August 11, 2017

Michael Schmoller
Wisconsin Department of Natural Resources
3911 Fish Hatchery Road
Fitchburg, WI 53711

Subject: Long-Term Groundwater Monitoring Plan
Klinke Cleaners
4518 Monona Drive
Madison, Wisconsin 53716
BRRTS: 02-13-551928

Dear Mr. Schmoller:

On behalf of Klinke's Clothing Care Corp, EnviroForensics, LLC (EnviroForensics) is pleased to submit this *Long-Term Groundwater Monitoring Plan* for Klinke Cleaners located at 4518 Monona Drive in Madison, Wisconsin (Site). This plan has been prepared as requested in your letter dated January 18, 2017 regarding review of the Site Investigation and Remedial Implementation Reports. Plan(s) for soil and vapor monitoring will be submitted separately.

The objectives of long-term groundwater monitoring are to:

- Evaluate performance of the groundwater remedy; and
- Demonstrate that the groundwater plume is fully defined and not expanding.

For purposes of this plan, "long-term" is intended to mean the typical timeframe required to demonstrate that the groundwater treatments implemented at the Site (i.e., enhanced reductive dechlorination combined with sorption and biodegradation) have remediated the plume adequately for case closure consideration. However, the rate of contaminant reduction can vary, and the exact duration of monitoring required is unknown. If contaminant reductions and plume contraction occur more rapidly than expected, one or more monitoring events may be eliminated. This plan may be modified in writing, if warranted, and submitted to WDNR for approval.

GROUNDWATER MONITORING PLAN

The existing groundwater monitoring network is depicted on **Figure 1**. The network consists of water table observation wells, piezometers, and continuous multi-channel tubing (CMT) systems. Monitoring well construction details are presented in **Table 1**.

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N16 W23390 Stone Ridge Drive, Waukesha, WI
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Data Collection Methods

Groundwater monitoring will be conducted according to the schedule outlined on **Table 2**. Activities performed during each monitoring event will include groundwater elevation measurements and groundwater sample collection. Groundwater elevations will be measured at all existing monitoring wells during the spring 2018 monitoring event and prior to the case closure request. During all other monitoring events, groundwater elevation will only be measured in those wells scheduled for sampling. The proposed well sample list is presented on **Table 2**. However, if VOC concentrations at any well are below the enforcement standard (ES) for two (2) consecutive sampling events, that well will be eliminated from subsequent events.

Groundwater samples will be collected using low-flow methods as described in the EnviroForensics standard operating procedure (SOP) provided in **Attachment 1**. One (1) duplicate sample and one (1) equipment blank will be collected for every 10 or fewer investigative samples, and one (1) trip blank sample will be analyzed per sample cooler for quality assurance/quality control (QA/QC) purposes. The groundwater samples will be transmitted to a state-certified laboratory and analyzed for volatile organic compounds (VOCs) according to U.S. EPA Method 8260.

Investigation-Derived Media Management

Purge water will be pumped through the existing carbon treatment unit associated with the soil vapor extraction system at the Site. Discharge to the sanitary sewer is permitted by the City of Madison.

Reporting

EnviroForensics will submit annual Groundwater Monitoring Reports to WDNR. The reports will be in letter format and will summarize the work performed and provide an analysis of the monitoring data. Tables, maps, figures, and charts will be provided in the report, as appropriate, to aid data presentation and interpretation. In addition, off-site sample results notification letters will be sent to Monona Grove High School and the owner of 4602 Monona Drive in accordance with s. NR 716.14.

PROJECTED SCHEDULE

The groundwater monitoring events will be conducted according to the schedule listed on **Table 2**, with the first event to occur during fall 2017. Each monitoring event can be completed in two (2) to five (5) days, depending on the number of samples collected. EnviroForensics expects to receive the laboratory analytical reports within two (2) weeks of sample submittal. The annual monitoring reports will be submitted within six (6) weeks of receipt of all laboratory reports for a given year. The off-site sample results notifications will be sent to property owners within 10 days of receiving the sample results, as required.

Please respond with approval of this plan or suggested modifications. Please contact us if you have any questions.

Sincerely,
EnviroForensics, LLC

Brian Kappen, PG
Project Manager

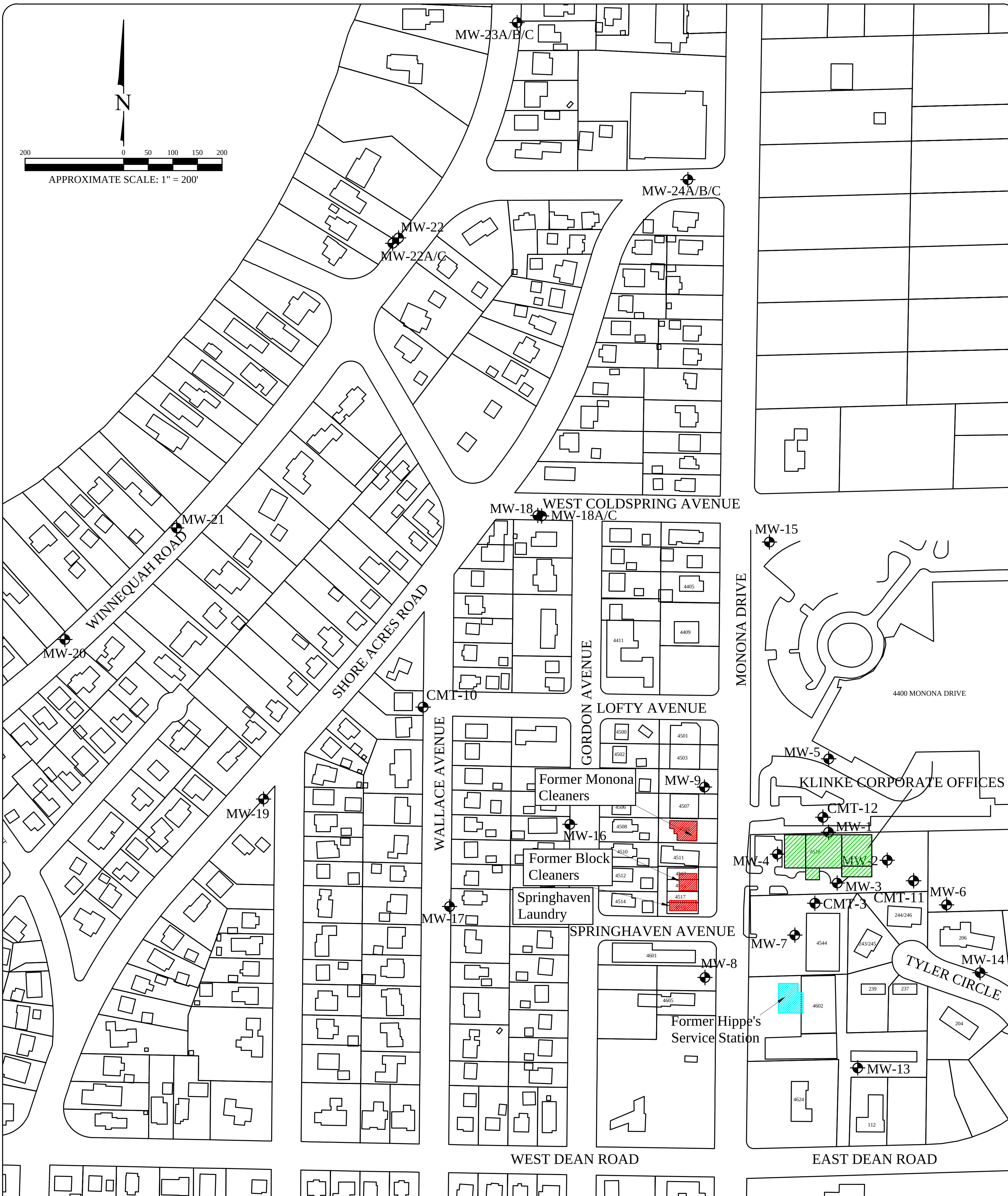
Brad Lewis, CHMM
Senior Project Manager

Attachments

List of Attachments

Figure 1 - Monitoring Well Location Map
Table 1 - Monitoring Well Construction Details
Table 2 - Long-Term Monitoring Well Sampling Schedule
Attachment 1 - Standard Operating Procedure: Low-Flow Rate Purging and Sampling of Groundwater Monitoring Wells

FIGURES



Legend

MW-1 ⊕ Monitoring Well Location

Historical Laundries

Klinke Cleaners Facility

Potential Past PCE usage

No.	Date	Revision	Approved

ENVIRO forensics

ENVIRONMENTAL FORENSIC INVESTIGATIONS, INC.
825 North Capitol Avenue • Indianapolis, IN 46204
EnviroForensics.com

Date:	9/21/15
Designed:	EB
Drawn:	EB
Checked:	BK
DWG file:	6404-0193

MONITORING WELL LOCATION MAP

Klinke Cleaners
4518 Monona Dr.
Madison, WI

Figure 1

Project 6404

TABLES

TABLE 1

MONITORING WELL CONSTRUCTION DETAILS

Klinke Clothing Care, Inc.
4518 Monona Drive, Madison, Wisconsin

Monitoring Well I.D.	Installation Date	Drilling Method	Drilling Contractor	Northing [1,2]	Easting [1,2]	Well Diameter (inches)	Top of Casing Elevation (feet amsl)	Ground Elevation (feet amsl)	Port #	Total Depth (feet bgs)	Screened Interval (feet bgs)	Screened Interval (feet amsl)
MW-1	10/13/2010	HSA/ Air Rotary	Badger State Drilling	391,099.86	2,148,770.95	2	901.59	901.98	NA	57.6	47.6 - 57.6	854.4 - 844.4
MW-2	10/14/2010	HSA/ Air Rotary	Badger State Drilling	391,051.20	2,148,884.82	2	901.10	901.47	NA	57.6	47.6 - 57.6	853.9 - 843.9
MW-3	10/14/2010	HSA/ Air Rotary	Badger State Drilling	390,994.20	2,148,778.42	2	900.66	900.92	NA	57.0	47.0 - 57.0	853.9 - 843.9
MW-4	10/15/2010	HSA/ Air Rotary	Badger State Drilling	391,047.96	2,148,675.35	2	901.03	901.63	NA	57.8	47.8 - 57.8	853.8 - 843.8
MW-5	6/10/2011	HSA/ Air Rotary	Badger State Drilling	391,244.16	2,148,762.05	2	900.18	900.56	NA	58.5	43.5 - 58.5	857.1 - 842.1
MW-6	6/13/2011	HSA/ Air Rotary	Badger State Drilling	390,955.00	2,148,987.92	2	899.58	899.90	NA	57.4	42.4 - 57.4	857.5 - 842.5
MW-7	6/16/2011	HSA/ Air Rotary	Badger State Drilling	390,880.86	2,148,691.15	2	899.68	899.96	NA	57.3	42.3 - 57.3	857.7 - 842.7
MW-8	6/14/2011	HSA/ Air Rotary	Badger State Drilling	390,807.71	2,148,531.08	2	896.70	897.06	NA	55.6	40.6 - 55.6	856.4 - 841.4
MW-9	6/15/2011	HSA/ Air Rotary	Badger State Drilling	391,194.39	2,148,530.08	2	904.25	904.71	NA	65.0	50.0 - 65.0	854.7 - 839.7
MW-13	11/21/2014	HSA/ Air Rotary	Badger State Drilling	390,624.08	2,148,841.77	2	898.12	898.60	NA	54.9	44.9 - 54.9	853.7 - 843.7
MW-14	12/12/2014	HSA/ Air Rotary	Badger State Drilling	390,799.26	2,149,085.24	2	896.52	896.81	NA	54.9	44.9 - 54.9	852.0 - 842.0
MW-15	11/18/2014	HSA/ Mud Rotary	Badger State Drilling	391,692.09	2,148,662.28	2	896.99	897.32	NA	81.2	71.2 - 81.2	826.1 - 816.1
MW-16	11/13/2014	HSA/ Mud Rotary	Badger State Drilling	391,118.71	2,148,256.75	2	897.96	898.26	NA	81.2	71.2 - 81.2	827.1 - 817.1
MW-17	11/13/2014	HSA/ Mud Rotary	Badger State Drilling	390,951.91	2,147,980.45	2	887.59	887.88	NA	76.1	66.1 - 76.1	821.8 - 811.8
MW-18A	2/12/2015	Mud Rotary	Ground Source	391,746.00	2,148,196.82	1	889.39	889.83	NA	60.0	50.0 - 60.0	839.8 - 829.8
MW-18	11/11/2014	HSA/ Mud Rotary	Badger State Drilling	391,746.13	2,148,191.74	2	889.11	889.65	NA	90.9	80.9 - 90.9	808.8 - 798.8
MW-18C	2/12/2015	Mud Rotary	Ground Source	391,746.00	2,148,196.82	1	889.52	889.83	NA	115.0	105.0 - 115.0	784.9 - 774.9
MW-19	11/26/2014	HSA/ Mud Rotary	Badger State Drilling	391,186.98	2,147,615.60	2	876.17	876.48	NA	85.2	75.2 - 85.2	801.3 - 791.3
MW-20	11/20/2014	HSA/ Mud Rotary	Badger State Drilling	391,494.44	2,147,230.72	2	850.92	851.21	NA	54.6	44.6 - 54.6	806.6 - 796.6
MW-21	11/14/2014	HSA/ Mud Rotary	Badger State Drilling	391,720.95	2,147,457.85	2	852.83	853.27	NA	52.7	42.7 - 52.7	810.5 - 800.5
MW-22A	2/13/2015	Mud Rotary	Ground Source	392,302.62	2,147,903.85	1	867.65	867.89	NA	37.9	27.9 - 37.9	840.0 - 830.0
MW-22	12/9/2014	HSA/ Mud Rotary	Badger State Drilling	392,309.85	2,147,908.95	2	867.68	867.98	NA	63.4	53.4 - 63.4	814.6 - 804.6
MW-22C	2/13/2015	Mud Rotary	Ground Source	392,302.62	2,147,903.85	1	867.48	867.89	NA	89.9	79.9 - 89.9	788.0 - 778.0
MW-23A	2/10/2015	Mud Rotary	Ground Source	392,748.14	2,148,110.38	1	867.60	867.90	NA	37.7	27.7 - 37.7	840.2 - 830.2
MW-23B	2/10/2015	Mud Rotary	Ground Source	392,748.14	2,148,110.38	1	867.70	867.90	NA	62.3	52.3 - 62.3	815.6 - 805.6
MW-23C	2/10/2015	Mud Rotary	Ground Source	392,748.14	2,148,110.38	1	867.64	867.90	NA	93.0	83.0 - 93.0	784.9 - 774.9
MW-24A	2/16/2015	Mud Rotary	Ground Source	392,429.11	2,148,499.41	1	876.28	876.67	NA	46.9	36.9 - 46.9	839.8 - 829.8
MW-24B	2/16/2015	Mud Rotary	Ground Source	392,429.11	2,148,499.41	1	876.43	876.67	NA	71.7	61.7 - 71.7	815.0 - 805.0
MW-24C	2/16/2015	Mud Rotary	Ground Source	392,429.11	2,148,499.41	1	876.18	876.67	NA	101.7	91.7 - 101.7	785.0 - 775.0
CMT-3	10/19/2013	Sonic	Major Drilling	390,958.49	2,148,754.86	0.375	900.29	900.81	2	55.4	50.4 - 55.4	850.5 - 845.5
									3	75.3	70.3 - 75.3	830.5 - 825.5
									4	93.5	88.5 - 93.5	812.4 - 807.4
									5	Obstructed		
									6	Obstructed		
									7	167.2	167.1 - 167.2	733.7 - 733.6
CMT-10	11/3/2013	Sonic	Major Drilling	391,356.83	2,147,958.68	0.375	891.41	892.10	1	65.8	60.8 - 65.8	831.3 - 826.3
									2	87.8	82.8 - 87.8	809.3 - 804.3
									3	109.6	104.6 - 109.6	787.5 - 782.5
									4	131.5	126.5 - 131.5	765.6 - 760.6
									5	153.6	148.6 - 153.6	743.5 - 738.5
									6	175.0	170.0 - 175.0	722.1 - 717.1
									7	193.6	193.5 - 193.6	698.6 - 698.5
CMT-11	12/5/2013	Mud Rotary	North Star Drilling	391,004.06	2,148,955.36	0.375	901.72	901.87	2	57.8	52.8 - 57.8	849.1 - 844.1
									3	85.7	80.7 - 85.7	821.2 - 816.2
									4	115.4	110.4 - 115.4	791.5 - 786.5
									5	146.8	141.8 - 146.8	760.1 - 755.1
									6	176.9	171.9 - 176.9	730.0 - 725.0
									7	200.0	199.9 - 200.0	702.0 - 701.9
CMT-12	12/11/2013	Mud Rotary	North Star Drilling	391,133.14	2,148,771.08	0.375	899.90	900.21	2	55.1	50.1 - 55.1	850.1 - 845.1
									3	84.4	79.4 - 84.4	820.8 - 815.8
									4	117.8	112.8 - 117.8	787.4 - 782.4
									5	143.1	138.1 - 143.1	762.1 - 757.1
									6	172.8	167.8 - 172.8	732.4 - 727.4
									7	200.0	199.9 - 200.0	700.3 - 700.2

Notes:

[1] Wisconsin State Plane, Southern Zone, NAD83

[2] The coordinates listed for MW-1 through MW-7 are estimated

bgs = below ground surface

amsl = feet above mean sea level

HSA = Hollow-stem auger

NA = Not Applicable

TABLE 2
LONG-TERM MONITORING WELL SAMPLING SCHEDULE
Klinke Clothing Care, Inc.
Madison, Wisconsin

Monitoring Well I.D.	Top of Casing Elevation (feet amsl)	Port #	Total Depth (feet bgs)	Screened Interval (feet bgs)	Fall 2017	Spring 2018	Fall 2018	Spring 2019	Spring 2020	Closure
MW-1	901.59	NA	57.6	47.6 - 57.6	X	X	X	X	X	X
MW-2	901.10	NA	57.6	47.6 - 57.6	X	X	X	X	X	X
MW-3	900.66	NA	57.0	47.0 - 57.0	X	X	X	X	X	X
MW-4	901.03	NA	57.8	47.8 - 57.8	X	X	X	X	X	X
MW-5	900.18	NA	58.5	43.5 - 58.5	X	X	X	X	X	X
MW-6	899.58	NA	57.4	42.4 - 57.4		X		X	X	X
MW-7	899.68	NA	57.3	42.3 - 57.3	X	X	X	X	X	X
MW-8	896.70	NA	55.6	40.6 - 55.6	X	X	X	X	X	X
MW-9	904.25	NA	65.0	50.0 - 65.0	X	X	X	X	X	X
MW-13	898.12	NA	54.9	44.9 - 54.9		X		X	X	X
MW-14	896.52	NA	54.9	44.9 - 54.9		X		X	X	X
MW-15	896.99	NA	81.2	71.2 - 81.2						X
MW-16	897.96	NA	81.2	71.2 - 81.2		X		X	X	X
MW-17	887.59	NA	76.1	66.1 - 76.1						X
MW-18A	889.39	NA	60.0	50.0 - 60.0		X				X
MW-18	889.11	NA	90.9	80.9 - 90.9	X	X	X	X	X	X
MW-18C	889.52	NA	115.0	105.0 - 115.0		X				X
MW-19	876.17	NA	85.2	75.2 - 85.2						X
MW-20	850.92	NA	54.6	44.6 - 54.6						X
MW-21	852.83	NA	52.7	42.7 - 52.7		X		X	X	X
MW-22A	867.65	NA	37.9	27.9 - 37.9		X		X	X	X
MW-22	867.68	NA	63.4	53.4 - 63.4	X	X	X	X	X	X
MW-22C	867.48	NA	89.9	79.9 - 89.9		X		X	X	X
MW-23A	867.60	NA	37.7	27.7 - 37.7		X		X	X	X
MW-23B	867.70	NA	62.3	52.3 - 62.3						X
MW-23C	867.64	NA	93.0	83.0 - 93.0						X
MW-24A	876.28	NA	46.9	36.9 - 46.9						X
MW-24B	876.43	NA	71.7	61.7 - 71.7						X
MW-24C	876.18	NA	101.7	91.7 - 101.7						X
CMT-3	900.29	2	55.4	50.4 - 55.4	X		X			X
		3	75.3	70.3 - 75.3						X
		4	93.5	88.5 - 93.5						
		5	Obstructed							
		6	Obstructed							
		7	167.2	167.1 - 167.2						
CMT-10	891.41	1	65.8	60.8 - 65.8						
		2	87.8	82.8 - 87.8		X		X	X	X
		3	109.6	104.6 - 109.6						
		4	131.5	126.5 - 131.5		X				X
		5	153.6	148.6 - 153.6						
		6	175.0	170.0 - 175.0		X				X
		7	193.6	193.5 - 193.6						
CMT-11	901.72	2	57.8	52.8 - 57.8		X		X	X	X
		3	85.7	80.7 - 85.7						
		4	115.4	110.4 - 115.4		X				X
		5	146.8	141.8 - 146.8						
		6	176.9	171.9 - 176.9		X				X
		7	200.0	199.9 - 200.0						
CMT-12	899.90	2	55.1	50.1 - 55.1		X		X	X	X
		3	84.4	79.4 - 84.4						
		4	117.8	112.8 - 117.8		X				X
		5	143.1	138.1 - 143.1						
		6	172.8	167.8 - 172.8		X				X
		7	200.0	199.9 - 200.0						
Total Samples					**11**	**29**	**11**	**21**	**21**	**40**

Notes:
bgs = below ground surface
amsl = feet above mean sea level
X = Sample collected for VOC analysis

ATTACHMENT 1

Standard Operating Procedure:
Low-Flow Rate Purging and Sampling of Groundwater Monitoring Wells

Standard Operating Procedure:
Low-Flow Rate Purging and Sampling of Groundwater Monitoring Wells

Introduction

Sampling of groundwater for contaminants is typically done to achieve one of the following goals, several of which are interrelated:

- To investigate the presence or absence of contaminants
- To delineate a plume
- To determine the concentrations of contaminants at specific points in a plume at a given time
- To understand the transport and fate of contaminants in the aquifer
- To carry out regulatory compliance monitoring
- To evaluate a treatment system through remediation performance monitoring

The common factor in achieving these objectives is that analytical data resulting from groundwater samples must accurately represent the contaminant concentrations and geochemistry of the subsurface at the points in space and time where the samples were acquired. Assuming the well screen is properly located and the well is appropriately constructed, the idea is to remove a portion of the water that represents the water in the aquifer at that precise screened location on that date. To accomplish this goal the water must be removed from the aquifer with as little disturbance as possible. This SOP assumes that sampling is being done from a properly constructed and adequately developed well. Groundwater samples can be compromised by aeration, mixing of the stagnant water in the well casing above the screened interval with the sample, the artificial entrainment of particulates pulled from the aquifer minerals or the sand pack (turbidity), and the loss of volatile dissolved compounds. All of these impacts can be caused by pumping water at a very high flow rate through the well screen and by using bailers, which induce surging in the well bore and require pouring or draining to collect the sample into containers for analysis. Low-flow purging and sampling technologies were developed to minimize these problematic issues and increase both accuracy and precision in sample collection.

Low-flow rate purging and sampling consists of a variety of concepts and processes designed to minimize disruption to the well, sand pack, outlying aquifer, and the collected samples. These techniques are also generally designed to provide confirmation that the water being collected is representative of the formation water through the observation of sensitive indicator parameters. Low-flow rate sampling concepts and techniques include:

- Low pump rates, usually 0.1-0.5 L/min
- Purging and sampling is always performed from within the screened interval when standard monitoring wells are used
- Collect samples in the formation immediately adjacent to the well and pump (or tubing)
- Sampling follows stabilization of the most sensitive purging indicator parameters

The low pumping rates and the elimination of the use of bailers minimize artificial turbidity, aeration, mixing of different waters, VOC loss and outgassing, while maintaining any naturally mobile colloidal particulates that might contribute to the total contaminant loading. Since waters are collected from the aquifer in the immediate vicinity of the well, better concentration data at that point are obtained. The development of low-flow purging and sampling techniques increased the list of parameters that had been routinely monitored during high-speed purging, i.e., temperature, pH, and conductivity, to include dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity. Flow-through cells are required during the purging because certain values immediately change upon exposure to the atmosphere, such as would occur in an open container.

It is also important that all of these parameters be measured accurately when their readings become stabilized. This is due to their importance for understanding contaminant transport and fate, speciation, monitored natural attenuation, performance monitoring and geochemical modeling when used in conjunction with the laboratory analytical data. To accurately measure these parameters requires that all the electrodes within the flow-through cell be properly calibrated using manufacturer's guidelines. This requires little time, is very important, and provides both the person assessing the data and the client for whom data-based decisions will be made with a much better cost to benefit ratio. For reference, typical ranges for various water quality parameters are as follows:

Parameter	Expected Range	Notes
pH	6 - 8	
DO	0 - 8 mg/L	Never negative. Should be in line with ORP (e.g., if ORP low or negative, DO should be low)
ORP	varies	Should be in line with DO (e.g., if DO low, ORP should be low or negative)
Turbidity	varies	Never negative. If low turbidity, water should be clear, if high turbidity, water should be cloudy
Specific Conductivity	450 - 1050 µS/cm	
Temperature	13^{o}C +/- 10^{o}	Groundwater temperature is around 13^{o}C, however your reading may be affected by the ambient air temperature.

Equipment

This equipment list may not include all items needed, which would depend upon a variety of factors including weather, availability of power, analyses to be done in the field, etc., but lists the basic needs and provides a starting point for consideration of items that will be required when in the field.

- Detailed well location map
- Groundwater Sampling Forms
- Total well depth and screened interval data and previous water level data
- Order of the well sampling (lowest to highest contaminant concentrations)
- Electronic water level tape
- Peristaltic sampling pump (if allowed by regulators) or bladder pump and controllers
- Tubing
- Sample bottles, cooler, ice, chain of custody forms
- Drums for purge water (if required)
- Water quality meter (e.g., Horiba or YSI) including the flow-through cell
- Bound record book for recording meter calibrations and any issues
- Calibration solutions and instructions, spare DO membranes, etc.
- Alconox and distilled water
- Graduated cylinder for measuring flow rate
- Markers and pens, calculator
- PPE

Procedure

1. Following manufacturer's instructions, calibrate the meter that will be used to collect the low-flow stabilization data. This should be done at least once per day prior to collecting samples and repeated if conditions warrant or should data appear to be overly noisy or otherwise suspect (e.g., DO values above 10 mg/L). Calibration should be done for pH, conductivity, DO, and turbidity. The DO membrane should be replaced occasionally based upon the manufacturer's guidelines or should calibration prove impossible. Bubbles must not be trapped under the membrane.

2. Decontaminate the pump, water level meter, and any other non-dedicated equipment according to the decontamination SOP.

3. Sample the wells beginning with those having the lowest concentrations of the contaminants of concern and work up to those with the highest concentrations (if this information is known).

4. Observe the condition of the wellhead; the cover, the lock, the standpipe, any standing water, etc., and note observations of anything unusual on the data sheet for that well. Notes should be made in the field notebook regarding anything out of the ordinary throughout the entire sampling procedure.

5. Open the well carefully and be cautious to avoid any dirt, water, or other materials entering the casing. If anything does enter the casing, note this in the field notebook.

6. The depth to water for each well should be approximately known from well logs or previous sampling data. Carefully lower a clean electronic water level measuring tape into the casing until it signals that water has been reached. Raise and lower the tape slowly and carefully to ascertain that you have reached the water table; try to avoid disturbing the water below the surface. Note the depth to 0.01 foot of resolution on the Sampling Form and remove the tape.

7. If the well contains either a dedicated length of tubing or a dedicated pump, confirm that the tubing/pump remains properly set at the correct depth for sampling (by whatever means this has been established at the site). Note any changes that are necessary.

8. If the well does not contain a dedicated pump or tubing, measure the length of new tubing needed to reach from the midpoint of the screened interval (or saturated interval if the water table is within the screen portion of the well) to the pump controller at the surface. If using a bladder pump, use a new disposable bladder for each sample.

9. Slowly lower the pump/ tubing until the pump intake reaches that depth, taking care not to disturb any sediment at the bottom of the well.

10. Attach the tubing from the well to the peristaltic pump or pump controller. The tubing that extends from the well to the peristaltic pump, pump controller, etc., must be replaced between wells. Attach tubing from the pump controller to the flow-through cell and from the outlet of the flow-through cell to a bucket.

11. Begin pumping the well at a very low flow-rate and calculate the volume pumped per unit time (using a graduated cylinder and stopwatch. Typically, 150 ml/minute is a reasonable initial pumping rate for wells that produce sufficient water having a five-foot or longer well screen. If production is unknown for the well, it can be useful to carefully measure the water level with the tape, while pumping, and track whether or not the cone of depression (drawdown) stabilizes with time. For piezometers, drawdown should be minimized to the extent possible to prevent stagnant casing water above the screened interval from being pulled into the screened interval. If drawdown doesn't occur to any appreciable extent, the pumping rate can be carefully increased. The pumping rate cannot exceed 500 ml/ min.

12. Begin collecting data from the sensors in the flow-through cell using either an automated data logger or by manually transcribing the readings displayed on the meter on the Groundwater Sampling Form. Water quality meter readings, pumping rate, and drawdown should be recorded approximately every five minutes. Readings can be recorded on shorter timeframe (e.g., every three minutes) if the well can maintain higher pumping rates with drawdown less than 0.33 feet.

13. If drawdown exceeds 0.33 feet at the lowest achievable pumping rate, low-flow sampling techniques are not appropriate for the monitoring well. Consult the project manager to

select an alternative sampling method. Typically, the well should be purged to dryness and samples collected as soon as the well has recovered to provide sufficient sample volume.

14. Stabilization is achieved after certain parameters have stabilized for three successive readings. As listed on the Groundwater Sampling Form, three successive readings must be within ± 3% for temperature, ± 0.1 for pH, and ± 3% for conductivity, ± 10 mv for oxidation-reduction potential (ORP), and ± 10% for turbidity and DO. However, for ORP, DO, and turbidity, only one of these three parameters needs to reach stability prior to sampling.

15. Upon stabilization, record all the final data for the flow-through cell parameters (temperature, pH, conductivity, ORP, DO, turbidity) and the flow rate at which they were collected.

16. Disconnect the tubing from the flow-through cell and drain into the bucket.

17. Collect samples from the tubing extending from the pump directly into laboratory-supplied containers. Collect in this order: VOCs, SVOCs, all other parameters. When collecting these samples, minimize agitation of the well by maintaining the pump elevation and a constant flow rate. If a duplicate VOC sample is being collected, alternate filling vials between the primary and duplicate sample.

18. Measure the total depth of the well and record on the Groundwater Sampling Form.

19. Clean the electrodes and flow-through cell, and other non-dedicated equipment such as the pump and water level indicator, with an Alconox solution followed by multiple rinses with distilled water, or by following manufacturer's guidelines, prior to use at the next well.