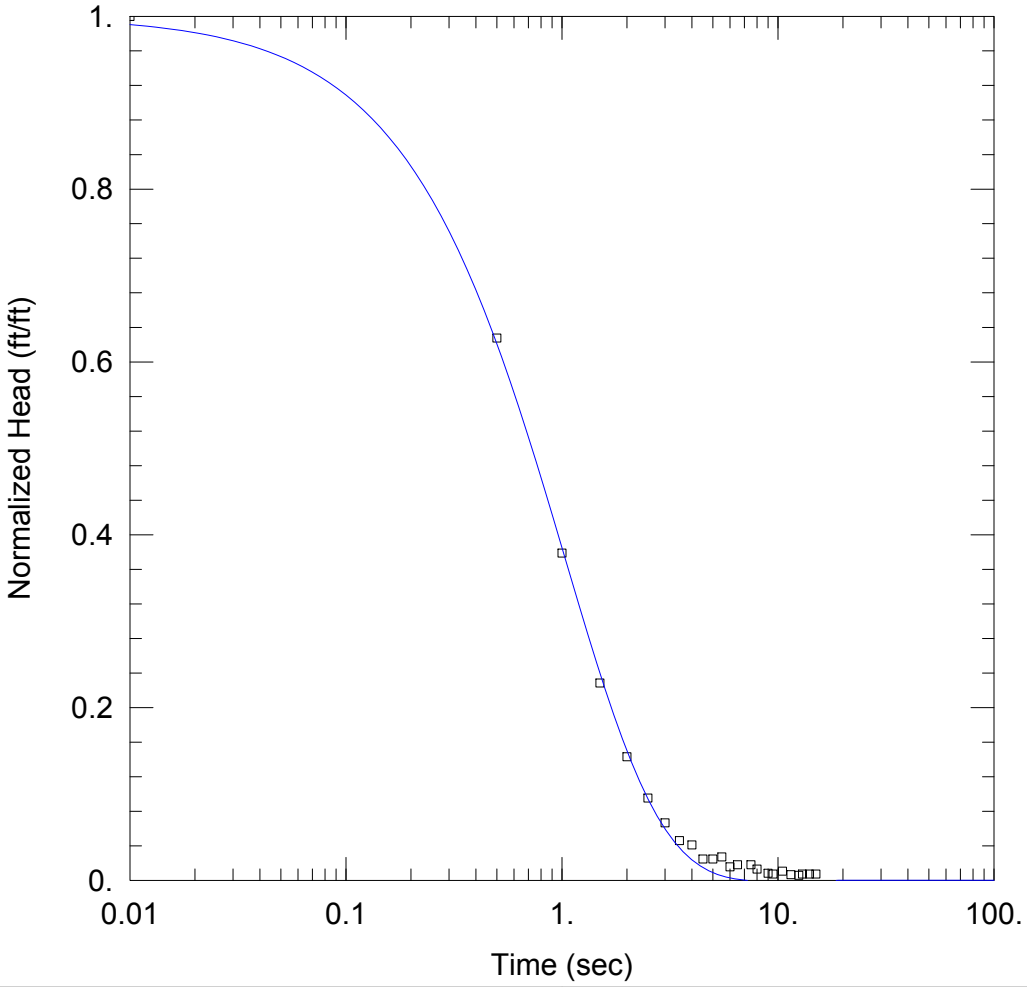
WELL DATA (JHC MW-B6)

Initial Displacement: 0.777 ft
Static Water Column Height: 5.71 ft
Total Well Penetration Depth: 5.71 ft
Screen Length: 5.71 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-B6 - Test 3

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 139. ft/day Ss = 5.05E-12 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 25.71 ft

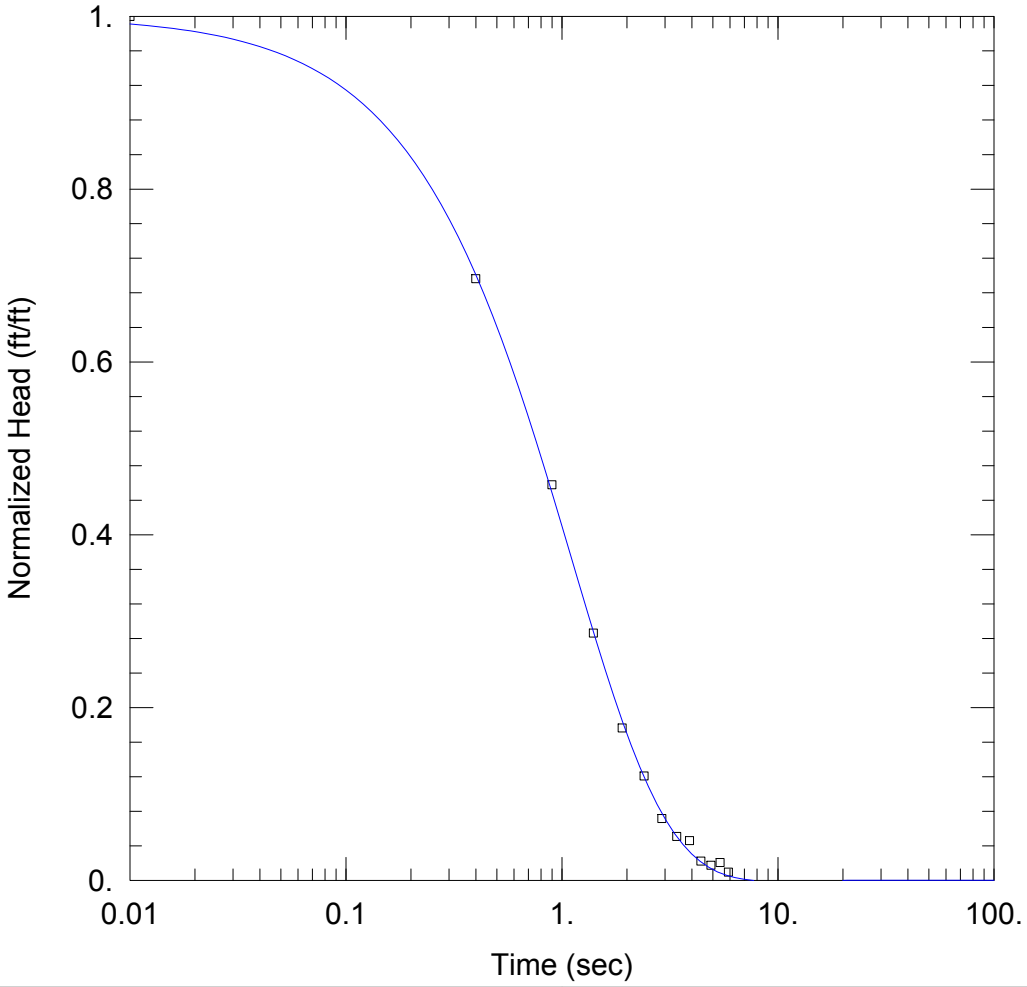
WELL DATA (JHC MW-B6)

Initial Displacement: 1.217 ft
Static Water Column Height: 5.71 ft
Total Well Penetration Depth: 5.71 ft
Screen Length: 5.71 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15007 - Test 1

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 130. ft/day Ss = 5.05E-12 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 23.37 ft

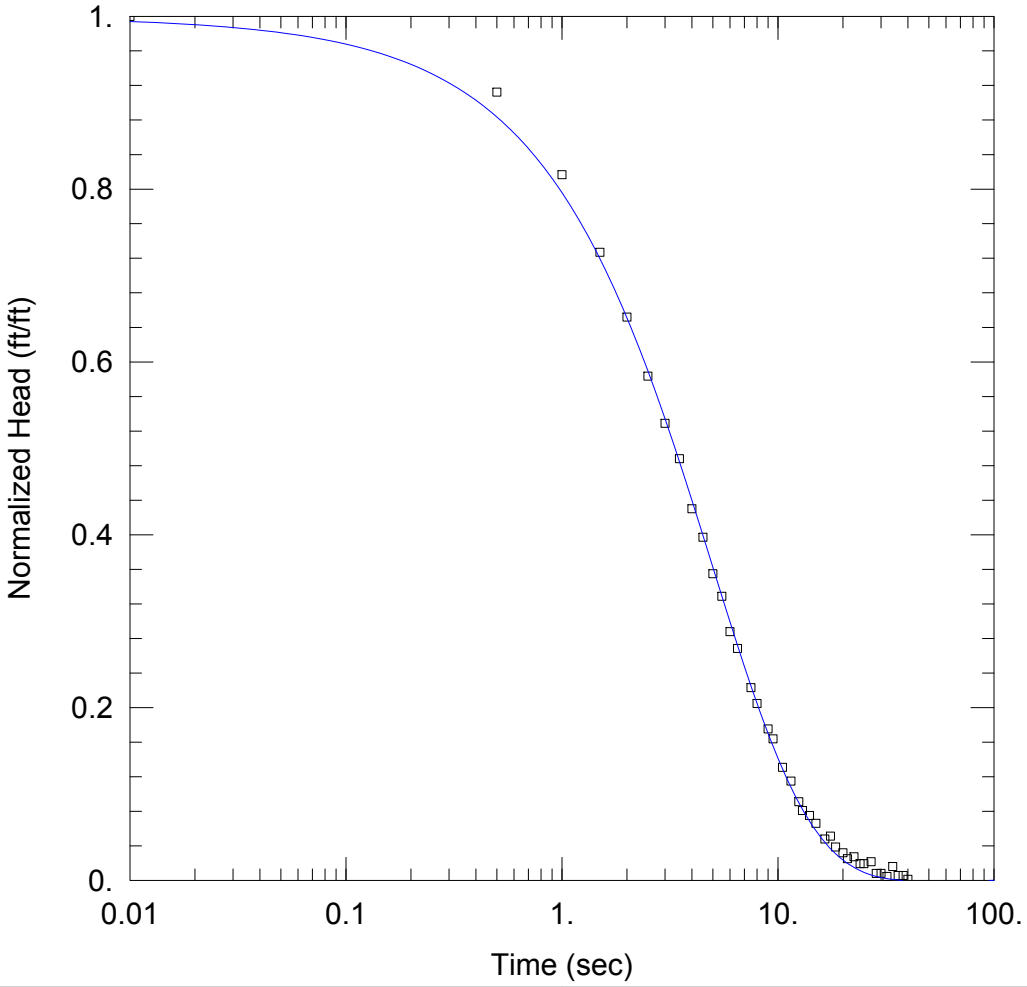
WELL DATA (JHC MW-15007)

Initial Displacement: 0.629 ft
Static Water Column Height: 5.37 ft
Total Well Penetration Depth: 5.37 ft
Screen Length: 5.37 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15015 - Test 2

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 22. ft/day Ss = 7.0E-6 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 24.57 ft

WELL DATA (JHC MW-15015)

Initial Displacement: 0.879 ft
Static Water Column Height: 12.57 ft
Total Well Penetration Depth: 12.57 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

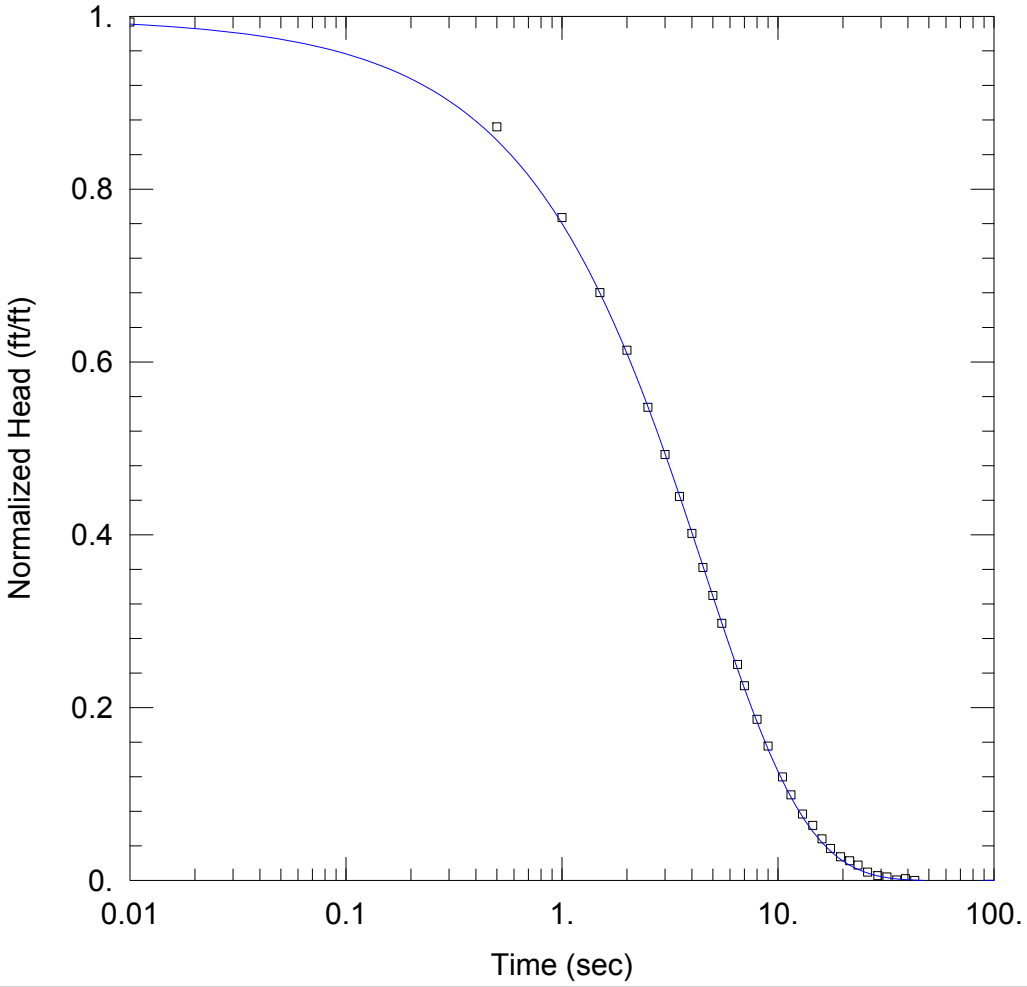
Slug Test Analysis Result for JHC MW-15015 - Test 3

Prepared By:
Arcadis

Prepared For:
Consumer Energy

Project:

Location:
West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 21. ft/day Ss = 1.9E-5 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 24.57 ft

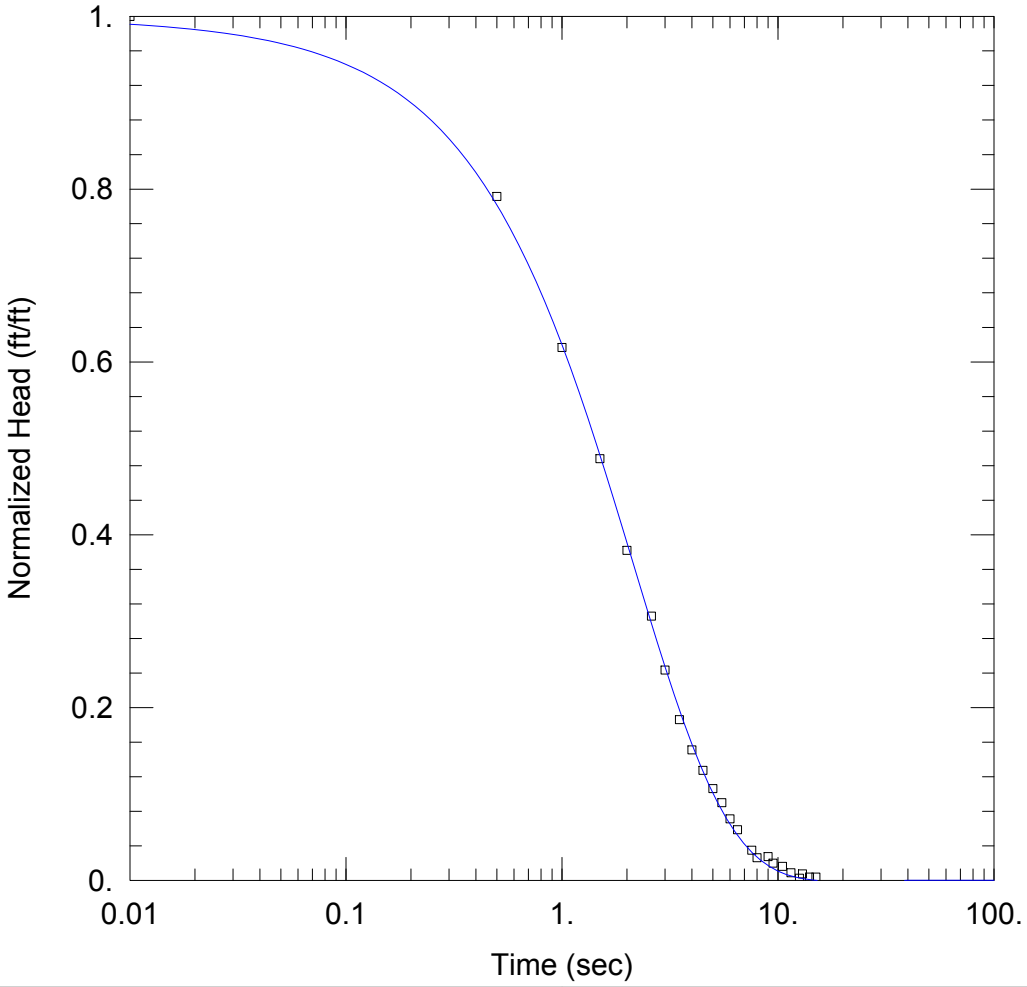
WELL DATA (JHC MW-15015)

Initial Displacement: 1.98 ft
Static Water Column Height: 12.57 ft
Total Well Penetration Depth: 12.57 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15024 - Test 2

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 49. ft/day Ss = 9.8E-6 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 38.71 ft

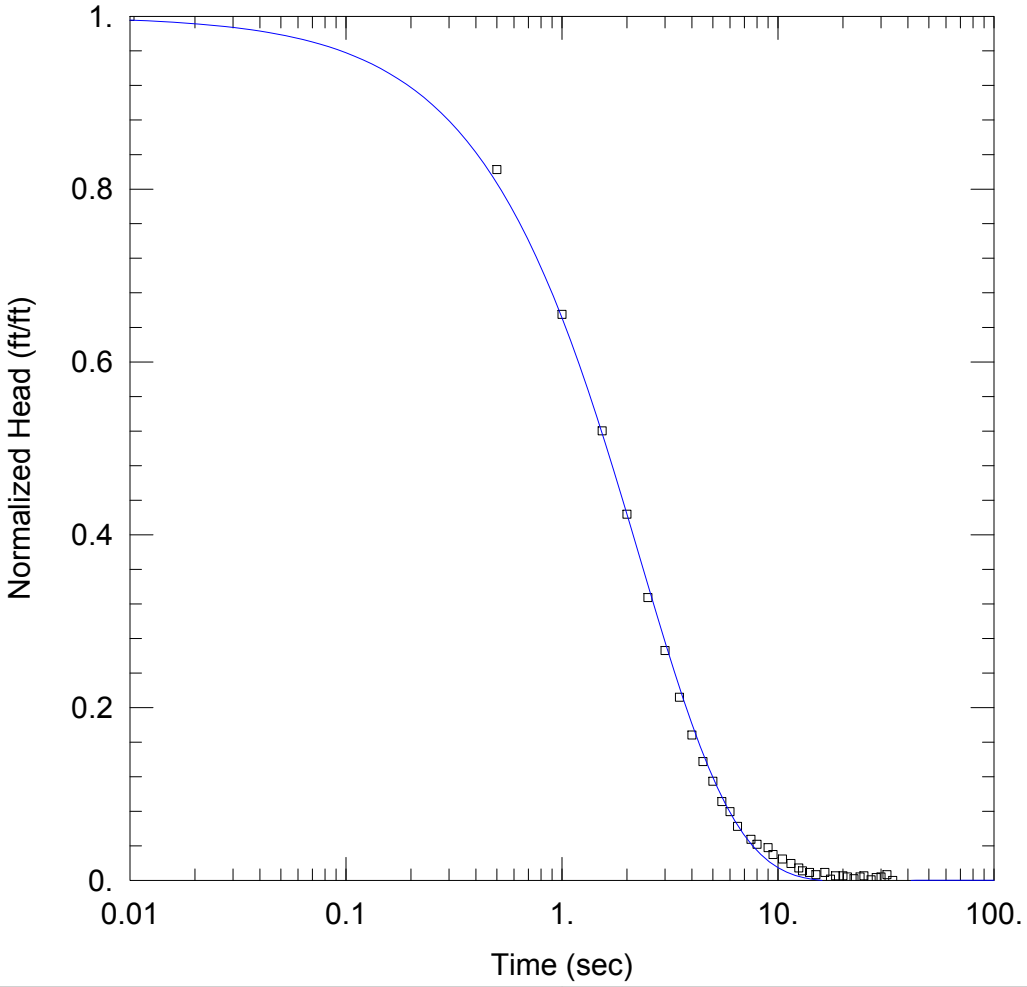
WELL DATA (JHC MW-15024)

Initial Displacement: 0.801 ft
Static Water Column Height: 5.71 ft
Total Well Penetration Depth: 5.71 ft
Screen Length: 5.71 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15024 - Test 3

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 45. ft/day Ss = 5.05E-12 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 38.71 ft

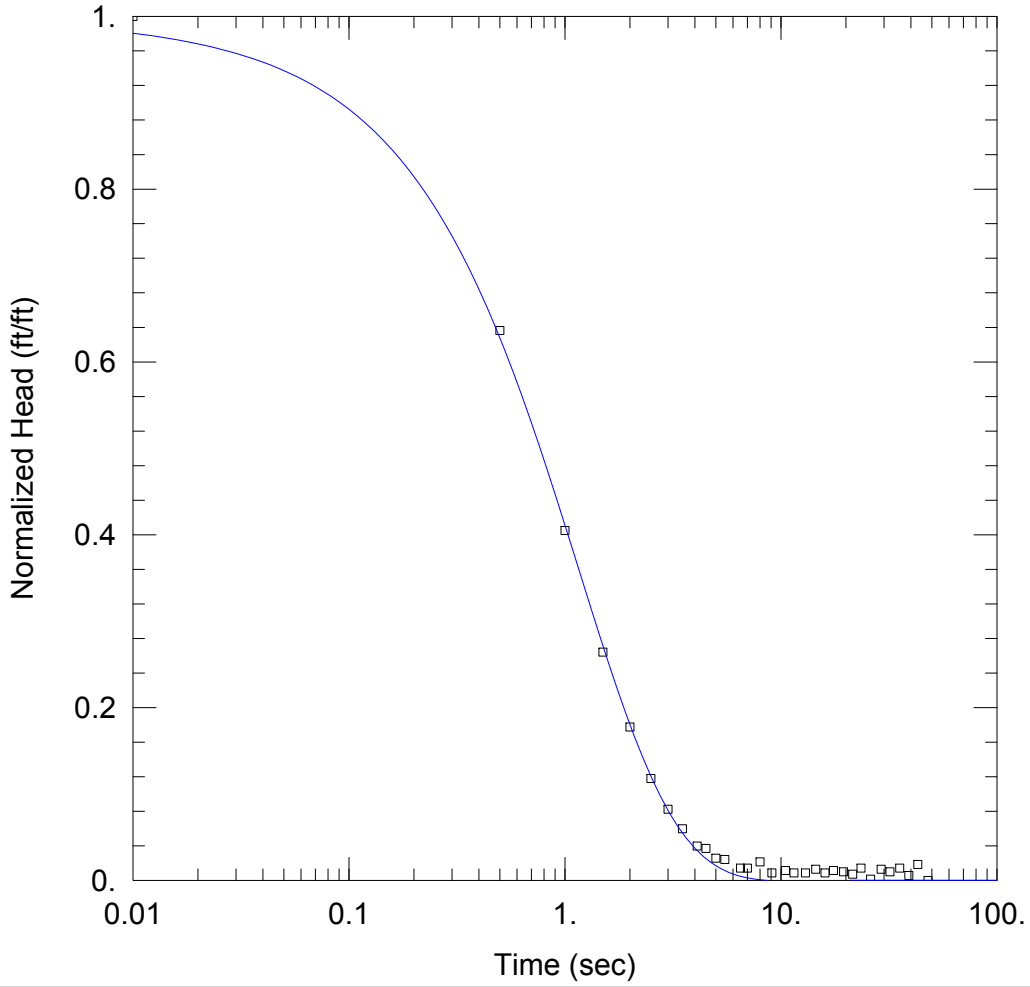
WELL DATA (JHC MW-15024)

Initial Displacement: 1.534 ft
Static Water Column Height: 5.71 ft
Total Well Penetration Depth: 5.71 ft
Screen Length: 5.71 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15028 - Test 1

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 104. ft/day Ss = 3.1E-5 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 38.22 ft

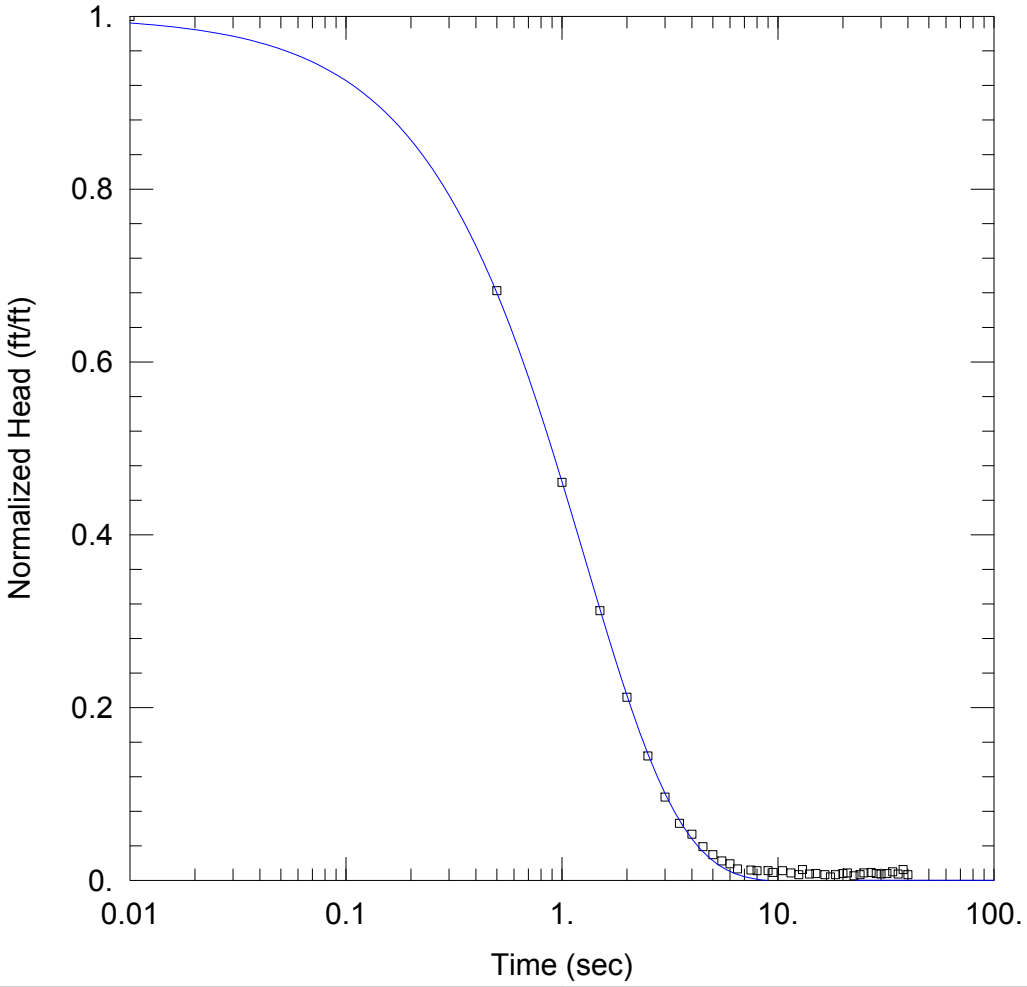
WELL DATA (JHC MW-15028)

Initial Displacement: 0.704 ft
Static Water Column Height: 6.22 ft
Total Well Penetration Depth: 6.22 ft
Screen Length: 6.22 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15028 - Test 3

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 86. ft/day Ss = 5.05E-12 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 38.22 ft

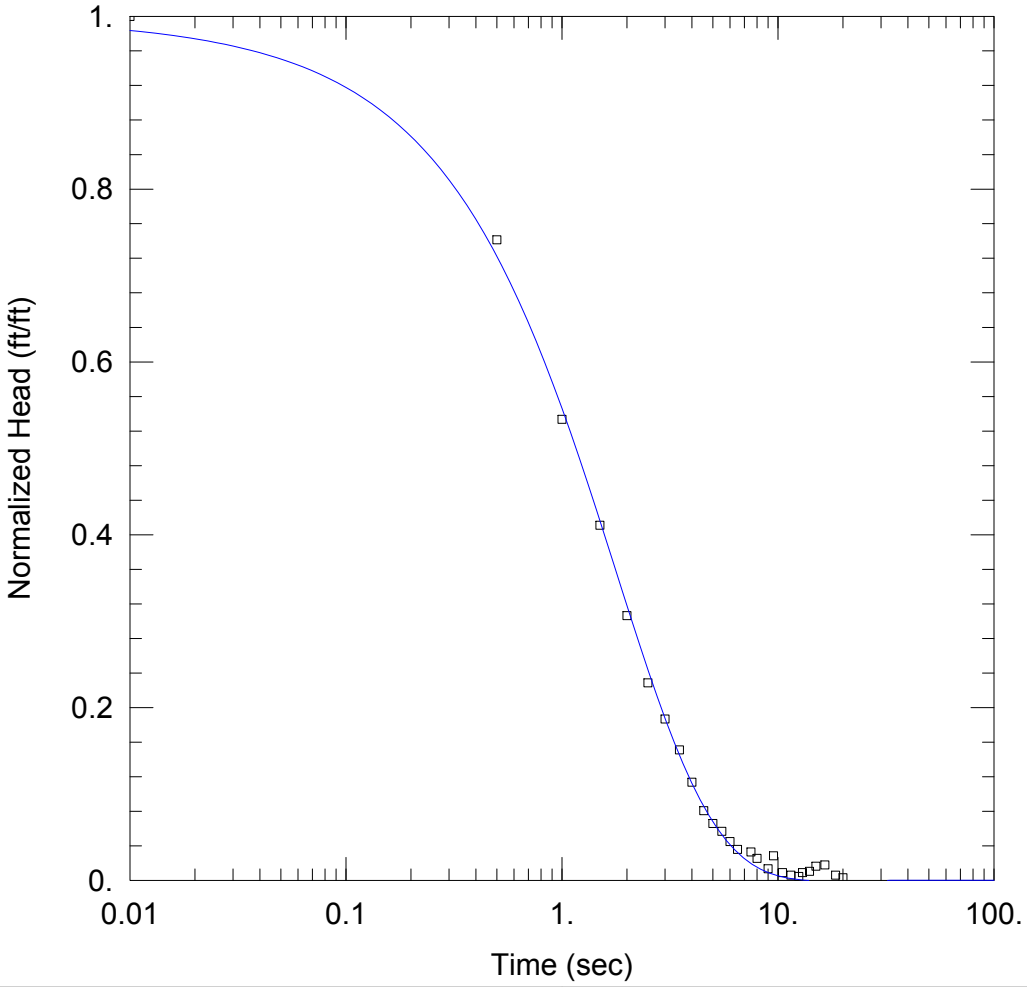
WELL DATA (JHC MW-15028)

Initial Displacement: 1.515 ft
Static Water Column Height: 6.22 ft
Total Well Penetration Depth: 6.22 ft
Screen Length: 6.22 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15033 - Test 2

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 74. ft/day Ss = 5.3E-5 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 29.83 ft

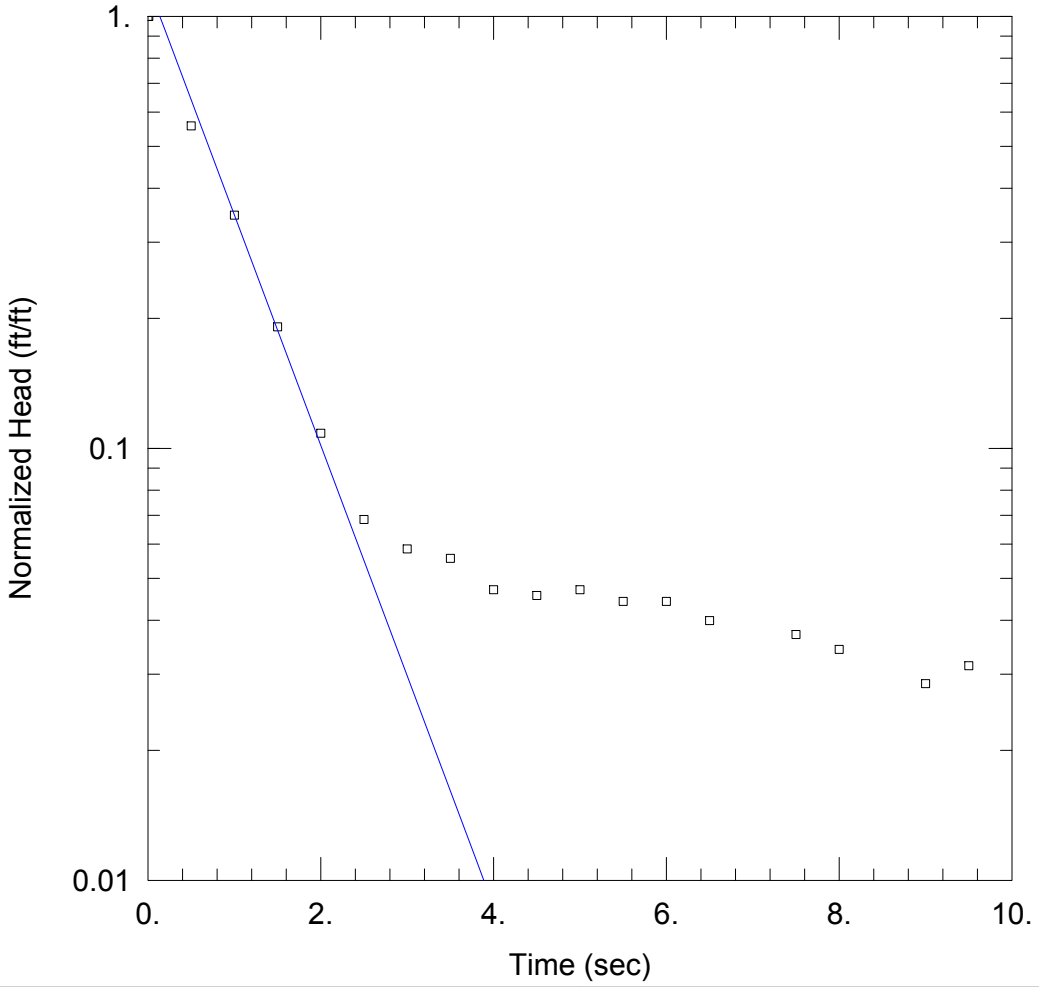
WELL DATA (JHC MW-15033)

Initial Displacement: 0.669 ft
Static Water Column Height: 5.83 ft
Total Well Penetration Depth: 5.83 ft
Screen Length: 5.83 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15030 - Test 2

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 100. ft/day y0 = 0.83 ft

AQUIFER DATA

Saturated Thickness: 45.12 ft

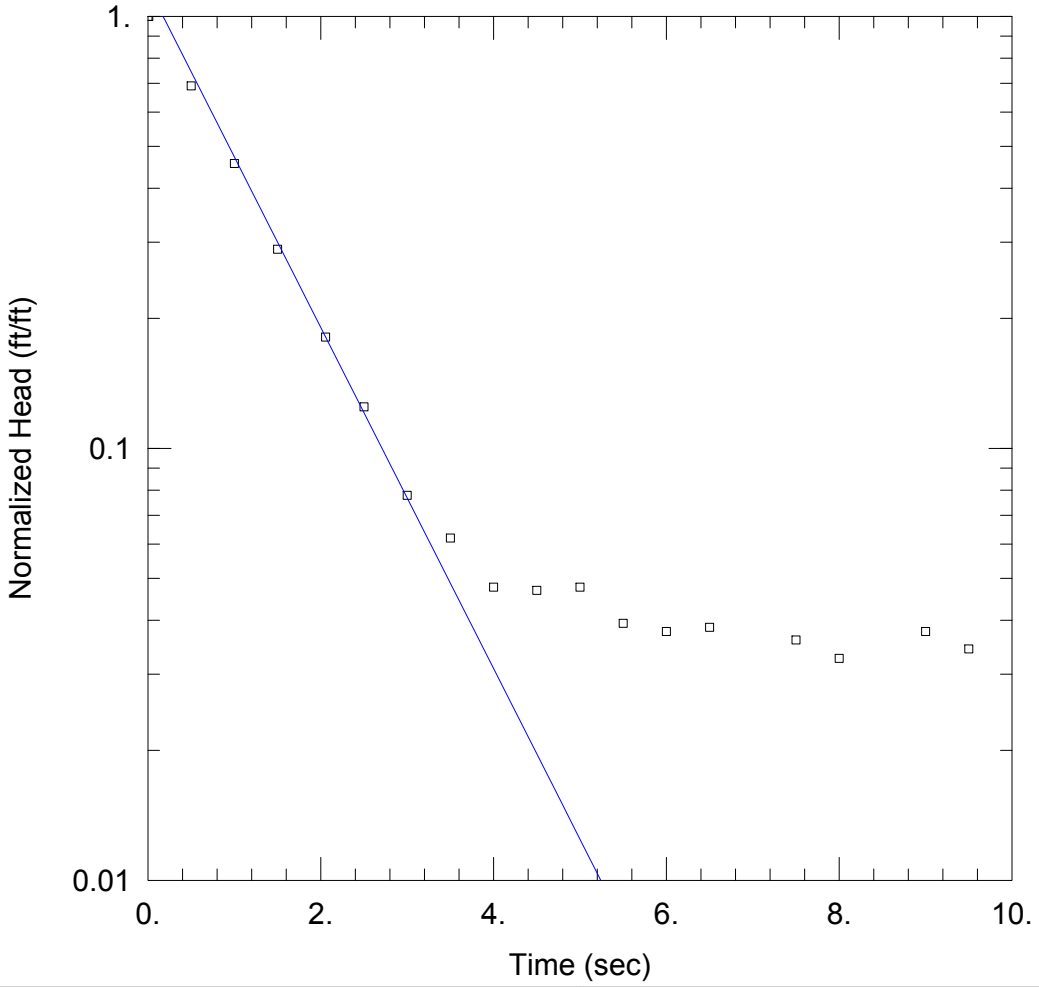
WELL DATA (JHC MW-15030)

Initial Displacement: 0.701 ft
Static Water Column Height: 9.12 ft
Total Well Penetration Depth: 9.12 ft
Screen Length: 9.12 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15030 - Test 3

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 87. ft/day y0 = 1.4 ft

AQUIFER DATA

Saturated Thickness: 45.12 ft

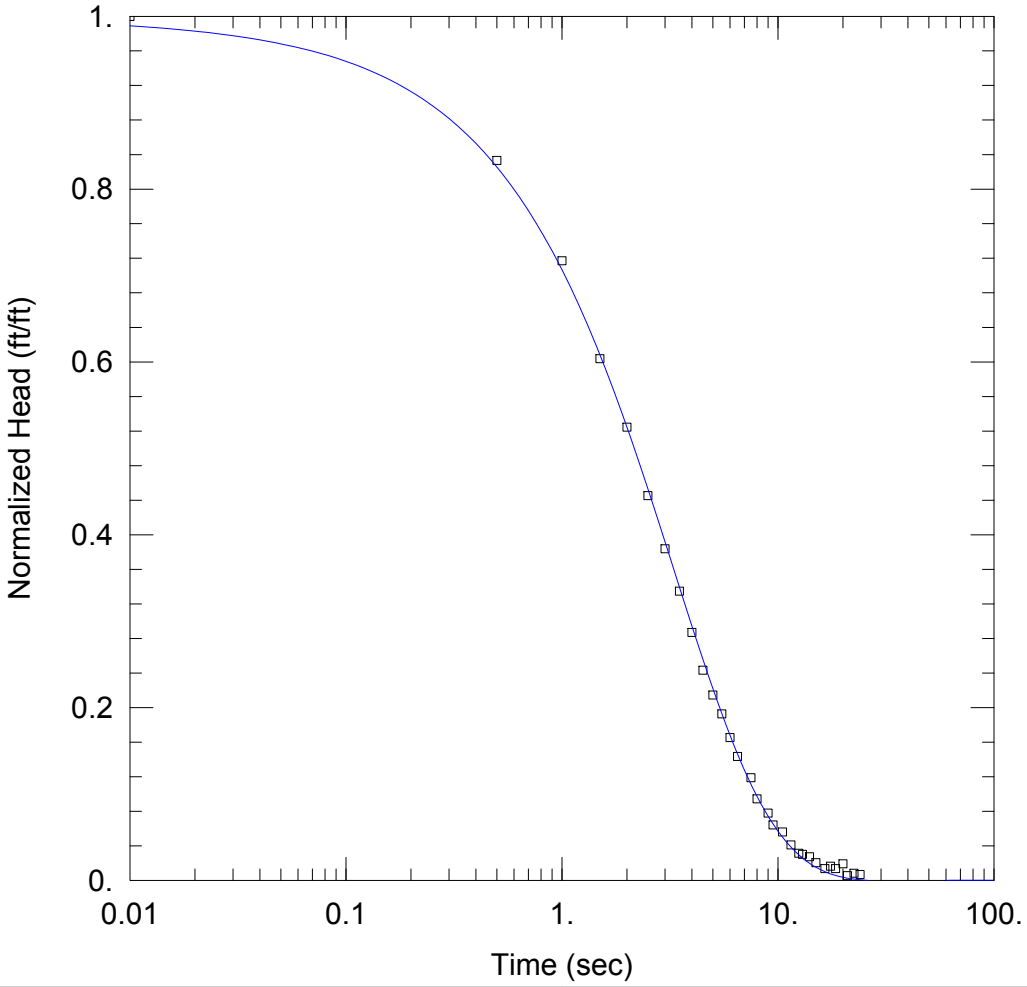
WELL DATA (JHC MW-15030)

Initial Displacement: 1.194 ft
Static Water Column Height: 9.12 ft
Total Well Penetration Depth: 9.12 ft
Screen Length: 9.12 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15018 - Test 1

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 34. ft/day Ss = 4.0E-5 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 36.5 ft

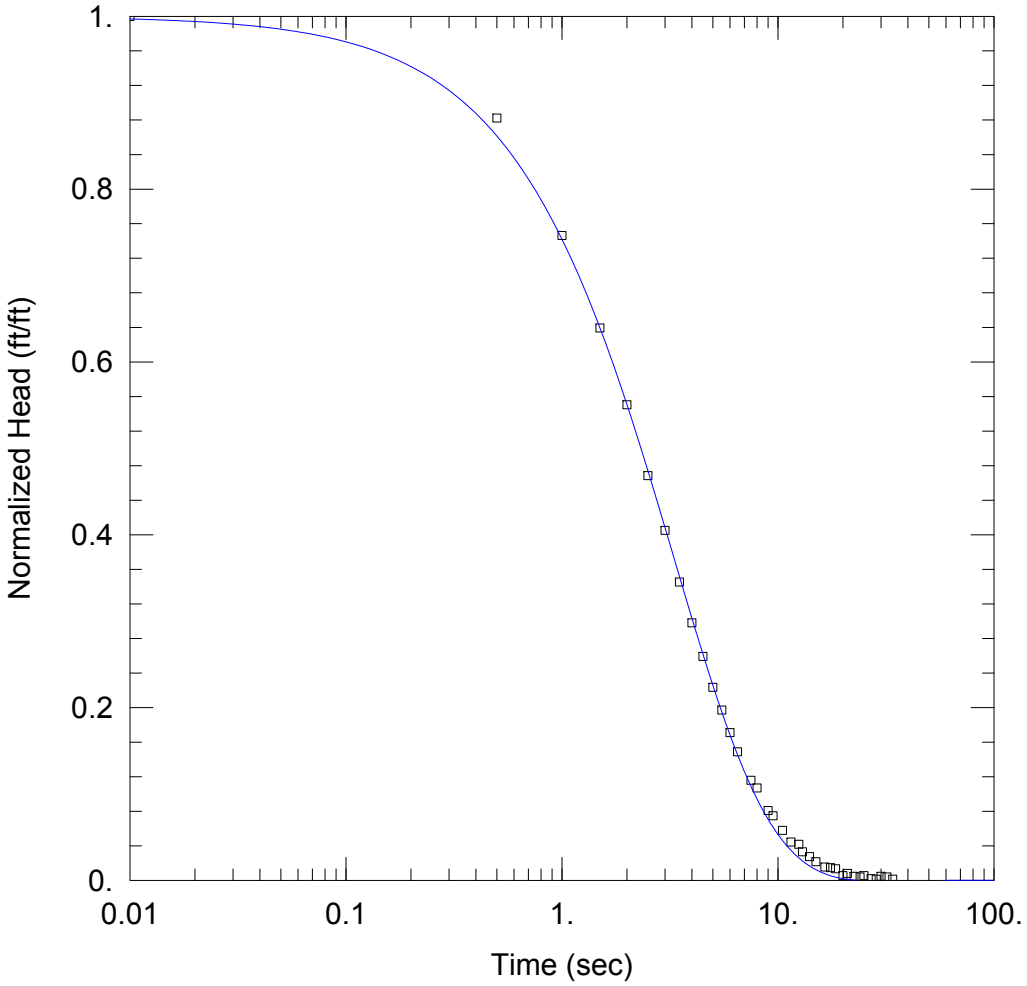
WELL DATA (JHC MW-15018)

Initial Displacement: 0.732 ft
Static Water Column Height: 6.5 ft
Total Well Penetration Depth: 6.5 ft
Screen Length: 6.5 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

ARCADIS

Slug Test Analysis Result for JHC MW-15018 - Test 3

Prepared By:	Prepared For:
Arcadis	Consumer Energy
Project:	Location: West Olive, MI



SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 33. ft/day Ss = 6.2E-12 ft^{-1}
Kz/Kr = 1.

AQUIFER DATA

Saturated Thickness: 36.5 ft

WELL DATA (JHC MW-15018)

Initial Displacement: 1.486 ft
Static Water Column Height: 6.5 ft
Total Well Penetration Depth: 6.5 ft
Screen Length: 6.5 ft
Casing Radius: 0.083 ft
Well Radius: 0.33 ft

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