



January 9, 2023

Mr. Kurt Fritz, P.G.
Pennsylvania Department of
Environmental Protection
South Central Regional Office
909 Elmerton Avenue
Harrisburg, Pennsylvania 17110

**Re: Fourth Quarter 2022 Environmental Monitoring Report
Waste Management Lancaster Landfill, Facility ID# 101559
Mount Joy Township, Lancaster County, Pennsylvania**

Dear Mr. Fritz:

Enclosed please find the Environmental Monitoring Report and completed Pennsylvania Department of Environmental Protection Forms for the 4th Quarter 2022 for Lancaster Landfill.

Sampling and analysis was performed by Geochemical Testing, Inc. Civil & Environmental Consultants, Inc. reviewed the data and prepared the Letter Report.

Should you have any questions or require any additional information, please contact me at (215) 269-2251.

Respectively Submitted,

A handwritten signature in blue ink that reads 'Jarod Freese'.

Jarod Freese
Waste Management
Environmental Protection

Enclosure



**LANCASTER LANDFILL
MOUNT JOY TOWNSHIP, LANCASTER COUNTY, PENNSYLVANIA
PADEP I.D. NO. 101559**

**FOURTH QUARTER 2022
ENVIRONMENTAL MONITORING REPORT**

**Submitted:
January 2023**

**Prepared by:
Civil & Environmental Consultants, Inc.
4350 Northern Pike, Suite 141
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CEC Project 306-896**

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- B. 4th Quarter 2022 PADEP EDD and Geochemical Testing Laboratory Reports, Quality Assurance/Quality Control Report, and Field Forms
- C. 4th Quarter 2022 PADEP Form 50 Leachate Laboratory Results
- D. 4th Quarter 2022 Methane Probe Monitoring Results
- E. 4th Quarter 2022 Dust Fall Results

1.0 INTRODUCTION

1.1 SCOPE AND PURPOSE

This report summarizes the results of the 4th Quarter 2022 groundwater monitoring activities at the Lancaster Landfill in Mount Joy Township, Lancaster County, Pennsylvania. The Lancaster Landfill is operated by Waste Management (WM) under Pennsylvania Department of Environmental Protection (PADEP) Permit No. 101559. This sampling event was performed on October 31 – November 1, 2022 to satisfy requirements of the PADEP.

Lancaster Landfill is located in the northern portion of Lancaster County, Pennsylvania approximately five miles east of the city of Elizabethtown, Pennsylvania (Figure 1). The facility is accessed from Cloverleaf Road.

The Groundwater Monitoring Program at Lancaster Landfill incorporates permanent monitoring elements to provide environmental protection during and after landfill development. All field work, sampling methodologies, data evaluation, data quality assurance and quality control (QA/QC), chemical analysis, and time-series analysis were conducted in accordance with the approved site permit.

1.2 SITE DESCRIPTION AND BACKGROUND

Lancaster Landfill is an active construction and demolition solid waste facility. Permit No. 101559 was originally issued on June 2, 1992. The facility consists of an approximately 135-acre parcel of land, of which approximately 58.81 acres are permitted for waste disposal.

2.0 GEOLOGY AND HYDROGEOLOGY

The information in this section was originally presented in Forms 6 and 7 of the 2007 Major Permit Application for the Phase I & II Landfill Expansion, prepared by Blazosky Associates, Inc. Refer to the complete Permit Application for more details.

2.1 REGIONAL GEOLOGY

Lancaster Landfill is located within the southwestern portion of the narrow neck sub-basin of the Gettysburg-Newark Basin Complex. This sub-basin is a transitional zone between the Newark sub-basin to the northwest and the Gettysburg sub-basin to the southeast. The Gettysburg-Newark Basin Complex lies between the Great Valley and Piedmont Physiographic Provinces and contains Triassic and Jurassic un-metamorphosed, sedimentary, and mafic igneous rocks (BAI, 2007a).

2.2 LOCAL GEOLOGY

Lancaster Landfill is underlain by Triassic conglomerate, sandstone, siltstone, and shale of the New Oxford Formation. These units are interpreted to record early syntectonic fluvial deposition in a half-graben basin, distal to the border fault in which surface water drainage was directed to the northwest, towards the border fault. Fluvial dominated stratigraphic successions such as these are typical of initial rift basin deposition and generally transition stratigraphically upward into lacustrine-dominated sedimentary successions. Lacustrine deposits have been reported by numerous works in the upper New Oxford and Gettysburg Formations. The sedimentary units in the vicinity of Lancaster Landfill generally strike east-northeast to west-southwest (approximately N60°E) and dip approximately 50 degrees to the north-northwest (BAI, 2007a).

2.3 SITE HYDROGEOLOGY

Groundwater is present beneath Lancaster Landfill within the New Oxford Formation. The New Oxford Formation is characterized by a series of interbedded sandstones, siltstones, and

shales. Groundwater movement within this unit is typical of fractured bedrock formations and flows primarily through secondary porosity (BAI, 2007b).

2.3.1 New Oxford Formation Hydrostratigraphic Unit

Based on aquifer pumping tests, the New Oxford Formation hydrostratigraphic unit has an average hydraulic conductivity of 24 to 98 ft/day. The storage coefficient is estimated to be 4.1×10^{-4} to 5.47×10^{-3} (unitless). Effective porosity is estimated to be 25 percent (BAI, 2007b).

3.0 FIELD PROGRAM, MONITORING RESULTS, AND DISCUSSION

3.1 VISUAL WELL INSPECTIONS

During completion of each groundwater sampling event, monitoring wells are visually inspected for integrity, any physical damage and/or changes that may have occurred to the well or surrounding area, or signs of distressed vegetation surrounding the well. Any variation from previous sampling events is noted on the Field Information Form or Well Condition Inspection Form, both of which are provided in Appendix B. Well casing stickup length, well casing diameter, and material of construction is recorded on the Field Information Form.

3.2 WELL AND SURFACE WATER MONITORING NETWORK AND GROUNDWATER ELEVATION MEASUREMENTS

3.2.1 Well and Surface Water Monitoring Network

The monitoring network at Lancaster Landfill includes quarterly sampling at wells completed within the New Oxford Formation as well as surface water monitoring locations. The monitoring well network targets the preferential flow path for the facility as described in the Groundwater Monitoring Plan [Civil & Environmental Consultants, Inc. (CEC), 2018] and is designed as an early detection monitoring system.

Form 21 Monitoring Points			
Monitored Zone		Location ID	
Groundwater	Upgradient Well	MW-101U	
	Downgradient Wells	MW-104D	MW-108DR
		MW-105DR	MW-109DR
		MW-106DR	MW-110DR
		MW-107DR	MW-111DR
Surface Water		MGSU01	MGSD05
		MGSD02	MGSU06
		MGSU03	MGSU07
		MGSD04	
Underdrains		U-C2	U-C9C
		U-C5	U-C10A
		U-C6A	U-C10B
		U-C6B	U-C10C
		U-C8A	U-C10D
		U-C9B	

As reported in previous quarterly reports, several underdrains to the north of the disposal area were first sampled in 2021. Four of these (U-C10A, U-C10B, U-C10C, and U-C10D) were recently found, and they were first sampled during the 1st Quarter 2022. During the process to locate and identify the underdrains, the on-site contractor and ARM Group (who prepared the certification report) confirmed that U-C9A was never installed because it was determined to be unnecessary during construction. All other underdrains have been located and will be sampled quarterly when flowing.

During the 1st Quarter 2022, MW-105DR and MW-106DR were installed to replace MW-105D and MW-106D at their approved locations to accommodate Cell 11 construction. In accordance with the permit, all four wells were sampled concurrently during the 1st and 2nd Quarters of 2022. The results from both sets of concurrent samples indicated that the groundwater quality in the replacement wells are generally comparable to the original wells. MW-105D and MW-106D were decommissioned in the spring of 2022.

3.2.2 Groundwater Elevation Measurements

Prior to initiation of groundwater purging and sampling activities, depth to water and water level elevation [feet above mean sea level (famsl)] were recorded to the nearest hundredth of a foot. The water level measurements are utilized in preparation of groundwater contours to determine groundwater flow direction and gradient at the site. Groundwater elevations for the 4th Quarter 2022 sampling event are generally comparable to historical groundwater elevation measurements (see Table 2).

3.3 GROUNDWATER GRADIENT AND FLOW VELOCITY

The horizontal groundwater seepage velocities were estimated using the following equation:

$$v = \frac{(K_h i)}{n_e}$$

Where:

- v = average groundwater velocity;
- K_h = aquifer horizontal conductivity;
- i = average hydraulic gradient; and
- n_e = effective aquifer porosity.

The potentiometric surface map of the New Oxford Formation Hydrostratigraphic Unit indicates that the horizontal gradient is to the northeast at 0.0308 ft/ft (Figure 3). Horizontal groundwater velocity in the New Oxford Formation Hydrostratigraphic Unit is 12.1 ft/day (4,417 ft/year), based upon an average hydraulic conductivity of 98 ft/day and an effective porosity of 25 percent (BAI, 2007b).

3.4 SAMPLING AND ANALYTICAL PROGRAM

3.4.1 Field Program

Field sampling activities for the detection monitoring wells for the 4th Quarter 2022 were conducted on October 31 – November 1, 2022 (Table 1). Monitoring well purging and sampling activities were implemented in accordance with the Groundwater Monitoring Plan (CEC, 2018) and site permit. The majority of the wells were sampled with a pump with low-flow purging and sampling techniques. Non-dedicated sampling equipment is decontaminated between locations. MW-107DR cannot support low-flow purging, so a dedicated bailer is used to purge the well dry and then a sample is collected within 24 hours.

3.4.2 Laboratory Analysis and Monitoring Parameters

In accordance with the Groundwater Monitoring Plan (CEC, 2018), monitoring wells and surface water at the site are analyzed for Form 21 detection constituents plus an additional 22 inorganic parameters (referred to as Form 21 Modified throughout the rest of this document). There is no annual sampling event. Refer to Table 1 of the Groundwater Monitoring Plan (CEC, 2018) for complete details.

All water samples collected at the site were delivered to Geochemical Testing, Inc. in Somerset, Pennsylvania for chemical analysis. Geochemical Testing is certified in the Commonwealth of Pennsylvania for performing chemical analysis of the reported parameters. The PADEP Form 21 Modified is included in Appendix A. The laboratory reports, laboratory quality control report, and field forms are included in Appendix B. A summary of the analytical results is provided in Table 3.

3.5 ANALYTICAL PROGRAM RESULTS

Nine wells, seven surface water monitoring points, and three underdrain points were sampled during the 4th Quarter 2022 (underdrains U-C5, U-C6B, U-C9B, U-C9C, U-C10A, U-C10B, U-C10C, and U-C10D were dry). As reported in previous quarterly reports, underdrain location U-C9A was never installed. Sample analysis was completed without any difficulties and the results are representative of groundwater at the site.

3.6 GEOCHEMICAL ANALYSIS

The PADEP permit requires Lancaster Landfill to submit quarterly sampling results for Form 21 Modified parameters. Lancaster Landfill is providing a quarterly review of time-series analysis for leachate indicator parameters.

3.6.1 Time-Series Analysis

The time versus concentration plots of five leachate indicator parameters [ammonia-nitrogen, alkalinity, total dissolved solids (TDS), chloride, and sodium] were analyzed for significant trends, unexpected geochemical signatures, and anomalously high results.

3.6.1.1 *New Oxford Formation*

As shown in the time-series graphs for the monitoring wells installed in the New Oxford Formation Hydrostratigraphic Unit (Figure 4), no historically significant upward trends were observed, except for alkalinity at MW-104D, MW-109DR, and MW-110DR and chloride, sodium, and TDS at MW-105DR. These trends do not appear to be a result of leachate influence because the remaining indicator parameters are relatively stable over the same period of time. It should also be noted that chloride, sodium, and TDS in MW-106DR and MW-107DR appear to fluctuate seasonally; however, detected concentrations are within historic levels.

3.7 SURFACE WATER ANALYSIS

The current surface water Form 21 Modified detection monitoring program consists of seven surface water monitoring points. Those points are MGSU01, MGSD02, MGSU03, MGSD04, MGSD05, MGSU06, and MGSU07.

Surface water was sampled on October 31, 2022 for the required analysis pursuant to the permit requirements. Seven surface water locations were sampled during the 4th Quarter 2022. The concentration of metals and general chemistry constituents in the surface water samples were generally consistent with historical results. Surface water at Lancaster Landfill does not appear to show signs of leachate influence.

3.8 LEACHATE ANALYSIS

Cells are monitored as part of the leachate collection zone (LCZ) and leachate detection zone (LDZ) monitoring network. During each quarter, a composite leachate collection sample is collected from the storage tank and analyzed for PADEP Form 50 parameters (Appendix C). All samples collected at Lancaster Landfill were delivered to Geochemical Testing for chemical analysis. During the 4th Quarter 2022, a grab sample from the composite LCZ was collected from the storage tank. Each LDZ was also sampled, except for LDZ-6 which was dry.

The average daily LCZ flow from the landfill during the quarter was 845.9 gallons per acre per day (g/a/d). This flow is generally comparable with historic results. Based on recommendations communicated to CEC from the PADEP, the flows were calculated using data collected from the entire calendar quarter.

The analytical results from the LDZ samples were generally consistent to historic results. MCLs were not exceeded, except for benzene at LDZ-7. MCL exceedances at LDZ-7 have occurred periodically in the past and additional parameters will be added to the groundwater sampling event conducted during the 1st Quarter 2023. It should be noted that the groundwater samples are analyzed for PADEP Form 21 parameters; however, the PADEP Form 19 Detection Zone add-on list of parameters will be added to the groundwater samples collected next quarter as a conservative analysis based on the requirements of the PADEP Form 50. The average daily flows from the LDZs are presented below. These flows are generally consistent with historical results.

- 11.5 g/a/d at LDZ-1;
- 0 g/a/d at LDZ-2;
- 0.1 g/a/d at LDZ-3;
- 0.8 g/a/d at LDZ-4;
- 5.3 g/a/d at LDZ-5;
- 1.2 g/a/d at LDZ-6;
- 2.1 g/a/d at LDZ-7; and
- 8.0 g/a/d at LDZ-10.

It should be noted that the reported flow volume for LDZ-1 is based on the October 2022 flows only. As reported by Lancaster Landfill, the pump house, which services LDZ-1, was removed in early November 2022 as part of cell construction; however, the sump remains. Lancaster Landfill reported that the LDZ produced minimal water during November and December 2022, and the sump will be pumped, as needed, during these construction activities.

Based on current and historical analytical and flow data from the LDZs as well as the requirements of the PADEP Form 50, the LDZ sampling and analysis schedule is as follows. LDZ-1, LDZ-2,

LDZ-3, LDZ-4, LDZ-5, and LDZ-10 do not appear to be influenced by leachate. Therefore, they should be sampled once per year (during the 4th quarter) for the PADEP Form 50 indicator parameters, assuming flows remain less than 10 g/a/d. LDZ-6 and LDZ-7 appear to be influenced by leachate. Therefore, they should be sampled once per year (during the 4th quarter) for the full PADEP Form 50 list of parameters, regardless of flow.

Based on the above discussion, the LDZ-1 is scheduled to be sampled for PADEP Form 50 indicator parameters during the 1st Quarter 2023 because flows were greater than 10 g/a/d during the 4th Quarter 2022. Additionally, LDZ-6 is scheduled to be sampled for the full PADEP Form 50 list of parameters during the 1st Quarter 2023 because it was dry during the 4th Quarter 2022.

3.9 METHANE PROBE MONITORING RESULTS

Field measurements of methane, carbon dioxide, oxygen, and balance were collected from the four on-site gas monitoring probes. Percent methane was then converted to percent lower explosive levels of methane. As shown in Appendix D, no methane was detected at or above the lower explosive limit in any probe during the 4th Quarter 2022.

3.10 DUST FALL RESULTS

Dust collection analysis is performed monthly through the placement of four dust fall jars around Lancaster Landfill. The jars are collected monthly, and a fresh jar is placed in the holders. It should be noted that analysis method American Society for Testing and Materials (ASTM) D 1739-98 MOD is a conservative analysis because it includes organic matter that would otherwise be removed for analysis via Method ASTM D 1739-82 MOD.

The results of the dust fall analysis contained in Appendix E indicate no sample exceeded the maximum dust fall of 1.5 mg/cm²/month as specified in PA 25 §131.3 and referenced in PA 25 §273.217 during the 4th Quarter 2022, except for Locations A, B, and D during October and Location B during November. A review of the laboratory case narratives indicates the exceedances do not appear to be entirely reflective of dust emissions generated from landfill operations due to

organic matter (insects, leaves, etc.), which is commonly present in the samples. During the month of October, Location A was noted as containing brown water with insects, leaves, seeds, and sticks and Locations B and D were noted as containing tan water with leaves and sticks. During the month of November, Location B was noted as containing brown water with dirt and leaves.

4.0 LABORATORY AND FIELD QUALITY ASSURANCE AND QUALITY CONTROL

4.1 HOLDING TIMES

All samples submitted to Geochemical Testing were analyzed within the required holding times as determined by the analytical method, except for lab pH, which has a 15-minute hold time. However, field pH readings were collected at the sampling locations in accordance with industry standard practices.

4.2 SAMPLE SURROGATE RECOVERIES

Sample surrogate recovery analyses are performed with each quarterly event. However, if results are not within acceptable ranges, notification would be included in the Quality Assurance Project Report prepared by Geochemical Testing (Appendix B).

4.3 METHOD BLANKS

No laboratory method blanks contained concentrations of any chemicals that would place the sampling event into question.

4.4 LABORATORY CONTROL SPIKES

Laboratory control spikes for all analytical methods are performed with each quarterly event. However, if results are not within advisory limits, notification would be included in the Quality Assurance Project Report prepared by Geochemical Testing (Appendix B).

4.5 INITIAL CALIBRATION, CONTINUING CALIBRATION, AND INTERNAL MACHINE STANDARDS

Laboratory calibration is performed with each quarterly event. However, if results are not within acceptable limits, notification would be included in the Quality Assurance Project Report prepared by Geochemical Testing (Appendix B).

5.0 CONCLUSIONS

Samples were collected at Lancaster Landfill according to appropriate sampling procedures and sent to Geochemical Testing. The following observations are noted for the 4th Quarter 2022 sampling event:

- Lancaster Landfill was sampled for Form 21 Modified or Form 50 constituents on October 31 – November 1, 2022.
- The New Oxford Formation Hydrostratigraphic Unit has a horizontal gradient to the north at 0.0308 ft/ft, with a horizontal velocity of 12.1 ft/day (4,417 ft/year) (Figure 3).
- Time-series analysis of select groundwater leachate indicator parameters shows no significant upward trends in these constituents through time, except for alkalinity at MW-104D, MW-109DR, and MW-110DR and chloride, sodium, and TDS at MW-105DR. However, these trends do not appear to be a result of leachate influence because the remaining indicator parameters are relatively stable over the same period of time.
- Field measurements of methane, carbon dioxide, oxygen, and balance were collected from the four on-site gas monitoring probes and no methane was detected at or above the lower explosive limit in any probe during the 4th Quarter 2022.
- The results of the 4th Quarter 2022 dust fall analysis indicate no sample exceeded the maximum dust fall of 1.5 mg/cm²/month, except for Locations A, B, and D during October and Location B during November. A review of the laboratory case narratives indicates the exceedances do not appear to be entirely reflective of dust emissions generated from landfill operations due to organic matter (insects, leaves, etc.), which is commonly present in the samples.

Therefore, the major conclusions of this report are:

1. Continued landfilling activities do not appear to be altering the existing groundwater or surface water conditions;
2. The groundwater monitoring network is capable of monitoring the hydrostratigraphic unit beneath Lancaster Landfill; and

3. The frequency of sampling and the constituents analyzed are appropriate for determining if a release has occurred.

6.0 REFERENCES

Blazosky Associates, Inc (BAI, 2007a). PADEP Form 6 Geologic Information. Veolia ES Lancaster, LLC; Veolia ES Lancaster Landfill; Phase I & II Landfill Expansion Application for Major Permit Modification. June 2007.

Blazosky Associates, Inc (BAI, 2007b). PADEP Form 7 Hydrogeologic Information. Veolia ES Lancaster, LLC; Veolia ES Lancaster Landfill; Phase I & II Landfill Expansion Application for Major Permit Modification. June 2007.

Civil & Environmental Consultants, Inc., 2018. “Lancaster Landfill Groundwater and Surface Water Sampling and Analysis Plan.” Submitted September 2018.

TABLES

TABLE 1
LANCASTER LANDFILL
PADEP ID NO. 101559

**FOURTH QUARTER 2022
FIELD PARAMETERS**

AQUIFER	SAMPLE LOCATION	SAMPLE DATE	SAMPLE TIME	WATER LEVEL ¹ (ft)	WELL DEPTH ¹ (ft)	WATER VOLUME ² (gallons)	THREE VOLUMES (gallons)	WATER PURGED (gallons)	VOLUMES PURGED	FIELD PARAMETERS			COMMENTS
										pH	COND (µS/cm)	TEMP (C)	
New Oxford Formation	MW-101U	10/31/22	10:52 AM	15.09	54.00	6.23	18.68	1.9	0.31	5.79	179	14.0	
	MW-104D	10/31/22	10:19 AM	40.08	76.50	5.83	17.48	1.9	0.33	6.62	590	13.9	
	MW-105DR	10/31/22	09:44 AM	32.67	66.63	5.43	16.30	1.9	0.35	6.08	497	13.6	
	MW-106DR	10/31/22	09:42 AM	37.98	105.13	10.74	32.23	1.9	0.18	7.26	254	12.8	
	MW-107DR	10/31/22	08:50 AM	25.32	50.50	4.03	12.09	5.0	1.24	6.65	874	14.8	
	MW-108DR	10/31/22	11:34 AM	46.77	80.00	5.32	15.95	1.9	0.36	7.22	381	15.6	
	MW-109DR	10/31/22	12:04 PM	56.28	101.70	7.27	21.80	1.9	0.26	5.38	492	14.1	
	MW-110DR	10/31/22	01:24 PM	8.17	32.00	3.81	11.44	1.9	0.50	6.72	739	13.6	
	MW-111DR	10/31/22	11:04 AM	29.98	120.15	14.43	43.28	1.9	0.13	6.31	248	13.3	
Surface Water	MGSU01	10/31/22	10:00 AM							7.37	461	11.9	
	MGSD02	10/31/22	09:40 AM							7.34	337	11.0	
	MGSU03	10/31/22	10:15 AM							7.35	306	11.6	
	MGSD04	10/31/22	10:30 AM							7.63	364	12.5	
	MGSD05	10/31/22	10:45 AM							7.22	351	12.3	
	MGSU06	10/31/22	09:20 AM							7.21	329	11.4	
		MGSU07	10/31/22	09:05 AM							7.32	339	12.8
Underdrain	U-C2	11/01/22	10:20 AM							7.47	408	21.0	
	U-C5												Dry
	U-C6A	11/01/22	11:00 AM							6.11	398	19.2	
	U-C6B												Dry
	U-C8A	11/01/22	09:00 AM							5.97	999	15.9	
	U-C9B												Dry
	U-C9C												Dry
	U-C10A												Dry
	U-C10B												Dry
	U-C10C												Dry
	U-C10D												Dry

TABLE 1
LANCASTER LANDFILL
PADEP ID NO. 101559

**FOURTH QUARTER 2022
FIELD PARAMETERS**

AQUIFER	SAMPLE LOCATION	SAMPLE DATE	SAMPLE TIME	WATER LEVEL ¹ (ft)	WELL DEPTH ¹ (ft)	WATER VOLUME ² (gallons)	THREE VOLUMES (gallons)	WATER PURGED (gallons)	VOLUMES PURGED	FIELD PARAMETERS			COMMENTS
										pH	COND (μ S/cm)	TEMP (C)	
Leachate	Leachate Storage Tank	10/31/22	02:00 PM							8.00	5,540	17.0	
	LDZ-1	10/31/22	01:30 PM							7.11	580	24.5	Sampled annually
	LDZ-2	10/31/22	01:10 PM							7.13	2,600	21.5	Sampled annually
	LDZ-3	10/31/22	12:40 PM							7.16	2,800	20.9	Sampled annually
	LDZ-4	10/31/22	12:35 PM							6.81	1,992	22.0	Sampled annually
	LDZ-5	10/31/22	12:15 PM							6.83	1,863	20.1	Sampled annually
	LDZ-6												Dry
	LDZ-7	10/31/22	11:15 AM							7.17	4,910	19.2	Sampled annually
LDZ-10	10/31/22	11:35 AM							6.91	2,520	21.3	Sampled annually	

Notes:

¹ Measured from top of inner casing.

² Calculated using 0.16 gallons per foot of water for 2-inch wells.
Calculated using 0.65 gallons per foot of water for 4-inch wells.
Calculated using 1.47 gallons per foot of water for 6-inch wells.

C = Degrees Centigrade.

μ S/cm = microSiemens/centimeter.

gpm = gallons per minute.

ft = feet

NA = not applicable

TABLE 2
LANCASTER LANDFILL
PADEP ID NO. 101559

FOURTH QUARTER 2022
WATER-LEVEL ELEVATIONS

AQUIFER	MONITORING POINT	MEASUREMENT DATE	MEASUREMENT POINT ELEV.¹ (ft amsl)	WATER LEVEL² (ft)	WATER LEVEL ELEV. (ft amsl)
New Oxford Formation	MW-101U	10/31/2022	495.93	15.09	480.84
	MW-104D	10/31/2022	418.32	40.08	378.24
	MW-105DR	10/31/2022	410.93	32.67	378.26
	MW-106DR	10/31/2022	427.53	37.98	389.55
	MW-107DR	10/31/2022	466.85	25.32	441.53
	MW-108DR	10/31/2022	471.40	46.77	424.63
	MW-109DR	10/31/2022	435.00	56.28	378.72
	MW-110DR	10/31/2022	428.00	8.17	419.83
	MW-111DR	10/31/2022	486.65	29.98	456.67

Notes:

¹ Elevation for the top of the PVC from field forms.

ft amsl = feet above mean sea level.

² Measured from the top of the PVC riser pipe.

NA = not applicable.

TABLE 3
LANCASTER LANDFILL
PADEP ID NO. 101559

FOURTH QUARTER 2022
RESULTS OF CHEMICAL ANALYSES PERFORMED ON GROUNDWATER AND SURFACE WATER

				GROUNDWATER								
Chemical Constituent	Unit	Analytical Method No.	MCL	MW-101U	MW-104D	MW-105DR	MW-106DR	MW-107DR	MW-108DR	MW-109DR	MW-110DR	MW-111DR
Form 21 Inorganics												
Chemical Oxygen Demand	mg/L	HACH 8000	NA	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Chloride	mg/L	EPA 300.0	250*	7.8	14.2	50.1	1.3	131	8.8	27.5	12.7	14.3
Iron	mg/L	EPA 200.7	0.3*	< 0.05	0.57	< 0.05	0.16	0.10	< 0.05	0.06	< 0.05	2.75
Iron, dissolved	mg/L	EPA 200.7	0.3*	< 0.05	< 0.05	< 0.05	0.14	< 0.05	< 0.05	< 0.05	< 0.05	1.50
pH (Field)	su	Field	NA	5.79	6.62	6.08	7.26	6.65	7.22	5.38	6.72	6.31
Lab pH	su	SM 4500-H+ B	NA	6.51 H	7.33 H	6.82 H	7.88 H	7.25 H	7.92 H	6.13 H	7.56 H	7.00 H
Sodium	mg/L	EPA 200.7	NA	7.0	15.3	21.0	14.8	15.1	9.1	20.4	5.1	15.3
Sodium, dissolved	mg/L	EPA 200.7	NA	7.1	15.6	20.7	15.1	14.8	9.0	21.1	5.1	14.9
Specific Conductance (Field)	µmhos/cm	Field	NA	179	590	497	254	874	381	492	739	248
Specific Conductance	µmhos/cm	EPA 120.1	NA	192	623	522	271	912	405	529	793	264
Sulfate	mg/L	EPA 300.0	250*	17.9	58.6	58.0	< 10	21.8	35.9	150	43.9	43.7
Total Organic Carbon	mg/L	SM 5310 C	NA	< 1.0	1.3	1.1	< 1.0	< 1.0	< 1.0	2.3	2.3	< 1.0
Total Organic Halogen	µg/L	EPA 9020	NA	< 50	< 50 C3 C1	< 50	< 50 C3	< 50	< 50	< 50 C1 M1	57 C1	< 50 C1
Additional Inorganics												
Alkalinity to pH 4.5	mg/L	ASTM D 1067-11	NA	44	225	107	118	230	141	50	345	54
Ammonia Nitrogen	mg/L	EPA 350.1	NA	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Arsenic	ug/L	EPA 200.8	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Arsenic, dissolved	ug/L	EPA 200.8	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Barium	mg/L	EPA 200.7	2	0.18	0.10	0.09	0.18	0.76	0.22	0.02	0.30	0.14
Barium, dissolved	mg/L	EPA 200.7	2	0.18	0.08	0.09	0.18	0.78	0.21	0.02	0.30	0.12
Calcium	mg/L	EPA 200.7	NA	17.2	71.8	53.7	27.3	113	53.6	48.5	134	14.0
Calcium, dissolved	mg/L	EPA 200.7	NA	17.5	73.6	52.7	28.0	114	52.8	49.6	136	13.9
Chromium	mg/L	EPA 200.7	0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chromium, dissolved	mg/L	EPA 200.7	0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lead	ug/L	EPA 200.8	15	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	12.3	< 5.0	< 5.0
Lead, dissolved	ug/L	EPA 200.8	15	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	11.8	< 5.0	< 5.0
Magnesium	mg/L	EPA 200.7	NA	6.1	18.1	16.9	6.8	31.0	12.1	16.1	14.1	10.6
Magnesium, dissolved	mg/L	EPA 200.7	NA	6.2	18.5	16.6	6.9	31.7	11.9	16.4	14.2	10.3
Manganese	mg/L	EPA 200.7	0.05*	< 0.01	0.11	0.08	0.31	0.02	< 0.01	1.13	< 0.01	1.32
Manganese, dissolved	mg/L	EPA 200.7	0.05*	< 0.01	0.08	0.08	0.32	< 0.01	< 0.01	1.16	< 0.01	1.27
Nickel	mg/L	EPA 200.7	NA	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Nickel, dissolved	mg/L	EPA 200.7	NA	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Phenolics	ug/L	EPA 420.4	NA	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0
Potassium	mg/L	EPA 200.7	NA	1.7	3.0	2.8	1.6	2.4	2.4	4.0	1.4	1.9
Potassium, dissolved	mg/L	EPA 200.7	NA	1.7	2.9	3.3	1.7	2.3	2.9	4.1	1.4	2.0
Total dissolved solids	mg/L	SM 2540 C	500*	114	354	284	132	524	216	292	448	196

MCL = Maximum Contaminant Level (EPA Federal Drinking Water Standards or PADEP Statewide Health Standards for used aquifers in a residential setting where EPA Standard does not exist).

* These values represent secondary MCLs.

TABLE 3
LANCASTER LANDFILL
PADEP ID NO. 101559

FOURTH QUARTER 2022
RESULTS OF CHEMICAL ANALYSES PERFORMED ON GROUNDWATER AND SURFACE WATER

Chemical Constituent	Unit	Analytical Method No.	MCL	SURFACE WATER						
				MGSU01	MGSD02	MGSU03	MGSD04	MGSD05	MGSU06	MGSU07
Form 21 Inorganics										
Chemical Oxygen Demand	mg/L	HACH 8000	NA	< 10	< 10	< 10	< 10	11	< 10	< 10
Chloride	mg/L	EPA 300.0	250*	63.8	31.4	15.2	29.1	32.3	23.0	40.5
Iron	mg/L	EPA 200.7	0.3*	0.05	0.06	0.12	0.08	0.14	0.19	0.63
Iron, dissolved	mg/L	EPA 200.7	0.3*	< 0.05	0.05	< 0.05	0.06	< 0.05	0.07	0.05
pH (Field)	su	Field	NA	7.37	7.34	7.35	7.63	7.22	7.21	7.32
Lab pH	su	SM 4500-H+ B	NA	8.00 H	7.98 H	7.82 H	8.15 H	8.05 H	7.89 H	7.91 H
Sodium	mg/L	EPA 200.7	NA	30.7	17.2	10.6	16.1	17.6	13.8	18.8
Sodium, dissolved	mg/L	EPA 200.7	NA	29.8	17.1	10.6	15.8	17.4	13.5	18.8
Specific Conductance (Field)	µmhos/cm	Field	NA	461	337	306	364	351	329	339
Specific Conductance	µmhos/cm	EPA 120.1	NA	502	373	316	405	377	367	371
Sulfate	mg/L	EPA 300.0	250*	31.9	33.9	24.7	35.2	25.6	28.0	23.3
Total Organic Carbon	mg/L	SM 5310 C	NA	1.6	3.7	2.1	2.7	3.5	2.9	3.7
Total Organic Halogen	µg/L	EPA 9020	NA							
Additional Inorganics										
Alkalinity to pH 4.5	mg/L	ASTM D 1067-11	NA	70	79	52	100	79	83	75
Ammonia Nitrogen	mg/L	EPA 350.1	NA	0.34	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Arsenic	ug/L	EPA 200.8	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Arsenic, dissolved	ug/L	EPA 200.8	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Barium	mg/L	EPA 200.7	2	0.16	0.08	0.15	0.13	0.09	0.07	0.08
Barium, dissolved	mg/L	EPA 200.7	2	0.15	0.08	0.14	0.13	0.09	0.07	0.07
Calcium	mg/L	EPA 200.7	NA	45.1	34.6	29.3	42.4	36.7	36.9	30.6
Calcium, dissolved	mg/L	EPA 200.7	NA	44.0	34.1	29.0	41.4	36.8	36.2	30.7
Chromium	mg/L	EPA 200.7	0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chromium, dissolved	mg/L	EPA 200.7	0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lead	ug/L	EPA 200.8	15	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Lead, dissolved	ug/L	EPA 200.8	15	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Magnesium	mg/L	EPA 200.7	NA	11.7	10.2	10.1	12.0	10.9	9.8	10.1
Magnesium, dissolved	mg/L	EPA 200.7	NA	11.4	10.1	9.9	11.7	10.9	9.7	10.1
Manganese	mg/L	EPA 200.7	0.05*	0.01	0.03	0.02	< 0.01	0.06	0.07	0.15
Manganese, dissolved	mg/L	EPA 200.7	0.05*	0.01	0.03	< 0.01	< 0.01	0.05	0.06	0.02
Nickel	mg/L	EPA 200.7	NA	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Nickel, dissolved	mg/L	EPA 200.7	NA	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Phenolics	ug/L	EPA 420.4	NA	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0
Potassium	mg/L	EPA 200.7	NA	3.9	3.2	4.4	3.7	3.4	3.5	2.9
Potassium, dissolved	mg/L	EPA 200.7	NA	3.9	3.2	4.3	3.7	3.4	3.4	2.9
Total dissolved solids	mg/L	SM 2540 C	500*	276	206	192	214	218	202	212

MCL = Maximum Contaminant Level (EPA Federal Drinking Water Standards or PADEP Statewide Health Standards for used aquifers in a residential setting where EPA Standard does not exist).

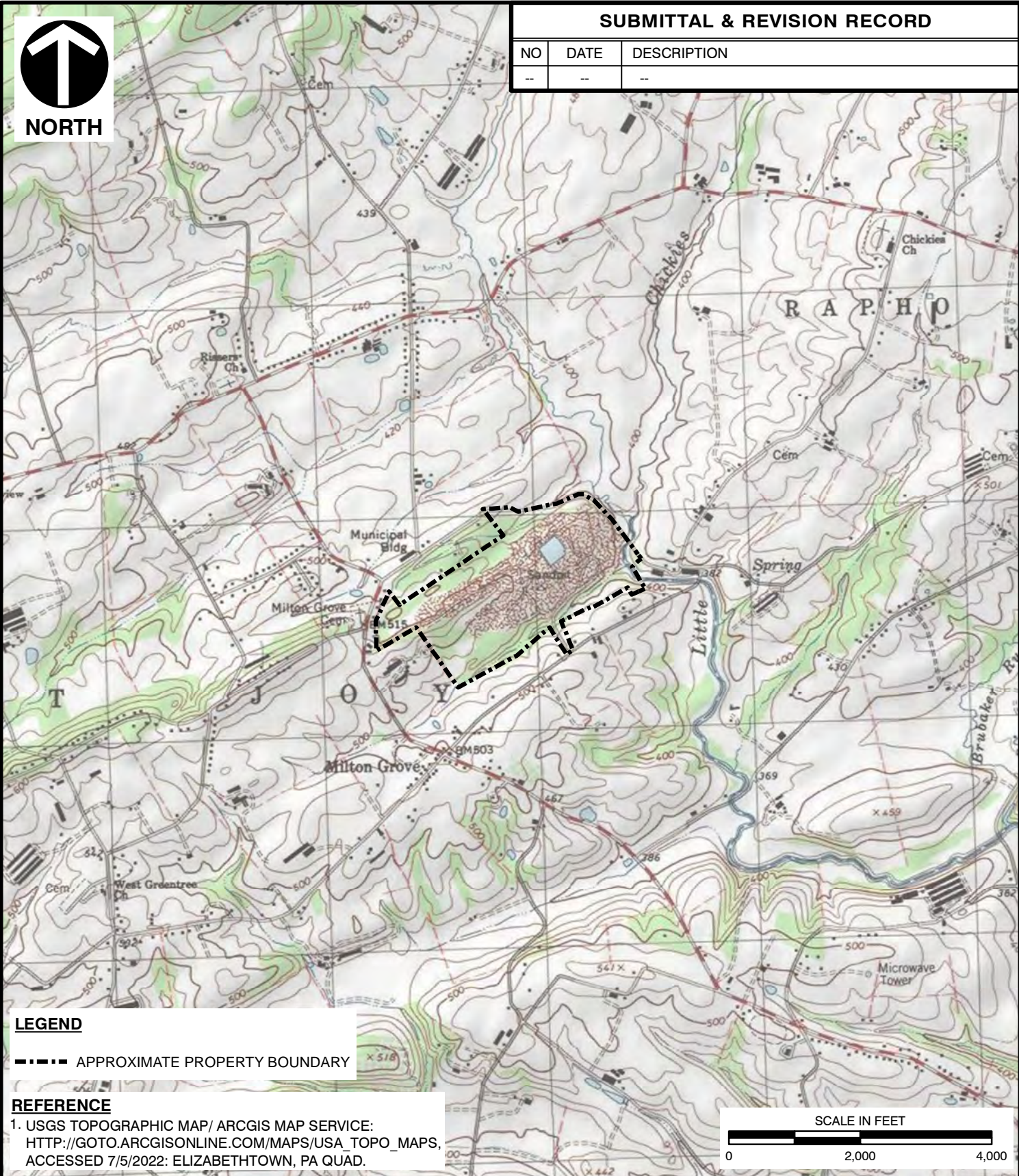
* These values represent secondary MCLs.

FIGURES



SUBMITTAL & REVISION RECORD

NO	DATE	DESCRIPTION
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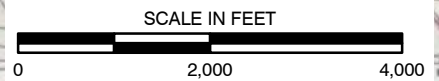


LEGEND

----- APPROXIMATE PROPERTY BOUNDARY

REFERENCE

1. USGS TOPOGRAPHIC MAP/ ARCGIS MAP SERVICE:
[HTTP://GOTO.ARCGISONLINE.COM/MAPS/USA_TOPO_MAPS](http://goto.arcgisonline.com/maps/usa_topo_maps),
 ACCESSED 7/5/2022: ELIZABETHTOWN, PA QUAD.



P:\300-000\306-896\GIS\MapInfo\EN06\FIG1.mxd 7/5/2022 4:15 PM (kcoliazz)



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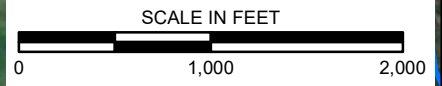
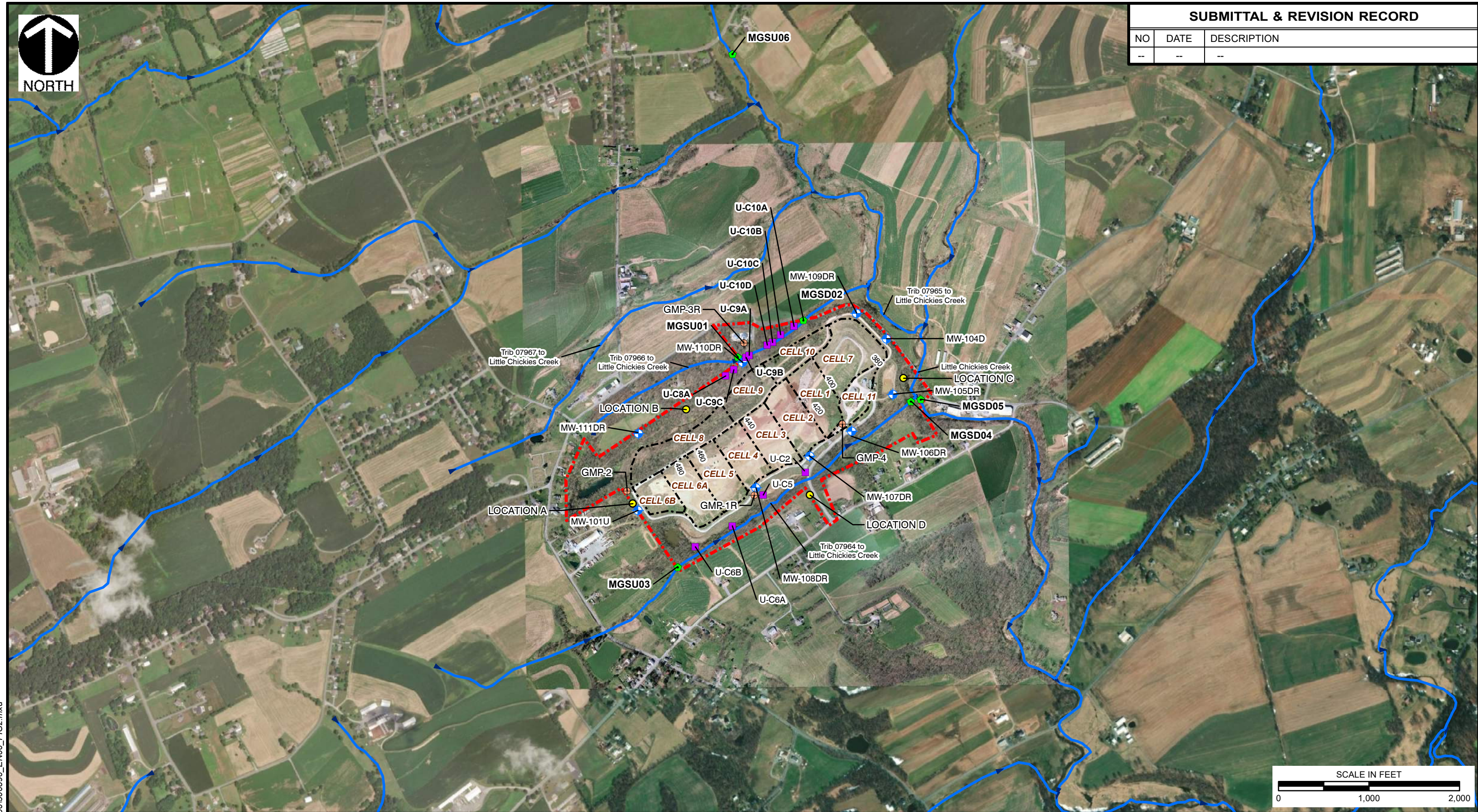
**WASTE MANAGEMENT
 LANCASTER LANDFILL
 MOUNT JOY TOWNSHIP,
 LANCASTER COUNTY, PENNSYLVANIA**

SITE LOCATION MAP

DRAWN BY:	KMC	CHECKED BY:	TEA	APPROVED BY:	RCD*	FIGURE NO:	1
DATE:	07/05/2022	SCALE:	1" = 2,000'	PROJECT NO:	306-896	* Hand signature on file	



SUBMITTAL & REVISION RECORD		
NO	DATE	DESCRIPTION
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P:\300-0001306-896-GIS\Maps\EN06\306896_EN06_FIG2.mxd

LEGEND	
	GROUNDWATER MONITORING WELLS
	SURFACE WATER POINTS
	UNDERDRAIN POINTS
	DUST FALL MONITORING POINTS
	GAS MONITORING PROBES
	PADEP 305B STREAM
	APPROXIMATE CELL LOCATION
	APPROXIMATE PROPERTY BOUNDARY

REFERENCE

- APRIL, 2016 IMAGERY PROVIDED BY CORNERSTONE.
- ESRI WORLD IMAGERY / ARCGIS MAP SERVICE:
[HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY](http://goto.arcgisonline.com/maps/world_imagery)
 ACCESSED 1/13/2023, IMAGERY DATE: 2017.



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DRAWN BY:	KMC	CHECKED BY:	TEA
DATE:	01/13/2023	SCALE:	1" = 1,000'

**WASTE MANAGEMENT
 LANCASTER LANDFILL
 MOUNT JOY TOWNSHIP,
 LANCASTER COUNTY, PENNSYLVANIA**

SAMPLE LOCATION MAP

APPROVED BY:	RCD*	FIGURE NO:	2
PROJECT NO:	306-896	* Hand signature on file	



SUBMITTAL & REVISION RECORD

NO	DATE	DESCRIPTION
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i (MW-101U to MW-104D) = 0.0308
 k = 98 ft/day
 n = 25%
 v = 12.1 ft/day (4,417 ft/yr)
 Measured October 31 - November 1, 2022



P:\300-0001306-8961-GIS\Maps\EN07_FIG_3_POTENTIOMETRIC_SURFACE_MAP.mxd 10/6/2022 4:21 PM (jmenclino)

LEGEND

- MW-101U GROUNDWATER MONITORING WELLS
- APPROXIMATE GROUNDWATER ELEVATION CONTOUR
- APPROXIMATE CELL LOCATION
- PADEP 305B STREAM
- HYDRAULIC GRADIENT MEASURED BETWEEN MW-101U AND MW-104D
- GROUNDWATER FLOW DIRECTION

REFERENCE

- APRIL, 2016 IMAGERY PROVIDED BY CORNERSTONE.

NOTES

- ELEVATIONS ARE MEASURED IN FEET ABOVE MEAN SEA LEVEL.
- THE WATER LEVELS PRESENTED HEREIN ARE APPLICABLE TO THE LOCATION AND TIME OF MEASUREMENT. WATER LEVELS MAY FLUCTUATE THROUGH TIME.
- POTENTIOMETRIC CONTOURS GENERATED FROM THIS DATA ARE CONSTRUCTED BY INTERPOLATION BETWEEN POINTS OF KNOWN STATIC WATER LEVEL ELEVATIONS AND USING KNOWLEDGE OF SPECIFIC SITE CONDITIONS. ACTUAL STATIC WATER LEVELS AT LOCATIONS BETWEEN THE MONITORING POINTS MAY DIFFER FROM THOSE DEPICTED.
- THE GROUNDWATER ELEVATION AT MW-107DR HAS BEEN OMITTED FROM THE CONTOUR CALCULATIONS DUE TO HISTORIC ANOMALOUS DATA FROM THIS WELL.



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DRAWN BY:	JDM	CHECKED BY:	JCD
DATE:	01/05/2023	SCALE:	1" = 300'

WASTE MANAGEMENT
 LANCASTER LANDFILL
 MOUNT JOY TOWNSHIP,
 LANCASTER COUNTY, PENNSYLVANIA

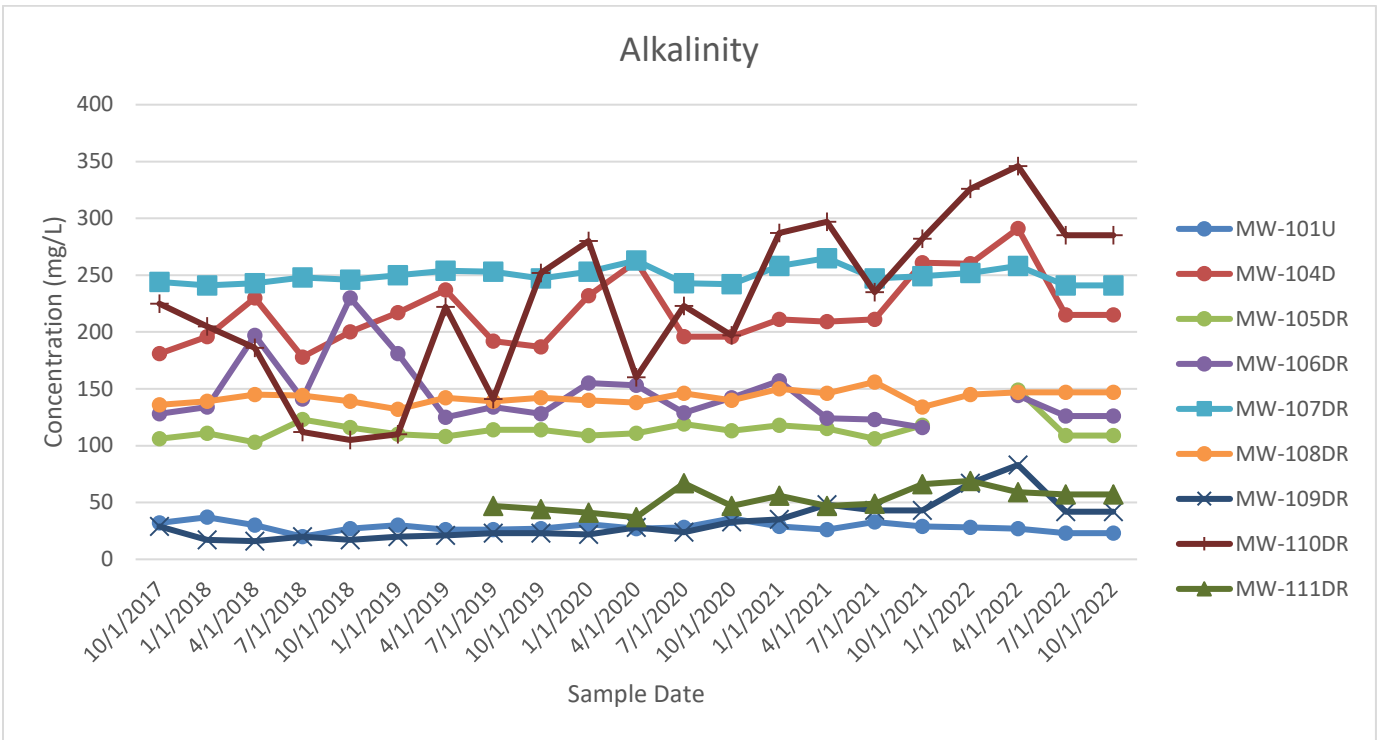
NEW OXFORD FORMATION
 POTENTIOMETRIC SURFACE MAP

APPROVED BY:	TEA*	FIGURE NO:
PROJECT NO:	306-896	3

* Hand signature on file

FIGURE 4

NEW OXFORD FORMATION
TIME SERIES PLOTS



Note: MW-105DR and MW-106DR were first sampled 1st Quarter 2022; prior results shown are from MW-105D and MW-106D.

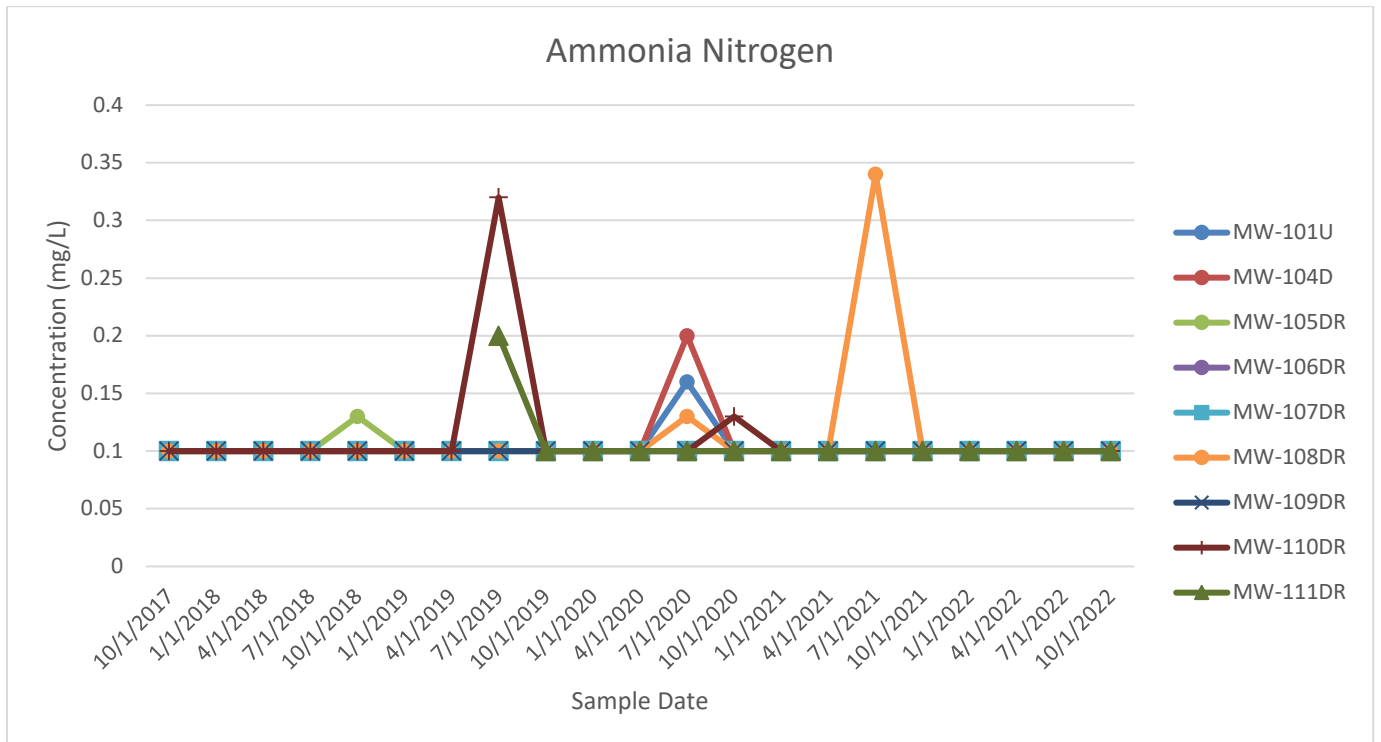


FIGURE 4

NEW OXFORD FORMATION
TIME SERIES PLOTS

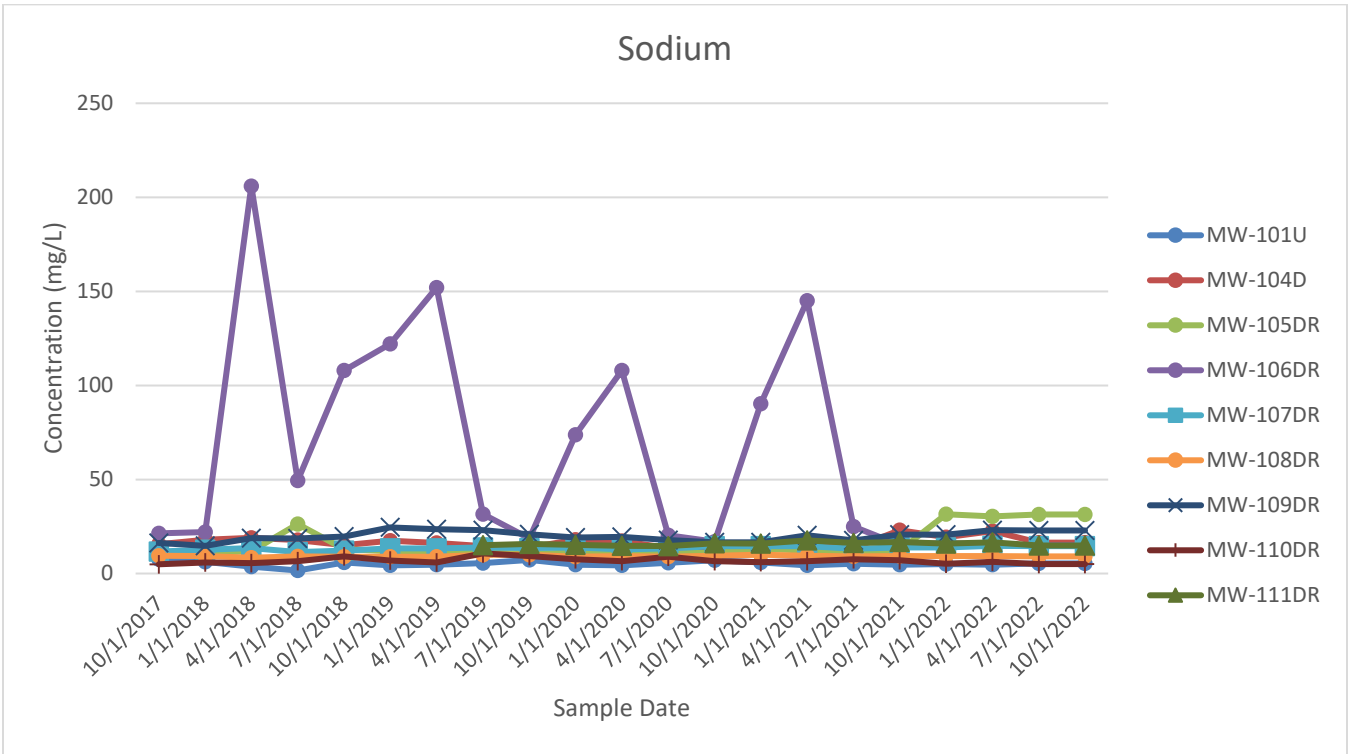
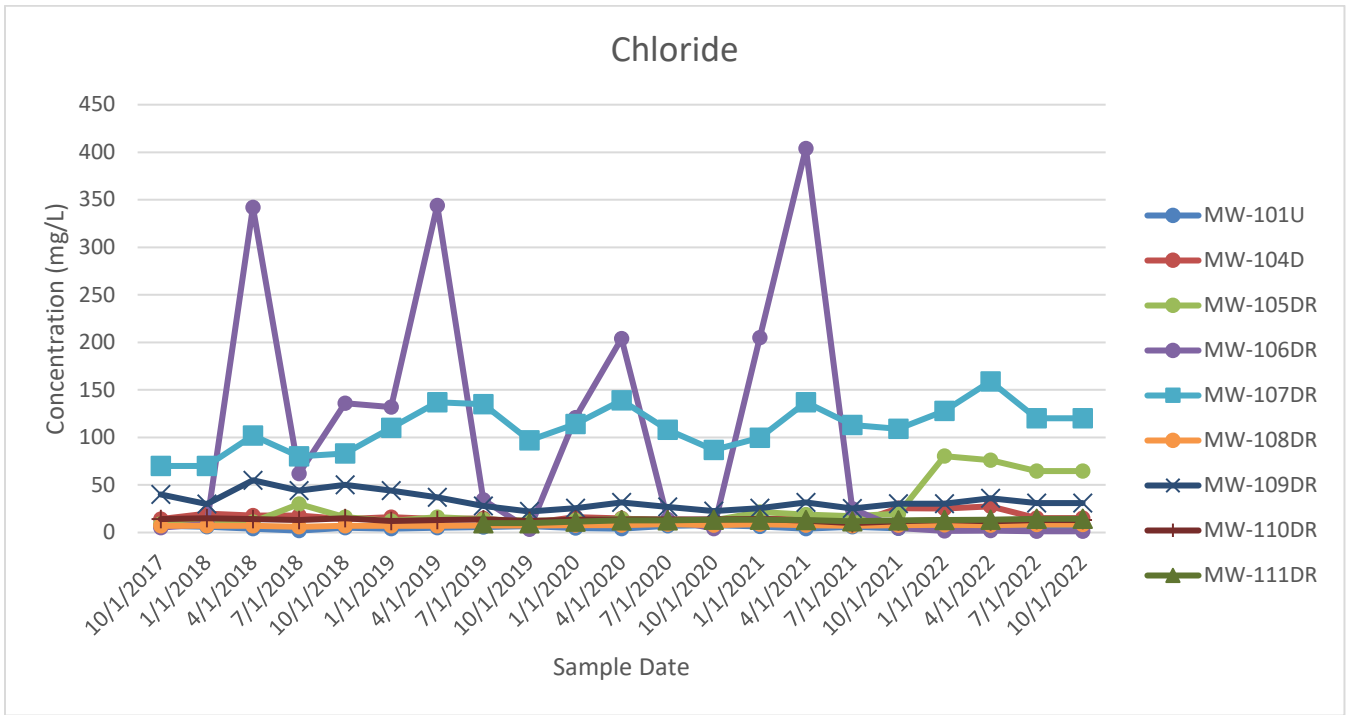
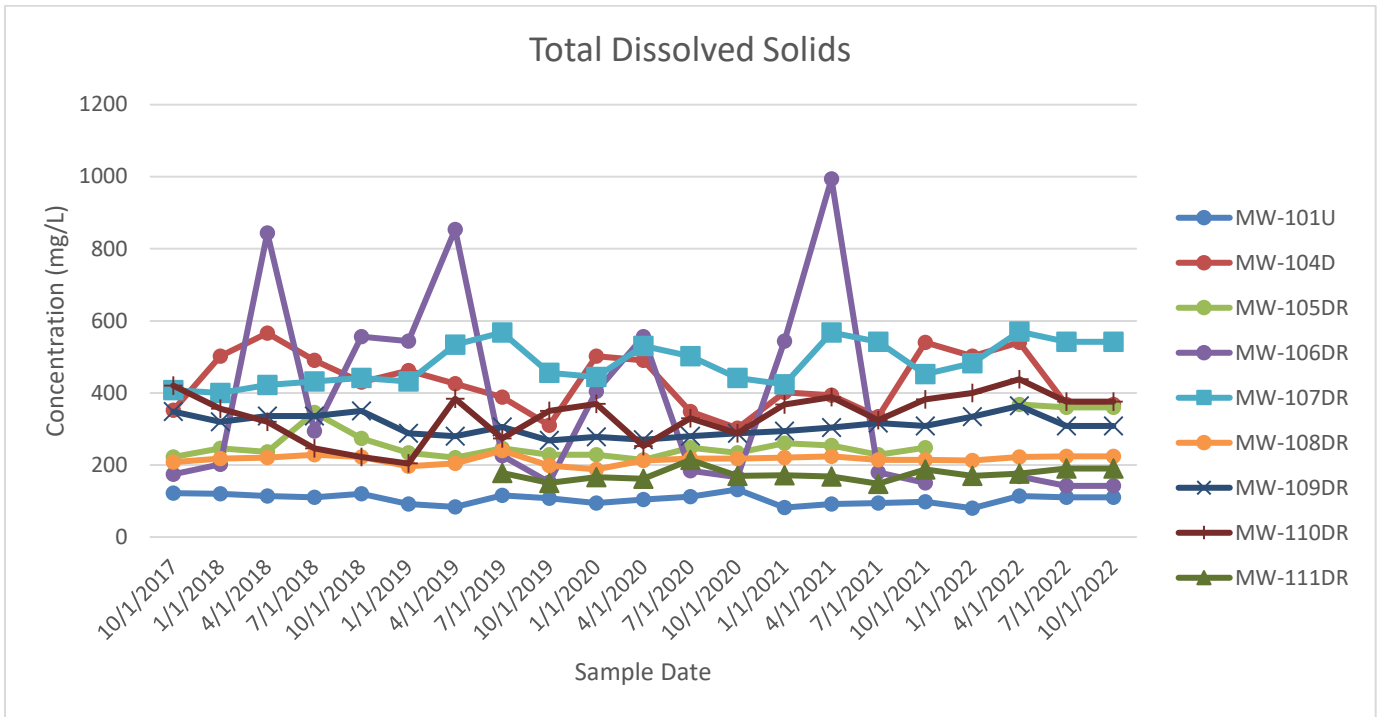


FIGURE 4

NEW OXFORD FORMATION
TIME SERIES PLOTS



APPENDICES (on CD)

Appendix A – PADEP Form 21 Groundwater and Surface Water Laboratory Results

Appendix B – PADEP EDD and Geochemical Testing Laboratory Reports, Quality Assurance/Quality Control Report, and Field Forms

Appendix C – PADEP Form 50 Leachate Laboratory Results

Appendix D – Methane Probe Monitoring Results

Appendix E – Dust Fall Monitoring Results
