STATE OF MICHIGAN
CIRCUIT COURT FOR THE 30TH JUDICIAL CIRCUIT
INGHAM COUNTY

MICHIGAN DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENT,

Plaintiff,

v

STRAITS STEEL & WIRE COMPANY,

Defendant.

No. 10-1186-CE

HON. JOYCE A. DRAGANCHUK

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FIRST AMENDMENT TO CONSENT DECREE

This First Amendment of the June 21, 2012 Consent Decree, File No. 10-1186-CE, is effective upon entry by the Court. The Parties stipulate and agree to be bound by all of its terms and conditions.

Unless otherwise defined herein, all terms used in this First Amendment are as defined in the Consent Decree.

WHEREAS, Defendant, Straits Steel & Wire Company, requested the Michigan Department of Environmental Quality (MDEQ)[1] approve a Revised Groundwater Sampling and Analysis Plan to replace the current Groundwater Sampling and Analysis Plan, which was attached as Exhibit C to the Consent Decree. The Revised Groundwater Sampling and Analysis Plan provides for the addition of several monitoring wells which are needed to monitor the effectiveness of the Defendant's remedial efforts, and the removal of certain monitoring wells that were originally required in the current Groundwater Sampling and Analysis Plan but are no longer necessary. In addition, the Revised Groundwater Sampling and Analysis Plan allows the Defendant to reduce the number of wells being sampled for available cyanide.

WHEREAS, MDEQ approved the Revised Groundwater Sampling and Analysis Plan on November 10, 2014, a copy of which is attached hereto as Exhibit 1.

Therefore, the June 21, 2012 Consent Decree is amended as follows:

The February 4, 2011 Groundwater Sampling and Analysis Plan attached as Exhibit C to the Consent Decree is hereby replaced with the Revised Groundwater Sampling and Analysis Plan dated November 10, 2014.

[1] During the pendency of this matter, the Department of Natural Resources and Environment (DNRE) was reorganized under Executive Order 2011-1 and the functions and responsibilities of the DNRE under the Natural resources and Environmental Protection Act, 1994 PA 451, MCL 324.101 to MCL 324.90106, were transferred to the Department of Environmental Quality (DEQ). MDEQ will be used throughout this document.

All references to the Groundwater Sampling and Analysis Plan now refer to the Revised Groundwater Sampling and Analysis Plan.

IT IS SO AGREED BY:

with permission P75046

Charles Denton — 1/2/2015

Charles M. Denton (P33269) — Date
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M. Bettenhausen — 1/2/2015

Margaret Bettenhausen (P75046) — Date
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Susan J. Erickson Acting — 29 Dec 2014

Robert Wagner, Chief — Date
Remediation and Redevelopment Division
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IT IS SO ORDERED, ADJUDGED AND DECREED THIS 5th day of January, 2015.

JOYCE DRAGANCHUK

Honorable Joyce A. Draganchuk

P-39417

Exhibit 1

REVISED

GROUNDWATER SAMPLING AND ANALYSIS PLAN

APPROVED BY MDEQ NOVEMBER 10, 2014

STRAITS STEEL & WIRE COMPANY

902 ROWE STREET

LUDINGTON, MICHIGAN

NOVEMBER 10, 2014

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LIST OF ACRONYMS

COC	Contaminant of Concern
CrVI	Hexavalent Chromium
DO	Dissolved Oxygen
Eh	Reduction Potential
FTC&H	Fishbeck, Thompson, Carr & Huber, Inc.
GSI	Groundwater Surface Water Interface
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MDEQ	Michigan Department of Environmental Quality
mg/L	Milligram Per Liter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
mV	Millivolts
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
POTW	Publicly Owned Treatment Works
RAP-RI	Response Activity Plan for the Investigation Phase
RAP-RD	Response Activity Plan for Remedial Design
RL	Reporting Limit
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
S.U.	Standard Unit
QA	Quality Assurance
QC	Quality Control
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared to provide the field procedures, sampling protocols, and monitoring locations for the ongoing groundwater monitoring activities as part of the remedial action for the Straits Steel & Wire Company (Straits) site at 902 Rowe Street, Ludington, Michigan (Figure 1). Data collected under this plan will be used to 1) Verify that the capture zone of PW-1 effectively contains contaminants of concern (COCs) that may exceed potentially applicable cleanup criteria, 2) Monitor the contaminant concentration trends, including effectiveness of the RA injections, 3) Verify temporal groundwater flow conditions, and 4) Meet a required condition of the Consent Decree.

1.1 GENERAL BACKGROUND

The Straits property is located at 902 Rowe Street, Ludington, Michigan. Straits has conducted manufacturing at the referenced site since the 1940s, including plating of refrigerator racks. Plating operations ceased by the early 1990s, after which refrigerator racks were electrostatically powder-coated. Historic environmental impacts to soil and groundwater at the site have been the subject of past and on-going remedial actions by Straits.

Straits completed numerous phases of a remedial investigation in the 1990s to determine the nature and extent of groundwater and soil contamination that may be associated with the property. The groundwater investigations delineated an area of groundwater with concentrations of chromium, zinc, and cyanide downgradient from the Straits property, generally west/northwest of the property. In 1994, the Michigan Department of Environmental Quality (MDEQ) approved Straits' remedial cleanup plan for this groundwater contamination, and Straits designed and installed a groundwater extraction well, PW-1, at the downgradient end of the impacted area. Straits has been performing quarterly monitoring as well as operation and maintenance of the groundwater extraction system since the installation of the extraction well in 1997. PW-1 operates continuously and extracted groundwater is discharged, under permit, to the Ludington publicly owned treatment works (POTW). Straits has been authorized to discharge from PW-1 to surface water pursuant to an National Pollution Discharge Elimination System (NPDES) permit issued by the MDEQ (Appendix 1). Straits is currently working with the City of Ludington to obtain permission to access the storm sewer. Before discharge to the

storm sewer commences, notification will be made to the MDEQ. In 2011, Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H), on behalf of Straits, submitted an updated Groundwater SAP (FTC&H, 2011) to the MDEQ. Quarterly monitoring and operation of PW-1 according to this approved plan has been conducted since 2011. The FTC&H Groundwater SAP was incorporated in to the Consent Decree as Attachment C.

In accordance with the Final Response Activity Plan for the Investigation Phase (RAP-RI) approved by the MDEQ on January 9, 2013, source area investigation phase response activities were implemented at the Straits site from March 25 – 28, 2013 and September 17-19, 2013 to assess possible sources of chromium contamination at and emanating from the Straits property. The purpose of the investigation was to perform a screening level evaluation of soil and/or groundwater in or near suspected historical hexavalent chromium (CrVI) source areas located near the southeast corner of the Straits property along with other areas within the plant suspected of being possible source areas. The investigation phase activities included the advancement of soil borings and collection of soil and groundwater samples.

As a result of the initial screening level evaluation, additional delineation activities were recommended and additional investigation phase response activities were implemented. On March 26 and 27, 2014, pre-design activities including collection of treatability study samples and further delineation activities were completed. 74 borings were advanced in previously identified suspect areas during investigation activities (in March 2013, September 2013, and March 2014). Additionally, 64 temporary wells were installed (within the soil borings), and 6 pre-existing monitoring wells were selected for groundwater sample collection. Of the 74 borings advanced, soil samples were collected from 27 soil borings. Two distinct source areas were identified during the investigation phase screening level evaluation: Area #1 - central portion of the plant, and to a lesser extent Area #2 - southeast portion of site. Soil and groundwater results indicated that a relatively lower CrVI source area exists in the southeastern corner of the property (maximum CrVI in groundwater of 1.2 mg/l in SB70), while a higher concentration CrVI source area is located in the central portion of the property (maximum CrVI in groundwater of 49 mg/l in SB49). Soil and groundwater results and details of these activities are included in the Response Activity Plan for Source Area Remedial Design (RAP-RD) (BB&E, 2014).

In August 2014, 13 performance monitoring wells were installed or converted from existing temporary wells. Newly installed performance monitoring wells included MW-109S, MW-110M, MW-110D, and MW-111D. New performance wells that were converted from existing temporary wells (soil boring locations) included MW-109M, MW-109D, MW-110S, MW-111S, MW-111M, MW-112, MW-113, MW-114, and MW-115.

In September 2014, calcium polysulfide (CPS) injections were conducted in accordance with the approved RAP-RD. Treatment activities were conducted in the central portion (Area #1) and southeastern corner (Area #2) of the Straits property to address the identified CrVI source areas through chromium reduction. Additional details on the remedial activities can be found in the RAP-RD.

1.2 PURPOSE AND OBJECTIVES

This groundwater SAP is designed to effectively monitor the impacted groundwater located at and downgradient from the Straits site extending to the groundwater extraction well PW-1. Straits has been performing quarterly monitoring as well as operations and maintenance of the groundwater extraction system since the installation of PW-1 in 1997. The purpose for this SAP is to provide an update to the existing SAP (FTC&H, 2011) in order to provide further data and information for meeting the following objectives:

- Verify that the capture zone of PW-1 effectively contains contaminants of concern (COCs) that may exceed potentially applicable cleanup criteria.
- Monitor the contaminant concentration trends, including effectiveness of the RA injections.
- Verify temporal groundwater flow conditions.
- Meet a required condition of the Consent Decree.

1.3 CONTAMINANTS OF CONCERN

Historical groundwater sampling conducted by Straits has identified that the COCs above cleanup criteria, Part 201 drinking water criteria or Groundwater Surface Water Interface (GSI) criteria, at the Straits site are chromium and available cyanide. Most of the chromium that is dissolved in the groundwater is in the form of hexavalent chromium (CrVI). Details on historical

groundwater sampling can be found in the Groundwater Sampling and Analysis Plan (FTC&H, 2011) included for reference in Appendix 2.

2 GROUNDWATER SAMPLING AND ANALYSIS

Sampling procedures, analytical methods, and quality assurance/quality control (QA/QC) protocols that will be implemented under this SAP are included in the following sections.

2.1 MONITORING WELLS AND LOCATIONS

Groundwater monitoring will be conducted quarterly at 28 wells at and downgradient of the Straits site. Sample collection at monitoring well MW-47 has been discontinued beginning with the March 2012 event. In e-mail correspondence dated May 8, 2012, the MDEQ agreed that sampling of this well was no longer appropriate as it is screened in a different aquifer unit. Monitoring locations are illustrated on Figures 2 and 3. Well locations and sampling parameters are summarized in Table 1.

Groundwater sampling will be conducted on a quarterly basis. Groundwater sampling frequency will be reexamined based on COC concentrations, as needed. Changes to the sampling schedule will be submitted to the MDEQ as an amendment to this SAP or in the Quarterly Monitoring Reports.

2.2 GROUNDWATER SAMPLING METHODOLOGY

2.2.1 Equipment Calibration

Field sampling parameters, indicative of water quality, will include pH, specific conductance, Oxidation Reduction Potential (ORP), temperature, dissolved oxygen (DO), turbidity, and water level measurements. Parameters will be measured using a multi-parameter meter (flow-through) connected in-line to the purged groundwater. Turbidity will be measured from discrete samples using a stand-alone, external (not-in-line) turbidimeter. Water level measurements will be taken using an electric water level meter. At the beginning of each day of sampling, field meters will be calibrated for the specified parameters. Calibration will also be verified at the end of each sampling day. Equipment calibration will be conducted in accordance with the equipment

manufacturer's requirements and BB&E's Standard Operating Procedure (SOP). BB&E field activities SOPs are provided in Appendix 3.

2.2.2 Sample Collection

Samples will be obtained using low-flow (minimal drawdown) techniques in all well locations except purge well PW-1. Prior to purging each well, the static water level will be measured relative to the top-of-casing using an electric water level meter. The sampling equipment, either a peristaltic pump or a portable bladder pump, will be lowered into the well until the pump intake is at or slightly above the midpoint of the well screen. Wells will be purged at rates of 100 to 500 milliliters (mL) per minute. Purge rates will be verified with a graduated cylinder and adjusted to stabilize or minimize drawdown. Field parameters, including pH, specific conductance, ORP, temperature, DO, and turbidity, and water level measurements, will be monitored with the flow-cell, turbidimeter, and water level meter and will be recorded every 3-5 minutes. Field parameter measurements will be made in accordance with this SAP and the BB&E SOPs (Appendix 3). A sample will then be collected when drawdown and field parameters have stabilized for three successive readings. If parameters have not stabilized for three successive readings after 45 minutes of purging have been completed, the sample will then be collected. Prior to sample collection, a final reading of the field parameters will be recorded. The following stabilization criteria will be used:

- ± 0.1 Standard Unit (S.U.) for pH
- ± 3% for specific conductance
- ± 10 millivolts (mV) for ORP
- ± 10% for DO > 1
- ± 3% for temperature
- ± 10% for turbidity values or < 20 Nephelometric Turbidity Units (NTU)

Upon stabilization, groundwater samples will be collected for parameters as shown in Table 1, in accordance with the BB&E SOPs, included in Appendix 3.

Samples for available cyanide will be pretreated in the field in accordance with U.S. Environmental Protection Agency Method OIA-1677. Filtration prior to lead carbonate treatment

will be performed using a membrane-filtration apparatus attached to the effluent of the downhole tubing. At each location sampled, a bottle pre-preserved with lead carbonate will be filled to the neck with minimum aeration, capped, and gently swirled to mix the sample and the lead carbonate. The sample will then be filtered using a new disposable membrane-filtration apparatus and hand pump. The collected filtrate will then be transferred into a bottle pre-preserved with lead carbonate and sodium hydroxide.

CrVI samples will be field filtered using a membrane-filtration apparatus attached to the effluent of the downhole tubing. At each location sampled, a bottle without preservative will be filled to the neck and capped.

Groundwater samples at PW-1 will be collected at Outfall 01 (sewer manhole on Bryant Road between Beechwood Drive and William Street) where the extraction well discharges to the sanitary sewer. The sample will be collected with a dedicated dip-bucket and analyzed for CrVI, available cyanide, and total cyanide. Total cyanide is monitored at PW-1 Outfall 1 in accordance with the Wastewater Discharge Permit No. 006, dated June 1, 2012 (Appendix 4). For available cyanide analysis, the sample will be field filtered using a disposable membrane-filtration apparatus and hand pump into a bottle pre-preserved with lead carbonate and will be filled to the neck with minimum aeration, capped, and gently swirled to mix the sample and the lead carbonate. The sample will then be filtered using a new disposable membrane-filtration apparatus and hand pump. The collected filtrate will then be transferred into a bottle pre-preserved with lead carbonate and sodium hydroxide. Hexavalent Chromium will not be field filtered for PW-1 and will require lab filtration. An additional grab sample will be collected for measurement of field parameters. Static water level of PW-1 will not be recorded.

Groundwater samples will be stored in an iced cooler during field work activities. Samples will be transported to a fixed laboratory via a laboratory supplied courier.

2.2.3 Equipment Decontamination

Decontamination procedures will be implemented during field work to prevent cross-contamination of the groundwater samples. Sampling pumps and flow cells used for field parameter measurement will be decontaminated in accordance with the BB&E SOPs presented in

Appendix 3. With the exception of PW-1, dedicated tubing will be used in each of the monitoring wells selected for sampling to reduce the potential of cross-contamination.

2.2.4 Disposal of Investigation-Derived Waste

All purge water from downgradient locations will be containerized during field sampling and discharged to the Ludington sanitary sewer system, at PW-1 Outfall 01, in compliance with Wastewater Discharge Permit No. 006, dated June 1, 2012 (Appendix 4). For monitoring wells located within Area #1 and Area #2 (depicted on Figure 3) purge water will be returned to the injection locations.

2.3 SAMPLE ANALYSIS

Groundwater samples collected under this SAP will be submitted to ALS Analytical Laboratory in Holland, MI via a laboratory supplied courier and will be analyzed for the following COCs:

- CrVI using United States Environmental Protection Agency (USEPA) Method 7196.
    - The Reporting Limit (RL) for CrVI samples will be 5 micrograms per liter (µg/L).
- Available cyanide using USEPA Method OIA 1677
    - The RL for available cyanide samples will be 2 µg/L.
- Total cyanide (PW-1 Outfall 01 only) using USEPA Method 9012.
    - The RL for total cyanide samples will be 5 µg/L.

2.4 QUALITY CONTROL

2.4.1 Field Sampling

Field duplicates will be collected at a rate of 1 per 10 groundwater samples. The field duplicates will be collected immediately after the investigative sample. Matrix Spike/Matrix Spike Duplicates (MS/MSD) samples will be collected at a rate of 1 per 20 investigative samples.

2.4.2 Laboratory

Method blank, duplicate, laboratory control sample (LCS)/LCS duplicate (LCSD), and MS samples will be prepared and analyzed to assess the quality of the data resulting from the laboratory analytical program.

Method blank samples will be prepared and analyzed at the frequency specified in the referenced methods to assess potential sample contamination during the analytical process.

Duplicate samples will be analyzed to check for analytical reproducibility. The frequency of laboratory duplicate preparation and analysis is specified in the referenced USEPA methods.

LCS/LCSD samples will be prepared and analyzed as a primary demonstration of the ability of the laboratory to analyze samples with acceptable qualitative and quantitative accuracy. The frequency of LCS/LCSD sample preparation is specified in the referenced USEPA methods. Matrix spike determinations will be performed in duplicate (MS/MSD) and will serve as an indication of the effect of sample matrix on recision and accuracy. Typically, one LCS/LSCD and MS/MSD pair will be prepared per batch (20 or fewer samples).

2.5 SAMPLING DOCUMENTATION AND HANDLING

2.5.1 Field Documentation

Records of the field activities and sampling information will be maintained in field notebooks created for the project. The field notebooks will document field activities including sample locations, sampling times, types of samples collected, and other information pertinent to the monitoring event. In addition, field activities and sampling information for groundwater monitoring will be recorded in detail on individual Monitoring Well Sample Collection Forms (Appendix 5). The sample collection forms will include location, equipment used, well information, casing information, dates, times, recorded parameters, and laboratory analysis information. Water levels will be recorded in the field notebook as well as on the Monitoring Well Static Water Level Form (Appendix 5).

2.5.2 Sample Labeling

Each field sample collected will be assigned a specific number based on the well it was taken from. Sample identification will include a site identifier, year and month of sample collection, sample location and sample type (monitoring, investigative, duplicate, or MS/MSD).

Pre-printed sample labels will be provided to the field staff, which will include: sample identification, type of bottle and preservative, and required analyses. At the time of sample collection, the field staff will record the sample identification, date/time, and their initials on the sample labels using waterproof ink.

2.5.3 Chain of Custody

Chain-of-custody procedures are intended to document sample possession from collection to disposal in accordance with federal guidelines. A separate chain-of-custody record will accompany each sample from the field to the laboratory and will serve as a record for the receipt of samples by the laboratory. The chain-of-custody protocol will be conducted in accordance with the BB&E's SOPs (Appendix 3).

- The field sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.
- As few people as possible will handle the samples.
- A chain-of-custody record will be completed for all samples. The following information will be included on the chain-of-custody forms:
  - Sample identification
  - Date and time of sampling
  - Project location
  - Sample matrix type
  - Number of containers, preservative, and required analyses
  - Names or initials of persons involved in sample collection.
- When transferring possession of samples, individuals relinquishing and receiving samples will sign, date, and note the time on the chain-of-custody.

2.5.4 Sample Storage and Transport

Groundwater samples will be stored in an iced cooler during field work activities. Samples will be transported to a fixed laboratory via a laboratory supplied courier.

3 EXTRACTION WELL MONITORING

Groundwater monitoring of discharges from the extraction well (PW-1) to the sanitary sewer will be monitored in accordance with the Wastewater Discharge Permit No. 006, issued by the City of Ludington to Straits. The Wastewater Discharge Permit is provided in Appendix 4. Quarterly sampling will be conducted and samples will be analyzed for CrVI, available cyanide, and total cyanide (PW-1 only) (as discussed previously in Section 2.2.2).

4 GROUNDWATER FLOW MAPPING

Static water level measurements will be obtained quarterly from all 28 sampling locations and 7 additional monitoring wells using the electric water level meter as described in the BB&E SOPs (Appendix 3). The well locations for static water level measurements are summarized in Table 1 and presented on Figures 2 and 3. The water level data will be used to construct groundwater potentiometric surface figures to verify the groundwater flow direction.

5 REPORTING

A quarterly sampling report will be submitted to the MDEQ within 45 days following receipt of all analytical data reports from the laboratory. The quarterly reports will include the following:

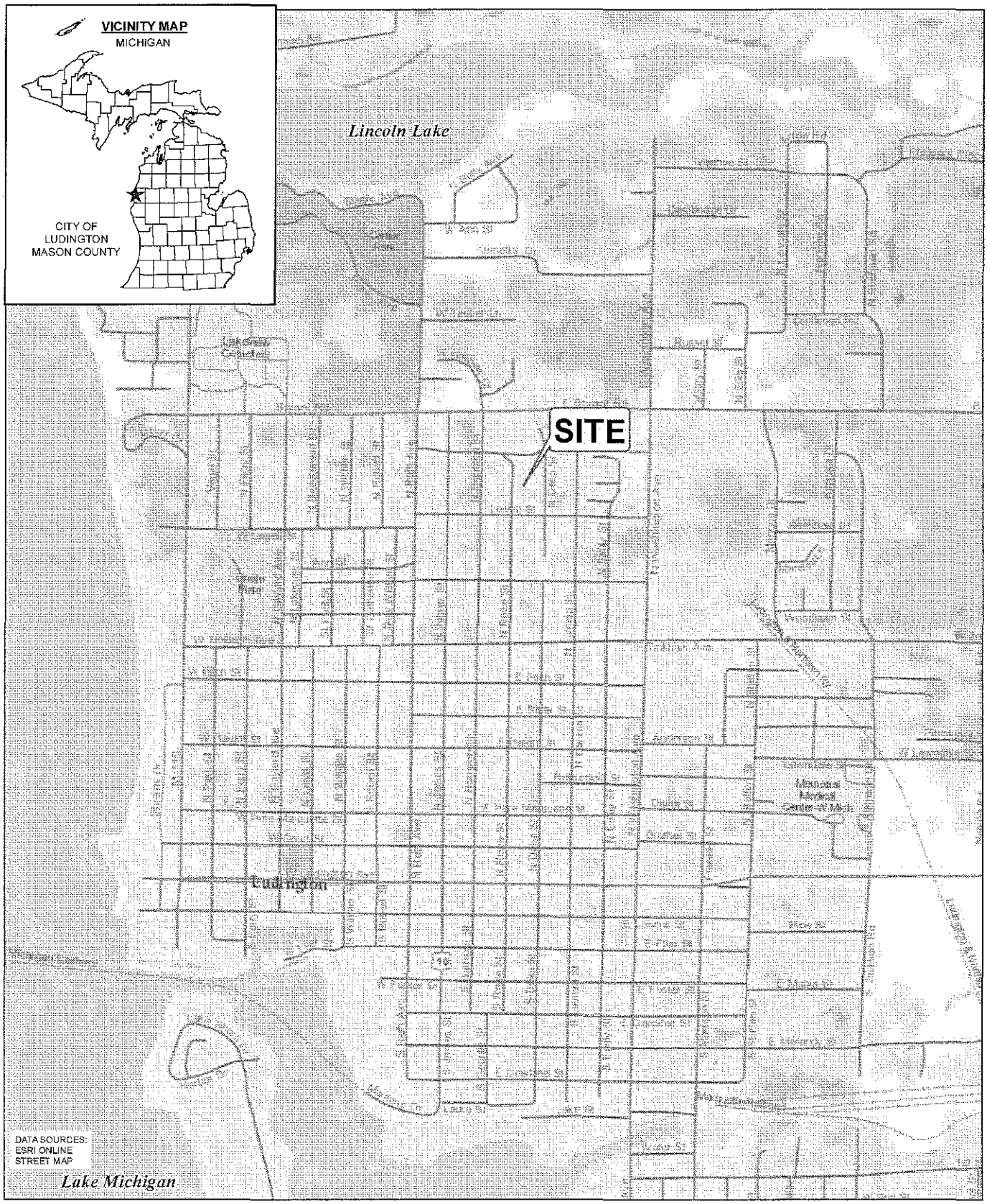
- Laboratory analytical reports.
- A table summarizing the analytical data.
- Figure with groundwater contours and posted concentrations of COCs.
- A SAP compliance evaluation.

6 REFERENCES

BB&E, 2014. Final Response Activity Plan for Source Area Remedial Design, Straits Steel & Wire Company, Ludington, Michigan. August 2014.

Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H), 2011. *Groundwater Sampling and Analysis Plan,* Straits Steel & Wire Company, 902 Rowe Street, Ludington, Michigan. February 4, 2011.

FIGURES



PLOTTED: Fri, 11 Jan 2013 11:12:05 AM By: jplummer

FIGURE 1

SITE LOCATION MAP

Straits Steel & Wire, Ludington, MI

N

0 250 500 1,000

Feet

BB&E

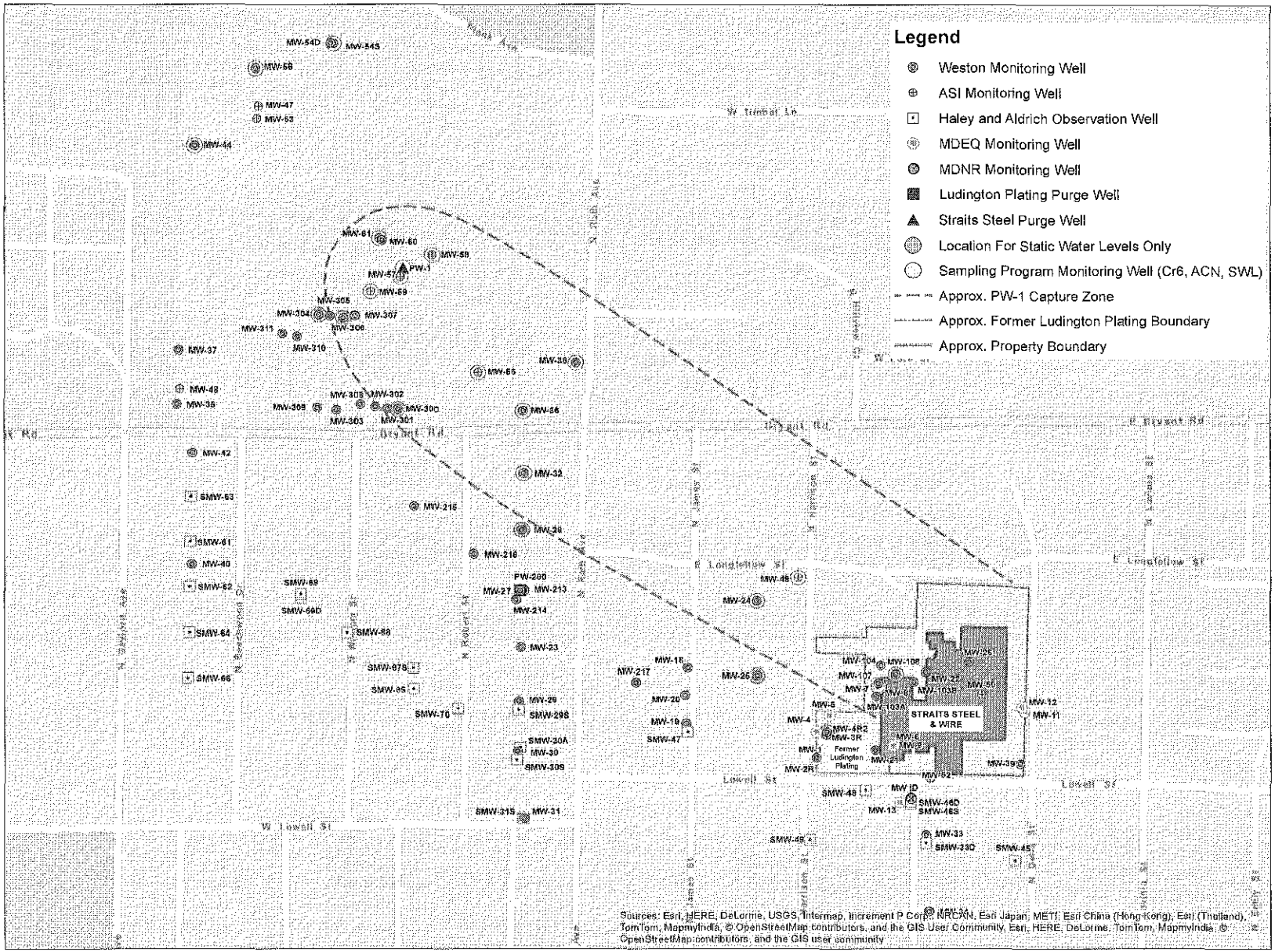


FIGURE 2

DOWN GRADIENT SAMPLING LOCATIONS SAP

Straits Steel & Wire
Ludington, MI

Note: RA Performance Monitoring Wells to be sampled are indicated on Figure 3

N

0 150 300 600
Feet

BB&E

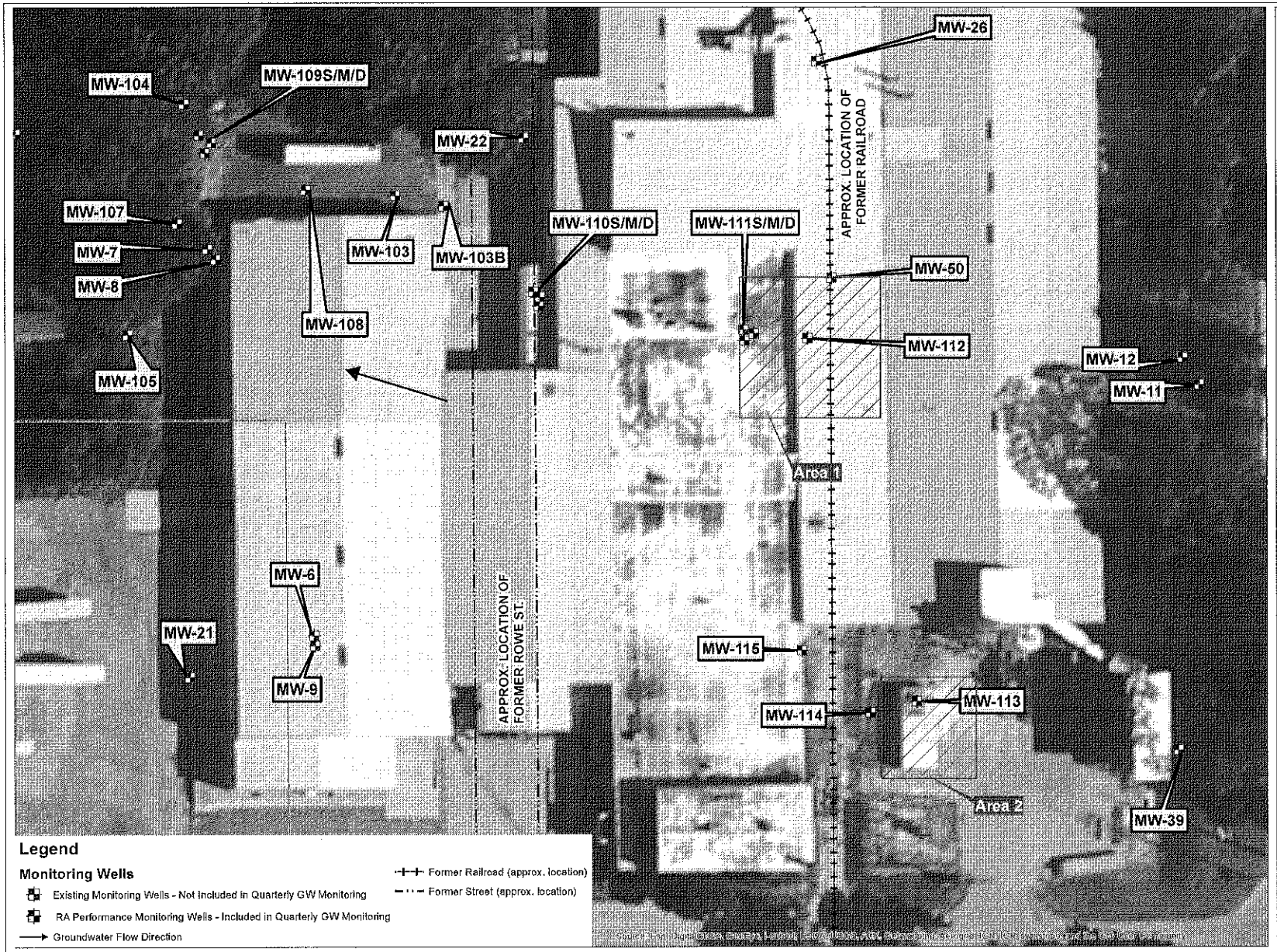


FIGURE 3

REMEDIAL ACTION (RA) PERFORMANCE MONITORING LOCATIONS

SAP

Straits Steel & Wire
Ludington, MI

NOTE:

1. Monitoring well locations are approximate. Wells have not been surveyed.

2. Shallow/medium/deep well nests are indicated on this map as "S/M/D".

N

0 25 50 100
Feet

BB&E

RMD - 10/14/2014

TABLES

Table 1
Site Sampling Plan
Straits Steel Wire, Ludington, Michigan

Monitoring Location	Existing or New (2014)	Location	Purpose	TOC Elevation (ft)	Well Depth (ft)	Approx. Screen Interval (ft bgs)	Sampling Frequency [1]	Fixed Lab							Field Parameters							
								Available Cyanide	Hexavalent Chromium	Iron	Manganese	Arsenic	Sulfide	Sulfate	Static Water Level (ft)	pH	DO (mg/l)	ORP (mV)	Cond. (mS/cm²)	Temp (F)	Turbidity (NTU)
Monitoring Wells *																						
MW-8	Existing	Near SSW Plant	PA	620.5	26.4	21.4-26.4	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-24	Existing	Downgradient of SSW Plant	PA	613.15	54.5	49.5-54.5	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-32	Existing	Downgradient of SSW Plant	LPB	625.06	84.5	79.5-84.5	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-36	Existing	Downgradient of SSW Plant	PA	625.84	85.8	80.8-85.8	Quarterly	X	X	--	--		--	--	X	X	X	X	X	X	X	
MW-38	Existing	Downgradient of SSW Plant	LPB	614.15	52.8	47.8-52.8	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-44	Existing	Downgradient of PW-1 Capture Zone	DG	617.23	93.1	88.1-93.1	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-49	Existing	Downgradient of SSW Plant	PA	619.23	59.7	54.7-59.7	Quarterly	X	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-54S	Existing	Downgradient of PW-1 Capture Zone	DG	603.43	18.5	82-85	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-55	Existing	Downgradient of SSW Plant	PA	628.41	85	80-85	Quarterly	X	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-56	Existing	Downgradient of PW-1 Capture Zone	DG	604.45	78	75-78	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-57 [2]	Existing	Downgradient of SSW Plant	PA	619.88	77.5	80-83	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-58	Existing	Downgradient of SSW Plant	LPB	619.3	85.6	80.6-85.6	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-59	Existing	Downgradient of SSW Plant	LPB	619.05	83.8	78.8-83.8	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-61	Existing	Downgradient of PW-1 Capture Zone	DG	616.47	85	80-85	Quarterly	--	X	--	--	--	--	--	X	X	X	X	X	X	X	
PW-1	Existing	Purge Well	PA	618.34[4]	na	-	Quarterly	X	X	--	--	--	--	--	X	X	X	X	X	X	X	
MW-4R2	Existing	Near SSW Plant	WL	616.11	na	-	Quarterly	--	--	--	--	--	--	--	X	--	--	--	--	--	--	
MW-25	Existing	Downgradient of SSW Plant	WL	613.36	22.1	17.1-22.1	Quarterly	--	--	--	--	--	--	--	X	--	--	--	--	--	--	
MW-28	Existing	Downgradient of SSW Plant	WL	631.55	105.2	100.2-105.2	Quarterly	--	--	--	--	--	--	--	X	--	--	--	--	--	--	
MW-108	Existing	Near SSW Plant	WL	621.01	13	8-13	Quarterly	--	--	--	--	--	--	--	X	--	--	--	--	--	--	
MW-300	Existing	Downgradient of SSW Plant	WL	635.49	98	93-98	Quarterly	--	--	--	--	--	--	--	X	--	--	--	--	--	--	
MW-304	Existing	Downgradient of SSW Plant	WL	624.65	94	89-94	Quarterly	--	--	--	--	--	--	--	X	--	--	--	--	--	--	
MW-306	Existing	Downgradient of SSW Plant	WL	617.04	88	83-88	Quarterly	--	--	--	--	--	--	--	X	--	--	--	--	--	--	
Remedial Action (RA) Performance Monitoring Wells																						
MW-109S	New	SSW Plant (NW) boundary-New	DG	NA	17	12-17	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-109M	New	SSW Plant (NW) boundary-convert SB65	DG	NA	25	20-25	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-109D	New	SSW Plant (NW) boundary-convert SB69	DG	NA	43	38-43	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-110S	New	Area 1-Truckwell-convert SB60	PA	NA	12	7-12	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-110M	New	Area 1-New	PA	NA	20	15-20	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-110D	New	Area 1-New	PA	NA	30	25-30	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-111S	New	Area 1-SB49 location	SA	NA	12	7-12	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-111M	New	Area 1-SB74 location	SA	NA	23	18-23	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-111D	New	Area 1-New	SA	NA	30	25-30	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-112	New	Area 1-convert SB54	SA	NA	12	7-12	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-113	New	Area 2-convert SB70	SA	NA	12	7-12	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-114	New	Area 2-convert SB06	PA	NA	12	7-12	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	
MW-115	New	Area 2-convert SB23	DG	NA	12	7-12	Quarterly	--	X	X	X	X	X	X	X	X	X	X	X	X	X	

Notes:
1.) Sampling frequencies for the performance monitoring wells are subject to change, based on results of the initial sampling events
2.) MW-57 is currently damaged (obstruction noted near the screen interval)
3.) MW-47 has been removed from the Quarterly Monitoring Program per correspondence with the MDEQ, dated 8 May 2012
4.) Ground elevation was recorded for PW-1
*Adapted from 2012 Groundwater Monitoring Results, First Quarter 2012 (FTC&H, May 24, 2012)

Abbreviations
Cond - conductivity
DG - downgradient monitoring location
DO - dissolved oxygen
ft - feet
LPB - lateral plume boundary monitoring location
MW - monitoring well
na - not available currently
ORP - oxidation reduction potential
PA - plume axis monitoring location
SA - source area monitoring location
TBD - to be determined
TOC - top of casing
WL - water level
"--" - not sampled

APPENDIX 1
NPDES PERMIT

PERMIT NO. MI0059187

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 *et seq.*) (the "Federal Act"), Michigan Act 451, Public Acts of 1994, as amended (the "Michigan Act"), Parts 31 and 41, and Michigan Executive Order 2011-1,

Straits Steel & Wire
902 North Rowe Street
Ludington, Michigan 49431

is authorized to discharge from the facility located at

902 North Rowe Street
Ludington, Michigan 49431

designated as **Straits Steel & Wire**

through storm sewers to the receiving water named Lincoln Lake in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

This permit is based on a complete application submitted on May 2, 2013.

This permit for a new use takes immediate effect on the date of issuance. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules. On its effective date this permit shall supersede Certificate of Coverage No. MIS210089, issued October 18, 2012, which is hereby revoked.

This permit and the authorization to discharge shall expire at midnight, **October 1, 2015**. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application which contains such information, forms, and fees as are required by the Department of Environmental Quality (Department) by **April 4, 2015**.

Issued: May 16, 2014

Philip Argiroff, Chief
Permits Section
Water Resources Division

PERMIT FEE REQUIREMENTS

In accordance with Section 324.3120 of the Michigan Act, the permittee shall make payment of an annual permit fee to the Department for each October 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by January 15 for notices mailed by December 1. The fee is due no later than 45 days after receiving the notice for notices mailed after December 1.

Annual Permit Fee Classification: Industrial-Commercial Minor, low-flow (Individual Permit)

In accordance with Section 324.3118 of the Michigan Act, the permittee shall make payment of an annual storm water fee to the Department for each January 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by March 15 for notices mailed by February 1. The fee is due no later than 45 days after receiving the notice for notices mailed after February 1.

ANTIDEGRADATION

The Department has determined that the permittee's Antidegradation Exemption, based on information required by Subrule (4) of R323.1098, shows that lowering of water quality is necessary to support the identified important social and economic development in the area. This determination is solely for purposes of satisfying state water quality regulations and is not intended to supplant local requirements, including land use or zoning laws. It is not, and should not be construed as, a finding by the Department that the proposed development meets local requirements or ordinances.

CONTACT INFORMATION

Unless specified otherwise, all contact with the Department required by this permit shall be made to the Cadillac District Supervisor of the Water Resources Division. The Cadillac District Office is located at 120 West Chapin Street, Cadillac, Michigan 49601-2158, Telephone: 231-876-4474, Fax: 231-775-1511.

CONTESTED CASE INFORMATION

Any person to whom this permit is not acceptable may file a sworn petition with the Michigan Administrative Hearing System within the Michigan Department of Licensing and Regulatory Affairs, c/o the Michigan Department of Environmental Quality, setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Department of Licensing and Regulatory Affairs may reject any petition filed more than 60 days after issuance as being untimely.

PART I

Section A. Effluent Limitations And Monitoring Requirements

1. Final Effluent Limitations, Monitoring Point 001A

During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee is authorized to discharge a maximum of 0.0576 MGD of purged groundwater from Monitoring Point 001A through Outfall 001 via storm sewers. Outfall 001 discharges to Lincoln Lake. Such discharge shall be limited and monitored by the permittee as specified below.

	Maximum Limits for Quantity or Loading			Maximum Limits for Quality or Concentration			Monitoring	Sample
Parameter	Monthly	Daily	Units	Monthly	Daily	Units	Frequency	Type
Flow	(report)	(report)	MGD	---	---	---	Monthly	Report Total Daily Flow
Available Cyanide	---	---	---	---	(report)	ug/l	Annually	Grab
Hexavalent Chromium	---	---	---	---	(report)	ug/l	Annually	Grab
Outfall Observation	(report)	---	---	---	---	---	Monthly	Visual
				Minimum Daily	Maximum Daily			
Dissolved Oxygen	---	---	---	3.0	---	mg/l	Monthly	Grab
pH	---	---	---	6.5	9.0	S.U.	Monthly	Grab

a. Analytical Testing for Available Cyanide and Quantification Level for Hexavalent Chromium
Available cyanide shall be analyzed using United States Environmental Protection Agency (USEPA) Method OIA-1677. The quantification level for hexavalent chromium shall be 5.0 ug/l unless a higher level is appropriate because of sample matrix interference. Justification for a higher quantification level shall be submitted to the Department within 30 days of such determination. Upon approval of the Department, the permittee may use alternate analytical methods (for parameters with methods specified in 40 CFR 136, the alternate methods are restricted to those listed in 40 CFR 136).

b. Narrative Standard
The receiving water shall contain no turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, or deposits as a result of this discharge in unnatural quantities which are or may become injurious to any designated use.

c. Monitoring Locations
Samples, measurements, and observations taken in compliance with the monitoring requirements above shall be taken prior to discharge to the storm sewers.

d. Outfall Observation
Any unusual characteristics of the discharge (i.e., unnatural turbidity, color, oil film, floating solids, foams, settleable solids, suspended solids, or deposits) shall be reported within 24 hours to the Department followed with a written report within five (5) days detailing the findings of the investigation and the steps taken to correct the condition.

PART I

Section A. Effluent Limitations And Monitoring Requirements

e. Water Treatment Additives
This permit does not authorize the discharge of water additives without approval from the Department. Approval of water additives is authorized under separate correspondence. Water additives include any material that is added to water used at the facility or to a wastewater generated by the facility to condition or treat the water. In the event a permittee proposes to discharge water additives, including an increased discharge concentration of a previously approved water additive, the permittee shall submit a request to the Department for approval. See Part I.A.2. for information on requesting water treatment additive use.

2. Request for Discharge of Water Treatment Additives

In the event a permittee proposes to discharge water additives, the permittee shall submit a request to discharge water additives to the Department for approval. Such requests shall be sent to the Permits Section, Water Resources Division, Department of Environmental Quality, P.O. Box 30458, Lansing, Michigan 48909, with a copy to the Department contact listed on the cover page of this permit. Instructions to submit a request electronically may be obtained via the Internet (http://www.michigan.gov/deqnpdes; then click on Applicable Rules and Regulations which is under the Information banner and then click on Water Treatment Additive Discharge Application Instructions). Written approval from the Department to discharge such additives at specified levels shall be obtained prior to discharge by the permittee. Additional monitoring and reporting may be required as a condition for the approval to discharge the additive.

A request to discharge water additives shall include all of the following water additive usage and discharge information:

a. Material Safety Data Sheet

b. the proposed water additive discharge concentration with supporting calculations

c. the discharge frequency (i.e., number of hours per day and number of days per year)

d. the monitoring point from which the product is to be discharged

e. the type of removal treatment, if any, that the water additive receives prior to discharge

f. product function (i.e. microbiocide, flocculant, etc.)

g. a 48-hour LC_{50} or EC_{50} for a North American freshwater planktonic crustacean (either *Ceriodaphnia sp., Daphnia sp., or Simocephalus sp.*)

h. the results of a toxicity test for one other North American freshwater aquatic species (other than a planktonic crustacean) that meets a minimum requirement of Rule 323.1057(2) of the Water Quality Standards.

Prior to submitting the request, the permittee may contact the Permits Section by telephone at 517-284-5568 or via the Internet at the address given above to determine if the Department has the product toxicity data required by items g. and h. above. If the Department has the data, the permittee will not need to submit product toxicity data.

PART I

Section A. Effluent Limitations And Monitoring Requirements

3. Storm Water Pollution Prevention Plan

The permittee is authorized to discharge storm water associated with industrial activities as defined in 40 CFR 122.26(b)(14)(i-ix). These storm water discharges shall be controlled in accordance with the requirements of this special condition. The permittee has developed and implemented a Storm Water Pollution Prevention Plan (SWPPP). The permittee shall continue implementation of the SWPPP for maximum control of significant materials (as defined in Part II.A.) so that storm water discharges will not cause a violation of the Water Quality Standards. The SWPPP shall be routinely reviewed and updated in accordance with the requirements of this section.

Storm water discharges are a violation of this permit if:

The receiving water will contain unnatural turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, or deposits as a result of this discharge; or

The permittee has not implemented an acceptable SWPPP.

a. Source Identification
To identify potential sources of significant materials that can pollute storm water and subsequently be discharged from the facility, the SWPPP shall, at a minimum, include the following:

1) A site map identifying the following: buildings and other permanent structures; storage or disposal areas for significant materials; secondary containment structures and descriptions of what is contained in the primary containment structures; storm water discharge outfalls (numbered or otherwise labeled for reference); location of storm water and non-storm inlets (catch basins, roof drains, conduits, drain tiles, retention pond riser pipes, and sump pumps) (numbered or otherwise labeled for reference) contributing to each outfall; location of NPDES permitted discharges other than storm water; outlines of the drainage areas contributing to each outfall; structural runoff controls or storm water treatment facilities; areas of vegetation (with brief description such as lawn, old field, marsh, wooded, etc); areas of exposed and/or erodible soils and gravel lots; impervious surfaces (roofs, asphalt, concrete); name and location of receiving water(s); and areas of known or suspected impacts on surface waters as designated under Part 201 (Environmental Response) of the Michigan Act;

2) A list of all significant materials that could pollute storm water. For each material listed, the SWPPP shall include each of the following descriptions:

a) ways in which each type of significant material has been or has reasonable potential to become exposed to storm water (e.g., spillage during handling; leaks from pipes, pumps, and vessels; contact with storage piles, contaminated materials, or soils; waste handling and disposal; deposits from dust or overspray, etc.);

b) an evaluation of the reasonable potential for contribution of significant materials to runoff from at least the following areas or activities: loading, unloading, and other significant material handling operations; outdoor storage, including secondary containment structures; outdoor manufacturing or processing activities; significant dust or particulate generating processes; discharge from vents, stacks and air emission controls; on-site waste treatment, storage, and disposal practices; maintenance and cleaning of vehicles, machines and equipment; sites of exposed and/or erodible soil; Sites of Environmental Contamination listed under Part 201 (Environmental Response) of the Michigan Act; waste management units and areas of concern subject to corrective action under Part 111 (Hazardous Waste Management) or Part 115 (Solid Waste Management) of the Michigan Act; areas of significant material residues; areas where animals congregate (wild or domestic) and deposit wastes; and other areas where storm water may contact significant materials;

c) identification of the outfall(s) and the inlet(s) contributing the significant material to each outfall through which the significant material may be discharged if released;

PART I

Section A. Effluent Limitations And Monitoring Requirements

d) a listing of significant spills and significant leaks of polluting materials that occurred at areas that are exposed to precipitation or that otherwise discharge to a point source at the facility. The listing shall include spills that occurred over the three (3) years prior to the completion of the SWPPP or latest update of the SWPPP; the date, volume and exact location of release; and the action taken to clean up the material and/or prevent exposure to storm water runoff or contamination of surface waters of the state. Any release that occurs after the SWPPP has been developed shall be controlled in accordance with the SWPPP and is cause for the SWPPP to be updated as appropriate within 14 calendar days of obtaining knowledge of the spill or loss; and

e) the permittee shall determine whether its facility discharges storm water to a water body for which the Department has established a Total Maximum Daily Load (TMDL). If so, the permittee shall assess whether the TMDL requirements for the facility's discharge are being met through the existing SWPPP controls or whether additional control measures are necessary. The permitee's assessment of whether the TMDL requirements are being met shall focus on the effectiveness, adequacy, and implementation of the permitee's SWPPP controls; and

3) A summary of existing storm water discharge sampling data (if available) describing pollutants in storm water discharges at the facility. This summary shall be accompanied by a description of the suspected source(s) of the pollutants detected.

b. Preventive Measures and Source Controls, Non-Structural
To prevent significant materials from contacting storm water at the source, the SWPPP shall, at a minimum, include the following non-structural controls:

1) A program which includes a schedule for routine preventive maintenance. The preventive maintenance program shall consist of routine inspections and maintenance of storm water management and control devices (e.g., cleaning of oil/water separators and catch basins, routine housekeeping activities, etc.) as well as inspecting and testing plant equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to the storm sewer system or the surface waters of the state. The routine inspection shall include areas of the facility in which significant materials have the reasonable potential to contaminate runoff. A written report of the inspection and corrective actions shall be maintained on file by the permittee, and shall be retained in accordance with Record Keeping, below;

2) Good housekeeping procedures to maintain a clean, orderly facility. Good housekeeping procedures shall include routine inspections that focus on the areas of the facility that have a reasonable potential to contaminate storm water runoff from the property. The routine housekeeping inspections may be combined with the routine inspections for the preventive maintenance program. A written report of the inspection and corrective actions shall be retained in accordance with Record Keeping, below;

3) Regularly scheduled comprehensive site inspections. The inspections shall include, but not be limited to, the structural controls in use at the facility and the areas and equipment identified in the preventive maintenance program and good housekeeping procedures. The inspections shall also include a review of the routine preventive maintenance reports, good housekeeping inspections reports, and any other paperwork associated with the SWPPP. The comprehensive site inspection shall be conducted by the Certified Storm Water Operator at least quarterly. The permittee may request Department approval of an alternate schedule for comprehensive site inspections. A written report of the inspection and corrective actions shall be retained in accordance with Record Keeping, below. Included in the report shall be a certification that the facility is in compliance with this permit and the SWPPP;

PART I

Section A. Effluent Limitations And Monitoring Requirements

4) Material handling procedures and storage requirements for significant materials. Equipment and procedures for cleaning up spills shall be identified in the SWPPP and made available to the appropriate personnel. The procedures shall identify measures to prevent the spilled materials or material residues from contaminating storm water runoff from the property. The SWPPP shall include language describing what a reportable spill or release is and the appropriate reporting requirements in accordance with Part II.C.6. and Part II.C.7. of the permit. The SWPPP may include, by reference, requirements of either a Pollution Incident Prevention Plan (PIPP) prepared in accordance with the Part 5 Rules (Rules 324.2001 through 324.2009 of the Michigan Administrative Code); a Hazardous Waste Contingency Plan prepared in accordance with 40 CFR 264 and 265 Subpart D, as required by Part 111 of the Michigan Act; or a Spill Prevention Control and Countermeasure (SPCC) plan prepared in accordance with 40 CFR 112;

5) Measures used to control soil erosion and sedimentation including identification of the areas that, due to topography, activities, or other factors, have a high potential for significant soil erosion. Gravel lots are to be included;

6) A description of the employee training program which will be implemented on an annual basis to inform appropriate personnel at all levels of their responsibility as it relates to the components and goals of the SWPPP. The SWPPP shall identify periodic dates for the employee training program. Records of the employee training program shall be retained in accordance with Record Keeping, below; and

7) Actions being taken to limit the discharge of significant materials in order to comply with TMDL requirements.

The SWPPP shall identify significant materials expected to be present in storm water discharges following implementation of non-structural preventative measures and source controls.

c. Structural Controls for Prevention and Treatment
Where implementation of the measures required by Preventive Measures and Source Controls, Non-Structural; above; does not control storm water discharges in accordance with Water Quality Standards, below, the SWPPP shall provide a description of the location, function, design criteria, and installation/construction schedules of structural controls for prevention and treatment. Structural controls may be necessary:

1) To prevent uncontaminated storm water from contacting or being contacted by significant materials, and/or

2) If preventive measures are not feasible or are inadequate to keep significant materials at the site from contaminating storm water.

Structural controls shall be used to treat, divert, isolate, recycle, reuse, or otherwise manage storm water in a manner that reduces the level of significant materials in the storm water and provides compliance with the Water Quality Standards, below.

d. Keeping SWPPPs Current
1) The permittee and/or the Certified Storm Water Operator shall review the SWPPP annually after it is developed and maintain a written report of the review in accordance with Record Keeping, below. Based on the review, the permittee or the Certified Storm Water Operator shall amend the SWPPP as needed to ensure continued compliance with the terms and conditions of this permit. The written report shall be submitted to the Department on or before January 10th of each year.

2) The SWPPP developed under the conditions of a previous permit shall be amended as necessary to ensure compliance with this permit.

PART I

Section A. Effluent Limitations And Monitoring Requirements

3) The SWPPP shall be updated or amended whenever changes at the facility have the potential to increase the exposure of significant materials to storm water, significant spills at the facility occur, or when the SWPPP is determined by the permittee or the Department to be ineffective in achieving the general objectives of controlling pollutants in storm water discharges associated with industrial activity. Updates based on increased activity at the facility shall include a description of how the permittee intends to control any new sources of significant materials or respond to and prevent spills in accordance with the requirements of Source Identification; Preventive Measures and Source Controls; Non-Structural; and Structural Controls for Prevention and Treatment; above.

4) The Department or authorized representative may notify the permittee at any time that the SWPPP does not meet minimum requirements. Such notification shall identify why the SWPPP does not meet minimum requirements. The permittee shall make the required changes to the SWPPP within 30 days after such notification from the Department or authorized representative and shall submit to the Department a written certification that the requested changes have been made.

5) Amendments to the SWPPP shall be signed and retained on-site pursuant to Record Keeping, below.

e. Certified Storm Water Operator Requirements
A Certified Storm Water Operator certified by the Department is required by Section 3110 of the Michigan Act. The Certified Storm Water Operator shall have supervision over the facility's storm water treatment and control measures included in the SWPPP. The names and certification numbers of the Certified Storm Water Operators shall be included in the SWPPP.

If the Certified Storm Water Operator is changed or an additional Certified Storm Water Operator is added, the permittee shall provide the name and certification number of the new Certified Storm Water Operator to the Department. If a facility has multiple Certified Storm Water Operators, the names and certification numbers of the Certified Storm Water Operators shall be included in the SWPPP.

f. Signature and SWPPP Review
1) The SWPPP shall be signed by the Certified Storm Water Operator and by either the permittee or an authorized representative in accordance with 40 CFR 122.22. The SWPPP and associated records shall be retained on-site at the facility which generates the storm water discharge.

2) The permittee shall make SWPPPs, reports, log books, storm water discharge sampling data (if collected), and items required by Record Keeping, below, available upon request to the Department or authorized representative.

g. Record Keeping
The permittee shall maintain records of all SWPPP related inspection and maintenance activities. Records shall also be kept describing incidents such as spills or other discharges that can affect the quality of storm water runoff. All such records shall be retained for three (3) years.

h. Water Quality Standards
At the time of discharge, there shall be no violation of the Water Quality Standards in the receiving waters as a result of the storm water discharge. This requirement includes, but is not limited to, the following conditions:

1) In accordance with Rule 323.1050 of the Water Quality Standards, the receiving waters shall not have any of the following unnatural physical properties as a result of this discharge in quantities which are or may become injurious to any designated use: turbidity, color, oil film, floating solids, foams, settleable solids, suspended solids, or deposits;

PART I

Section A. Effluent Limitations And Monitoring Requirements

2) Any unusual characteristics of the discharge (i.e., unnatural turbidity, color, oil film, floating solids, foams, settleable solids, suspended solids, or deposits) shall be reported within 24 hours to the Department followed by a written report within five (5) days detailing the findings of the investigation and the steps taken to correct the condition; and

3) Any pollutant for which a level of control is specified to meet a TMDL established by the Department shall be controlled at the facility so that its discharge is reduced by/to the amount specified in the TMDL.

i. Prohibition of Non-storm Water Discharges
Discharges of material other than storm water shall be in compliance with an NPDES permit issued for the discharge. Storm water shall be defined to include the following non-storm water discharges provided pollution prevention controls for the non-storm water component are identified in the SWPPP: discharges from fire hydrant flushing, potable water sources including water line flushing, water from fire system testing and fire fighting training without burned materials or chemical fire suppressants, irrigation drainage, lawn watering, routine building wash down which does not use detergents or other compounds, pavement wash water where toxic or hazardous materials have not occurred (unless all contamination by toxic or hazardous materials have been removed) and where detergents are not used, air conditioning condensate, springs, uncontaminated groundwater, foundation or footing drains where flows are not contaminated with process materials such as solvents, and discharges from fire fighting activities. Discharges from fire fighting activities are exempted from the requirement to be identified in the SWPPP.

4. Facility Contact

The "Facility Contact" was specified in the application. The permittee may replace the facility contact at any time, and shall notify the Department in writing within 10 days after replacement (including the name, address and telephone number of the new facility contact).

a. The facility contact shall be (or a duly authorized representative of this person):
- for a corporation, a principal executive officer of at least the level of vice president, or a designated representative, if the representative is responsible for the overall operation of the facility from which the discharge described in the permit application or other NPDES form originates,
- for a partnership, a general partner,
- for a sole proprietorship, the proprietor, or
- for a municipal, state, or other public facility, either a principal executive officer, the mayor, village president, city or village manager or other duly authorized employee.

b. A person is a duly authorized representative only if:
- the authorization is made in writing to the Department by a person described in paragraph a. of this section; and
- the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the facility (a duly authorized representative may thus be either a named individual or any individual occupying a named position).

Nothing in this section obviates the permittee from properly submitting reports and forms as required by law.

5. Discharge to the Groundwaters

This site is a known source of groundwater pollution. The issuance of this permit does not authorize any discharge to the groundwaters or venting of contaminated groundwaters to the surface waters, nor does it constitute a release of liability for any groundwater contamination at or around the site. The state reserves its rights to seek remedies to abate any groundwater contamination.

PART II

Part II may include terms and /or conditions not applicable to discharges covered under this permit.

Section A. Definitions

Acute toxic unit (TU_A) means $100/LC_{50}$ where the LC_{50} is determined from a whole effluent toxicity (WET) test which produces a result that is statistically or graphically estimated to be lethal to 50% of the test organisms.

Bioaccumulative chemical of concern (BCC) means a chemical which, upon entering the surface waters, by itself or as its toxic transformation product, accumulates in aquatic organisms by a human health bioaccumulation factor of more than 1000 after considering metabolism and other physiochemical properties that might enhance or inhibit bioaccumulation. The human health bioaccumulation factor shall be derived according to R 323.1057(5). Chemicals with half-lives of less than 8 weeks in the water column, sediment, and biota are not BCCs. The minimum bioaccumulation concentration factor (BAF) information needed to define an organic chemical as a BCC is either a field-measured BAF or a BAF derived using the biota-sediment accumulation factor (BSAF) methodology. The minimum BAF information needed to define an inorganic chemical as a BCC, including an organometal, is either a field-measured BAF or a laboratory-measured bioconcentration factor (BCF). The BCCs to which these rules apply are identified in Table 5 of R 323.1057 of the Water Quality Standards.

Biosolids are the solid, semisolid, or liquid residues generated during the treatment of sanitary sewage or domestic sewage in a treatment works. This includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes and a derivative of the removed scum or solids.

Bulk biosolids means biosolids that are not sold or given away in a bag or other container for application to a lawn or home garden.

Certificate of Coverage (COC) is a document, issued by the Department, which authorizes a discharge under a general permit.

Chronic toxic unit (TU_C) means 100/MATC or $100/IC_{25}$, where the maximum acceptable toxicant concentration (MATC) and IC_{25} are expressed as a percent effluent in the test medium.

Class B biosolids refers to material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with the Part 24 Rules. Processes include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

Daily concentration is the sum of the concentrations of the individual samples of a parameter divided by the number of samples taken during any calendar day. If the parameter concentration in any sample is less than the quantification limit, regard that value as zero when calculating the daily concentration. The daily concentration will be used to determine compliance with any maximum and minimum daily concentration limitations (except for pH and dissolved oxygen). When required by the permit, report the maximum calculated daily concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the Discharge Monitoring Reports (DMRs).

For pH, report the maximum value of any individual sample taken during the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs and the minimum value of any individual sample taken during the month in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. For dissolved oxygen, report the minimum concentration of any individual sample in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Daily loading is the total discharge by weight of a parameter discharged during any calendar day. This value is calculated by multiplying the daily concentration by the total daily flow and by the appropriate conversion factor. The daily loading will be used to determine compliance with any maximum daily loading limitations. When required by the permit, report the maximum calculated daily loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMRs.

Department means the Michigan Department of Environmental Quality.

PART II

Section A. Definitions

Detection level means the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Discharge event is a discrete occurrence during which effluent is discharged to the surface water up to 10 days of a consecutive 14 day period.

EC_{50} means a statistically or graphically estimated concentration that is expected to cause 1 or more specified effects in 50% of a group of organisms under specified conditions.

Fecal coliform bacteria monthly is the geometric mean of the samples collected during a discharge event. Days with no discharge shall not be used to determine the value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the period in which the discharge event occurred was partially in each of two months, the monthly value shall be reported on the DMR of the month in which the last day of discharge occurred.

Fecal coliform bacteria 7-day is the geometric mean of the samples collected in any 7-day period during a discharge event. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the maximum calculated 7-day concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. If the seven day period was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

Flow proportioned sample is a composite sample with the sample volume proportional to the effluent flow.

Geometric mean is the average of the logarithmic values of a base 10 data set, converted back to a base 10 number.

Grab sample is a single sample taken at neither a set time nor flow.

IC_{25} means the toxicant concentration that would cause a 25% reduction in a nonquantal biological measurement for the test population.

Interference is a discharge which, alone or in conjunction with a discharge or discharges from other sources, both: 1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and 2) therefore, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or, of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent state or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including state regulations contained in any state sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act. [This definition does not apply to sample matrix interference.]

Land application means spraying or spreading biosolids or a biosolids derivative onto the land surface, injecting below the land surface, or incorporating into the soil so that the biosolids or biosolids derivative can either condition the soil or fertilize crops or vegetation grown in the soil.

LC_{50} means a statistically or graphically estimated concentration that is expected to be lethal to 50% of a group of organisms under specified conditions.

Maximum acceptable toxicant concentration (MATC) means the concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration that did not cause the occurrence of a specific adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specific adverse effect and above which all tested concentrations caused such an occurrence.

PART II

Section A. Definitions

MGD means million gallons per day.

Monthly concentration is the sum of the daily concentrations determined during a discharge event divided by the number of daily concentrations determined. The calculated monthly concentration will be used to determine compliance with any maximum monthly concentration limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly concentration in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the seven day period was partially in each of two months, the monthly average shall be reported on the DMR of the month in which the last day of discharge occurred.

For minimum percent removal requirements, the monthly influent concentration and the monthly effluent concentration shall be determined. The calculated monthly percent removal, which is equal to 100 times the quantity [1 minus the quantity (monthly effluent concentration divided by the monthly influent concentration)], shall be reported in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Monthly loading is the sum of the daily loadings of a parameter divided by the number of daily loadings determined during a discharge event. The calculated monthly loading will be used to determine compliance with any maximum monthly loading limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly loading in the "AVERAGE" column under "QUANTITY OR LOADING" on the DMR. If the seven day period was partially in each of two months, the monthly average shall be reported on the DMR of the month in which the last day of discharge occurred..

Monthly monitoring frequency refers to a calendar month. When required by this permit, an analytical result, reading, value or observation must be reported for that period if a discharge occurs during that period.

National Pretreatment Standards are the regulations promulgated by or to be promulgated by the Federal Environmental Protection Agency pursuant to Section 307(b) and (c) of the Federal Act. The standards establish nationwide limits for specific industrial categories for discharge to a POTW.

No observed adverse effect level (NOAEL) means the highest tested dose or concentration of a substance which results in no observed adverse effect in exposed test organisms where higher doses or concentrations result in an adverse effect.

Noncontact cooling water is water used for cooling which does not come into direct contact with any raw material, intermediate product, by-product, waste product or finished product.

Nondomestic user is any discharger to a POTW that discharges wastes other than or in addition to water-carried wastes from toilet, kitchen, laundry, bathing or other facilities used for household purposes.

Partially treated sewage is any sewage, sewage and storm water, or sewage and wastewater, from domestic or industrial sources that is treated to a level less than that required by the permittee's National Pollutant Discharge Elimination System permit, or that is not treated to national secondary treatment standards for wastewater, including discharges to surface waters from retention treatment facilities.

Pretreatment is reducing the amount of pollutants, eliminating pollutants, or altering the nature of pollutant properties to a less harmful state prior to discharge into a public sewer. The reduction or alteration can be by physical, chemical, or biological processes, process changes, or by other means. Dilution is not considered pretreatment unless expressly authorized by an applicable National Pretreatment Standard for a particular industrial category.

POTW is a publicly owned treatment works.

Quantification level means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

PART II

Section A. Definitions

Quarterly monitoring frequency refers to a three month period, defined as January through March, April through June, July through September, and October through December. When required by this permit, an analytical result, reading, value or observation must be reported for that period if a discharge occurs during that period.

Regional Administrator is the Region 5 Administrator, U.S. EPA, located at R-19J, 77 W. Jackson Blvd., Chicago, Illinois 60604.

Significant industrial user is a nondomestic user that: 1) is subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; or 2) discharges an average of 25,000 gallons per day or more of process wastewater to a POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process wastestream which makes up five (5) percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the permittee as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's treatment plant operation or violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

Significant materials Significant Materials means any material which could degrade or impair water quality, including but not limited to: raw materials; fuels; solvents, detergents, and plastic pellets; finished materials such as metallic products; hazardous substances designated under Section 101(14) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see 40 CFR 372.65); any chemical the facility is required to report pursuant to Section 313 of Emergency Planning and Community Right-to-Know Act (EPCRA); polluting materials as identified under the Part 5 Rules (Rules 324.2001 through 324.2009 of the Michigan Administrative Code); Hazardous Wastes as defined in Part 111 of the Michigan Act; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

Stoichiometric means the quantity of a reagent calculated to be necessary and sufficient for a given chemical reaction.

Tier I value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier I toxicity database.

Tier II value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier II toxicity database.

Total Maximum Daily Loads (TMDLs) are required by the Federal Act for waterbodies that do not meet Water Quality Standards. TMDLs represent the maximum daily load of a pollutant that a waterbody can assimilate and meet Water Quality Standards and an allocation of that load among point sources, nonpoint sources, and a margin of safety.

Toxicity Reduction Evaluation (TRE) means a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

Water Quality Standards means the Part 4 Water Quality Standards promulgated pursuant to Part 31 of Act No. 451 of the Public Acts of 1994, as amended, being Rules 323.1041 through 323.1117 of the Michigan Administrative Code.

Weekly monitoring frequency refers to a calendar week which begins on Sunday and ends on Saturday. When required by this permit, an analytical result, reading, value or observation must be reported for that period if a discharge occurs during that period.

Yearly monitoring frequency refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation must be reported for that period if a discharge occurs during that period.

PART II

Section A. Definitions

24-hour composite sample is a flow-proportioned composite sample consisting of hourly or more frequent portions that are taken over a 24-hour period. A time-proportioned composite sample may be used upon approval of the Department if the permittee demonstrates it is representative of the discharge.

3-portion composite sample is a sample consisting of three equal volume grab samples collected at equal intervals over an 8-hour period.

7-day concentration is the sum of the daily concentrations determined during any 7 days of discharge during a discharge event divided by the number of daily concentrations determined. If the number of days of the discharge event is less than 7 days the number of actual days of discharge shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations. When required by the permit, report the maximum calculated 7-day concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. If the seven day period was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

7-day loading is the sum of the daily loadings of a parameter divided by the number of daily loadings determined during any 7 consecutive days. If the number of days of the discharge event is less than 7 days the number of actual days of discharge shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations. When required by the permit, report the maximum calculated 7-day loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. If the seven day period in which the discharge event occurred was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

PART II

Section B. Monitoring Procedures

1. Representative Samples

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations promulgated pursuant to Section 304(h) of the Federal Act (40 CFR Part 136 - Guidelines Establishing Test Procedures for the Analysis of Pollutants), unless specified otherwise in this permit. Test procedures used shall be sufficiently sensitive to determine compliance with applicable effluent limitations. Requests to use test procedures not promulgated under 40 CFR Part 136 for pollutant monitoring required by this permit shall be made in accordance with the Alternate Test Procedures regulations specified in 40 CFR 136.4. These requests shall be submitted to the Chief of the Permits Section, Water Resources Division, Michigan Department of Environmental Quality, P.O. Box 30458, Lansing, Michigan, 48909-7958. The permittee may use such procedures upon approval.

The permittee shall periodically calibrate and perform maintenance procedures on all analytical instrumentation at intervals to ensure accuracy of measurements. The calibration and maintenance shall be performed as part of the permittee's laboratory Quality Control/Quality Assurance program.

3. Instrumentation

The permittee shall periodically calibrate and perform maintenance procedures on all monitoring instrumentation at intervals to ensure accuracy of measurements.

4. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information: 1) the exact place, date, and time of measurement or sampling; 2) the person(s) who performed the measurement or sample collection; 3) the dates the analyses were performed; 4) the person(s) who performed the analyses; 5) the analytical techniques or methods used; 6) the date of and person responsible for equipment calibration; and 7) the results of all required analyses.

5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the Department.

PART II

Section C. Reporting Requirements

1. Start-up Notification

If the permittee will not discharge during the first 60 days following the effective date of this permit, the permittee shall notify the Department within 14 days following the effective date of this permit, and then 60 days prior to the commencement of the discharge.

2. Submittal Requirements for Self-Monitoring Data

Part 31 of Act 451 of 1994, as amended, specifically Section 324.3110(3) and Rule 323.2155(2) of Part 21 allows the Department to specify the forms to be utilized for reporting the required self-monitoring data. Unless instructed on the effluent limitations page to conduct "Retained Self-Monitoring" the permittee shall submit self-monitoring data via the Department's Electronic Environmental Discharge Monitoring Reporting (e2-DMR) system.

The permittee shall utilize the information provided on the e2-Reporting website at https://secure1.state.mi.us/e2rs/ to access and submit the electronic forms. Both monthly summary and daily data shall be submitted to the Department no later than the **20th day of the month** following each month of the authorized discharge period(s). The permittee may be allowed to submit the electronic forms after this date if the Department has granted an extension to the submittal date.

3. Retained Self-Monitoring Requirements

If instructed on the effluent limits page to conduct retained self-monitoring, the permittee shall maintain a year-to-date log of retained self-monitoring results and, upon request, provide such log for inspection to the staff of the Water Resources Division, Michigan Department of Environmental Quality. Retained self-monitoring results are public information and shall be promptly provided to the public upon request.

The permittee shall certify, in writing, to the Department, on or before January 10th of each year, that: 1) all retained self-monitoring requirements have been complied with and a year-to-date log has been maintained; and 2) the application on which this permit is based still accurately describes the discharge. With this annual certification, the permittee shall submit a summary of the previous year's monitoring data. The summary shall include maximum values for samples to be reported as daily maximums and/or monthly maximums and minimum values for any daily minimum samples.

4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

Monitoring required pursuant to Part 41 of the Michigan Act or Rule 35 of the Mobile Home Park Commission Act (Act 96 of the Public Acts of 1987) for assurance of proper facility operation shall be submitted as required by the Department.

5. Compliance Dates Notification

Within 14 days of every compliance date specified in this permit, the permittee shall submit a written notification to the Department indicating whether or not the particular requirement was accomplished. If the requirement was not accomplished, the notification shall include an explanation of the failure to accomplish the requirement, actions taken or planned by the permittee to correct the situation, and an estimate of when the requirement will be accomplished. If a written report is required to be submitted by a specified date and the permittee accomplishes this, a separate written notification is not required.

PART II

Section C. Reporting Requirements

6. Noncompliance Notification

Compliance with all applicable requirements set forth in the Federal Act, Parts 31 and 41 of the Michigan Act, and related regulations and rules is required. All instances of noncompliance shall be reported as follows:

a. 24-hour reporting - Any noncompliance which may endanger health or the environment (including maximum and/or minimum daily concentration discharge limitation exceedances) shall be reported, verbally, within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission shall also be provided within five (5) days.

b. other reporting - The permittee shall report, in writing, all other instances of noncompliance not described in a. above at the time monitoring reports are submitted; or, in the case of retained self-monitoring, within five (5) days from the time the permittee becomes aware of the noncompliance.

Written reporting shall include: 1) a description of the discharge and cause of noncompliance; and 2) the period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and the steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

7. Spill Notification

The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwaters of the state, unless the permittee has determined that the release is not in excess of the threshold reporting quantities specified in the Part 5 Rules (Rules 324.2001 through 324.2009 of the Michigan Administrative Code), by calling the Department at the number indicated on the second page of this permit, or if the notice is provided after regular working hours call the Department's 24-hour Pollution Emergency Alerting System telephone number, 1-800-292-4706 (calls from out-of-state dial 1-517-373-7660).

Within ten (10) days of the release, the permittee shall submit to the Department a full written explanation as to the cause of the release, the discovery of the release, response (clean-up and/or recovery) measures taken, and preventative measures taken or a schedule for completion of measures to be taken to prevent reoccurrence of similar releases.

8. Upset Noncompliance Notification

If a process "upset" (defined as an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee) has occurred, the permittee who wishes to establish the affirmative defense of upset, shall notify the Department by telephone within 24 hours of becoming aware of such conditions; and within five (5) days, provide in writing, the following information:

a. that an upset occurred and that the permittee can identify the specific cause(s) of the upset;

b. that the permitted wastewater treatment facility was, at the time, being properly operated and maintained (note that an upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation); and

c. that the permittee has specified and taken action on all responsible steps to minimize or correct any adverse impact in the environment resulting from noncompliance with this permit.

No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

In any enforcement proceedings, the permittee, seeking to establish the occurrence of an upset, has the burden of proof.

PART II

Section C. Reporting Requirements

9. Bypass Prohibition and Notification

a. Bypass Prohibition - Bypass is prohibited, and the Department may take an enforcement action, unless:

1) bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

2) there were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass; and

3) the permittee submitted notices as required under 9.b. or 9.c. below.

b. Notice of Anticipated Bypass - If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least ten (10) days before the date of the bypass, and provide information about the anticipated bypass as required by the Department. The Department may approve an anticipated bypass, after considering its adverse effects, if it will meet the three (3) conditions listed in 9.a. above.

c. Notice of Unanticipated Bypass - The permittee shall submit notice to the Department of an unanticipated bypass by calling the Department at the number indicated on the second page of this permit (if the notice is provided after regular working hours, use the following number: 1-800-292-4706) as soon as possible, but no later than 24 hours from the time the permittee becomes aware of the circumstances.

d. Written Report of Bypass - A written submission shall be provided within five (5) working days of commencing any bypass to the Department, and at additional times as directed by the Department. The written submission shall contain a description of the bypass and its cause; the period of bypass, including exact dates and times, and if the bypass has not been corrected, the anticipated time it is expected to continue; steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass; and other information as required by the Department.

e. Bypass Not Exceeding Limitations - The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of 9.a., 9.b., 9.c., and 9.d., above. This provision does not relieve the permittee of any notification responsibilities under Part II.C.11. of this permit.

f. Definitions

1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

10. Bioaccumulative Chemicals of Concern (BCC)

Consistent with the requirements of Rules 323.1098 and 323.1215 of the Michigan Administrative Code, the permittee is prohibited from undertaking any action that would result in a lowering of water quality from an increased loading of a BCC unless an increased use request and antidegradation demonstration have been submitted and approved by the Department.

PART II

Section C. Reporting Requirements

11. Notification of Changes in Discharge

The permittee shall notify the Department, in writing, as soon as possible but no later than 10 days of knowing, or having reason to believe, that any activity or change has occurred or will occur which would result in the discharge of: 1) detectable levels of chemicals on the current Michigan Critical Materials Register, priority pollutants or hazardous substances set forth in 40 CFR 122.21, Appendix D, or the Pollutants of Initial Focus in the Great Lakes Water Quality Initiative specified in 40 CFR 132.6, Table 6, which were not acknowledged in the application or listed in the application at less than detectable levels; 2) detectable levels of any other chemical not listed in the application or listed at less than detection, for which the application specifically requested information; or 3) any chemical at levels greater than five times the average level reported in the complete application (see the first page of this permit for the date(s) the complete application was submitted). Any other monitoring results obtained as a requirement of this permit shall be reported in accordance with the compliance schedules.

12. Changes in Facility Operations

Any anticipated action or activity, including but not limited to facility expansion, production increases, or process modification, which will result in new or increased loadings of pollutants to the receiving waters must be reported to the Department by a) submission of an increased use request (application) and all information required under Rule 323.1098 (Antidegradation) of the Water Quality Standards or b) by notice if the following conditions are met: 1) the action or activity will not result in a change in the types of wastewater discharged or result in a greater quantity of wastewater than currently authorized by this permit; 2) the action or activity will not result in violations of the effluent limitations specified in this permit; 3) the action or activity is not prohibited by the requirements of Part II.C.10.; and 4) the action or activity will not require notification pursuant to Part II.C.11. Following such notice, the permit may be modified according to applicable laws and rules to specify and limit any pollutant not previously limited.

13. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall submit to the Department 30 days prior to the actual transfer of ownership or control a written agreement between the current permittee and the new permittee containing: 1) the legal name and address of the new owner; 2) a specific date for the effective transfer of permit responsibility, coverage and liability; and 3) a certification of the continuity of or any changes in operations, wastewater discharge, or wastewater treatment.

If the new permittee is proposing changes in operations, wastewater discharge, or wastewater treatment, the Department may propose modification of this permit in accordance with applicable laws and rules.

14. Operations and Maintenance Manual

Part 41 of Act 451 of 1994, as amended, specifically Section 324.4104 and associated Rule 299.2957, allow the Department to require an Operations and Maintenance (O&M) manual for the wastewater treatment facility. An up-to-date copy of the O&M manual shall be kept at the wastewater treatment facility. Upon request a copy of the O&M manual shall be provided to the Department. The Department may review the manual in whole or in part at their discretion and require modifications to it if portions are determined to be inadequate.

At a minimum, the O&M manual should include the following information: permit standards, description and operation information for all equipment, staffing information, laboratory requirements, record keeping requirements, maintenance plan for equipment, emergency operating plan, safety program information and copies of all pertinent forms, as-built plans, and manufacturer's manuals.

Certification of the existence and accuracy of the operations and maintenance manual is required to be submitted to the Department at least sixty days prior to startup of a new wastewater treatment plant. Submittal of re-certifications will also be required sixty days prior to start-up of any substantial improvements or modifications made at the wastewater treatment plant.

PART II

Section C. Reporting Requirements

15. Signatory Requirements

All applications, reports, or information submitted to the Department in accordance with the conditions of this permit that require a signature shall be signed and certified as described in the Federal Act and Michigan Act.

The Federal Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

The Michigan Act (Section 3115(2)) provides that a person who at the time of the violation knew or should have known that he or she discharged a substance contrary to this part, or contrary to a permit or order issued or rule promulgated under this part, or who intentionally makes a false statement, representation, or certification in an application for or form pertaining to a permit or in a notice or report required by the terms and conditions of an issued permit, or who intentionally renders inaccurate a monitoring device or record required to be maintained by the Department, is guilty of a felony and shall be fined not less than $2,500.00 or more than $25,000.00 for each violation. The court may impose an additional fine of not more than $25,000.00 for each day during which the unlawful discharge occurred. If the conviction is for a violation committed after a first conviction of the person under this subsection, the court shall impose a fine of not less than $25,000.00 per day and not more than $50,000.00 per day of violation. Upon conviction, in addition to a fine, the court in its discretion may sentence the defendant to imprisonment for not more than 2 years or impose probation upon a person for a violation of this part. With the exception of the issuance of criminal complaints, issuance of warrants, and the holding of an arraignment, the circuit court for the county in which the violation occurred has exclusive jurisdiction. However, the person shall not be subject to the penalties of this subsection if the discharge of the effluent is in conformance with and obedient to a rule, order, or permit of the Department. In addition to a fine, the attorney general may file a civil suit in a court of competent jurisdiction to recover the full value of the injuries done to the natural resources of the state and the costs of surveillance and enforcement by the state resulting from the violation.

16. Electronic Reporting

Upon notice by the Department that electronic reporting tools are available for specific reports or notifications, the permittee shall submit electronically all such reports or notifications as required by this permit.

PART II

Section D. Management Responsibilities

1. Duty to Comply

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit.

It is the duty of the permittee to comply with all the terms and conditions of this permit. Any noncompliance with the Effluent Limitations, Special Conditions, or terms of this permit constitutes a violation of the Michigan Act and/or the Federal Act and constitutes grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of an application for permit renewal.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

2. Operator Certification

The permittee shall have the waste treatment facilities under direct supervision of an operator certified at the appropriate level for the facility certification by the Department, as required by Sections 3110 and 4104 of the Michigan Act. Permittees authorized to discharge storm water shall have the storm water treatment and/or control measures under direct supervision of a storm water operator certified by the Department, as required by Section 3110 of the Michigan Act.

3. Facilities Operation

The permittee shall, at all times, properly operate and maintain all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures.

4. Power Failures

In order to maintain compliance with the effluent limitations of this permit and prevent unauthorized discharges, the permittee shall either:

a. provide an alternative power source sufficient to operate facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit; or

b. upon the reduction, loss, or failure of one or more of the primary sources of power to facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit, the permittee shall halt, reduce or otherwise control production and/or all discharge in order to maintain compliance with the effluent limitations and conditions of this permit.

5. Adverse Impact

The permittee shall take all reasonable steps to minimize or prevent any adverse impact to the surface waters or groundwaters of the state resulting from noncompliance with any effluent limitation specified in this permit including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the discharge in noncompliance.

PART II

Section D. Management Responsibilities

6. Containment Facilities

The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (Rules 324.2001 through 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the Michigan Act.

7. Waste Treatment Residues

Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit, or other pollutants or wastes) removed from or resulting from treatment or control of wastewaters, including those that are generated during treatment or left over after treatment or control has ceased, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the Michigan Act, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwaters of the state.

8. Right of Entry

The permittee shall allow the Department, any agent appointed by the Department or the Regional Administrator, upon the presentation of credentials:

a. to enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect process facilities, treatment works, monitoring methods and equipment regulated or required under this permit; and to sample any discharge of pollutants.

9. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Act and Rule 2128 (Rule 323.2128 of the Michigan Administrative Code), all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department and the Regional Administrator. As required by the Federal Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Act and Sections 3112, 3115, 4106 and 4110 of the Michigan Act.

10. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

PART II

Section E. Activities Not Authorized by This Permit

1. Discharge to the Groundwaters

This permit does not authorize any discharge to the groundwaters. Such discharge may be authorized by a groundwater discharge permit issued pursuant to the Michigan Act.

2. POTW Construction

This permit does not authorize or approve the construction or modification of any physical structures or facilities at a POTW. Approval for the construction or modification of any physical structures or facilities at a POTW must be by permit issued under Part 41 of the Michigan Act.

3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypass" (Part II.C.9. pursuant to 40 CFR 122.41(m)), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond the permittee's control, such as accidents, equipment breakdowns, or labor disputes.

4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee may be subject under Section 311 of the Federal Act except as are exempted by federal regulations.

5. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Federal Act.

6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Department of Environmental Quality permits, or approvals from other units of government as may be required by law.

APPENDIX 2
2011 FTC&H SAP

Groundwater Sampling and Analysis Plan Straits Steel & Wire Company 902 Rowe Street Ludington, Michigan

February 4, 2011
Project No. G04467

FTC&H
Fishbeck, Thompson, Carr & Huber
engineers • scientists • architects • constructors

FTC&H

GROUNDWATER SAMPLING AND ANALYSIS PLAN
STRAITS STEEL & WIRE COMPANY
902 ROWE STREET
LUDINGTON, MICHIGAN

FEBRUARY 4, 2011
PROJECT NO. G04467

Fishbeck, Thompson, Carr & Huber, Inc. **Engineers • Scientists • Architects • Constructors**
1515 Arboretum Drive, SE, Grand Rapids, MI 49546 Telephone: 616-575-3824

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LIST OF ABBREVIATIONS/ACRONYMS

µg/L	micrograms per liter
COC	chain-of-custody
FTC&H	Fishbeck, Thompson, Carr & Huber, Inc.
GSI	Groundwater Surface Water Interface
LCS	laboratory control sample
LFB	laboratory fortified blank
LPC site	Ludington Plating Company
MDEQ	Michigan Department of Environmental Quality
MDNRE	Michigan Department of Natural Resources and Environment
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
PCOC	Potential Contaminants of Concern
QA/QC	quality assurance/quality control
RL	reporting limit
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SSW	Straits Steel & Wire
TriMatrix	TriMatrix Laboratories, Inc.
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared to provide the field procedures, sampling protocols, and monitoring locations for the ongoing groundwater monitoring activities as part of the remedial action for the Straits Steel & Wire Company (SSW) site at 902 Rowe Street, Ludington, Michigan (Figure 1). Data collected under this plan will be used to verify the effectiveness of groundwater extraction in containing and reducing residual inorganic contaminants in groundwater in the study area.

1.1 GENERAL BACKGROUND

SSW has conducted manufacturing at the referenced site since the 1940s. Part of the SSW business at the site included plating of refrigerator racks. Plating operations ceased by the early 1990s, after which, refrigerator racks were electrostatically powder-coated. The first documented environmental concern relating to the site was discovered on or about May 4, 1972, when Michigan Department of Natural Resources and Environment (MDNRE) (formerly the Michigan Department of Environmental Quality) staff sampled and analyzed groundwater from a dewatering project at the rear of the SSW plant. The dewatering was accomplished using a sump at the base of an excavation that was part of the construction of a new wastewater treatment system for the plating operations. The groundwater sample indicated the presence of certain metals/inorganics. The rear area of the SSW building was excavated from the surface to below the water table for removal of the historical impacts.

SSW also currently owns the real property of another former plating operation (previously known as the Ludington Plating Company and Industrial Plating and Manufacturing, Inc.), herein referred to as the LPC site located at 902 Harrison Street, Ludington, Michigan. The two properties are contiguous as indicated on Figure 2. LPC also conducted a wire plating operation. SSW purchased the property in 1982 but did not engage in any plating operations at the LPC site. The first documented environmental problem impacting the LPC site occurred on or about May 13, 1968, when a nearby sanitary sewer collapsed, and plating wastes were allegedly discharged to earthen pits. In 1974, 2,000 gallons of cyanide solution were reportedly spilled at the LPC site, and MDNRE documents indicate that in 1976 plating sludge was dumped by LPC into a pit on the north side of the main building. Dry wells for the containment pit under the LPC plating line may also have leaked. Soils were excavated from the LPC site by the MDNRE in 1998, and the excavated area was covered with clean soil. The MDNRE demolished the LPC site building in 2002 and removed additional soils and other materials from under the building; this area was also covered with clean soil.

The MDNRE has conducted site-wide investigations between 1993 and 2002 to aid in the determination of the nature and extent of groundwater contamination. The MDNRE also designed, installed, and tested a groundwater extraction well (PW 200) in 1998 for the purpose of capturing contaminated groundwater originating from the LPC site. This extraction well was never put into operation by the MDNRE. The

groundwater plume emanating from the LPC property migrates generally west/northwest. Figure 3 shows the locations of the site-wide monitoring wells and groundwater extraction wells.

SSW completed numerous phases of a remedial investigation in the 1990s to determine the nature and extent of groundwater and soil contamination that may be associated with the SSW property. The groundwater investigations delineated an area of groundwater with concentrations of chromium, zinc and cyanide downgradient from the SSW site. In 1994, the MDNRE approved SSW's remedial cleanup plan for this groundwater contamination, and SSW designed and installed a groundwater extraction well at the downgradient end of the impacted area. The extraction well (PW-1) has been operating continuously since 1997. The extracted groundwater is discharged, under permit, to the Ludington POTW. SSW has conducted and is currently conducting ongoing groundwater and system performance monitoring. The estimated extent of the groundwater capture zone, based on modeling and testing, is shown on Figure 3.

Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H), on behalf of SSW, conducted additional groundwater investigative activities in June 2005 by performing an extensive groundwater sampling and analysis event. This study is documented in the Predesign Technical Memorandum, Ludington Plating Groundwater (Predesign Tech Memo, FTC&H, August 31, 2005) and was submitted to the MDNRE. This study was performed to assess the current nature and extent of the metals and cyanide in groundwater and to provide information necessary to evaluate the cleanup alternatives for the LPC plume and the effectiveness of the existing SSW cleanup program. The results of this study indicated the following:

- Based on the concentrations of the potential contaminants of concern (PCOCs) that exceeded any potentially relevant Part 201 cleanup criteria, there was divisibility between the impacted groundwater downgradient of the LPC site and the SSW site.
- The SSW extraction well PW-1 captures and contains the impacted groundwater downgradient of the SSW site.
- The chemical distribution (vertical and horizontal) downgradient of the SSW site has been determined. The only PCOC apparently reaching PW-1 above any potentially relevant cleanup criteria is available cyanide at a very low concentration (6 micrograms per liter [µg/L]). All other PCOCs, especially hexavalent chromium and available cyanide, are only present upgradient of the extraction well. Given the expected groundwater flow velocity, it appeared the PCOCs in the groundwater downgradient of the SSW site are significantly attenuated prior to groundwater transport to the extraction well.
- The difference in historical total cyanide results, which were higher than the available cyanide results, is attributed to the presence of iron. Cyanide forms very stable complex ions with iron resulting in an "unavailable" cyanide complex ion. Unavailable cyanide exhibits considerably less toxicity than the available form. Part 201 cleanup criteria focus on the available form of cyanide and the sampling data indicate that this form of cyanide is not widespread in the area.

- In regard to the contaminants detected downgradient of the LPC site, few of the samples exceeded potentially applicable Part 201 cleanup criteria. None of the plating-related PCOCs were detected above the parameter reporting limits in any of the far downgradient monitoring wells. It appears the LPC site groundwater contamination is naturally attenuating and is in a stable and possibly shrinking condition.

1.2 PURPOSE AND OBJECTIVES

This groundwater sampling and analysis plan is designed to effectively monitor the groundwater contamination downgradient from the SSW site to the groundwater extraction well PW-1. SSW has been performing quarterly monitoring as well as operations and maintenance of the groundwater extraction system since the installation of the extraction well in or about 1997. The MDNRE has requested that SSW formalize and update the remedial system sampling and analysis plan.

The purpose for this sampling and analysis plan is to provide a monitoring program that will provide data and information for meeting the following objectives:

- Verify that the capture zone effectively contains chemicals of concern that may exceed potentially applicable cleanup concentrations.
- Monitor the contaminant concentration trends.
- Verify temporal groundwater flow conditions.

1.3 CONTAMINANTS OF CONCERN

SSW has historically sampled groundwater for chromium (total), cyanide (total) and zinc (total). The comprehensive groundwater sampling event conducted as part of the Predesign Tech Memo included the analysis of total metals (cadmium, chromium, iron, nickel, and zinc), hexavalent chromium; dissolved chromiumavailable cyanide; and field parameters (pH, specific conductance, Eh, dissolved oxygen and turbidity). The same study included a separate sampling investigation to determine the appropriate sampling and analysis method for cyanide.

The results of this 2005 study concluded that the only contaminants downgradient from the SSW site above the Part 201 drinking water or GSI criteria were chromium, cadmium (only at MW-24 at 3.2 µg/L), copper (only at MW-49 at an estimated concentration of 341 µg/L) and available cyanide (only at MW-49 at 252 µg/L). Most of the chromium that is dissolved in the groundwater is in the form of hexavalent chromium. A copy of the Predesign Tech Memo Table 2 – Groundwater Data Summary is provided in Appendix 1.

A summary of the historical quarterly sampling results from 2007 through 2010 is provided in Table 1. A review of these results indicates only detection of chromium and cyanide above either the Part 201 drinking water or GSI criteria in the last three years.

The primary chemicals of concern are hexavalent chromium and available cyanide. Other contaminants present in the area that are either at very low concentrations or appear to be very isolated include: cadmium, trivalent chromium (as determined by the difference between hexavalent and total chromium), copper, and zinc. Based on the low concentration and limited distribution of these other contaminants (cadmium, trivalent chromium, copper, and zinc) they are not included in the ongoing monitoring program but will be considered for closure monitoring when the primary chemicals of concern (hexavalent chromium and available cyanide) meet applicable cleanup standards.

2.0 GROUNDWATER SAMPLING AND ANALYSIS

The following section describes the sampling procedures, analytical methods, and quality assurance/quality control (QA/QC) protocols that will be implemented under this SAP.

2.1 MONITORING WELLS AND LOCATIONS

Groundwater monitoring will be performed on a quarterly basis at 16 well locations for the parameters specified in Section 2.3. The sample locations included in this SAP were selected to monitor conditions and also verify the lateral and downgradient extent of PCOCs. The well locations and sampling rationale are summarized in Table 2. The sample locations are shown on Figure 3.

Groundwater sampling will be conducted on a quarterly basis. After one year, the frequency of groundwater sampling will be evaluated based on the documented concentrations of the PCOCs in the area. Proposed changes in sampling frequency will be submitted to the MDNRE as an amendment to this SAP.

2.2 GROUNDWATER SAMPLING METHODOLOGY

2.2.1 EQUIPMENT CALIBRATION

Water quality parameters, which include pH, Eh, dissolved oxygen, specific conductance, and temperature, will be measured during sampling activities with a multi-parameter meter (flow-cell) connected in-line to the purged groundwater. Turbidity will be measured from discrete samples using an external or stand-alone turbidimeter (not in-line). The field meters will be calibrated for the specified parameters at the beginning of each day of sampling. Verification of the instrument calibration will be performed approximately mid-day and at the end of each day of sampling. Equipment calibration will be

performed according to FTC&H SOPs 11-08 and 11-10. The field activities SOPs are provided in Appendix 2.

2.2.2 SAMPLE COLLECTION

Prior to the collection of groundwater samples, water level measurements will be obtained at each well using the electric tape method described in FTC&H SOP 18-04. Groundwater samples from the 15 monitoring well locations (all locations except the purge well [PW-1]) will be collected using a low-flow minimal drawdown techniques. Groundwater will be purged using either a peristaltic pump (FTC&H SOP 10-06) or a portable bladder pump (FTC&H SOP 10-09) at a rate of 100 to 500 mL per minute. The low-flow sampling procedure is described in detail in FTC&H SOP 10-02. Water quality parameters will be monitored with the flow cell and turbidimeter and recorded every 3 to 5 minutes during purging to check for stabilization. Field parameter measurements will be made in accordance with FTC&H SOPs 11-08 and 11-10. Stabilization will be achieved when the field parameters are stable for three successive readings using the following criteria:

- ± 0.1 standard unit for pH
- ± 3% for temperature
- ± 3% for specific conductance
- ± 10 millivolt for Eh
- ± 10% for dissolved oxygen
- ± 10% for turbidity values >20 NTU
- Drawdown <0.3 feet

Upon stabilization, groundwater samples will be collected in accordance with FTC&H SOP 10-10. The field activities SOPs are provided in Appendix 2.

Groundwater samples from PW-1 will be collected at Outfall 01 (sewer manhole on Bryant Road between Beechwood Drive and William Street) where the extraction well discharges to the sanitary sewer. The sample will be collected with a dedicated dip-bucket. An additional grab sample will be obtained for measurement of field parameters for the quarterly event samples.

2.2.3 EQUIPMENT DECONTAMINATION

During field work, decontamination procedures will be implemented to prevent cross-contamination of the groundwater samples. Sampling pumps and flow cells used for field parameter measurement will be decontaminated in accordance with the FTC&H SOPs presented in Appendix 2. With the exception of PW-1, dedicated tubing will be installed in the 15 monitoring wells selected for sampling to reduce potential of cross-contamination.

2.2.4 Disposal of Investigation-Derived Waste

All purge water will be containerized during field sampling and discharged to the Ludington sanitary sewer system, at Outfall 01, in compliance with Wastewater Discharge Permit No. 006.

2.3 SAMPLE ANALYSIS

Groundwater samples collected under this SAP will be submitted to Trimatrix Laboratories, Inc. (Grand Rapids, Michigan) and analyzed for the following PCOCs:

- Hexavalent chromium using USEPA Method 7196.
  - The reporting limit (RL) for hexavalent chromium samples will be 5 µg/L.
- Available cyanide using USEPA Method OIA-1677.
  - The RL for available cyanide samples will be 2 µg/L.

2.4 QUALITY CONTROL

2.4.1 FIELD SAMPLING

Field duplicates will be collected at a rate of 1 per 10 investigative samples. The field duplicates will be collected immediately after the investigative sample. MS/MSD samples will be collected at a rate of 1 per 20 investigative samples. The sampling network, summarizing the number of investigative samples, field duplicates, and MS/MSD samples to be collected per event, is summarized in Table 3.

2.4.2 LABORATORY

Method blank, duplicate, LFB/LCS, and MS samples will be prepared and analyzed to assess the quality of the data resulting from the laboratory analytical program.

Method blank samples will be prepared and analyzed at the frequency specified in the referenced methods to assess potential sample contamination during the analytical process.

Duplicate samples will be analyzed to check for analytical reproducibility. The frequency of laboratory duplicate preparation and analysis is specified in the referenced USEPA methods.

LFB/LCS samples will be prepared and analyzed as a primary demonstration of the ability of the laboratory to analyze samples with acceptable qualitative and quantitative accuracy. The frequency of LFB/LCS sample preparation is specified in the referenced USEPA methods. Matrix spike determinations will be performed in duplicate (MS/MSD) and will serve as an indication of the effect of sample matrix on

precision and accuracy. Typically, one LFB/LCS and MS/MSD pair will be prepared per batch (20 or fewer samples).

2.5 SAMPLING DOCUMENTATION AND HANDLING

2.5.1 FIELD DOCUMENTATION

Records of the field activities and sampling information will be maintained in field notebooks created for the project. The field notebooks will consist of project specific forms which direct documentation of the field activities including sample locations, sampling times, types of samples collected, and other information pertinent to the monitoring event. Additional information regarding documentation of groundwater sampling activities is provided in FTC&H SOPs 3-01 and 10-03 in Appendix 2.

2.5.2 SAMPLE LABELING

A unique number will be assigned to each field sample collected. Sample identification will include a site identifier, year and month of sample collection, sample location and sample type (investigative, duplicate, or MS/MSD. For example, SSW-10-11-MW-8(I) would represent an investigative groundwater sample collected in November 2010 from MW-8 at the SSW site.

Pre-printed sample labels will be provided to the field staff, which will include: project number, sample identification, type of bottle and preservative, and required analyses. At the time of sample collection, the field staff will record the the date/time and their initials on the sample labels using waterproof ink.

2.5.3 CHAIN-OF-CUSTODY

Chain-of-custody (COC) procedures are intended to document sample possession from collection to disposal in accordance with federal guidelines. A separate COC record will accompany each sample shipment or cooler from the field to the laboratory and will serve as a record for the receipt of samples by the laboratory. The chain-of-custody protocol is described in detail in FTC&H SOP 3-02 (Appendix 2) and summarized below.

- The field sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.
- As few people as possible will handle the samples.
- A COC record will be completed for all samples. The following information will be included on the COC forms:
    - Sample identification

- Date and time of sampling
- Project location
- Sample matrix type
- Number of containers, preservative, and required analyses
- Names or initials of persons involved in sample collection.

- When transferring possession of samples, individuals relinquishing and receiving samples will sign, date, and note the time on the COC.

2.5.4 SAMPLE STORAGE AND TRANSPORT

All samples will be held on ice in an insulated cooler during the collection process. Samples will be packaged, shipped, and handled in accordance with the procedures outlined in SOP 10-10 (Appendix 2).

3.0 EXTRACTION WELL MONITORING

Discharges from the extraction well (PW-1) to the sanitary sewer will be monitored in accordance with the Wastewater Discharge Permit No. 006, issued by the City of Ludington to SSW. A copy of the discharge permit is provided in Appendix 3. A summary of the sampling details are as follows:

- Monthly sampling of the extraction well's discharge to Outfall 01 (sewer manhole on Bryant Road, between Beechwood Drive and William Street)
- Samples collected for the following analysis
  - Total chromium
  - Total zinc
  - Total cyanide
- All samples will be collected, preserved, and analyzed in accordance with procedures established in 40 CFR Part 136 and Amendments.
- Samples will be submitted to TriMatrix following the sample documentation and handling procedures described in Section 2.5.
- SSW or their representative will notify the Ludington Wastewater Plant of any significant change to the permitted groundwater discharge.
- Discharge limitations are listed on page 3 of Wastewater Discharge permit (Appendix 3)

During the monthly sampling activities at PW-1, field sampling personnel will also record the extraction well's flow meter reading (City of Ludington water meter).

4.0 GROUNDWATER FLOW MAPPING

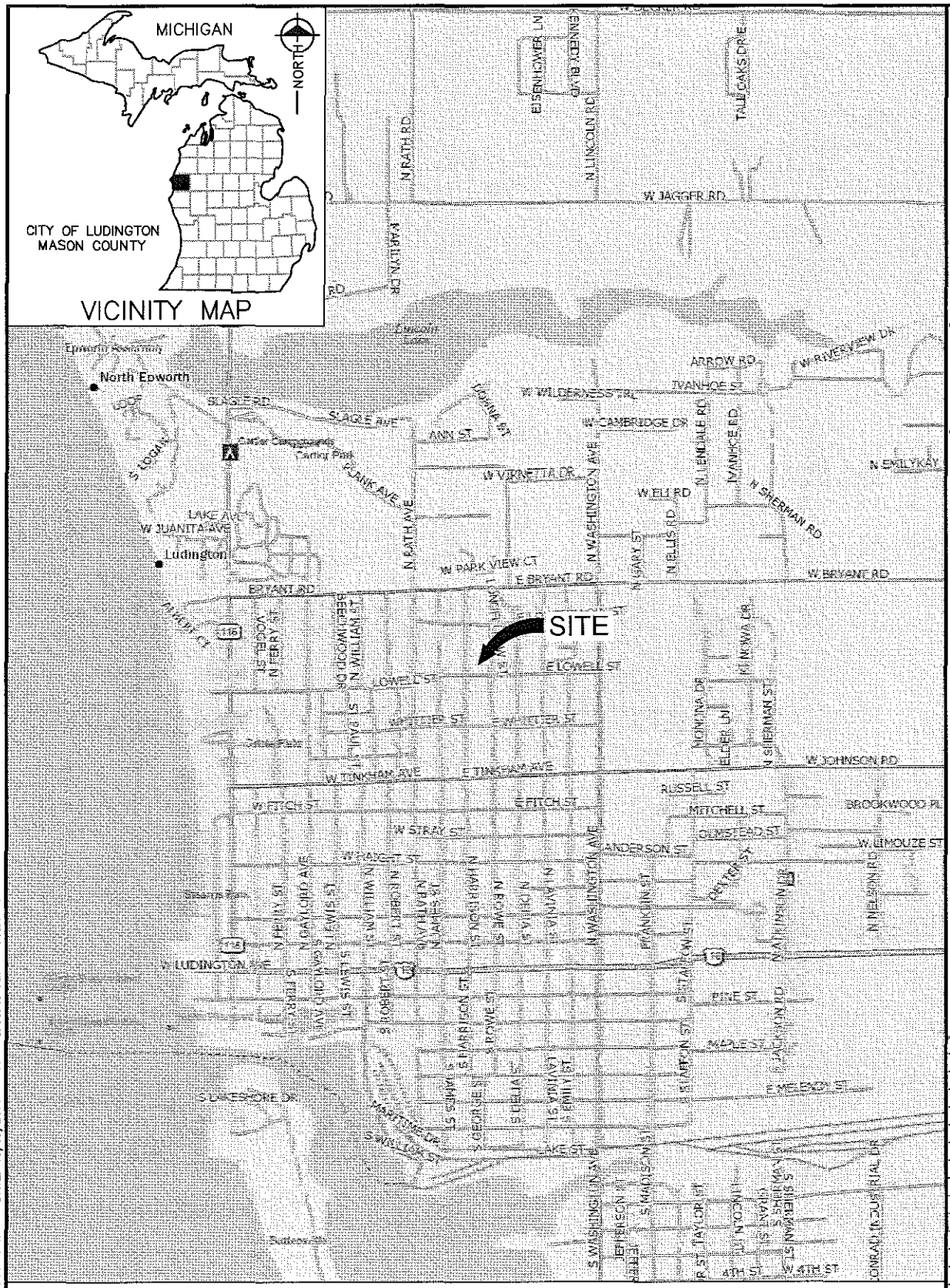
Water level measurements will be obtained quarterly from the 16 sample locations and 7 additional monitoring wells using the electric tape method described in FTC&H SOP 18-04 (Appendix 2). The well locations for static water level measurements are summarized in Table 2 and presented on Figure 3. The water level data will be used to construct groundwater potentiometric surface figures to verify the groundwater flow direction and verify that the extraction well is effectively capturing impacted groundwater.

5.0 REPORTING

A quarterly report will be submitted to the MDNRE within 45 days following receipt of all analytical data reports from the laboratory. The quarterly reports will include:

- A copy of the laboratory analytical reports (including the monthly groundwater discharge reports).
- A table summarizing the analytical data.
- Figure with groundwater contours and posted concentrations of PCOCs.
- A SAP compliance evaluation.

Figures



REFERENCE:
DeLORME STREET ATLAS
USA – 2009

SITE LOCATION MAP

fteh
engineers
scientists
architects
constructors

fishbeck, thompson, carr & huber, inc.

Hard copy is intended to be 8.5"x11" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Straits Steel & Wire
Ludington, Michigan

Groundwater Sampling and Analysis Plan

PROJECT NO.
G04467

FIGURE NO.
1

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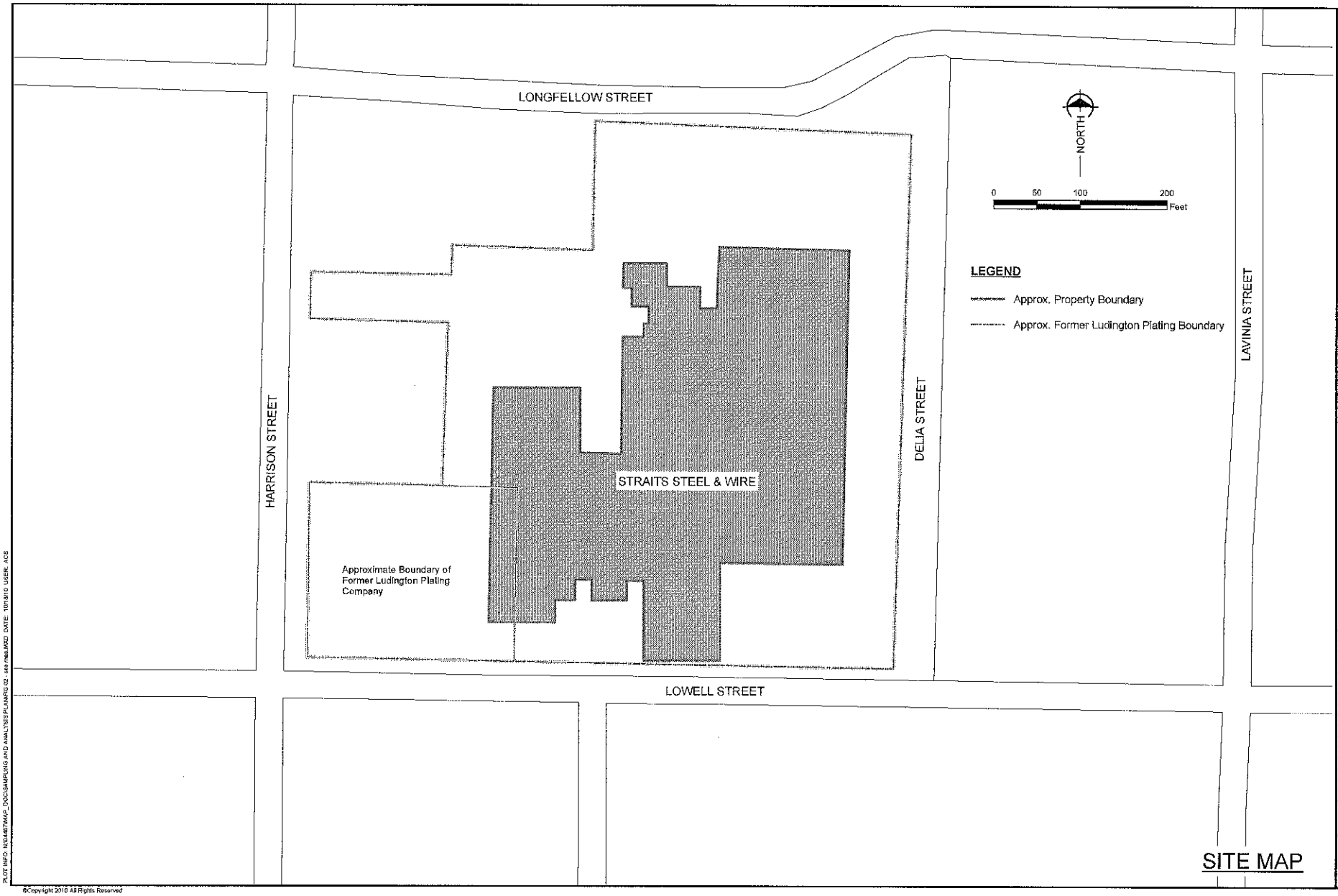

SITE MAP

fish

engineers
scientist
architects
constructors

fishbeck, thompson, carr & huber, inc.

Hard copy is intended to be 11"x17" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

Straits Steel & Wire
Ludington, Michigan

Groundwater Sampling and Analysis Plan

PROJECT NO.
G04467

FIGURE NO.
2

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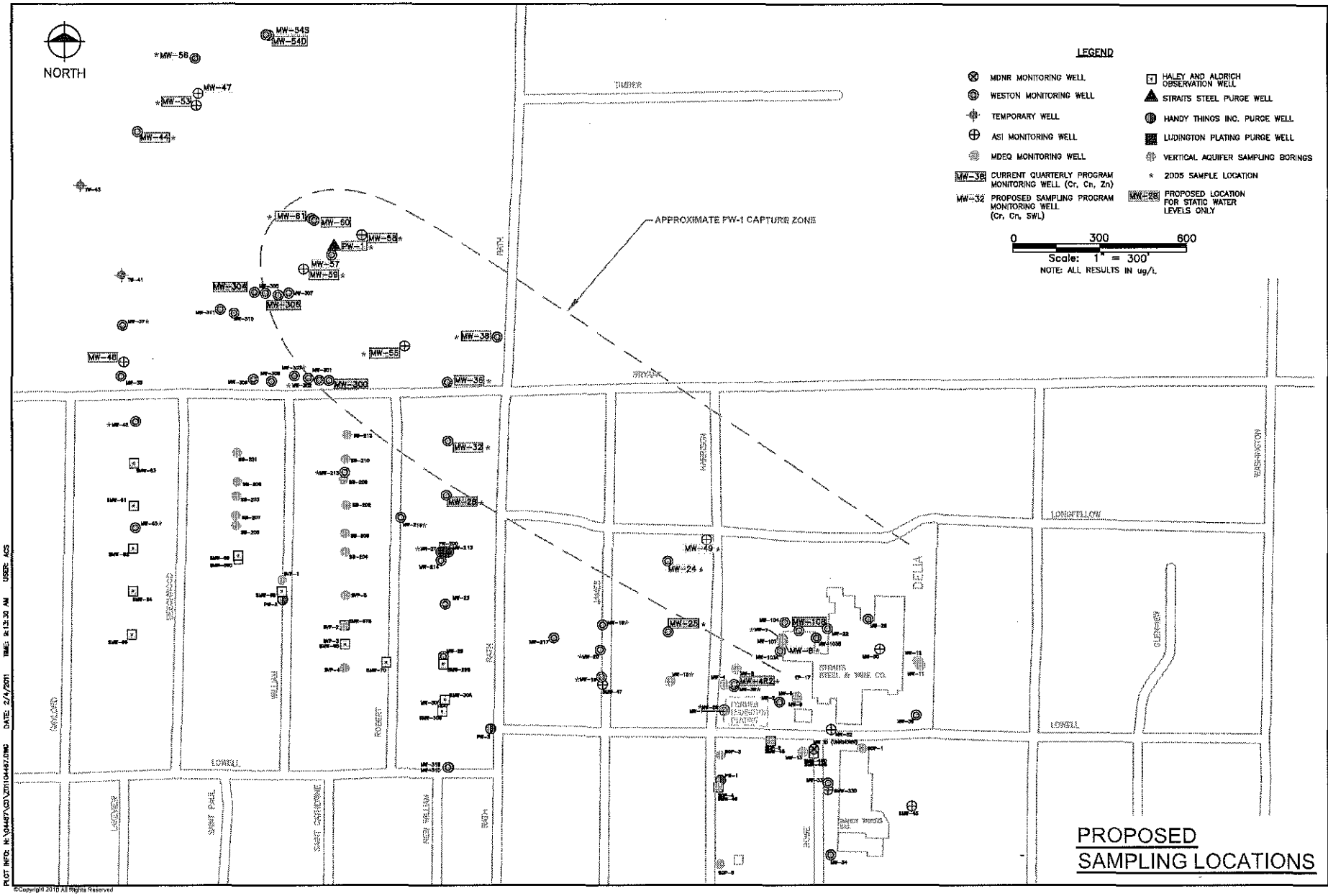

fr&h
engineers
scientists
architects
constructors

fishback, thompson, carr & huber, inc.

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Straits Steel & Wire
Ludington, Michigan

Groundwater Sampling and Analysis Plan

PROJECT NO.
G04467

FIGURE NO.
3

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Tables

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-32		09/19/07	0.01 U	--	0.0083	0.5
		12/18/07	0.01 U	--	0.0058	0.61
		03/27/08	0.01 U	--	0.0052	0.4
		06/26/08	0.01 U	--	0.005 U	0.36
		09/17/08	0.01 U	--	0.006	0.37
	X	09/17/08	0.01 U	--	0.005 U	0.36
		12/30/08	0.01 U	--	0.005 U	0.05 U
		03/17/09	0.01 U	--	0.0052	0.05 U
		06/16/09	0.03	--	0.0086	0.05 U
		09/22/09	0.014	--	0.02	0.05 U
		11/30/09	0.01 U	--	0.02	0.05 U
		03/16/10	0.01 U	0.002 U	--	0.05 U
		06/14/10	0.019	0.002 U	--	0.05 U
		09/13/10	0.012	0.002 U	--	0.05 U
		11/30/10	0.17	0.002 UJ	0.027	0.05 U
MW-36		09/19/07	3.2	--	0.0083	0.053
		12/18/07	3.3	--	2.5	0.05 U
		03/27/08	3.1	--	2.2	0.05 U
		06/27/08	1.9	--	3.1	0.05 U
		09/17/08	1.8	--	3	0.05 U
		12/30/08	2	--	3.6	0.05 U
		03/17/09	1.8	--	3.9	0.05 U
		06/16/09	1.7	--	3.6	0.05 U
		09/22/09	1.6	--	4	0.05 U
		11/30/09	0.82	--	4.4	0.05 U
		03/16/10	1.2	0.054	--	0.05 U
		06/14/10	0.9	0.019	--	0.05 U
		09/15/10	0.73	0.033	--	0.05 U
	X	09/15/10	0.73	0.034	--	0.05 U
		11/30/10	0.64	0.014 J	4.9	0.05 U
MW-38		09/19/07	0.01 U	--	0.012	0.05 U
		12/18/07	0.01 U	--	0.013	0.05 U
	X	12/18/07	0.01 U	--	0.014	0.05 U
		03/27/08	0.01 U	--	0.017	0.05 U
		06/27/08	0.01 U	--	0.02	0.05 U
		09/17/08	0.025	--	0.015	0.05 U
		12/30/08	0.01 U	--	0.017	0.05 U
		03/17/09	2.8	--	0.016	0.05 U
		06/15/09	0.01 U	--	0.018	0.05 U
	X	06/15/09	0.01 U	--	0.017	0.05 U
		09/22/09	0.01 U	--	0.011	0.05 U
	X	09/22/09	0.01 U	--	0.012	0.05 U
		11/30/09	0.01 U	--	0.014	0.05 U
	X	11/30/09	0.01 U	--	0.014	0.05 U
		03/16/10	0.01 U	0.002 U	--	0.05 U
	X	03/16/10	0.01 U	0.002 U	--	0.05 U
		06/14/10	0.01 U	0.002 U	--	0.05 U
	X	06/14/10	0.01 U	0.002 U	--	0.05 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-38		09/13/10	0.01 U	0.002 U	--	0.05 U
	X	09/13/10	0.01 U	0.002 U	--	0.05 U
		11/30/10	0.01 U	0.002 U	0.013	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.019	0.05 U
MW-44		09/17/07	0.01 U	--	0.017	0.73
		12/17/07	0.01 U	--	0.016	0.9
		03/26/08	0.01 U	--	0.0055	0.089
		06/26/08	0.01 U	--	0.07	0.05 U
		09/16/08	0.01 U	--	0.066	0.05 U
	X	09/16/08	0.01 U	--	0.065	0.05 U
		12/29/08	0.01 U	--	0.036	0.05 U
		03/17/09	0.01 U	--	0.039	0.05 U
		06/16/09	0.01 U	--	0.046	0.05 U
		09/22/09	0.01 U	--	0.044	0.05 U
		11/30/09	0.01 U	--	0.032	0.05 U
		03/16/10	0.01 U	0.006	--	0.05 U
		06/14/10	0.01 U	0.038	--	0.05 U
	X	06/15/10	0.01 U	0.038	--	0.05 U
		09/15/10	0.01 U	0.014	--	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.025	0.05 U
MW-48		09/17/07	0.01 U	--	0.005 U	0.55
		12/17/07	0.01 U	--	0.025	0.65
		03/26/08	0.01 U	--	0.012	0.3
		06/26/08	0.01 U	--	0.005 U	0.39
		09/16/08	0.01 U	--	0.0089	0.14
		12/29/08	0.01 U	--	0.005 U	0.05 U
	X	12/29/08	0.01 U	--	0.005 U	0.05 U
		06/16/09	0.01 U	--	0.012	0.05 U
		09/22/09	0.01 U	--	0.005 U	0.05 U
		11/30/09	0.01 U	--	0.005 U	0.05 U
		03/16/10	0.01 U	0.004 U	--	0.05 U
		06/14/10	0.01 U	0.02	--	0.05 U
		09/15/10	0.01 U	0.002 U	--	0.05 U
		12/03/10	0.01 U	0.002 U	0.005 U	0.05 U
	X	12/03/10	0.01 U	0.002 UJ	0.005 U	0.05 U
MW-53		09/17/07	0.01 U	--	0.005 U	0.05 U
		12/17/07	0.01 U	--	0.0065	0.05 U
	X	12/17/07	0.012	--	0.005 U	0.05 U
		03/26/08	0.01 U	--	0.005 U	0.05 U
		06/26/08	0.01 U	--	0.005 U	0.05 U
		09/16/08	0.01 U	--	0.005 U	0.05 U
		12/29/08	0.01 U	--	0.005 U	0.05 U
		03/17/09	0.01 U	--	0.005 U	0.05 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-53		06/16/09	0.01 U	--	0.005 U	0.05 U
	X	06/16/09	0.01 U	--	0.005 U	0.05 U
		09/23/09	0.01 U	--	0.005 U	0.05
		12/02/09	0.01 U	--	0.005 U	0.05 U
		03/16/10	0.01 U	0.002 U	--	0.05 U
		06/15/10	0.01 U	0.002 U	--	0.05 U
		09/13/10	0.01 U	0.002 U	--	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.005 U	0.05 U
MW-54D		09/17/07	0.01 U	--	0.005 U	0.18
		12/17/07	0.01 U	--	0.0054	0.094
		03/26/08	0.01 U	--	0.005 U	0.083
		06/27/08	0.01 U	--	0.005 U	0.05 U
		09/16/08	0.01 U	--	0.005 U	0.05 U
		12/30/08	0.01 U	--	0.005 U	0.05 U
		03/19/09	0.01 U	--	0.005 U	0.05 U
		06/16/09	0.01 U	--	0.005 U	0.05 U
		09/23/09	0.01 U	--	0.005 U	0.05 U
		12/02/09	0.01 U	--	0.005 U	0.05 U
		03/16/10	0.01 U	0.004 U	--	0.11
		06/14/10	0.01 U	0.002 U	--	0.05 U
		09/17/10	0.01 U	0.002 U	--	0.05 U
	X	09/17/10	0.01 U	0.002 U	--	0.05 U
		12/03/10	0.01 U	0.002 UJ	0.005 U	0.05 U
MW-55		09/19/07	0.22	--	0.49	0.095
		12/18/07	0.096	--	0.28	0.085
		03/27/08	0.12	--	0.42	0.054
		06/27/08	0.1	--	0.52	0.05 U
		09/17/08	0.11	--	0.52	0.05 U
		12/31/08	2.4	--	0.83	0.05 U
		03/17/09	2.8	--	0.84	0.05 U
		06/15/09	2.7	--	0.77	0.05 U
		09/29/09	2.9	--	1	0.05 U
	X	09/29/09	2.9	--	1	0.05 U
		12/02/09	2	--	0.92	0.05 U
	X	12/02/09	1.9	--	0.92	0.05 U
		03/17/10	1.6	0.016	--	0.05 U
	X	03/17/10	1.6	0.013	--	0.05 U
		06/15/10	1.1	0.007	--	0.05 U
	X	06/15/10	1.1	0.007	--	0.05 U
		09/13/10	1.1	0.010	--	0.05 U
		12/03/10	1.1	0.005 J	0.98	0.05 U
MW-58		09/17/07	0.01 U	--	1.2	0.08
		12/17/07	0.01 U	--	1.3	0.18
		03/27/08	0.01 U	--	2.5	0.05 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-58		06/27/08	0.01 U	--	0.17	0.05 U
		09/16/08	0.01 U	--	0.17	0.05 U
		12/31/08	0.01 U	--	0.52	0.05 U
		03/19/09	0.01 U	--	0.42	0.05 U
		06/15/09	0.028	--	0.41	0.05 U
		09/23/09	0.01 U	--	0.48	0.05 U
		11/30/09	0.01 U	--	0.25	0.05 U
		03/17/10	0.01 U	0.004 U	--	0.05 U
		06/15/10	0.01 U	0.002	--	0.05 U
		09/13/10	0.01 U	0.002 U	--	0.05 U
		12/03/10	0.01 U	0.002 UJ	0.078	0.05 U
MW-59		09/17/07	0.01 U	--	0.011	0.063
		12/17/07	0.01 U	--	0.012	0.072
		03/27/08	0.01 U	--	0.016	0.05 U
	X	03/27/08	0.01 U	--	0.011	0.05 U
		06/27/08	0.01 U	--	0.0071	0.05 U
		09/16/08	0.01 U	--	0.0072	0.05 U
		12/30/08	0.01 U	--	0.0071	0.05 U
	X	12/30/08	0.01 U	--	0.007	0.05 U
		03/19/09	0.022	--	0.0074	0.64
		06/15/09	0.01 U	--	0.0092	0.05 U
		09/23/09	0.01 U	--	0.0055	0.05 U
	X	09/23/09	0.01 U	--	0.0067	0.05 U
		11/30/09	0.01 U	--	0.0089	0.05 U
		03/17/10	0.01 U	0.006	--	0.05 U
		06/15/10	0.01 U	0.026	--	0.05 U
		09/13/10	0.01 U	0.005	--	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.005 U	0.05 U
MW-60		09/17/07	0.01 U	--	0.005 U	0.51
		12/17/07	0.01 U	--	0.0056	0.21
		03/26/08	0.01 U	--	0.005	0.05 U
		06/27/08	0.01 U	--	0.005 U	0.16
		09/16/08	0.01 U	--	0.005 U	0.05
		12/31/08	0.01 U	--	0.005 U	0.05 U
	X	12/31/08	0.01 U	--	0.005 U	0.05 U
		03/19/09	0.01 U	--	0.005 U	0.072
		06/15/09	0.01 U	--	0.006	0.05 U
		09/29/09	0.01 U	--	0.005 U	0.05 U
		12/02/09	0.01 U	--	0.005 U	0.05 U
		03/17/10	0.01 U	0.12	--	0.05 U
		03/23/10	0.01 U	0.002 U	--	0.05 U
		06/15/10	0.01 U	0.022	--	0.05 U
	X	06/15/10	0.01 U	0.011	--	0.05 U
		09/15/10	0.01 U	0.002 U	--	0.05 U
		12/03/10	0.01 U	0.002 UJ	0.005 U	0.05 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
MW-61		09/17/07	0.01 U	--	0.0078	0.51
		12/17/07	0.01 U	--	0.0072	0.41
		03/26/08	0.01 U	--	0.0067	0.05 U
	X	03/26/08	0.01 U	--	0.0098	0.05 U
		09/17/08	0.01 U	--	0.005 U	0.05 U
		12/29/08	0.01 U	--	0.005 U	0.05 U
		03/19/09	0.01 U	--	0.005 U	0.05 U
		06/15/09	0.01 U	--	0.0057	0.05 U
		09/22/09	0.01 U	--	0.005 U	0.05 U
		12/02/09	0.01 U	--	0.0059	0.05 U
		03/17/10	0.01 U	0.13	--	0.05 U
		06/15/10	0.01 U	0.16	--	0.05 U
		09/15/10	0.01 U	0.067	--	0.05 U
		11/30/10	0.01 U	0.002 UJ	0.005 U	0.05 U
Purge Well		07/24/07	0.01 U	--	0.47	0.02 U
		08/21/07	0.01 U	--	0.48	0.02 U
		09/17/07	0.05 U	--	0.46	0.02 U
		10/31/07	0.05 U	--	0.48	0.02 U
		11/29/07	0.05 U	--	0.47	0.02 U
		12/17/07	0.05 U	--	0.48	0.022
		01/29/08	0.05 U	--	0.48	0.02 U
		02/28/08	0.05 U	--	0.52	0.02 U
		03/26/08	0.05 U	--	0.48	0.02 U
		04/28/08	0.05 U	--	0.48	0.02 U
		05/20/08	0.05 U	--	0.49	0.02 U
		06/27/08	0.05 U	--	0.46	0.02 U
		08/19/08	0.05 U	--	0.48	0.025
		09/04/08	0.05 U	--	0.48	0.02 U
		10/06/08	0.05 U	--	0.48	0.02 U
		11/11/08	0.05 U	--	0.58	0.02 U
		12/03/08	0.05 U	--	0.52	0.02 U
		01/13/09	0.05 U	--	0.53	0.02 U
		02/04/09	0.05 U	--	0.54	0.02 U
		03/05/09	0.05 U	--	0.57	0.02 U
		04/06/09	0.05 U	--	0.51	0.02 U
		05/11/09	0.05 U	--	0.58	0.02 U
		06/09/09	0.05 U	--	0.56	0.02 U
		07/08/09	0.05 U	--	0.54	0.02 U
		08/07/09	0.05 U	--	0.59	0.02 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
Purge Well		09/02/09	0.05 U	--	0.61	0.02 U
		10/07/09	0.05 U	--	0.47	0.02 U
		11/09/09	0.05 U	--	0.47	0.02 U
		12/02/09	0.05 U	--	0.44	0.02 U
		01/07/10	0.05 U	--	0.43	0.031
		02/08/10	0.05 U	--	0.45	0.02 U
		03/04/10	0.05 U	--	0.43	0.02 U
		03/15/10	--	0.002 U	--	--
		04/19/10	0.05 U	0.002 U	--	0.02 U
		05/13/10	0.05 U	0.002 U	--	0.02 U
		06/01/10	0.05 U	0.002 U	0.40	0.02 U
		07/15/10	0.05 U	0.003	0.30	0.035
		08/05/10	0.05 U	0.002 U	--	0.02 U
		09/08/10	0.05 U	0.002 U	--	0.02 U
		11/02/10	0.05 U	0.002 U	0.35	0.027
		12/03/10	0.05 U	0.002 U	0.20	0.021
		12/09/10	0.05 U	0.002 U	0.31	0.023
Equipment Blank		09/17/07	0.01 U	--	0.005 U	0.05 U
		09/19/07	0.01 U	--	0.005 U	0.05 U
		12/17/07	0.01 U	--	0.0073	0.05 U
		12/18/07	0.01 U	--	0.0097	0.05 U
		03/26/08	0.01 U	--	0.005 U	0.05 U
		03/27/08	0.01 U	--	0.0062	0.05 U
		06/26/08	0.01 U	--	0.005 U	0.05 U
		06/27/08	0.01 U	--	0.005 U	0.05 U
		09/16/08	0.01 U	--	0.03	0.05 U
		09/17/08	0.1	--	0.53	0.05 U
		12/29/08	0.01 U	--	0.005 U	0.05 U
		12/30/08	0.01 U	--	0.005 U	0.05 U

Table 1 - Cummulative Data Summary - Quarterly Groundwater Monitoring (2007-2010)
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Duplicate	Collection Date	Chromium (mg/L)	Cyanide, Available mg/L	Cyanide, Total mg/L	Zinc mg/L
Equipment Blank		12/31/08	0.01 U	--	0.005 U	0.05 U
		03/17/09	0.01 U	--	0.005 U	0.05 U
		03/19/09	0.01 U	--	0.005 U	0.05 U
		06/15/09	0.01 U	--	0.005 U	0.05 U
		06/16/09	0.01 U	--	0.005 U	0.05 U
		09/22/09	0.01 U	--	0.0083	0.05 U
		09/23/09	0.01 U	--	0.005 U	0.05 U
		09/29/09	0.01 U	--	0.005 U	0.05 U
		11/30/09	0.01 U	--	0.005 U	0.05 U
		12/02/09	0.01 U	--	0.005 U	0.05 U
		03/16/10	0.01 U	0.002 U	--	0.05 U
		03/17/10	0.01 U	0.004 U	--	0.05 U
		06/14/10	0.01 U	0.002 U	--	0.05 U
		06/15/10	0.01 U	0.002 U	--	0.05 U
		09/13/10	0.01 U	0.002 U	--	0.05 U
		09/15/10	0.01 U	0.002 U	--	0.05 U
		09/17/10	0.01 U	0.002 U	--	0.05 U
		11/30/10	0.01 U	0.002 U	0.0063	0.05 U
		12/03/10	0.01 U	0.002 U	0.005 U	0.05 U
		12/03/10	0.01 U	0.002 U	0.005	0.05 U
Field Blank		09/17/07	0.01 U	--	0.005 U	0.05 U
		09/19/07	0.01 U	--	0.0061	0.05 U
		12/17/07	0.01 U	--	0.005 U	0.05 U
		12/18/07	0.01 U	--	0.0078	0.05 U
		03/26/08	0.01 U	--	0.005 U	0.05 U
		03/27/08	0.01 U	--	0.005 U	0.05 U
		06/26/08	0.01 U	--	0.005 U	0.05 U
		06/27/08	0.01 U	--	0.005 U	0.05 U
		09/16/08	0.01 U	--	0.03	0.05 U
		09/17/08	0.01 U	--	0.03	0.05 U
		12/29/08	0.01 U	--	0.005 U	0.05 U
		12/30/08	0.01 U	--	0.017	0.05 U
		12/31/08	0.01 U	--	0.005 U	0.05 U
		03/17/09	0.01 U	--	0.005 U	0.05 U
		03/19/09	0.01 U	--	0.005 U	0.05 U
		06/15/09	0.01 U	--	0.005 U	0.05 U
		06/16/09	0.01 U	--	0.005 U	0.05 U
		09/22/09	0.01 U	--	0.005 U	0.05 U
		09/23/09	0.01 U	--	0.005 U	0.05 U
		09/29/09	0.01 U	--	0.005 U	0.05 U
		11/30/09	0.01 U	--	0.0084	0.05 U
		12/02/09	0.01 U	--	0.0051	0.05 U
		03/16/10	0.01 U	0.004 U	--	0.05 U
		03/17/10	0.01 U	0.002 U	--	0.05 U
		03/23/10	0.01 U	0.002 U	--	0.05 U
		06/14/10	0.01 U	0.002 U	--	0.05 U
		06/15/10	0.01 U	0.002 U	--	0.05 U
		09/13/10	0.01 U	0.002 U	--	0.05 U
		09/15/10	0.01 U	0.002 U	--	0.05 U
		09/17/10	0.01 U	0.002 U	--	0.05 U
		12/03/10	0.01 U	0.002 U	0.005 U	0.05 U

Data Qualifiers:
U - Not detected above the given limit.
J - Estimated value.

Table 2 - Groundwater Sampling and Static Water Level Measurement Locations
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Location	Location	Purpose	TOC Elevation (ft)	Well Depth (ft)	Static Water Level	Available Cyanide	Hexavalent Chromium
MW-8	Near SSW Plant	PA	620.50	26.4	X	X	X
MW-24	Downgradient of SSW Plant	PA	613.15	54.5	X	X	X
MW-32	Downgradient of SSW Plant	LPB	625.06	84.5	X	X	X
MW-36	Downgradient of SSW Plant	PA	625.84	85.8	X	X	X
MW-38	Downgradient of SSW Plant	LPB	614.15	52.8	X	X	X
MW-44	Downgradient of PW-1 Capture Zone	DG	612.33	93.1	X	X	X
MW-47	Downgradient of PW-1 Capture Zone	DG	621.05	97.2	X	X	X
MW-49	Downgradient of SSW Plant	PA	619.23	59.7	X	X	X
MW-54S	Downgradient of PW-1 Capture Zone	DG	610.91	18.5	X	X	X
MW-55	Downgradient of SSW Plant	PA	603.86	132	X	X	X
MW-56	Downgradient of PW-1 Capture Zone	DG	604.45	78	X	X	X
MW-57	Downgradient of SSW Plant	PA	619.88	77.5	X	X	X
MW-58	Downgradient of SSW Plant	LPB	619.30	85.6	X	X	X
MW-59	Downgradient of SSW Plant	LPB	619.07	83.8	X	X	X
MW-61	Downgradient of PW-1 Capture Zone	DG	614.13	85	X	X	X
PW-1	Purge Well	PA	618.38 *	na	X	X	X
MW-4R2	Near SSW Plant	WL	616.11	na	X	--	--
MW-25	Downgradient of SSW Plant	WL	613.36	22.1	X	--	--
MW-28	Downgradient of SSW Plant	WL	631.55	105.2	X	--	--
MW-108	Near SSW Plant	WL	na	na	X	--	--
MW-300	Downgradient of SSW Plant	WL	na	98	X	--	--
MW-304	Downgradient of SSW Plant	WL	na	94	X	--	--
MW-306	Downgradient of SSW Plant	WL	na	88	X	--	--

Notes:
PA - Plume axis monitoring location
LPB - Lateral plume boundary monitoring location
DG - Downgradient monitoring location
WL - Water level measurement
"--" - Not Applicable
na - Not available currently
*Ground elevation

Table 3 - Sampling Network
Groundwater Sampling and Analysis Plan
Straits Steel & Wire, Ludington, Michigan

Monitoring Event	Parameters	Investigative Samples			Field Duplicate			MS/MSD			Matrix
		No.	Events	Total	No.	Events	Total	No.	Events	Total	Total[1]
Quarterly (15 monitoring wells and PW-1)	*Laboratory*										
	Hexavalent Chromium	16	4	64	2	4	8	1	4	4	80
	Available Cyanide	16	4	64	2	4	8	1	4	4	80
	Field										
	Dissolved oxygen	16	4	64	NA	NA	NA	NA	NA	NA	64
	Eh	16	4	64	NA	NA	NA	NA	NA	NA	64
	pH	16	4	64	NA	NA	NA	NA	NA	NA	64
	Specific Conductance	16	4	64	NA	NA	NA	NA	NA	NA	64
	Temperature	16	4	64	NA	NA	NA	NA	NA	NA	64
	Turbidity	16	4	64	NA	NA	NA	NA	NA	NA	64
Monthly Wastewater Discharge Sampling (PW-1)	*Laboratory*										
	Total Chromium	1	12	12	0	12	0	0	12	0	12
	Total Zinc	1	12	12	0	12	0	0	12	0	12
	Total Cyanide	1	12	12	0	12	0	0	12	0	12

[1]Matrix spikes count as 2 samples when calculating sample total.

Appendix 1

Predesign Technical Memo
Table 2 – Groundwater
Data Summary

Table 2 • Groundwater Data Summary
Straits Steel & Wire, Ludington, Michigan
June 2005

Sampling Location	Collection Date	Total Cadmium (µg/L)	Hexavalent Chromium (µg/L)	Dissolved Chromium (µg/L)	Total Chromium (µg/L)	Trivalent Chromium* (µg/L)	Total Copper (µg/L)	Available Cyanide (µg/L)	Total Iron (µg/L)	Total Nickel (µg/L)	Total Zinc (µg/L)	pH (s.u.)	Specific Conductance (µmhos/cm)	Eh (mV)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
MW-2R	06/20/05	0.3	5 U	20	26	26	11	2 U	100 U	4.4 J	611	6.4	370	395	3.4	2.5
MW-3R	06/20/05	0.2 U	30	68	113	83	14 J	2 U	1740	24	880	6.3	210	361	2.5	19.4
MW-3R2	06/20/05	0.2 U	30	24	58	28	1.5	2 U	110	6 J	77	7.3	460	338	2.9	2.86
MW-7	06/20/05	0.2 U	5 U	1 U	1 UJ	1 UJ	1.2 J	2 U	100 U	1 UJ	50 U	7.3	980	321	0.3	1.98
MW-8	06/20/05	1.2	210	202	235	25	5.6	2 U	100 U	5.5 J	50 U	7.1	770	451	0.3	4.9
MW-15	06/24/05	2.2	5 U	2.1 J	37	37	2.8	2 U	470	3.6 J	274	7.2	570	288	0.1	8.12
MW-18	06/23/05	0.2 U	5 U	1.8 J	3.7	3.7	1 UJ	2 U	3930	1 UJ	50 U	7.4	590	38	0.1	14.7
MW-19	06/24/05	0.2 U	5 U	1 U	1 U	1 U	1.5 J	2 U	100 U	1 UJ	50 U	7.4	1300	234	0.2	7.13
MW-20	06/24/05	0.2 U	5 U	1 UJ	7.4	7.4	1 J	2 U	350	14 J	50 U	6.9	1120	177	0.1	12.7
MW-24	06/24/05	3.2	100	115	159	59	11	2 U	220	9.8 J	68	12.1	3180	82	3.5	11.4
MW-25	06/24/05	0.2 U	5 U	1 UJ	3.1	3.1	1 UJ	2 U	7230	1 UJ	50 U	7.2	850	57	0.2	31.9
MW-27	06/22/05	0.4	5 U	1 UJ	140	140	5.2	2 U	1780	4.3 J	90 U	7.9	610	164	0.3	132
MW-28	06/22/05	0.2 U	5 U	1 U	1 UJ	1 UJ	1 UJ	2 U	690	1.5 J	60 U	8.6	600	130	1.8	16.1
MW-32	06/22/05	0.3	5 U	1 U	1.8	1.8	5.7	2 U	800	2.5 J	65	7.4	470	216	0.2	7.61
MW-36	06/21/05	0.2 U	1000	1120	1180	180	3.8 J	5	1290	4.9 J	50 U	7.5	1030	442	0.1	18.7
MW-37	06/23/05	1.2	5 U	1 UJ	2.5	2.5	2 J	2 U	2540	17 J	50 U	7.0	1530.0	60.0	0.3	19.6
MW-38	06/21/05	0.2 U	5 U	1 U	1.5	1.5	1 UJ	2 U	4310	1 UJ	50 U	7.4	740	59	0.3	17.9
MW-40	06/22/05	0.4	5 U	1 U	4.3	4.3	2.5	2 U	1840	6 J	80 U	7.8	700	35	0.4	130
MW-42	06/22/05	0.4	5 U	1 U	1.3	1.3	8.5	2 U	2270	11 J	50 U	7.1	1490	62	0.2	26.6
MW-44	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 UJ	2 U	760	1.6 J	50 U	7.2	820	68	0.3	8.12
MW-44 (D)	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 UJ	2 U	810	1.7 J	50 U					
MW-48	06/23/05	0.2 U	5 U	1 U	1 UJ	1 UJ	2.1 J	2 U	1020	23	50 U	7.2	1280	86	0.2	9.86
MW-49	06/20/05	0.2 U	5 U	4.8	28	28	341 J	252	4500	46	78	9.2	1150	304	0.4	46.9
MW-53	06/22/05	0.2 U	5 U	1 U	1 UJ	1 UJ	2.5	2 U	170	1 UJ	50 U	7.0	150.0	262.0	3.0	2.9
MW-53 (D)	06/22/05	0.2 U	5 U	1 U	1 UJ	1 UJ	2.5	2 U	180	1 UJ	50 U					
MW-55	06/21/05	0.2 U	520	581	615	95	3.8 J	4	710	4.8	50 U	7.4	740	414	0.3	6.56
MW-55 (D)	06/21/05	0.4	550	608	647	97	3.6 J	6	710	4.4	50 U					
MW-56	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 UJ	2 U	2510	1 UJ	50 U	7.5	670	66	1.4	8.07
MW-58	06/21/05	0.2 U	5 U	1 U	1.2	1.2	1.1 J	6	3630	4 J	50 U	7.4	1060	66	0.1	12.9
MW-59	06/21/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	1460	1 UJ	50 U	7.3	570	49	0.2	3.06
MW-61	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	310	1 UJ	50 U	7.4	530	56	0.2	3.5
MW-215	06/22/05	1.3 J	5 U	1 UJ	61	61	86	10	45100	103	308	7.2	1140	132	2	146
MW-216	06/22/05	0.2 U	5 U	1 UJ	81	81	5	2 U	1510	10 J	50 U	7.0	1190.0	301.0	0.2	51.6
MW-302	06/21/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2	840	1.1 J	50 U	7.3	560	69	0.7	3.72
MW-303	06/21/05	0.2 U	5 U	1 U	1 UJ	1 UJ	1 U	2 U	810	1.3 J	50 U	7.3	550	63	0.2	5.31
MW-303 (D)	06/21/05	0.2 U	5 U	1 U	1 UJ	1 UJ	1 U	2 U	890	1 UJ	50 U					
PW-1 Sump	06/23/05	0.2 U	5 U	7	9.3	9.3	1.6 J	6	880	2.4 J	50 U	7.4	790	56	0.2	0.98
MWEB-1	06/20/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	100 U	1 U	50 U					
MWEB-2	06/21/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	100 U	1 U	50 U					
MWEB-3	06/23/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	100 U	1 U	50 U					
MWEB-4	06/24/05	0.2 U	5 U	1 U	1 U	1 U	1 U	2 U	100 U	1 U	50 U					
*Residential & Commercial I Drinking Water***		*5.0*	*100*			*100*	*1000*	*200*	*300*	*100*	*2400*	*6.5 to 8.5*				
*Groundwater Surface Water Interface***		*2.2*	*11*			*74*	*9.0*	*5.2*	*NA*	*52*	*120*	*6.5 to 9.0*				

Footnotes:
(D) - Indicates a field duplicate sample.
MWEB - Indicates an equipment blank.

Data Qualifiers:
U - Not detected.
J - Estimated value.

*Calculated values (total chromium concentration less hexavalent chromium concentration)
**Part 201 Residential Generic Cleanup Criteria, RRD Operational Memorandum No. 1; December 10, 2004, reported in µg/L.

Appendix 2

FTC&H Field SOPs

frc&h **STANDARD OPERATING PROCEDURE** **SOP 03-01**
Documentation of Field Activities
05/18/1998; Revised 06/24/2004

Scope: This SOP provides guidance for documentation of field activities.

Equipment: Project field notebook
Calculator
Pen with waterproof, nonerasable ink
Watch (for time of day)

Procedure:

1. A field notebook must be prepared for each project. The notebook provides for documentation of all field activities, including sample collection and handling, and visual observations.

2. All records must be legible and should be made in waterproof, nonerasable ink. All entries should contain accurate and inclusive documentation of the project activities.

3. If errors are made, corrections must be made by crossing a single line through the error and entering the correct information. All corrections should be initialed and dated. If possible, the correction should be made by the individual making the error.

4. All entries should be dated and the time of the entry recorded. At the end of each day's activity (or entry of a particular event, if appropriate), a diagonal line should be drawn at the conclusion of the entry and initialed, indicating the conclusion of the entry or activity. The daily field notes section of the notebook should be completed in chronological order. No blank pages should be found within this section.

5. Field notebook records should include the following information where applicable:

   - Sample collection equipment used.
   - Field analytical equipment used.
   - Equipment used for physical measurements.
   - Calculations, calibration data, and results for field sampling, analytical, and physical measurement equipment.
   - Type and number of samples collected along with sample location and identification number.
   - Sample handling, packaging, labeling, and shipping information, including destination.

6. The field notebook should be kept in a secure place during the field activities (e.g., in hand, in sight, locked in field vehicle). Upon completion of the activity, the field notebook should be checked for completeness, and signed and dated by appropriate field personnel. The field notebook will become part of the project file.

ENVIRONMENTAL SERVICES DIVISION
STANDARD OPERATING PROCEDURE **SOP 3-02**
Chain-of-Custody
05/18/1998; Revised 05/10/2007

Scope: This SOP describes the procedures and documentation required to trace possession and handling of samples from time of collection through receipt by the laboratory.

Equipment: Sample labels
Custody seals
Chain-of-Custody (COC) Record
Pen with waterproof, nonerasable ink

Definition:

A sample is considered to be in custody if:

1. It is in one's actual possession.
2. It is in one's view after being in one's possession.
3. It was in one's possession and then secured to prevent tampering.
4. It is placed in a designated secure area.

Procedure:

1. The field team leader or designate is responsible for proper handling and custody of field samples until they are formally transferred to another person or facility. As few people as possible should handle the samples during the field event.

2. Sample labels (Figure 1) must be completed in waterproof, nonerasable ink and securely affixed to sample containers at the time of collection. All samples must be documented in the field notebook.

3. Samples should be securely wrapped in bubble packing or other suitable packaging material and placed in an insulated shipping container. Samples should be packed in such a way as to minimize the chance for breakage. Bagged ice should be placed on top of the samples to maintain a temperature of 2° to 6°C during transport.

4. Following sample collection, a COC Record (Figure 2) must be completed. The COC Record must accompany the samples to the laboratory. If more than one sample shipping container is used, a separate COC Record should be completed for each container.

5. The COC Record must be completed in waterproof, nonerasable ink. If errors are made, corrections should be made by crossing a single line through the error and entering the correct information. All corrections should be initialed and dated.

6. The COC Record should include the following information:

   - Project name, number, and location.
   - Sampler(s) name(s).
   - Name of project manager along with telephone and fax number.
   - Sample date, time, identification, and matrix type.
   - Total number of containers for each sample and type of preservative added.

7. Transfer of the samples listed on the COC Record must be documented in the spaces provided at the bottom of the form. One of the samplers listed under the sampler(s) section, or a designated field sample custodian who receives secured samples from the sampling team and maintains the samples under secure conditions, must be the person that originally relinquishes the samples. Both the person relinquishing the samples and the person receiving them must sign the form. Typically, the last person receiving the samples should be the laboratory sample custodian.

8. The COC Record is a multipage form. The three copies should be distributed as follows:

   Pink Copy — Removed by FTC&H sampling personnel once sample transfer has been documented. Retained in the project file.

   Yellow Copy — Retained by analytical laboratory.

   White Copy — Accompanies final data package from laboratory. Retained with data in project file.

9. The completed COC Record should be placed in a resealable plastic bag and placed inside the sample shipment container.

10. Custody seals (Figure 3) should be used to seal sample shipping containers that are ready to be transported by means other than the FTC&H sampling team. Custody seals must be completed in waterproof, nonerasable ink and should include the following information:

    - Project name.
    - Project number.
    - Date sealed.
    - Signature of person relinquishing the samples.

    Custody seals should be placed on the shipping container so that it cannot be opened without breaking the seals. If shipping by common carrier (e.g., UPS, Federal Express), the shipping container should also be securely taped shut.

11. Samples should be delivered to the laboratory as soon as possible after collection. There are three basic routes by which samples are transported to the laboratory:

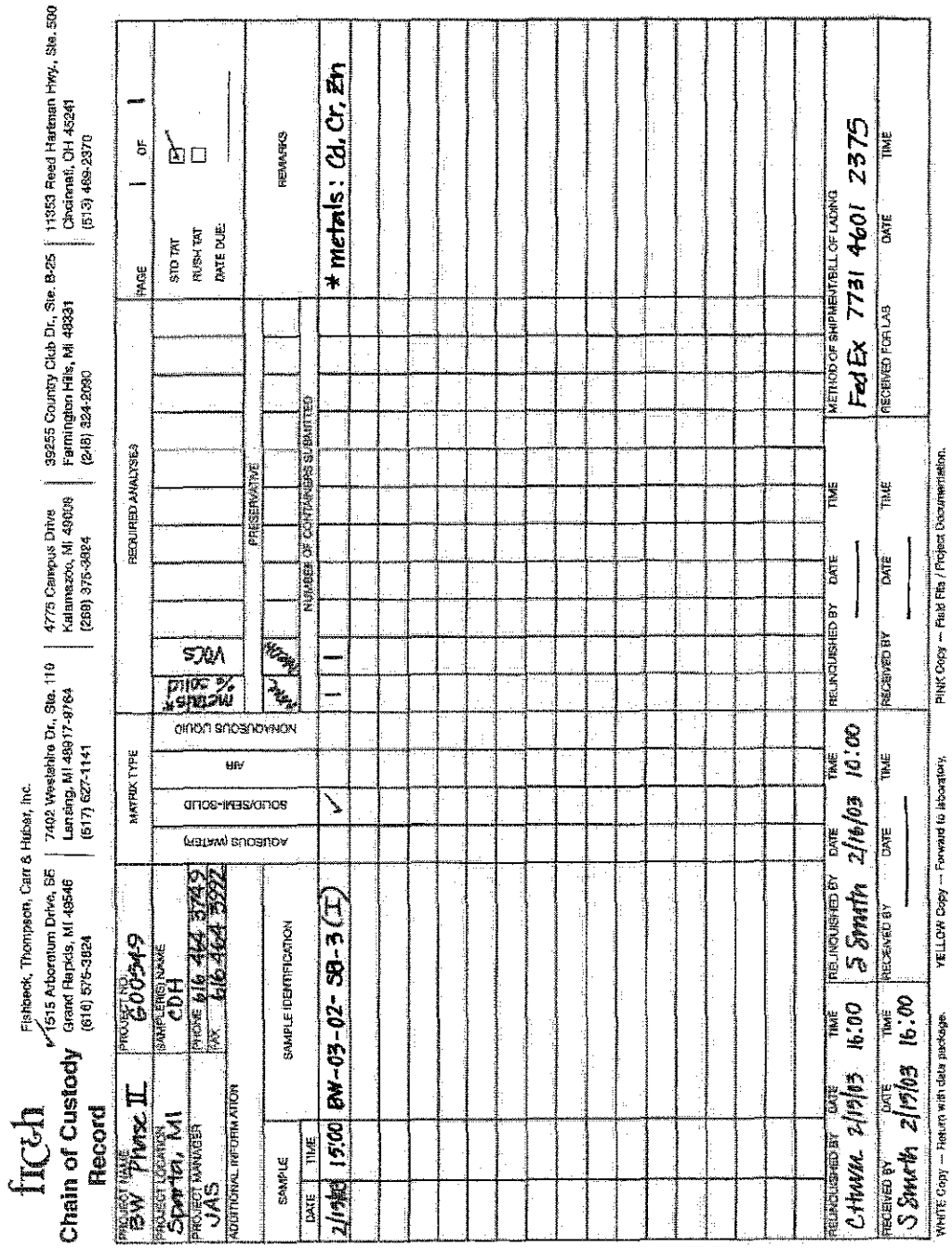
    a. Hand delivered by a member of the FTC&H sampling team.

    b. Samples are placed in the secured sample area at the FTC&H offices, and the field sample custodian arranges for delivery to the laboratory.

    c. Samples are shipped via common carrier to the laboratory. In this case, the method of shipment and associated bill of lading number must be recorded in the appropriate block on the COC Record.

Project No./Name G00492
Sample I.D. BLF-03-07-MW-1 (I)
Date/Time 3/15/07 16:30
Collected By TLP
Bottle/Preservative 40 mL G/HCl
Parameters 8260 VOCs

FIGURE 1



fTC&h Fishbeck, Thompson, Carr & Huber, Inc.
1515 Arboretum Drive, SE | Grand Rapids, MI 49546 | (616) 575-3824
7402 Westshire Dr., Ste. 110 | Lansing, MI 48917-8764 | (517) 627-1141
4775 Campus Drive | Kalamazoo, MI 49008 | (269) 375-3824
39255 Country Club Dr., Ste. B-25 | Farmington Hills, MI 48331 | (248) 324-2090
11353 Reed Hartman Hwy., Ste. 500 | Cincinnati, OH 45241 | (513) 489-2370

Chain of Custody Record

PROJECT NAME: BW Phase II
PROJECT NO.: 600349
PROJECT LOCATION: Sparta, MI
SAMPLER(S) NAME: CDH
PHONE: 616 464 3749
FAX: 616 464 5992
PROJECT MANAGER: JAS
ADDITIONAL INFORMATION

MATRIX TYPE: AQUEOUS (WATER) | SOLID/SEMI-SOLID | AIR | NONAQUEOUS LIQUID
REQUIRED ANALYSES: Metals* filtered | VOCs
PRESERVATIVE: None | HNO3
NUMBER OF CONTAINERS SUBMITTED

PAGE 1 OF 1
STD TAT ☑
RUSH TAT ☐
DATE DUE: ____

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	AQUEOUS (WATER)	SOLID/SEMI-SOLID	AIR	NONAQUEOUS LIQUID	Metals* filtered	VOCs	REMARKS
2/16/03	15:00	BW-03-02-SB-3(I)	✓				1	1	* metals: Cd, Cr, Zn

RELINQUISHED BY: C Hamm — DATE: 2/15/03 — TIME: 16:00
RECEIVED BY: S Smith — DATE: 2/15/03 — TIME: 16:00
RELINQUISHED BY: S Smith — DATE: 2/16/03 — TIME: 10:00
RECEIVED BY: ____ — DATE: ____ — TIME: ____
RELINQUISHED BY: ____ — DATE: ____ — TIME: ____
RECEIVED BY: ____ — DATE: ____ — TIME: ____

METHOD OF SHIPMENT/BILL OF LADING: FedEx 7731 4601 2375
RECEIVED FOR LAB — DATE — TIME

WHITE Copy -- Return with data package. YELLOW Copy -- Forward to laboratory. PINK Copy -- Field File / Project Documentation.

G 28973

FIGURE 2

fTC&h

Project No. _____

Signature _____ **Date** _____

FIGURE 3

STANDARD OPERATING PROCEDURE **SOP 10-01**
Groundwater Sampling—General Overview
06/10/1998; Revised 06/24/2004

Scope: Procedures outlined in the SOP are intended to provide general instruction for groundwater sampling activities. Field personnel should consult the project work plan for additional information.

Reference: Minnesota Pollution Control Agency, *Groundwater Sampling Guidance: Development of Sampling Plans, Protocols and Reports*, January 1995.

New Jersey Department of Environmental Protection and Energy, *Field Sampling Procedures Manual*, May 1992.

U.S. Environmental Protection Agency-Region IV, *U.S. EPA Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, February 1, 1991.

Selection of Sampling Equipment:

Factors to consider in selection of appropriate sampling equipment for a project should be based on technical performance of the equipment. A listing of several sampling devices, in order of preference, and their expected degree of sampling alteration are contained in the following table:

Device	Purging	Sampling	Comments
Bladder Pump	Minimal to slight	Minimal to slight	Acceptable for all analyte groups Maximum depth: 100 ft plus Minimum well diameter: 1.5 inches Requires portable power source (compressed gas)
Submersible Centrifugal Pump (Grundfos)	Minimal to slight	Minimal to slight	Acceptable for all analyte groups Maximum depth: 200 ft plus Minimum well diameter: 1.75 inches Portable use may require winch or reel system
Submersible Helical Rotor Pump (Keck)	Minimal to slight	Minimal to slight	Acceptable for all analyte groups Maximum depth: Up to 100 ft Minimum well diameter: 2 inches Flow rate controller required
Suction Lift Pump (Peristaltic)	Slight to moderate	Moderate	Not suitable for VOC, SVOC, or dissolved gas sample collection Maximum depth: Up to 25 ft Minimum well diameter: 0.5 inch
Bailer	High to very high	Moderate to High	Can cause substantial alteration of water chemistry; highly dependent on sampler's ability to minimize turbulence and aeration Maximum depth: 200 ft Minimum well diameter: 0.5 inch

Procedure:

1. Determine the order in which the wells should be sampled. Typically, sampling order should proceed from the cleanest well to the most contaminated. When no historical water quality data are available, sample background wells first followed by the farthest downgradient wells. The wells expected to be most significantly contaminated should be sampled last. Sampling order is not as critical when a peristaltic pump is used, as the pump tubing is replaced after each use.

2. Obtain the following information prior to the sampling event:

   a. Well depth. If not previously measured, determine by subtracting the distance between ground surface and top-of-casing (stick-up) and add this distance to the installation screen depth.
   b. Screen length.
   c. Depth to bottom of screen and depth to top of screen from top-of-casing. Using this information, determine the depth to the midpoint of the well screen.

3. Record the condition of the well in the field notes. Additional information may be required for documentation before, during, and after groundwater sampling. Refer to the project work plan and SOP 10-03 for additional information.

4. Determine static water level using SOP 18-04. Record in the field notebook. Minimize disturbances of the stagnant water column during water level measurement.

   Water levels are measured prior to and possibly during a groundwater sampling event for the following reasons:

   a. To assess whether the static water column length is sufficient to allow purging and sampling to proceed in the normal manner, provided that drawdown is moderate.
   b. To select the depth to which the pump intake, bailer, or other purging or sampling device should be lowered.
   c. To monitor the water level during purging and sampling.
   d. To determine groundwater flow directions.

   Unless stated in the work plan, groundwater from monitoring wells containing free product will not be sampled. (Free product refers to a mobile regulated substance that is present as a nonaqueous phase liquid.) If the groundwater must be sampled, use disposable equipment.

5. Rinse reusable sampling equipment with deionized water before inserting the equipment into the monitoring well.

6. Calibrate field measurement equipment as required by the project work plan.

7. Determine the volume of water to be purged prior to sample collection. The U.S. EPA guidelines recommend that a minimum of three well volumes be purged before a representative sample can be collected.

   Calculate the volume of water constituting three well volumes, first calculating the linear feet of water in the well (total depth of the well, ft - depth to water, ft). Then, calculate the amount of water within the well casing by multiplying the linear feet of water by the volume per foot for the proper diameter casing. The capacity of common casing diameters are as follows:

Casing Diameter	Gallons/Linear Foot
2-inch	0.1632
4-inch	0.6528
6-inch	1.4688
8-inch	2.6112
10-inch	4.0800
12-inch	5.8752

Example:

Total depth of well casing	100 ft
Depth to water	-20 ft
Linear feet of water	80 ft
2-inch casing	x 0.1632
Amount of water in casing (gallons)	13.06

Multiply the volume of water in the casing by three (3) to determine the minimum volume to be purged from the well prior to sample collection. Record data in the field notes.

8. Rinse the sampling equipment with deionized water prior to inserting the equipment into the well. Dispose of all rinse water in accordance with the project work plan.

9. Insert the sampling equipment into the well and begin extracting groundwater. When using a sampling pump, the pump should be lowered into the well and set just below the water surface.

   During purging, lowering of the water level causes cascading of water into the well if the purge rate is greater than the recovery rate of the well. Keep cascading to a minimum by not drawing the water level in the well below the top of the screen. If the water level is already at the top of or within the well screen, select a purging rate that results in minimum drawdown while allowing the well to be purged in a reasonable length of time.

   If the pump begins to pump dry, lower it further into the well. Allow the well to recover to provide sufficient water to completely fill the appropriate sample containers, and collect the sample.

10. Record purging start time in the field notes. A calibrated 5-gallon bucket should be used to monitor the volume of water purged. Dispose of all purge water in accordance with the project work plan.

11. Obtain the necessary field parameter measurements after 1 well volume, 2 well volumes, and 3 well volumes have been purged.

12. Fill required sample containers in accordance with the procedures described in SOP 10-10. Record the type of bottle filled, preservatives added, and the time and date of collection in the field notebook. Samples should be collected in the following order:

    a. Field parameters.
    b. Volatile organics.
    c. Semivolatile organics (includes samples for pesticides, herbicides, and PCBs).
    d. General chemistry parameters.
    e. Metals.

    Refer to the project work plan for sample requirements.

13. Decontaminate the equipment after each use in accordance with procedures described in the equipment-specific SOPs. Dispose of all decontamination water in accordance with the project work plan.

fTC&h **STANDARD OPERATING PROCEDURE SOP 10-02**
Low-Flow (Minimal Drawdown) Groundwater Sampling
06/10/1998; Revised 06/12/2006

Scope: This SOP describes a low-flow (minimal drawdown) technique used for groundwater sample collection. Procedures outlined in this SOP are intended to provide general instruction for groundwater sampling activities. Field personnel should consult the project work plan for additional information.

Discussion: Contaminant studies account for interaction between the mobile aqueous and immobile solid phase. The mobile, reactive solid phase (colloidal-size particles) is not accounted for and may be present in sufficient mass, possess high sorption reactivity, and remain stable in suspension; and thus, serve as an important mechanism to facilitate contaminant transport. Collection and processing of groundwater samples is required to determine the significance of collodial-size particles.

Colloidal-size particles (secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials; and viruses and bacteria) are reactive particles that have been shown to be mobile and may be required to be included in monitoring programs to identify the total mobile contaminant loading (dissolved + naturally suspended particles) at a site.

Conventional sampling methods (purging 3 to 5 well volumes) can cause an increase in turbidity, thus affecting the sample quality. Filtering to decrease turbidity of the sample may remove contaminant-associated mobile particles, thus artificially biasing contaminant concentrations low.

Purging is performed to remove water in the casing for the following reasons: oxygen concentration gradient between the top of the water column at the air interface to the bottom of the water column; loss of volatile compounds up the water column; leaching from or sorption to the casing or filter pack; chemical changes due to clay seals; or backfill and surface infiltration. Low-flow purging minimizes mixing between the overlying stagnant casing water and water within the screened interval.

Low-flow refers to the velocity of water from the pore water of the formation, through the well screen and into the pump intake. It does **not** necessarily refer to the flow rate of water discharged at the surface. Flow rates of 0.1 to 0.5 L/min (0.026 to 0.13 gpm or 100 to 500 mL/min) are typically used. If the pump intake is located within the screened interval, most of the water pumped will be drawn directly from the formation with little mixing of casing water or disturbance to the sampling zone.

Advantages of low-flow purging include:

- Representative samples (dissolved and colloid-associated).
- Minimal disturbance of the sampling point.
- Less operator variability; greater operator control.
- Less mixing of stagnant casing water with formation water.
- Smaller purging volume decreasing waste disposal costs.
- Increased sample consistency; reduced artificial sample variability.

Equipment:
Pump (Bladder, Fultz, or Peristaltic)
Plastic graduated cylinder
Electric water level meter
Flowcell for field parameter measurements
Turbidimeter
Stop watch
Polyethylene bucket, 5-gallon

FID or PID (if appropriate)
Decontamination supplies
Precleaned, pre-preserved sample containers
Sample labels
Field notebook

References: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Ground Water Issue: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA/540/S-95/504, April 1996.

Minnesota Pollution Control Agency, *Groundwater Sampling Guidance: Development of Sampling Plans, Protocols and Reports*, January 1995.

New Jersey Department of Environmental Protection and Energy, *Field Sampling Procedures Manual*, May 1992.

U.S. Environmental Protection Agency-Region IV, *U.S. EPA Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, February 1, 1991.

Selection of Sampling Equipment

Factors to consider in selection of appropriate sampling equipment for a project should be based on technical performance of the equipment (e.g., how the equipment affects the chemistry of the water sample), and on how well the equipment will perform for the project.

Device	Comments
Bladder pump	Acceptable for all analyte groups Maximum depth to water: 250 ft. plus Minimum well diameter: 2 inches Requires portable power source (compressed gas)
Fultz pump	Submersible positive displacement pump Acceptable for all analyte groups (with exception of hydrogen) Maximum depth to water: 150 – 200 ft.(dependent on pump model) Minimum well diameter: 2 inches Requires portable power source (24 volts direct current power supply)
Peristaltic pump	Suction lift pump May not be acceptable for VOC sample collection; special collection technique may be required. Maximum depth to water: 25 ft Minimum well diameter: 0.5 inch

Procedure:

1. Determine the order in which the wells should be sampled. Typically, sampling order should proceed from the cleanest well to the most contaminated. When no historical water quality data are available, sample background wells first, followed by the farthest downgradient wells. The wells expected to be most significantly contaminated should be sampled last. Sampling order is not as critical when a peristaltic pump is used as the pump tubing may be dedicated to the well location or replaced after each use.

2. Obtain the following information prior to the sampling event:

   a. Well depth. If not previously measured, determine by subtracting the distance between ground surface and top-of-casing (stick-up) and add this distance to the installation screen depth.

   b. Screen length.

   c. Depth to bottom of screen and depth to top of screen from top-of-casing. Using this information, determine the depth to the midpoint of the well screen.

3. Record the condition of the monitoring well in the field notes. Additional information may be required for documentation before, during, and after groundwater sampling. Refer to the project-specific work plan and SOP 10-03 for additional information.

4. Determine static water level using SOP 18-04 and record in the field notebook. Every effort should be made to minimize disturbances of the stagnant water column during water level measurement.

   Water levels are measured prior to and during a groundwater sampling event for the following reasons:

   a. To assess whether the static water column length is sufficient to allow purging and sampling to proceed in a normal manner, provided that drawdown is moderate.

   b. To select the depth to which the pump intake or other purging or sampling device should be lowered.

   c. To monitor the water level during purging and sampling and determine the optimum pumping rate to minimize drawdown.

   d. To determine groundwater flow direction.

5. Rinse reusable sampling equipment with deionized water before inserting the equipment into the monitoring well. (This assumes full equipment decontamination was performed after last use.)

6. Calibrate field measurement equipment as required by the project work plan.

7. Note the depth to the top and bottom of the well screen (if known) from top-of-casing. Depth of the well should **not** be measured prior to purging as this may cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure the well depth after sample collection. Compare the static water level to the depth to the top of the screen. If the water level is above the screen, insert the pump intake to the middle or slightly above the middle of the screened interval. If the water level is across the well screen, place the pump near the top (within 0.5 ft) of the water column.

8. Lower the pump into the well slowly (to minimize disturbance) to the desired depth and begin to purge at a rate (0.026 to 0.13 gpm or 100 to 500 mL/min) that will minimize drawdown (<0.3 ft). Monitor drawdown during purging using an electric tape. Adjustments are best made in the first 5 to 15 minutes of pumping in order to minimize purging time.

   When purging wells screened in low-permeability formations (<0.1 L/min recharge), lowering of the water level can cause cascading of water into the well if the purge rate is greater than the

recovery rate of the well. Cascading of water into the well can accelerate alteration of the water. Cascading should be kept to a minimum by not drawing the water level in the well below the top of the screen. If the water level is already at the top of or within the well screen, select a purging rate that results in minimum drawdown while allowing the well to be purged in a reasonable length of time.

Record purge start time in the field notebook. Monitor and record the water level and pumping rate every 3 – 5 minutes (or as appropriate) during purging. Use a plastic graduated cylinder or beaker to monitor the pumping rate and a 5-gallon bucket to monitor the volume of water purged. Dispose of purge water in accordance with the project work plan. Record any pumping rate adjustments on the sample collection form.

During pump start-up, drawdown may exceed the 0.3 ft. target and then recover as the pump flow adjustments are made. Purge volume calculations should utilize the stabilized drawdown value, not the initial drawdown.

9. If the minimal drawdown that can be achieved exceeds 0.3 ft but remains stable, continue purging until the field parameters stabilize. Drawdown should not proceed below the top of the pump. If a sustained pumping rate cannot be achieved and the monitoring well is evacuated, shut the pump off and allow the well to recover. When the well has recovered to the point that there is a sufficient volume of water stored, restart the pump and collect samples for field and laboratory analysis.

10. Monitor water quality parameters (pH, temperature, specific conductance, Eh, dissolved oxygen, and turbidity) every 3 to 5 minutes during purging to check for stabilization. These parameters should be recorded in conjunction with time, drawdown, flow rate, and volume pumped. Temperature and pH commonly have the same signature between stagnant casing water and formation water, but should be measured. Turbidity is a very conservative parameter and will require longer purge times for stabilization. Stabilization is reached when the field parameters are stable for three successive readings using the following criteria:

- ±0.1 s.u. for pH
- ±3% for temperature
- ±3% for specific conductance
- ±10 mV for Eh
- ±10% for dissolved oxygen
- ±10% for turbidity values >20 NTU

Field personnel should watch for particulate buildup within the flowcell. This buildup may affect the indicator parameter values measured within the cell and may cause an overestimation of turbidity values measured after the flowcell. If the cell requires cleaning during purging operations, continue pumping and disconnect the flowcell for cleaning. Reconnect the flowcell after cleaning and continue monitoring activities.

If stabilization of the field parameters is not achieved after 45 minutes of purging and all attempts have been made to minimize drawdown, check instrument condition and calibration, purging flow rate, and ability to achieve stable measurements. All measurements made during the attempt should be documented. A field decision must then be made to either continue purging or to collect the samples. If it is determined that significant stabilization can be achieved, continue purging until stabilization occurs or until it is determined that a reasonable effort has been made to maximize stabilization.

If the monitoring well is sampled repeatedly (quarterly, annually, etc.) for assessment of temporal variations in water quality with time, the pump should be set to the same depth, and purged at approximately the same rate and for the same volume of water during each subsequent sampling event. If the same purging criteria does not result in stabilization in subsequent sampling events, consider the following:

- Groundwater chemistry has changed over time.
- The monitoring well may need rehabilitation (redeveloped, replaced, etc.).
- Errors in field measurements may have been made during one or more sampling events.
- Collect a set of samples at the normal purging time and also collect time-series samples to compare with changes in field parameters.

It may not be possible in certain situations to reach stabilization due to:

- Nonuniform distribution of chemical and physical parameters in the water-yielding zone(s) being monitored.
- Previously undetected coalescing plumes.
- Multiple water-yielding zones screened by the monitoring well(s).
- Leaky confining layers, perched zones, etc., nearby.
- Poor well development (excessive fines in purge water)

11. Record field parameters (pH, temperature, specific conductance, Eh, turbidity, and dissolved oxygen) after stabilization.

12. Fill the required sample containers in accordance with the procedures described in SOP 10-10. Record the type of bottle filled, preservatives added, and the time and date of collection on the sample collection form. Samples should be collected in the following order:

    a. Field parameters.
    b. Volatile organics.
    c. Semivolatile organics (includes samples for pesticides, herbicides, and PCBs).
    d. General chemistry parameters.
    e. Metals.

    Fill all containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. Water samples for laboratory analysis should be collected before water has passed through the flowcell.

    Refer to the project work plan for sample requirements.

13. Decontaminate the equipment after each use in accordance with the procedures described in the equipment-specific SOPs.

14. Before securing the well, measure and record the well depth on the sample collection form.

ENVIRONMENTAL SERVICES DIVISION
STANDARD OPERATING PROCEDURE **SOP 10-06**
Sample Collection Using Peristaltic Pump
06/10/1998; Revised 02/18/2000

Scope: The following SOP outlines the technique to be used to acquire groundwater samples from monitoring wells using a self-priming suction lift pump. This SOP is intended to provide general instruction. Consult the equipment manual and project work plan for additional information.

References: New Jersey Department of Environmental Protection and Energy, *Field Sampling Procedures Manual*, May 1992

USEPA Environmental Compliance Branch, *Standard Operating Procedures and Quality Assurance Manual*, February, 1991

Operators Manual, Masterflex Easy-Load Pump Head, Model 7518 Series, Cole-Parmer Instrument Company

Operating Manual, Masterflex L/S Portable Sampling Pump Drive, Model 7570-10, Cole-Parmer Instrument Company

Procedure:

1. Check pump tubing for cracks or leaks. Replace if necessary.
2. Feed a new piece (approximately 3 feet in length) of the flexible tubing through the rotor opening.
3. Lock the tubing (approximately mid-length) in place by pushing the loading lever 180° to the right. Allow the discharge end of the tubing to extend into a bucket.
4. Release the 2 tubing retainers from the retracted position by pushing them slightly into the body, then downward and firmly against the tubing. Adjust as necessary.
5. Unroll and cut off a new piece of rigid tubing with length equal to the well depth plus an additional 5 to 10 feet.
6. Insert the free end of the rigid tubing into the well just below the water surface, leaving the excess extending out of the well.
7. Secure the rigid tubing to the well casing or other suitable object to prevent the tubing from dropping in the well should the tubing come loose from the pump head.
8. Attach the rigid tubing to the piece of flexible tubing connected to the pump.
9. Turn on the pump to produce a vacuum on the well side of the pump head and begin purging. Observe the pump direction to ensure that a vacuum is being applied to the sample/purge line.
10. Refer to SOP 10-1 for guidance on standard groundwater sampling. Refer to SOP 10-2 for guidance on low-flow groundwater sampling.
11. Pump tubing must be replaced after each use. Place used tubing in a plastic trash bag for disposal. Wipe the pump unit down with a Liquinox® soap and water solution, followed by a deionized water wipe.

fTC&h **STANDARD OPERATING PROCEDURE SOP 10-09**
Low-Flow Groundwater Sample Collection Using a Bladder Pump
11/15/2002; Revised 00/00/0000

Scope: This SOP outlines a low-flow sampling technique for collecting groundwater samples from monitoring wells using a variable speed positive displacement bladder pump. This SOP is to be used in conjunction with other SOPs for the collection of water samples for analysis of specific parameters as stated in the project work plan.

Discussion: A bladder pump allows water to flow through an inlet check valve into the interior of the pump bladder due to the pressure gradient exerted by the hydrostatic head of the water it is submerged in. After the interior of the bladder is filled with water, compressed gas is applied to the exterior of the bladder to force the water to flow through an outlet check valve at the top of the pump and toward the surface. The compressed gas is delivered to the pump through a gas supply tube connected to a compressed gas source with a control device located at the wellhead, and the pump liquid discharge is delivered to the well head through a water discharge tube with both tubes terminated in a wellhead cap. The water is pumped and conveyed in a manner to minimize alteration of water quality in any way. When the pump bladder is squeezed sufficiently to empty it of water, the compressed gas control device stops the flow of compressed gas and vents the pump's gas supply tube to the atmosphere. This venting allows the pressure on the outside of the pump bladder to decrease to less than that of the hydrostatic head present a the pump inlet due to the pump's submergence. The pump bladder can thereby refill and repeat the cycle as needed to achieve desired flow for purging and sampling the well. The pump controller at the wellhead controls the sequencing of applying compressed gas to and venting of the pump. A compressed gas source at the wellhead provides the necessary flow of compressed gas to the controller. A water level meter is used to measure water levels in the well before and during pumping. A flow cell connected to the water discharge tube measures water quality parameters and provides indication of completion of well purging.

The Portable MicroPurge® pump is manufactured by QED Environmental Systems, P.O. Box 3726, Ann Arbor, MI 48106-3726, U.S., 1-800-624-2026. The pump has a diameter of 1.75 inches, a length of 14.76 inches, and weighs approximately 4 pounds. The pump body is constructed of 316 stainless steel. The inlet and discharge housing is 303 stainless steel, bladder is Teflon® or polyethylene (PE), and O-rings are Viton.

A 5 lb. compressed air cylinder provides enough gas for up to 3 hours of sampling and is refillable. An air compressor can also be used when a power source is available.

The pump is controlled by the Micropurge basics™ MP10 controller.

References: User's Guide for Sample Pro Portable MicroPurge pump, Part No. 95181, Revision 3-19-01

User's Guide for MicroPurge Model MP10 Controller, Part No. 95177, Revision 11-9-01

Ground-Water Data–Collection Protocols and Procedures for the National Water-Quality Assessment Program: Collection and Documentation of Water-Quality Samples and Related Data, Michael T. Koterba, et al., U.S. Geological Survey, Open-File Report 95-399, 1995.

Expendable Supplies:

Polyethylene bladder kit (10 per pkg)	Part No. 38360
O-Rings (10 per pkg)	Part No. 38362
Stainless steel screens (10 per pkg)	Part No. 38361
Teflon® check balls (5 per pkg)	Part No. 38408

Procedure:

A. Preparing the Pump

1. Install the following O-rings on the pump: 2 discharge O-rings, air tube O-ring, inlet O-ring, and 2 head O-rings. Refer to Figure 3 of the User's Guide for location of these O-rings.

2. Connect the bladder to the pump head. If a PE bladder will be used, push the bladder onto the pump head barb until the bladder fully covers the barb. Use a clamping collar (white ring) when the pump will be submerged over 50 feet to assure a leak-tight seal of the bladder. Pull the clamp collar over the pump head barb before pushing the bladder on, then pull the collar back down firmly over the bladder and barb. If a Teflon bladder is to be used, install it by inserting the cartridge nipple into the center hole in the bottom of the pump head barb.

3. Attach the pump head to the pump body by engaging the bayonet dimples into the grooves and twisting them together until the engagement snap is felt and the head and body alignment marks line up.

4. With the pump on its side, insert the inlet check ball into the side of the pump head, then press in the inlet valve seat by pushing and twisting with your thumb.

5. With the pump vertical, insert the discharge check ball into the top of the pump head, then press in the discharge ball seat by pushing and twisting with your thumb.

6. For the push-in fittings, place the thin metal lock disk in the "TOP" up position on the top of the pump head, with the lock disk edge slots lined up with the posts on the pump head. Place the upper plate on top of the lock disk with slots and posts lined up. Twist the pump cap onto the pump head until the engagement snap is felt and the hole in the side of the pump cap lines up with the inlet port. The cover and body alignment marks should line up.

7. For the compression nut fittings, place the compression fitting plate on the top of the pump head, with slots and posts lined up. Rotate or remove the fitting nuts to allow the pump cap to be placed over the compression fitting assembly. Twist the pump cap on to the pump head until the engagement snap is felt and the hole in the side of the pump cap lines up with the inlet port. The cover and body alignment marks should line up.

8. Use a new lock plate and fresh cut end of tubing to ensure proper pull-out strength of the tubing connection. The upper plate is marked "W" for water discharge, and "A" for the air supply tube. QED air supply tubing is shaded gray to distinguish it from the water discharge tube which is clear. Insert each tube separately into the proper opening in the pump head, pushing firmly so that the tube penetrates beyond first resistance at least ½-inch into the pump. To check, pull back on each tube to check that it is secure.

9. Connect the light blue coiled pump hose to the fitting labeled AIR OUT on the MP-10. Connect the red air supply hose to the compressed air source and connect it to the fitting labeled AIR IN on the MP-10.

B. Well Purging

1. Calibrate the flow-cell in accordance with SOP 11-10.

2. Determine the order in which the wells should be sampled. Typically, sampling order should proceed from the cleanest well to the most contaminated. When no historical water quality

data are available, sample background wells first, followed by the farthest downgradient wells. The wells expected to be most contaminated should be sampled last.

3. Determine the depth to the midpoint of the well screen . Record the condition of the monitoring well in the field notes. Additional information may be required for documentation before, during, or after groundwater sampling. Refer to the project work plan and SOP 10-03 for additional information.

4. Determine static water level using SOP 18-04 and record in the field notes. Minimize disturbances of the stagnant water column during water level measurement.

5. Note the depth to the top and bottom of the well screen (if known) from top-of-casing. Depth of the well should not be measured prior to purging as this may cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure the well depth after sample collection. Compare the static water level to the depth to the top of the screen. If the water level is above the screen, insert the pump to the middle or slightly above the middle of the screened interval. If the water level is across the screen, place the pump at the top of the water column.

6. Slowly insert the pump into the well to the desired depth. Open the lid on the MP10 to power it on. At this point, the MP 10 is in the micropurge mode (MP) but is not cycling the pump. Select the desired Cycles per Minute (CPM) with the arrow keys on the MP-10, turn the throttle to set depth on the gauge to 10 – 20 feet deeper than the pump location in the well, and press CYCLE to start pumping. Purge at a rate (100 mL to 500 mL/min) that will minimize drawdown (<0.1 m or <0.33 ft). Monitor drawdown during purging using an electric tape. Make adjustments to stabilize the flow rate as soon as possible.

7. When purging wells screened in low-permeability formations (<0.1 L/min recharge), lowering of the water level can cause cascading of water into the well if the purge rate is greater than the recovery rate of the well. Cascading of water into the well can accelerate alteration of the water. Cascading should be kept at a minimum by not drawing the water level in the well below the top of the screen. If the water level is already at the top of or within the well screen, select a purging rate that results in minimum drawdown while allowing the well to be purged in a reasonable length of time.

8. Record purge start time in the field notes. Use a plastic graduated cylinder or beaker to monitor the pumping rate and a 5-gallon bucket to monitor the volume of water purged. Dispose of purge water in accordance with the project work plan.

9. If drawdown is excessive during low-flow pumping, and the low-flow method is not feasible without dewatering the stored water in the well casing, the following procedure should be used:

    a. Pump the well down to the maximum extent possible with the pump set at the existing setting.

    b. Allow the pumping rate to increase to maximize removal of stored water in the well casing. Drawdown should not proceed below the top of the pump. (Maximum pumping rate with the bladder pump is 1 L/min.)

    c. If a sustained pumping rate can be achieved with drawdown not exceeding the depth to the top of the pump, continue pumping until three stored casing volumes have been excavated. Collect samples for field and laboratory analysis.

d. If a sustained pumping rate cannot be achieved and the monitoring well is evacuated, shut the pump off and allow the well to recover. When the well has recovered to the point that there is a sufficient volume of water stored, restart the pump and collect samples for field and laboratory analysis.

10. Monitor water quality parameters (pH, temperature, specific conductance, Eh, dissolved oxygen, and turbidity) every 3 to 5 minutes during purging to check for stabilization. These parameters should be recorded in conjunction with the time, drawdown, flow rate, and volume pumped. Temperature and pH commonly have the same signature between stagnant casing water and formation water, but should be measured. Turbidity is a very conservative parameter and will require longer purge times for stabilization. Stabilization is reached when at least three parameters are stable for three successive readings using the following criteria:

- ± 0.1 s.u. for pH
- ± 3% for specific conductance
- ± 10 mV for Eh
- ± 10% for dissolved oxygen
- ± 10% for turbidity

If stabilization of three field parameters is not achieved after three stored casing volumes have been evacuated, a field decision must be made to either continue purging or to collect the samples. If it is determined that significant stabilization can be achieved, continue purging until stabilization occurs or until it is determined that a reasonable effort has been made to maximize stabilization.

If the monitoring well is sampled repeatedly (quarterly, annually, etc.) for assessment of temporal variations in water quality with time, the pump should be set to the same depth, and purged at approximately the same rate and for the same volume of water during each sampling event. If the same purging criteria do not result in stabilization in subsequent events, consider the following:

- Groundwater chemistry has changed over time.
- The monitoring well may need rehabilitation (redeveloped, replaced, etc.).
- Errors in field measurements may have been made during one or more sampling events.
- Collect a set of samples at the normal purging time and also collect time-series samples to compare with changes in field parameters.

It may not be possible in certain situations to reach stabilization due to:

- Non-uniform distribution of chemical and physical parameters in the water-yielding zone(s) being monitored.
- Previously undetected coalescing plumes.
- Multiple water-yielding zones screened by the monitoring wells.
- Leaky confining layers, perched zones, etc., nearby.

11. Record field parameters after stabilization.

C. Sample Collection

1. Disconnect the flow cell and its tubing from the pump line before collecting samples. Use the PAUSE key to freeze the controller action, allowing time to collect a sample. When the PAUSE key is pressed, the controller enters the HOLD state, drive air is vented from the

pump and the pump fills and waits. Pressing the PAUSE key a second time causes the controller to immediately enter the SAMPLE state. Drive air is directed to the pump causing the pump to discharge its volume of liquid. Using the HOLD and SAMPLE states, fill required sample containers in accordance with the procedures described in SOP 10-10. Samples should be collected in the following order:

a. Field parameters
b Volatile organics
c. Semivolatile organics (includes samples for pesticides, herbicides, and PCBs)
d. General chemistry parameters
e. Metals.

Refer to the project work plan for sample requirements. Record the type of bottle filled, preservatives added, and the time and date of collection in the field notes.

2. When sampling is complete using a dedicated pump, remove the water level tape, disconnect the air supply line and water discharge line from the wellhead and close the wellhead assembly/protective casing. During cold weather months, insert the 0.125-inch OD flexible polyethylene tubing into the pump discharge tube at the well head, then connect the quick connect fitting to the compressed gas source and apply low pressure to force the water near the surface out of the water discharge line.

After completing sample collection using a non-dedicated pump, remove the water level tape, disconnect the air supply line, remove the pump and tubing from the well, and close the wellhead assembly/protective casing. Store dedicated tubing in a large zip-lock bag with the well location clearly labeled. Non-dedicated tubing should be bagged for proper disposal.

D. Equipment Decontamination

1. Decontaminate non-dedicated pumps between each use. Decontamination should consist of cleaning the pump casing, Teflon checkball, and the inlet and outlet valves with a mild phosphate-free laboratory grade detergent solution and the supplied brushes. Rinse all parts with deionized water and flush deionized water through the Teflon checkball until the discharge water runs clear (no surfactant observed). When rinsing is complete, reassemble the pump with a new disposable bladder and new grab plate. Store the pump in an untreated plastic bag to eliminate potential contamination during transport and storage.

2. Decontaminate the water level tape after each use by wiping down the equipment body, probe, and cable with phosphate-free laboratory grade detergent solution, rinsing thoroughly with tap water, followed by a deionized water rinse. Store the water level meter in an untreated plastic bag to eliminate potential contamination during transport and storage.

ENVIRONMENTAL SERVICES DIVISION
STANDARD OPERATING PROCEDURE **SOP 10-10**
Groundwater Sample Handling and Preparation
05/13/1998; Revised 06/07/2002

Scope: This SOP outlines procedures for groundwater sample handling and preservation. Procedures outlined in this SOP are intended to provide general instruction for groundwater sampling activities. Refer to the project work plan for additional information.

References: *Minnesota Pollution Control Agency, Groundwater Sampling Guidance: Development of Sampling Plans, Protocols and Reports*, January 1995.

U.S. Environmental Protection Agency-Region IV, *USEPA Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, February 1, 1991.

Procedure:

1. An appropriate volume of groundwater must be removed from the monitoring well prior to sample collection. Refer to SOP 10-01 for a general overview of groundwater sampling using the conventional (3 to 5 well volumes) purge method. Refer to SOP 10-02 for a general overview of low-flow purge method.
2. Field parameters (pH, specific conductance, Eh, dissolved oxygen, turbidity, and temperature) should be measured using a flow-through cell when possible. When ambient measurements are required, use a groundwater containment vessel of sufficient size to allow for temperature equilibration with the atmosphere but with a relatively small surface area exposed to the atmosphere. Measurements should be taken as soon as practical after the groundwater has been removed from the well.
3. After field parameters have been measured, groundwater samples may be collected. Samples should be collected in the following order:
   a. Volatile organics:
      (1) Three 40 mL vials with Teflon septa should be filled with the groundwater to be tested. Vials are pre-preserved with 1:1 hydrochloric acid solution. Hydrochloric acid is corrosive; gloves should be worn. If the sample preservative comes in contact with the skin, flush with water. Seek medical attention if necessary.
      (2) Tilt the vial slightly and with minimum turbulence; fill the vial until it just overflows.
      (3) Carefully set the cap in place and screw on firmly.
      (4) Invert the vial to check for air bubbles. If air bubbles are present, a new sample vial must filled until a sample is obtained with no trapped air.
      (5) Label each vial and place samples on ice in an insulated container to maintain sample temperature at 2° to 6°C.
   b. Semivolatile organics (includes samples for acid/base-neutral extractables, pesticides, herbicides, and PCBs):
      (1) A minimum of 1 liter amber-glass bottle is required per scan. No chemical preservation is required.
      (2) Fill bottle with the groundwater to be tested, allowing minimal headspace for expansion.
      (3) Label each bottle and place samples on ice in an insulated container to maintain sample temperature at 2° to 6°C.

c. General chemistry parameters:

(1) Container size and type and chemical preservative are dependent upon the analyses to be performed. Table 1 provides general information for routinely performed analyses. Refer to the project work plan for specific requirements. The laboratory will provide the required containers and preservatives for the project. Some preservatives are corrosive; gloves should be worn. If the sample preservative comes in contact with the skin, flush with water. Seek medical attention if necessary.

(2) Fill each bottle to the shoulder with the groundwater to be tested and cap tightly.

(3) Label each bottle and place samples on ice in an insulated container to maintain sample temperature at 2° to 6°C.

d. Metals:

(1) Typically, a 500 mL plastic bottle pre-preserved with 1:1 nitric acid will be supplied by the laboratory for metals. Nitric acid is corrosive; gloves should be worn. If the sample preservative comes in contact with the skin, flush with water. Seek medical attention if necessary.

(2) Samples for dissolved metals must be field-filtered prior to preservation.

(a) Attach a 0.45 µm in-line filter cartridge unit onto the discharge line from the sampling device and adjust the discharge and flow rate with a three-way valve system, if necessary. A new cartridge must be used at each sampling location.

(b) Discharge the required volume of filtered groundwater to waste as specified by the filter manufacturer.

(c) Fill the required sample container to the bottle shoulder with the filtered groundwater and cap tightly.

(d) Label the bottle and place sample on ice in an insulated container to maintain sample temperature at 2° to 6°C.

(3) When total metals are required, fill the sample container provided to the bottle shoulder with the groundwater to be tested and cap tightly.

(4) Label the bottle and place sample on ice in an insulated container to maintain sample temperature at 2° to 6°C.

Table 1 – Sample Container Type, Size, and Preservative Routine – Groundwater Analyses

Analysis	Container Type	Required Volume	Chemical Preservative
Alkalinity (all forms)	Plastic	100 mL	None
BOD	Plastic	500 mL	None
Chloride	Plastic	100 mL	None
COD	Plastic	50 mL	1:1 sulfuric acid
Chromium, Hexavalent	Plastic	100 mL	None
Cyanide	Plastic	250 mL	Sodium hydroxide
Fluoride	Plastic	100 mL	None
N, Ammonia	Plastic	250 mL	1:1 sulfuric acid
N, Total Kjeldahl	Plastic	250 mL	1:1 sulfuric acid
N, Nitrate	Plastic	100 mL	None
N, Nitrite	Plastic	100 mL	None
Phenols, Recoverable	Glass	500 mL	1:1 sulfuric acid
Phosphorus	Plastic	100 mL	1:1 sulfuric acid
Solids (all types)	Plastic	250 mL	None
Sulfate	Plastic	250 mL	None
TOC	Plastic	250 mL	1:1 sulfuric acid

Scope: This SOP outlines procedures for the collection of groundwater quality control samples. These samples may include equipment blanks, atmosphere blanks, filter blanks, duplicates, and matrix spike samples. Refer to the project work plan for specific information regarding the QC samples required.

References: Minnesota Pollution Control Agency, *Groundwater Sampling Guidance: Development of Sampling Plans*, Protocols and Reports, January 1995.

Procedure:

A. Equipment Blanks

Equipment blanks are collected to evaluate if the investigative groundwater samples may have been contaminated through contact with the sampling equipment. An impacted equipment blank sample may indicate inadequate decontamination procedures, or that parts of the sampling equipment (e.g., pump tubing) may have become contaminated through continued use and should be replaced. Equipment blanks are typically collected at a rate of 1 equipment blank per 10 investigative samples.

Equipment blank samples are collected by passing deionized water through the sampling equipment using the same procedure used to collect the investigative groundwater samples.

1. Prior to collecting the equipment blank sample, be sure that the sampling equipment has been decontaminated following standard procedures.

2. If a pump is used for sample collection, prepare the equipment blank by pumping deionized water from the final rinse container into the appropriate sample containers.

3. If a bailer is used for sample collection, pour deionized water (with as little agitation as possible) into the top of the bailer. The length of time the blank water has contact with the bailer should simulate the length of time that an actual groundwater sample would contact the bailer. If a disposable bailer is used, do not rinse it with deionized water prior to collection of the equipment blank.

4. Equipment blanks are analyzed for the same parameters as the groundwater samples and therefore an identical "set" of bottles should be filled. The bottles should be filled in the same order required for the groundwater samples. If field filtering is required, follow the procedures described in Section C below.

5. Standard decontamination procedures should be followed after collection of the equipment blank.

B. Atmosphere Blanks

Atmosphere blanks are collected during sampling events where dedicated equipment is used to collect groundwater samples (such as Well Wizard dedicated pumps).These samples are used to determine if contact with ambient air has impacted the groundwater samples.

1. Collect an atmosphere blank sample by pouring deionized water into the appropriate sample containers at the same rate and duration that it takes to collect a groundwater sample. Atmosphere blanks are analyzed for the same parameters as the groundwater samples and therefore an identical "set" of bottles should be filled.

2. The bottles should be filled in the same order and preserved in the same manner required for the groundwater samples. If field filtering is required, follow the procedures discussed in Section C below.

3. Atmosphere blanks should be collected at a rate of one per 10 investigative groundwater samples.

C. Filter Blanks

Filter blanks are collected when groundwater samples are filtered onsite. These samples are used to evaluate the impact of the filtering equipment on the groundwater samples.

1. Collect a filter blanks by running deionized water through decontaminated filtering equipment fitted with a new filter. Do not pass the sample through the sampling equipment. The filter blank is used to determine whether the filtering equipment has affected the groundwater sample, independent from the sampling equipment

2. Filter blanks will be analyzed for the same parameters as the filtered groundwater samples and therefore an identical "set" of bottles should be filled. The bottles should be filled in the same order required for the groundwater samples.

3. Filter blanks should be collected at a rate of one for every 10 investigative filtered groundwater samples.

D. Field Duplicates

Field duplicates are collected as a check of sampling and analytical reproducibility.

1. Sample duplicates should be collected using the same procedure as for the investigative samples. Sample duplicates will be analyzed for the same parameters as the investigative groundwater samples and therefore an identical "set" of bottles must be filled.

2. The parameter dictated bottle order should be followed, however the sample duplicate bottles for specific parameter analysis should be filled immediately after the "primary" groundwater sample bottles. Following this procedure, the "primary" sample and sample duplicate bottles are filled alternately, and the parameter dictated sampling order is maintained.

3. Field duplicates are typically collected at a rate of one for every 10 investigative groundwater samples.

E. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD samples are used to evaluate laboratory precision and accuracy. MS/MSD samples are typically analyzed by laboratory as part of their QA/QC program. To insure that project specific matrix spike analysis is performed, it must be requested from the analytical laboratory. Consult the project work plan for sample volume requirements. Typically, triple the normal sample volume is required for analysis.

MS/MSD samples are collected in the same manner as field duplicates. Refer to Section D of this SOP.

F. Trip Blanks

Trip blanks, consisting of deionized water in sealed 40 mL glass vials, are prepared by the laboratory prior to the sampling event and are included in each sample shipping container. Trip blanks must be kept with the investigative samples throughout the sampling event and shipment to the laboratory. Trip blanks are used to assess potential contamination of samples due to compound migration during sample handling, shipment, and storage.

frc&h **STANDARD OPERATING PROCEDURE** **SOP 11-08**
Field Measurement of Turbidity
12/07/1998; Revised 05/09/00

Scope: This SOP outlines the technique required for the accurate field measurement of turbidity using the Cole-Parmer Field Turbidimeter Model 8391-50.

Equipment: Cole Parmer Field Turbidimeter Model 8391-50
Methanol
Sample cuvette
Turbidity standards (.5 NTU and 10 NTU) - DO NOT ALLOW TO FREEZE.
Distilled or Deionized Water
Field Notebook
Kimwipes

Procedure:

A. Primary Calibration

This procedure should be performed quarterly or any time a NEW sample cuvette is put into use.

1. Turn on the turbidimeter and allow to warm up for 5 minutes.

2. Set the range switch to 0-20.0 NTU and prepare the cuvette with the 10 NTU primary standard.

3. Insert the cuvette into the test well, align and cover with the light shield.

4. Adjust the SET/CAL control until the display reads 10.0.

5. Remove the primary standard and replace it with the sealed 10.0 NTU secondary standard. Align the cuvette and cover with the light shield.

6. Record the NTU value of the sealed standard on the label. This value will now be used for daily calibration.

7. Pour the 10 NTU standard out of the sample cuvette and shake out the remaining droplets. Rinse twice with distilled water and wipe the outside of the cuvette with a Kimwipe moistened with a small amount of methanol.

8. Change the range switch to 0-2 NTU range and prepare the sample cuvette with the 0.5 NTU standard.

9. Insert the cuvette into the test well, align and cover with the light shield.

10. Adjust the ZERO NTU adjust screw so that the display reads 0.500. Make sure the reading has stabilized.

11. Remove the primary standard and replace it with the sealed 0.5 NTU secondary standard. Align it and cover with the light shield.

12. Record the NTU value of the sealed standard on the label. This value will now be used for daily calibration.

13. Set the range switch to 0-20.0 NTU. Insert the 10 NTU sealed standard, align and cover.

14. The SET/CAL adjust may require a slight adjustment. Set the meter to read the calibrated value of the sealed standard that was recorded in step 6.

B. Daily Calibration

1. Turn on the turbidimeter and allow it to warm up for 5 minutes.

2. Set the range switch to 0-20.0 NTU.

3. Insert the 10 NTU sealed secondary standard cuvette into the test well, align and cover with the light shield.

4. Using the SET/CAL control, adjust the display to the calibrated standard value obtained during primary calibration.

5. Remove the 10 NTU standard and set the range switch to 0-2.

6. Insert the 0.5 NTU sealed secondary standard into the test well, align and cover with the light shield.

7. Using the zero NTU adjust screw, set the display to the calibrated standard value obtained during primary calibration.

8. Remove the 0.5 NTU standard.

9. Set the range switch back to 0-20.0 NTU, insert the 10 NTU sealed secondary standard, align and cover.

10. The SET/CAL adjust may require a slight adjustment. Set the meter to read the NTU value of the sealed secondary standard. The turbidimeter is now calibrated and ready for sample measurements.

C. Sample Analysis

1. After calibrating the turbidimeter, set the switch to 0-20.0 NTU range.

2. Rinse the cuvette twice with the sample to be tested and then slowly fill the cuvette to the alignment mark. Refill if air bubbles form on the walls of the cuvette.

3. Cap the cuvette and carefully wipe the outside of the sample cuvette with a Kimwipe moistened with a small amount of methanol to remove any fingerprints or moisture.

4. Insert the cuvette into the test well, align and cover with the light shield.

5. Once the reading has stabilized, record in the field notes.

6. If the reading is outside the 0-20.0 NTU calibration range, adjust the range to the appropriate setting (0-2 NTU or 0-200 NTU), allow the sample to stabilize and record the reading in the field notes.

7. Rinse the cuvette thoroughly with deionized water and cap upon completion of testing.

D. Quality Control

1. A sample duplicate should be run at a frequency of 1 per 10 investigative samples. Duplicate readings should agree within ±10%. If values fall outside this range, recalibrate the turbidimeter and reanalyze.

ENVIRONMENTAL SERVICES DIVISION
STANDARD OPERATING PROCEDURE SOP 11-10
In-line Measurement of Temperature, Specific Conductance, pH, Eh, and Dissolved Oxygen - 05/15/1998; Revised 04/02/2010

Scope: This SOP outlines the technique required for the accurate field measurement of temperature, specific conductance, pH, Eh, and dissolved oxygen (DO), using the YSI Model 556 MPS multi-meter with in-line flow cell. The unit consists of a suite of three probes with five sensors mounted together inside a flow-through cell. As water is pumped through the cell, field parameters are simultaneously measured and displayed.

Equipment: Sampling Pump
YSI Model 556 MPS multi-meter equipped with probe module
3/8-inch diameter polyvinyl discharge tubing
Deionized water

Standards: Conductivity standards (147, 1412, 2765 µS/cm)
pH buffers (4.00, 7.00, 10.00 s.u. @ 25°C)
Eh standard (Zobell's Solution 428 mV @ 25°C)

Replace solutions by expiration date on label.

All solutions should be protected from freezing and physical damage. Zobell's solution will degrade when exposed to excessive temperature variation or light. Store it in a cool, dry area protected from light.

Safety: Review all material safety data sheets (MSDS) for the standard solutions prior to use. Chemical resistant gloves should be worn when handling these solutions.

Eh standard solution waste should be containerized for proper disposal. The solution contains cyanide compounds; contact with acid will liberate hydrogen cyanide, a very toxic, flammable gas.

General Information:

The multi-meter and sonde should be thoroughly checked for proper operation prior to leaving for job site. This should include a check of internal calibration, and any adjustments should be made as required. Procedures for internal calibration meter adjustments can be found in the operation manual.

When installing, removing, or replacing a sensor, the entire probe module and all sensors must be thoroughly dried prior to removal of a sensor or sensor port plug. This will prevent water from entering the port. When a sensor or plug is removed, examine the connector inside the port. If moisture is present, use compressed air to completely dry the connector. Do not use if the connector is corroded; service on the unit will be required.

The YSI multi-meter is capable of displaying the parameters in various units of measure. The desired reporting unit for each parameter should be selected prior to calibration – pH in s.u., dissolved oxygen in mg/L, Eh in mV, specific conductance in µS/cm, and temperature in °C.

Procedure:

A. Electrode Preparation

1. Temperature/Conductivity Probe

Inspect the thermistor and electrodes for corrosion or fouling.

2. Dissolved Oxygen Probe

   Inspect the probe membrane. Replace the probe membrane when it becomes wrinkled, bubbled, dirty, torn, or otherwise damaged.

3. pH/Eh Probe

   Inspect probe for damage or fouling. Gently clean the bulb area with a very soft brush and Liquinox soap solution when obviously coated with oil, sediment, or biological growth. **Caution: The bulb glass is very fragile.**

B. Flow-cell Inspection

1. Inspect flow-cell for cleanliness. Disassemble and clean with a mild soap solution as necessary. Rinse well with clean tap water, followed by a deionized water rinse.

2. Inspect O-rings and O-ring seats for damage that may prevent sealing. Replace as necessary.

C. Meter Connection and Inspection

1. Connect the cable to the meter by lining up the pins and guides on the cable with the holes and indentations on the cable connector at the bottom of the instrument. While holding the cable firmly against the cable connector, turn the locking mechanism clockwise until it snaps into place.

2. Confirm that there is sufficient battery charge remaining (lower right corner of meter window) and that 4 replacement alkaline C batteries are available in the storage case. Typically, the YSI 556 will operate continuously for approximately 180 hours. Assuming a standard usage of 3 hours of "on" time in a typical day, the alkaline cells will last approximately 60 days. See Section 2 of the Operations Manual for battery replacement information.

D. Calibration

Calibration Tips:

Use the transport cup that comes with the probe module as the calibration chamber for all calibrations. Use a clamp or ring stand to secure the probe body and prevent it from tipping over.

With the exception of the dissolved oxygen sensor calibration, ensure that all sensors are immersed in the calibration solution. Many of the calibrations utilize readings from other sensors (e.g., temperature sensor).

Make certain that port plugs are installed in all ports where sensors are not installed. It is extremely important to keep these electrical connectors dry.

1. Dissolved Oxygen

   The membrane covering the tip of the DO probe should be gently wiped free of visible moisture with a Kim wipe before starting the air calibration (% saturation) sequence. Refer to the green calibration reference sheet (*Oxygen Solubility Values in Fresh Water*) provided in the field notebook for the correct DO/temperature correlation. The instrument must be on for at least 20 minutes before calibrating to polarize the DO sensor.

a. Turn the meter on by pressing the **On/off** key in the upper left corner of the key pad (small green vertical dash inside a green circle). The meter will be in Run mode.

b. Screw the calibration cup onto the probe. Pour approximately 1/8" of tap water into the bottom of the calibration cup, avoiding the DO membrane while pouring. Screw the cap onto the cup, engaging only 1 or 2 threads to allow venting to the atmosphere. Ensure that the DO and temperature sensors are not immersed in the water.

c. Allow approximately 10 minutes or more for the air in the cup to become water saturated and for the temperature to equilibrate before proceeding.

d. When the DO% and mg/L readings are stable, the meter is ready for calibration. From the Run mode menu, press the **Escape** key and use the down arrow to highlight **Calibrate**. Press the **Enter** key (a left pointing arrow). Arrow down to highlight **DO 2 mil PE**, and press the **Enter** key. Select *DO%* by pressing enter. The internal barometer's real time measurement in mmHg will be displayed. Press the **Enter** key to accept the calibration of dissolved oxygen.

e. Observe the DO mg/L and DO% readings. When there is no significant change in the readings (after approximately 30 seconds), record the temperature and DO (in mg/L) on the calibration form. The percent dissolved oxygen (DO%), should be within 90 – 110% of the theoretical value for acceptable calibration.

f. Rinse the sonde with deionized water and shake to remove excess water.

g. Calibration of the DO probe should be verified every 4 hours and at the end of each day. If calibration verification values fall outside the acceptance range, check the condition of the probe membrane. Clean or replace if necessary (see H.1), and recalibrate the probe prior to any further sample measurements.

2. Specific Conductance

a. Press the **On/off** key to display the run screen.

b. Rinse the calibration cup and conductivity probe with DI water and discard the rinse water. Rinse the cup and probe a second time using a small volume (10 – 15 mL) of the 1412 µS/cm conductivity standard in the calibration cup. Discard this rinse solution and refill the calibration cup with approximately 60 mL of 1412 µS/cm conductivity standard, ensuring that the calibration cup is sufficiently filled and covering the probe.

c. Press the **Escape** key to display the main menu screen and use the down arrow key to highlight **Calibrate**. Press the **Enter** key. The calibration screen is displayed.

d. Use the arrow keys to highlight the **Conductivity** selection and press **Enter**. Use the arrow key to highlight the **Specific Conductance** selection. Press **Enter**.

e. Use the keypad to enter the calibration value of the standard (1412 µS/cm) and press **Enter**. The conductivity calibration screen is displayed. Allow about 1 minute for temperature equilibration.

f. When the reading shows no significant change for approximately 30 seconds, press **Enter**. The specific conductance calibration will be accepted and display the newly

calibrated reading on the screen. Record the specific conductance reading and temperature on the calibration form

g. Press the **Enter** key and continue to more calibration options, or press the **Escape** key 4 times to exit to the run mode.

h. The calibration standard may be saved for later calibration verification checks or discarded. Rinse the probe module with deionized water and shake to remove excess water.

i. Rinse the calibration cup and probe a second time with a small amount of 147 µS/cm conductivity standard. Discard the rinse solution and refill the calibration cup with the 147 µS/cm conductivity standard. When the reading shows no significant change for approximately 30 seconds, record the reading and temperature on the calibration form. Follow the same protocol for the 2765 µS/cm standard.

j. If any of the readings fall outside of the acceptable calibration verification range indicated on the calibration form, repeat calibration using new standards. If the calibration is still out of range, clean the conductivity probe using the procedure described in H.2, and repeat the calibration sequence.

k. Calibration of the conductivity probe should be verified every 4 hours and at the end of each day using the 1412 µS/cm standard. If the calibration verification value falls outside the acceptance window, repeat the check using a new standard. If the check is still outside the acceptance window, check the condition of the probe, clean if necessary, and recalibrate prior to any further sample measurements.

3. pH

Perform a 2-point calibration as indicated below. The pH buffers selected should bracket the anticipated pH range of the samples to be measured.

a. Press the **On/off** key to display the run screen.

b. With the calibration cup attached to the sonde, rinse the cup and probes with DI water. Discard the rinse water and shake any excess water from cup and probes. Rinse the probe and cup a second time with a small volume of pH 7 buffer and discard the rinse. Add approximately 60 mL of pH 7 buffer to the cup.

c. Press **Escape** and highlight the **Calibrate** selection using the arrow keys. Press **Enter** and use the arrow keys to highlight the **pH** selection. Press **Enter**.

d. Arrow down to highlight **2 point** and press **Enter**. The unit will prompt the entry of the first pH buffer standard to be entered. Using the keypad, press **7.00** and then press **Enter**.

e. Observe the readings for pH and temperature. When they show no significant change for approximately 30 seconds, press the **Enter** key to calibrate.

f. When the display indicates that the 7.00 pH calibration has been accepted, record the reading and temperature on the calibration form. Rinse the cup and probes with deionized water and discard the rinse water. Rinse the cup and probe a second time with small amount of the second (pH 4 or pH 10) buffer and discard the buffer rinse. Add approximately 60 mL of the second buffer to the cup.

g. Press **Enter** to continue. The screen will prompt for the entry of the second pH buffer value. Using the keypad, enter the value for the second pH standard (4.00 or 10.00) and press **Enter**.

h. Observe the readings for pH and temperature. When they show no significant change for approximately 30 seconds, press the **Enter** key to lock in those values.

i. When the display indicates that the second pH buffer calibration has been accepted, record the reading on the calibration form.

j. Rinse the cup and probes with deionized water and discard the rinse water. Rinse the cup and probe a second time using a small volume of the third pH buffer and discard the buffer rinse. Add approximately 60 mL of the third pH buffer to the cup.

k. Observe the readings for pH and temperature. When they show no significant change for approximately 30 seconds, record the readings on the calibration form.

l. Check the recorded readings to ensure that they are within the acceptable calibration verification windows. If pH values are out of the acceptance range following calibration, repeat the calibration using new standards. If the values are still out of range following recalibration, the pH probe may need to be reconditioned. Soak the probe in pH 4 buffer for 2 hours and repeat the calibration procedure.

m. Calibration of the pH probe should be verified every 4 hours and at the end of each day using the pH 7 buffer. If the calibration verification value falls outside the acceptance window, repeat the check using a new standard. If the check is still outside the acceptance window, check the condition of the probe, clean if necessary and recalibrate prior to any further sample measurements.

4. Eh (ORP)

The measurement of Eh is accomplished by using an electrode designed to measure ORP (oxidation reduction potential). Eh is calculated by adding an offset voltage (200mV) to the ORP reading obtained.

Refer to the green calibration reference sheet (*Zobell's Calibration Check Standard Values*) for the acceptance range at various temperatures.

a. Press the **On/off** key to display the run screen.

b. Rinse the cup and probe with a small volume (10 – 15 mL) of Zobell's solution and discard this rinse solution. (Zobell's solution must be containerized for proper disposal). Refill the calibration cup with approximately 60 mL of Zobell's solution, ensuring that the calibration cup is sufficiently filled and covering the probe.

c. Allow for temperature equilibration before proceeding. When the temperature and ORP readings show no significant change for approximately 30 seconds, the meter is ready to calibrate.

d. Press the **Escape** key and highlight the **Calibrate** selection with the arrow keys. Press **Enter**. Use the arrow keys to highlight **ORP** and press **Enter**.

e. With the ORP calibration screen displayed, enter the mV value from the green calibration reference sheet (*Zobell's Calibration Check Standard Values*) for Zobell's solution at the observed temperature (in °C) and press **Enter.**

f. Confirm that the temperature and the Zobell's solution value are correct and press **Enter**. Because the meter and probe are set to recognize the calibration as ORP, the meter will display the following message: "**Out of range, accept anyway? Yes or No**". Select "**Yes**" and press **Enter**. The measurement displayed is Eh (in mV).

g. Record the temperature and Eh values on the calibration form, ensuring that the Eh reading is within the acceptance window for that temperature. If the Eh value is out of the acceptance range following calibration, repeat the calibration using a new standard. If the Eh value is still out of range following recalibration, the Eh probe may need to be reconditioned.

h. Rinse the sonde with deionized water, containerizing all rinse water. The calibration standard may be saved for later use for calibration verification checks or containerized for proper disposal.

i. Calibration of the Eh probe should be verified every 4 hours and at the end of each day using Zobell's solution. If the calibration verification value falls outside the acceptance window, repeat the check using a new standard. If the check is still outside the acceptance window, check the condition of the probe, clean if necessary and recalibrate prior to any further sample measurements.

E. Sample Analysis using In-line Flow-through Cell

Air in the flow-cell will affect the readings, especially specific conductance and DO. To help prevent air in the flow cell, elevate the sonde end of the flow cell to allow any air bubbles to escape. Install the sonde so that the conductivity sensor vent is facing upward when the sonde and flow cell are oriented horizontally. In addition, ensure that all fittings/connections are tight to eliminate potential for air leaking into the system.

If the initial purge water is silty, continue pumping until the discharge water clears before taking in-line measurements.

1. Connect the 3/8" OD Tygon inflow tubing from the pump to the in-port on the flow cell, and the other end of the inflow tubing to the pump. Connect the 1/2" OD Tygon discharge tubing to the out-port of the flow cell; the other end of the outflow tubing may discharge to ground or into an appropriate receptacle if purge water must be containerized. Refer to the project work plan for purge water disposal requirements.

2. Power on the instrument and check the display for readings.

3. Start the sampling pump and check for leaks in the discharge lines or flow-through cell. If leaking is observed, stop the pump and repair the leak.

4. Examine the flow-through cell to determine whether discharge water is entering and exiting the cell properly. Once the air is purged from the pump and discharge hoses, the flow-through cell should be completely filled with water and a steady flow of water should be exiting the outflow line from the cell. Record the initial meter readings on the field form.

5. Continue pumping until the readings stabilize. When low flow sampling, field parameters should be recorded every 3 to 5 minutes until stabilization has been achieved. Record the value for each field parameter on the field form, checking that the units displayed for each parameter are as noted on the field form.

6. Once stabilization of the field parameters has been achieved, disconnect the flow cell inflow tubing from the pump tubing and fill the appropriate sample containers. Samples for laboratory analysis should never be collected from water passing through the flow cell.

7. When sample collection is complete, remove the suite of probes from the flow-through cell and rinse the probes, flow-through cell, and inflow and outflow lines well with deionized water.

8. Attach storage/calibration cup and cap with a wet sponge or trace of tap water inside to keep the probes in a humid environment.

F. Sample Analysis using Calibration Cup

1. Screw the calibration cup onto the multiprobe unit and rinse 2 – 3 times with deionized water.

2. With the sensors pointing up, remove the cap and discard the rinse water. Rinse the sensors twice with a small volume of the sample to be measured and discard the rinse.

3. Fill the cup with the sample to be tested. The multiprobe should be completely immersed.

4. Allow 1 - 3 minutes for the readings to stabilize and record.

5. Repeat Steps F.1 – F.4 for each sample to be measured.

G. Electrode Storage

1. Short term storage

For short term storage, all sensors on the instrument require a moist environment. Immersion of the probes can cause drift or result in shorter sensor lifetime, so store the sensors installed in the sonde with 1/2" of tap water or moistened sponge inside the sealed calibration cup. *Do not store directly in water.*

2. Long term storage

a. Dissolved Oxygen Probe

Remove the sensor, following the instructions provided in the YSI instrument manual. Store the sensor in water with the membrane in place. The membrane cap and KCl solution must be replaced prior to use.

b. Temperature/Conductivity Probe

The temperature/conductivity probe has no special storage requirements; it may be stored wet or dry. The probe should be cleaned thoroughly prior to storage.

c. pH/Eh Probe

Remove the sensor from the sonde, following the instructions provided in the YSI instrument manual. Store the probe in 2M KCl solution in the pH/ORP sensor storage bottle. Insert a port plug into the vacant port on the sonde to keep the electrical connector dry.

H. Electrode Maintenance

1. Dissolved Oxygen Probe

If the DO sensor will not hold a calibration or if gas bubbles appear under the membrane, the membrane cap may need to be changed.

a. Unscrew the old membrane cap and discard.

b. Rinse the sensor tip with DI water and wipe gently with a Kimwipe.

c. Fill a new membrane cap half full with prepared KCl electrolyte and screw the cap onto the sensor tip. The tip should just be tightened so that there are no bubbles visible under the membrane. A small amount of electrolyte should overflow.

d. Rinse the sensor with DI water and proceed with the calibration sequence.

Periodic cleaning of the silver anode and the gold cathode may be necessary. Refer to the YSI instrument manual for these specific procedures.

2. Temperature/Conductivity Probe

Clean the conductivity portion of the electrode with the small brush provided in the maintenance kit. Wet the brush with a Liquinox solution and insert it into each hole 15- 20 times. Rinse well with clean tap water, followed by a deionized water rinse. The temperature portion of the sensor requires no maintenance.

3. pH/Eh Probe

Gently clean the bulb area with a very soft brush or cotton swab and a Liquinox soap solution when coated with oil, sediment, or biological growth is observed. Rinse well with clean tap water, followed by a deionized water rinse.

If the pH is out of range after calibration, the pH probe may need to be reconditioned. Soak the probe in pH 4 buffer for 2 hours and retry the calibration.

If rehydration of the electrode junction is required, soak the probe in 2M KCl solution for eight hours.

Zobell's Calibration Check Standard Values

Temperature (°C)	mV (vs Ag-AgCl electrode)	Acceptance Range (mV)
0	460.5	450.5 - 470.5
1	459.2	449.2 - 469.2
2	457.9	447.9 - 467.9
3	456.6	446.6 - 466.6
4	455.3	445.3 - 465.3
5	454.0	444.0 - 464.0
6	452.7	442.7 - 462.7
7	451.4	441.4 - 461.4
8	450.1	440.1 - 460.1
9	448.8	438.8 - 458.8
10	447.5	437.5 - 457.5
11	446.2	436.2 - 456.2
12	444.9	434.9 - 454.9
13	443.6	433.6 - 453.6
14	442.3	432.3 - 452.3
15	441.0	431.0 - 451.0
16	439.7	429.7 - 449.7
17	438.4	428.4 - 448.4
18	437.1	427.1 - 447.1
19	435.8	425.8 - 445.8
20	434.5	424.5 - 444.5
21	433.2	423.2 - 443.2
22	431.9	421.9 - 441.9
23	430.6	420.6 - 440.6
24	429.3	419.3 - 439.3
25	428.0	418.0 - 438.0
26	426.7	416.7 - 436.7
27	425.4	415.4 - 435.4
28	424.1	414.1 - 434.1
29	422.8	412.8 - 432.8
30	421.5	411.5 - 431.5
31	420.2	410.2 - 430.2
32	418.9	408.9 - 428.9
33	417.6	407.6 - 427.6
34	416.3	406.3 - 426.3
35	415.0	405.0 - 425.0

Oxygen Solubility Values (Fresh Water)

Temperature (°C)	DO Solubility (mg/L)
0	14.62
1	14.22
2	13.83
3	13.46
4	13.11
5	12.77
6	12.45
7	12.14
8	11.84
9	11.56
10	11.29
11	11.03
12	10.78
13	10.54
14	10.31
15	10.08
16	9.87
17	9.67
18	9.47
19	9.28
20	9.09
21	8.92
22	8.74
23	8.58
24	8.42
25	8.26
26	8.11
27	7.97
28	7.83
29	7.69
30	7.56
31	7.43
32	7.31
33	7.18
34	7.07
35	6.95

Appendix 3

Wastewater Discharge Permit

October 5, 2007

Mr. Vernon Campbell
Corporate Director of Environmental Compliance
SSW Holdings Company, Inc.
3501 So. Tulsa
P.O. Box 6537
Fort Smith, AR 72906

RE: Discharge Permit Renewal, Industrial Pretreatment Permit #006

Dear Mr. Campbell:

Enclosed please find the Industrial Pretreatment Permit for Straits Steel & Wire Company Permit No. 006, for the groundwater remediation pump station on Bryant Rd. The new permit expires on midnight October 15, 2012.

Please read the permit carefully, as it contains new requirements and reporting. I want to bring to your attention specifically page 5 "Certification Statement". This statement is required to accompany all reports made to the POTW. The certification is to be made by the authorized employee or officer of the company.

If you have any questions concerning this permit, the City of Ludington Sewer Ordinance, or any other related matter you can call me at 231-843-3190 or e-mail me at ludwwtp@t-one.net.

Sincerely,

Robert Allard Jr.
Superintendent

PC Duane Tyndal, General Manager Straits Steel & Wire
John Shay, City Manager
Jon Kortge, Utilities Maintenance Superintendent

Ludington Wastewater Plant
Wastewater Discharge **Permit No. 006** Expiration Date **10/15/2012**

Issued to: Straits Steel & Wire Company
902 North Rowe Street
Ludington, Michigan 49431
231-843-3416

Contact: Mr. Duane Tyndal

In accordance with all terms and conditions of the Ludington, Michigan Sewer Use Ordinance (SUO), supplement for the Industrial Pretreatment Program, and any applicable provisions of Federal, State and City law or regulation: the above named permittee is hereby authorized to discharge from the groundwater pumping station located between Bryant Rd. and Beachwood Street on the North side of Bryant Rd. To the Ludington Michigan sewer system at: sewer tap into manhole on Bryant Rd. between beechwood Street and William Street. Discharges will be in accordance with effluent limitations, monitoring requirements, and all other conditions set forth within this permit.

This permit and authorization to discharge shall expire at midnight, October 15, 2012. In order to receive authorization to discharge beyond the date of expiration the permittee shall submit such information and forms as are required by the City no later than 180 days prior to the date of expiration.

Issued this 15th day of October 2007 for the City of Ludington, Michigan.

Robert Allard Jr.

Wastewater Plant Superintendent

Permit No. 004

Conditions Chapter 27 Permit Industrial Sewage Pretreatment City of Ludington Sewer Use Ordinance (SUO)

All referenced Articles and Sections are also in EPA 40 CFR 3

1. Article I 2.251 (1) (2) Article 4 2.278

   The Public Owned Treatment Works (POTW) will review the permit annually and reserves the right to re-open the permit, and to deny specific discharges as deemed harmful! to the POTW.

2. Article 4 2.279

   The permit to discharge to the (POTW) is non-transferable without the written consent of the (POTW).

3. Article 4 2.280 (9)

   The permit holder shall notify the (POTW) of any significant change to it's discharge.

4. Article 4 2.280(10)

   The permit holder shall notify the (POTW) as soon as it becomes aware of any (a) Slug load discharge, (b) in the event of a un-contained spill, (c) pretreatment upset,
   (d) Any by-pass of the pretreatment system.

5. Article 5 2.286

   The permit holder is required to keep records as explained in the SUO.

6. Article 6 2.283

   Upon proper notification and identification the (POTW) reserves the right to enter, inspect and sample the permitted industry.

7. Article 6 2.284

   The (POTW) will post in the local newspaper, at least annually, all permitted industrial users who are in significant non-compliance with the (POTW) as it pertains to violations of sampling requirements, periodic compliance reports and the failure to meet time requirements in submitting reports.

8. Article 6 2.295 2.301 2.303

   Permit violations are subject to civil and criminal penalties for violation of pretreatment standards, reporting requirements, periodic compliance reporting schedules. Current SUO fines as required by USEPA are $1000.00.

Permit No. 006

Permit Conditions
Part I

A. Effluent Limitations and Monitoring Requirements

During the period beginning October 15, 2007, and lasting until, October 15, 2012, discharges from outfall 01, at sewer manhole on Bryant Rd. between Beachwood and William St., shall be limited and monitored by the permittee as specified below:

	Discharge Limitations		monitoring requirements		
Effluent Characteristics	30-day Average	Daily maximum	Frequency	sample type	location
Total chromium	1.71mg/l	2.77mg/l	1/month	grab	01
Total zinc	1.48mg/l	2.61mg/l	1/month	grab	01
Total cyanide	0.65mg/l	1.20mg/	l/month	grab	01
Flow *			1/month	Read	

*City water meter

All samples shall be collected, preserved, and analyzed in accordance with the procedures established in 40 CFR Part 136 and amendments.

Permit No. 006

Part II: Schedule of Compliance

The permittee shall achieve compliance with the effluent limitations specified for the outfall at the manhole in accordance with the following:

1. All parameter listed on page 2 of this permit "Permit Conditions"

2. Permittee shall mail to the POTW superintendent a copy of all required sampling analysis within 30 days of receipt of said analysis from their lab provider.

3. Permittee shall notify the POTW within 24 hours of identifying a violation and resample (and provide results) within 30 days of the known violation. 40CFR403.12(g) (2).

4. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or non-compliance. In the case of non-compliance, the notice shall include the cause of non-compliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

5. All non-compliance monitoring reports shall contain a Statement of Certification as contained in 40CFR403.8(f),(l)(iii)(d)&403.12 (e),(g), (h),(l),(n). A copy of which is enclosed.

6. Sampling Schedule:

2007	Monthly
2008	Monthly
2009	Monthly
2010	Monthly
2011	Monthly
2012	Monthly

PERMIT NO. 004

Certification Statement

The following certification statement must be signed by an authorized employee or officer of the company and must accompany all reports filed.

I certify under penalty of law that this document and all attachments were prepared under My direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

APPENDIX 3
BB&E FIELD STANDARD OPERATING PROCEDURES (SOPs)

SOP 2 – Use and Calibration of Field Instruments
SOP 3 – Water Level Measurements
SOP 9 – Cleaning and Decontamination of Sampling Equipment
SOP 10 – Groundwater Sampling
SOP 12 – Sample Management

Standard Operating Procedure 2
Use and Calibration of Field Instruments

2.1 Purpose and Applicability

This Standard Operating Procedure (SOP) provides guidelines and procedures which apply to field investigation methods for the use and calibration of field instruments. Manufacturers' manuals, specifications, and guidelines will be utilized when operating field equipment. The United States Environmental Protection Agency (USEPA) "Standard Operating Procedure for Calibration of Field Instruments" (EQASOP-FieldCalibrat Region 1 Calibration of Field Instruments) document was utilized as a reference for this SOP.

2.2 Definitions

None.

2.3 Procedure

Field instruments will be used for the collection of field data and measurement of various conditions observed during the site investigations. In general, take the following steps when using field instruments:

- Before field use, remove the instrument from its container and assemble and clean it according to the manufacturer's instructions.
- Before commencement of field activities each day, calibrate the instrument according to the manufacturer's instructions. Record the instrument's ID and serial number, along with the calibration process/results, in the field logbook and/or calibration logbook.
- Use the instrument to make the appropriate physical/chemical measurements and clean/decontaminate the instrument, if necessary, after each measurement.
- If erroneous measurements are observed or if changes in environmental conditions warrant recalibration, recalibrate the instrument as specified by the manufacturer. Record the recalibration information in the field logbook and/or the calibration logbook.
- At the end of each day, clean and decontaminate the instrument then return it to the storage location.
- Recharge instrument as necessary.
- Perform factory maintenance and calibration at the intervals specified by the manufacturer. Have repairs, maintenance, and calibration performed by trained individuals according to the manufacturer's requirements. Record repairs, maintenance, and calibration in the field logbook or instrument calibration/maintenance logbook.

Typical field instruments' SOPs are included in project specific work plan, if required.

2.4 References

USEPA, 2012; "Standard Operating Procedure Calibration of Field Instruments", EQASOP-FieldCalibrat Region 1 Calibration of Field Instruments, January, 2010.

Standard Operating Procedure 3
Water Level Measurements

3.1 Purpose and Applicability

This Standard Operating Procedure (SOP) provides guidelines and procedures which apply to field investigation methods for measurements of the depth to groundwater and total well depth in completed wells. Measurements may be taken either under static conditions or during aquifer testing where water elevations are varying and a second phase of floating liquid (such as gasoline) is not encountered. The United States Environmental Protection Agency (USEPA) "Groundwater Level and Well Depth Measurement" (SESDPROC-105-R2) document was utilized as a reference for this SOP.

3.2 Definitions

Discrete water level: Non-continuous measurement of the distance from a fixed reference point to the water surface in a given well.

3.3 Procedure

Water levels can be measured either continuously or at discrete times in a completed well or piezometer.

3.3.1 Discrete Water Level Measurements

Discrete water level measurements are made by determining the depth to the water surface below a fixed and surveyed reference point (e.g., top of casing). The fixed reference point is established by surveying a scribed or etched point on the northern, outer edge (lip) of the well casing.

3.3.1.1 Measurement with Electrical Sounders

The water level tape/wire on electrical sounders will be marked in 0.01-foot intervals to indicate depth. Depth will be referenced to the fixed/surveyed reference point at the top of the well casing. All sounders will be weighted by the manufacturer to maintain line tension. (The spacing of the 0.01-foot interval markers on the sounder wire should be checked regularly against a steel surveyor's tape and should be accurate to 0.1 foot per 100 feet, if steel, or 0.2 foot per 100 feet, if fiberglass.)

Take measurements using the following steps:

1. Locate, unlock, and open the well. Check the reference mark for legibility before taking water level measurements.
2. Clean and decontaminate the sounder wire.
3. Lower the sounder wire until it just makes contact with the water in the well. Record the position of the wire relative to the top of the well to the nearest 0.01 foot. Record the water level reading in the logbook. Repeat measurements to confirm depth.
4. Withdraw the sounder from the well and decontaminate the portions of the sounder wire and electrode that got wet.

3.4 References

USEPA, 2013; "Groundwater Level and Well Depth Measurement", SESDPROC-105-R2, January, 2013.

Standard Operating Procedure 9
Cleaning and Decontamination of Sampling Equipment

9.1 Purpose and Applicability

This Standard Operating Procedure (SOP) provides guidelines and procedures which apply to field investigation methods for cleaning and decontaminating sample containers and sampling devices. Decontamination procedures may be adjusted per project-specific Work Plan requirements.

9.2 Definitions

None.

9.3 Procedure

Sampling devices will be cleaned and decontaminated before and after field use, as well as between each sample collection location. Sample containers will be cleaned by the supplier before issuance to field personnel. Decontamination fluids will be regarded as investigation derived waste (IDW) and will be containerized and managed accordingly. Specific cleaning and decontamination materials and methods are discussed below.

9.3.1 Cleaning and Decontamination Materials

The following materials may be used for decontamination:

1. Trisodium phosphate or a laboratory detergent, such as Alquinox, Liquinox, or the equivalent.
2. Pesticide-grade isopropanol, if required. The project manager must justify the use of any solvent other than pesticide-grade isopropanol for cleaning and decontamination.
3. Tap water from an acceptable municipal water treatment system.
4. Organic/metal-free water rinse.

During cleaning and decontamination operations, the substitution of higher-grade water for tap water is permitted and does not have to be noted as a variation.

9.3.2 Marking and Storage

Cleaned and decontaminated equipment will be bagged and wrapped in aluminum foil or plastic, depending on the size of the equipment, and the decontamination process and occurrences will be recorded in the field logbook. Cleaned and decontaminated items will be stored in a contaminant-free environment.

Unused field equipment, reusable or disposable sample containers, and sample tubing that have been transported to a facility or site where contamination is known or suspected to be present or which may have become contaminated during the course of the field investigation should not be replaced in storage without being cleaned and decontaminated.

9.3.3 Decontamination Quality Control

9.3.3.1 Source Water Blank

Collecting samples in containers provided by the laboratory and submitting them for analysis monitors the quality of tap and organic-free rinse water. At least one sample per lot of organic-free water will be collected and submitted for analysis, and each tap water source used for decontamination will be sampled. When field deionizing or organic-free water units are used, quality control (QC) samples will be collected and analyzed more frequently. An initial sample plus subsequent weekly sampling is the minimum acceptable frequency of QC sampling, if sampling activities are performed greater than a week.

9.3.3.2 Equipment Rinsate

The effectiveness of the cleaning and decontamination procedures used in the field may be monitored by rinsing cleaned and decontaminated equipment with the organic-free water and submitting the rinse water to the laboratory for analysis. At least one rinse blank will be collected during each week (or 10 day event) of sampling operations. An attempt should be made to include as many of the same type of sampling for each rinse performed. This will help ensure that a representative sampling is obtained. A rinsate sample should be collected from each type of sampling equipment being used. Any time a cleaning material different from those specified in Section 9.3.1 is used, an equipment rinsate sample must be submitted to the laboratory for analysis. The rinse water will be collected and submitted for analyses of constituents for which normal samples collected with that piece of equipment are being analyzed.

9.3.4 Specified Field Equipment Cleaning and Decontamination Steps

Equipment used to collect samples that contain oil, grease, or other material difficult to remove may need to be rinsed several times before regular cleaning and decontamination steps are taken. In extreme cases, it may be necessary to steam clean the equipment. If the equipment cannot be adequately cleaned and decontaminated using these methods, it should be discarded.

9.3.4.1 Teflon® and Glass Field Sampling Equipment

1. Wash the equipment thoroughly with laboratory detergent and water using a brush to remove particulate matter or surface film.
2. Rinse the equipment thoroughly with tap water.
3. Rinse the equipment thoroughly with organic-free water.
4. Allow equipment to air dry.
5. Wrap the equipment completely with aluminum foil (dull side in) to prevent contamination during storage and/or transport to the field.

9.3.4.2 Stainless Steel or Metal Field Sampling Equipment

1. Wash the equipment thoroughly with laboratory detergent and water using a brush to remove particulate matter or surface film.
2. Rinse the equipment thoroughly with tap water.
3. Rinse the equipment thoroughly with organic-free water.

4. Allow to air dry.
5. Wrap the equipment completely with aluminum foil (dull side in) to prevent contamination during storage or transport to the field. Larger pieces of equipment (for example, auger flights with 5-foot split spoon samplers attached) may be wrapped in new Visqueen or equivalent.

9.3.5 Specific Cleaning and Decontamination Steps for Sample Tubing

9.3.5.1 Silastic Rubber Pump Tubing (Automatic Samplers and Peristaltic Pumps)

New clean tubing will be used for each automatic sampler setup. The silastic rubber pump tubing need not be replaced in peristaltic pumps where the sample does not contact the tubing or where the pump is being used for purging purposes (that is, not being used to collect samples). New tubing received from the supplier/manufacturer will inspected for cleanliness. If the visual inspection determines the tubing cleanliness is inadequate, the silastic tubing will be cleaned as follows:

1. Flush the tubing with tap water and phosphate-free laboratory detergent.
2. Rinse the tubing thoroughly with tap water.
3. Rinse the tubing with organic-free water.
4. Cap both ends of the tubing with aluminum foil (dull side in) until ready for use.

9.3.5.2 Teflon® Tubing (Bladder Pumps and Small-Diameter Electric Pumps)

New tubing received from the supplier/manufacturer will inspected for cleanliness. If the visual inspection determines the tubing cleanliness is inadequate, the Teflon® tubing, used for collection of samples for organic compound analyses, will be cleaned as follows:

1. Cut the Teflon® tubing into convenient lengths before cleaning.
2. Flush the tubing with tap water and phosphate-free laboratory detergent.
3. Rinse the tubing thoroughly with tap water.
4. Rinse the equipment thoroughly with organic-free water.
5. Allow equipment to drain and air dry.
6. Wrap the equipment completely with aluminum foil (dull side in) to prevent contamination during storage or transport to the field.

9.3.5.3 Polyvinyl Chloride Tubing (Bladder Pumps and Small-Diameter Electric Pumps)

PVC tubing is used selectively and only where organic compounds are of no concern. Only new tubing will be used. The tubing will be flushed with sample immediately before use to remove residues from the manufacturing or extruding process. The tubing will be stored in the original container and not removed until needed.

9.3.5.4 Stainless Steel Tubing

The stainless stell tubing will be cleaned as follows:

1. Wash stainless steel tubing with laboratory detergent and water using a long, narrow bottle brush.
2. Flush the tubing with tap water and phosphate-free laboratory detergent.
3. Rinse the tubing thoroughly with tap water.
4. Rinse the equipment thoroughly with organic-free water.
5. Allow equipment to drain and air dry.
6. Wrap the equipment completely with aluminum foil (dull side in) to prevent contamination during storage or transport to the field.

9.3.5.5 Glass Tubing

Only new glass tubing will be used. The tubing will be cleaned as follows:

1. Flush the tubing with tap water and phosphate-free laboratory detergent.
2. Rinse the tubing thoroughly with tap water.
3. Rinse the tubing with organic-free water.
4. Drain and air dry the tubing.
5. Wrap the tubing completely with aluminum foil (dull side in) to prevent contamination during storage.

9.3.6 Specific Cleaning and Decontamination Steps for Miscellaneous Equipment

1. Wash the equipment with laboratory detergent and tap water, running solutions through the pumps and pump hoses.
2. Rinse the equipment with tap water.
3. Rinse the equipment with organic-free water and allow to air dry.
4. Place the equipment in a polyethylene bag or wrap with polyethylene film to prevent contamination during storage or transit.

9.3.6.1 Well Sounders or Tapes Used to Measure Groundwater Levels

1. Rinse the equipment with laboratory detergent and tap water.
2. Rinse the equipment with organic-free water.
3. Air dry the equipment.
4. Wrap the equipment completely with aluminum foil (dull side in) or clean containers enclosing the equipment to prevent contamination during storage.

9.3.6.2 Miscellaneous Sampling, Flow Measuring, and Field Instrumentation and Equipment

Miscellaneous flow measuring and sampling instrumentation will be washed with laboratory detergent, rinsed with tap water, followed by a thorough deionized or organic-free water rinse, and dried before being stored. This procedure does not apply to equipment used for collecting samples for trace organic compounds or metals analyses.

The exterior of sealed, watertight equipment, such as flow meters, should be washed with a mild detergent (for example, liquid dishwashing detergent) and rinsed with tap water before storage. The interior of such equipment may be wiped with a damp cloth if necessary.

Other field instruments should be wiped with a clean, damp cloth; pH meter electrodes, conductivity electrodes, dissolved oxygen meter electrodes, etc., should be rinsed with deionized water before storage.

Ice chests and reusable shipping containers will be washed with laboratory detergent (interior and exterior), rinsed with tap water, and air dried before storage. In the event that an ice chest or shipping container becomes severely contaminated, it will be cleaned as thoroughly as possible, rendered unusable, and disposed of properly.

9.3.6.3 Pressure Field Filtration Apparatus

The steps for cleaning Teflon® and glass equipment will be used, except that the apparatus will be assembled and pressure will be applied after each rinse step to drive the rinse liquid through the porous glass filter holder in the bottom of the apparatus. After cleaning and decontamination, the apparatus will be assembled and the pressure inlet and sample discharge lines will be capped with aluminum foil (dull side in) to prevent contamination during storage.

9.3.7 Decontamination Procedures for Modified Low-Flow Sampling

Refer to SOP 10 for modified low-flow sampling procedures. The following procedures will be followed to reduce contamination between sampling points during modified low-flow sampling.

1. All wells sampled via modified low-flow techniques will be equipped with dedicated, Teflon®-lined, high- density polyethylene (HDPE) tubing.
2. Before each use, decontaminate any equipment/pump in accordance with the procedures outlined above, if the pump or pump equipment comes into contact with the sampling media.
3. Decontaminate the field parameter instrumentation before each use according to the procedures outlined above.
4. After each well has been sampled, decontaminate the applicable equipment as described above.
5. At visible signs of tubing wear (staining, odor, excessive nicks, and scrapes) or positive equipment rinse results, replace dedicated tubing.
6. Dedicated tubing may remain in wells and utilized during each sampling activity. If the tubing is compromised, replace with new tubing.

Standard Operating Procedure 10
Groundwater Sampling

10.1 Purpose and Applicability

This Standard Operating Procedure (SOP) provides guidelines and procedures which apply to field investigations methods for purging and sampling a groundwater monitoring well/piezometer to ensure that the sample collected is representative of the groundwater at the site. The United States Environmental Protection Agency (USEPA) "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" (EPA/540/S-95/504) document was utilized as a reference for this SOP.

10.2 Definitions

Bailer: A hollow tube constructed of stainless steel or Teflon® that is used to collect groundwater samples. A dedicated bailer remains inside the monitoring well casing.

Peristaltic Pump: A surface pump (non-submerged pump at ground level outside of casing) used to create a vacuum in a flexible polymer tube that is capable of drawing water out of a well.

Submersible pump: A subsurface pump (electrical or pneumatic) placed inside the well which pushes water out of the well through a water return line.

Open Borehole Sampling: Groundwater sampling from an open borehole in which no permanent well (temporary well may be established) will be installed during the boring operations.

10.3 Procedures

10.3.1 General Purging Requirements

The following equipment is required for well purging:

- Bailer or pump. The device used depends upon aquifer properties, individual well construction, well yield, and Data Quality Objectives (DQOs).
- Water level measuring device.
- Tape measuring device.
- Field book or standardized log sheet.
- pH, specific conductance, turbidity, and temperature measuring devices.

Well purging will be performed as follows, when required (undeveloped well, parameters stabilization not occurring, etc.):

1. For the well to be purged/developed, obtain and record the following information on the groundwater purging/sampling data sheet (EPA/540/S-95/504 Appendix A) or in the field log book: date, field conditions, well location, well identification (ID), well diameter, groundwater elevation, total well depth, screened interval, water quality field measurements (pH, specific conductance, turbidity, and temperature), and the method for disposal of purged water.
2. To prevent cross-contamination of wells, upgradient and background wells should be purged and sampled first. The order of sampling, based on previous investigation analytical results, will be from the lowest level contaminated areas to the highest level. The possibly contaminated or

contaminated areas should be evaluated to prevent cross-contamination. For unknown site conditions, using the historical available information to evaluate the possible impacted areas from least contaminated area to the most contaminated area must occur.

3. Field team members must use either new disposable gloves or decontaminated reusable gloves at each location.
4. Calibrate field instruments before purging activities and after the completion of the day's groundwater sampling activity and according to the manufacturer's instructions.
5. Before opening the well, place plastic sheeting on the ground surrounding the well head to prevent contamination by sample spillage, as needed.
6. Unlock and open the well and take a flame-ionization detector (FID)/photo-ionization detector (PID) reading immediately, as required.
7. Measure the water level and the total depth of the well. Total well depth may only need to be measured approximately once a year, depending on monitoring well conditions and purging/sampling frequencies.
8. Calculate the volume in gallons of water in the well casing or sections of telescoping well casing as follows:

$(\prod r^2 h)\ 7.48 = \text{gallons}$

where: $\prod = 3.142$

r = radius of the well pipe in feet (ft)

h = linear feet of water in well (total well depth – current water level depth below ground surface [bgs])

7.48 = gallons per cubic ft of water

The volume of water in typical well casings may be calculated as follows:

gallons/ft x _ (linear ft of water [h]) = total gallons

where gallons/ft for a specific well casing size:

1-inch well =	0.041 gallon per ft
2-inch well =	0.163 gallon per ft
3-inch well =	0.367 gallon per ft
4-inch well =	0.653 gallon per ft
5-inch well =	1.02 gallons per ft
6-inch well =	1.469 gallons per ft
7-inch well =	1.999 gallons per ft
8-inch well =	2.611 gallons per ft
10-inch well =	4.28 gallons per ft
12-inch well =	5.87 gallons per ft

9. To purge the well, lower the decontaminated purging apparatus (pump or bailer) to the standing water column so the water will be pulled through the casing and the entire static volume will be removed. Use a bailer when the well does not yield sufficient water for pumping; otherwise, a pump is preferred. For low- flow sampling techniques, see Section 10.3.2.3.
10. Measure the initial pH, specific conductance, turbidity, and temperature of water and record in the field logbook, along with the odor, color, clarity, silt concentrations, and general water condition. During purging, measure field parameters at least once during each well volume (more often is preferable). Record any changes in the physical condition of the monitoring wells that could affect the well integrity.

11. For well development to be complete, remove at least 5 volumes of groundwater from the well, and allow the field parameters to stabilize. Measure the amount of purged fluid by filling a graduated bucket or using a stopwatch and noting the flow rate of the pump versus elapsed time. Stabilization for each field parameter is defined as follows:
    - pH measurements ± 0.1 units,
    - temperature measurements ±1 degree (°) Celsius,
    - specific conductance measurements ± 10 percent, and
    - ± 10 percent for turbidity.
12. Purge wells with little or no recharge to near dryness, and allow the well to recover before sampling.
13. When using a pump before completing purging activities, bring the pump to the water surface to ensure complete removal of stagnant water.
14. Place purged water in a storage tank and dispose as investigation derived waste (IDW) (as specified in the IDW plan).

Wells will be sampled immediately after purging, if possible, but generally no later than 6 hours after purging. Wells that recharge slowly will be purged dry and allowed to recharge before sampling. If excessive time (greater than 10 hours) is required for the slow recharging wells to recharge, it will be documented in the field logbook.

This process may be used in conjunction with SOP 8 for monitoring well development.

10.3.2 Sample Collection

10.3.2.1 General

The purpose of this section is to provide general reference information on groundwater sample collection from groundwater wells. The methods and equipment described are for collecting water samples from the saturated zone of the substrata. The following procedures will be maintained during the sample collection:

1. Clean and decontaminate sampling equipment (as stated in SOP 9) before commencing sampling activities. A new pair of disposable gloves will be worn at each location by sampling personnel or more frequently, as required.
2. Use pre-labeled, pre-cleaned sample bottles (per laboratory SOPs) with the preservative added to contain the groundwater samples, as required based on analytical testing requirements.
3. Purge wells per the according procedure contained in Section 10.3.1, as required (If stabilization is not occurring).
4. Stabilization requirements for each parameter is defined as follows (site-specific QAPP or work plan may have different stabilization requirements and should be consulted prior to groundwater sampling activities):
    - ± 0.5 ° C for temperature,
    - ± 0.1 for pH,
    - ± 3 percent for specific conductance (conductivity),
    - ± 10 millivolts for oxygen reduction potential (ORP),
    - ± 10 percent Nephelometric Turbidity Unit (NTU) for turbidity (when > 10 NTU),
    - ± 10 percent for dissolved oxygen (DO), and
    - ± 0.3 ft for well water level drawdown.
5. Once field parameters have stabilized for three consecutive readings (measurements taken 3 – 5 minute intervals), samples may be taken. The same device used for purging should be used for

sampling (remove flow-through cell). Do not collect samples from the discharge point of the flow through cell, only the water discharge line downstream of the pump.

6. Volatile organic analysis (VOA) samples will be collected first, followed by other organic analyses. Inorganic analyses will be collected last, except where the influences of turbidity on metals concentrations are a concern. In that case, collect metals samples immediately following the volatile organic compounds (VOCs).
7. As the sample is taken, tilt the sample container slightly to allow the water to run down the inside of the sample bottle to minimize splashing.
8. Leave adequate space in the bottle to allow for expansion, except for VOA vials, which will be filled to overflowing and capped. Check VOA vials for air bubbles; if air bubbles are detected, carefully add more sample to the vial, taking care to minimize the loss of preservative.
9. Place samples in appropriate containers and immediately pack with ice in the coolers after the sample is collected. Follow SOP 12.
10. Follow the sample labeling, sample packaging, and proper chain of custody requirements.
11. Place purged water in a storage tank and disposed as IDW (as specified in the IDW plan).

10.3.2.2 Bailer

This section describes the procedures and processes utilizing bailers to collect groundwater samples. Bailers are the simplest evacuation device and offer several advantages:

- Few limitations on size and materials
- No external power source required
- Inexpensive and may be dedicated to the well to reduce cross-contamination

When sampling with a bailer is required, minimize disturbance to the well to the greatest extent practical.

1. A decontaminated stainless steel (SS) or Teflon® bailer can be used to remove groundwater samples from a well.
2. The bailer must be securely fastened to a rope/string.
3. The bailing rope will not be allowed to contact the ground to prevent the introduction of foreign contaminants into the well.
4. The other end of the rope should be secured to the protective casing/adequate anchor to prevent the bailer from falling down the well and being unable to recover the bailer.
5. To prevent the bailer from becoming lodged in the well, the loose end of the rope will be cut short enough not to extend beyond the sloping portion of the top of the bailer barrel.
6. The bailer will be slowly lowered into the water column of the well to the desired level which the sample will be collected. Care shall be used to minimize agitation that may cause turbid conditions when sampling the well.
7. Allow the bailer to fill with a minimum of surface disturbance to prevent sample water aeration. When the bailer is raised, the bailing rope must not touch the ground to prevent contamination from entering the well.
8. Bailer sampling apparatuses will be used to assist in collecting the groundwater sample from the bailer or slowly pour the sample from the bailer into the appropriate laboratory container, tilting the bottle slightly to allow the water to run down the inside of the sample bottle with a minimum of splashing.
9. If the bailer is dedicated, return it to the well and cap and lock the well. If the bailer is non-dedicated, remove the bailer and rope and cap and lock the well.
10. Clean and decontaminate non-dedicated bailers after use, if required. A new pair of disposable gloves will be worn at each location by sampling personnel.

11. Leave adequate space in the bottle to allow for expansion, except for VOA vials, which will be filled to overflowing and capped. Check VOA vials for air bubbles; if air bubbles are detected, carefully add more sample to the vial, taking care to minimize the loss of preservative.
12. Place samples in appropriate containers and immediately pack with ice in the coolers after the sample is collected. Follow SOP 12.

For wells which are sampled with a bailer due to low water level and a low rate of recharge (which low flow sampling is not preferable or unable to be performed), under requested site specific conditions, the following additional steps may be required.

1. At a well, a bailer may be used to fill a flow cell to observe and record parameter readings.
2. Remove one bailer volume of groundwater and measure the groundwater parameters. Allow one minute for the parameter readings to stabilize, more if the multiparameter probes have recently been unsaturated. If unable to obtain enough groundwater from the well for parameter readings, purge the well dry and sample the next day.
3. Remove another bailer volume if practicable to fill the scheduled sample containers (per the order contained in Section 10.3.2.1).
4. If insufficient water is available in the well to fill the scheduled sample containers, measure and record the water level in the well and add a note in the field book ("well dry" or "insufficient water present").
5. Return the following day to fill the containers with groundwater using the bailer, if sufficient water is present.

Dedicated bailers and non-dedicated bailers may be used but must be decontaminated prior to use. Dedicated bailers may be left inside the well after sampling/purging activities. Non-dedicated bailers must be decontaminated after use at each well. Disposable bailers may also be used. Disposable bailers may only be used at one specific well for purging/sampling activities and then discarded, per the IDW plan as general refuse.

If resistance is encountered when lowering the bailer into the well, the bailer will be withdrawn from the well. The field team leader will be informed of this condition, and a smaller diameter bailer may be required to sample the well. Additional methods of groundwater sampling may be required depending on the well condition.

10.3.2.3 Purging/Sampling Utilizing Low Flow Sampling Methods

Low-flow techniques are used to obtain a more representative sample from the aquifer formation. In general, the advantages of low-flow purging include (USEPA 1996):

- Samples which are representative of the mobile load of contaminants present (dissolved and colloid-associated)
- Minimal disturbance of the sampling point, thereby minimizing sampling artifacts (that is, less turbidity)
- Less operator variability, greater operator control
- Reduced stress on the formation (minimal drawdown)
- Less mixing of stagnant casing water with formation water
- Reduces the need for filtration and thus the time needed for sampling
- Smaller purging volume which decreases IDW disposal costs
- Better sample consistency; reduced artificial sample variability

The pumps selected to perform low-flow sampling should be capable of producing purge rates (< 0.5 Liter per minute (L/min), preferably 0.1 L/min to 0.3 L/min) sufficient to allow for the modified low-flow sampling technique. Pumps which meet these requirements include, but are not limited to, submersible pumps, including air bladder-type pumps and Grundfos Redi-Flow 2 pumps, and peristaltic pumps.

The depth of the well and depth to groundwater will require different types of pumps to be utilized.

Peristaltic pumps create a vacuum in a flexible polymer tube that is capable of drawing water out of a well up to approximately 25 bgs. This pump requires a power supply at the surface (normally a battery). The tubing runs through the pump's roller bearing housing, which cyclically squeezes the tubing, drawing water into the bottom of the tubing in the well and discharging water at the top of the tubing at ground surface. The pump sits at the surface, only the down well tubing is lowered into the well. The pump can draw water very slowly and steadily with a minimum of agitation, making it ideal for sampling wells less than approximately 25 ft bgs. Peristaltic pumps allow the groundwater sampling of piezometers and small diameter (< 2-inch) wells.

Submersible pumps may be electrically or pneumatically powered. These pumps take in water and push the water up the well through a water discharge line. The operation principles vary and the displacement of the sample can be by an inflatable bladder (air bladder pump), sliding piston, or impeller. These pumps are normally available for 2-inch diameter wells and larger. These pumps can lift water from considerable depths (several hundred ft).

The following are the procedures for modified low-flow groundwater sampling. These procedures include adaptations from USEPA's paper entitled "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures" (USEPA 1996):

For a peristaltic pump prior to purging the well:

1. The down well tubing (water intake) will be slowly lowered to the middle of the screened interval of the well. The installation of the tubing to the proper depth must be completed slowly to minimize the disturbance of solids and other particulate matter in the well.

For a submersible pump prior to purging the well:

1. The submersible pump must be securely fastened to a rope/string.
2. The submersible pump rope will not be allowed to contact the ground to prevent the introduction of foreign contaminants into the well.
3. The other end of the rope should be secured to the protective casing/adequate anchor to prevent the pump from falling down the well.
4. Slowly lower the decontaminated pump to the middle of the screened interval of the well. This method will minimize the mixing of stagnant water in the casing above the screen with the screened interval zone water, and minimize re-suspension of solids that have collected at the bottom of the well.

For peristaltic pumps and submersible pumps:

1. Once the submersible pump/end of the down well tubing is properly positioned in the well (middle of screened interval), an airtight flow-through cell (equipped with a Horiba-type or YSI-type water quality meter) will be plumbed to the water discharge line.
2. Lower a decontaminated water level gauge into the well to monitor the water table. May not be applicable to piezometers or small diameter (< 2-inch) wells due to the minimal space available in the well.

3. Once purging is initiated, water level measurements should be monitored continuously, and pumping rates adjusted as necessary (for example, 0.1 L/min to 0.3 L/min) to maintain minimal drawdown of the well's water level. Modified low-flow techniques should cause less than 3 ft of drawdown during purging.
4. While purging, the groundwater field parameters (including water level) should be continuously monitored every 3 to 5 minutes until parameters have stabilized for three consecutive readings.
5. The field parameter stabilization requirements are contained in Section 10.3.2.1.
6. Sample collection must be performed in accordance with Section 10.3.2.1.

10.3.2.4 Purging/Sampling Using a Small Diameter, Submersible Pump

Small-diameter electric submersible pumps include a range of small diameter, variable speed pumps capable of pumping rates ranging from < 0.5 mL/min to in excess of 9 gallons per minute (gal/min). The power source for these pumps can be provided directly from an automobile battery or a generator. Although small-diameter pumps are usually light-weight and easily lowered by one person into a well, two people are commonly utilized to remove the pump: one person to pull and the other to reel the hose and power lead.

Groundwater monitoring wells can be purged using a decontaminated pump and clean flexible tubing as follows:

1. The submersible pump must be securely fastened to a rope/string.
2. The submersible pump rope will not be allowed to contact the ground to prevent the introduction of foreign contaminants into the well.
3. The other end of the rope should be secured to the protective casing/adequate anchor to prevent the bailer from falling down the well and being unable to be retrieved.
4. Slowly lower the decontaminated pump to the middle of the screened interval of the well. This method will minimize the mixing of stagnant water in the casing above the screen with the screened interval zone water, and minimize re-suspension of solids that have collected at the bottom of the well
5. Following the manufacturer's procedures, begin pump-purging the monitoring well. If the recovery rate of the well is faster than the pump rate, the pump may be left hanging at the initial level. If the pump rate exceeds the recovery rate, the pump must be lowered to accommodate the drawdown, or the pump rate can be decreased.
6. Once the field parameters have stabilized or 3 to 5 well volumes have been removed (no stabilization of monitored parameters) from the well, sampling can be performed.
7. The field parameter stabilization requirements are contained in Section 10.3.2.1.
8. Sample collection must be performed in accordance with Section 10.3.2.1.

10.3.2.5 Purging/Sampling from an Open Borehole

Open borehole sampling may be performed during soil boring operations which encounter groundwater prior to the borehole ending depth bgs. Soil boring operations must have been completed. A temporary well utilizing a 1-inch or 2-inch diameter PVC piping screened at the appropriate depth, is inserted into the open borehole. A submersible or peristaltic pump will be utilized to purge the temporary well. Generally, field parameters are not measured during open borehole sampling activities. Field personnel will visually identify when the purge water turbidity has decreased and a sample will be collected into the appropriate containers. Sample collection must be per Section 10.3.2.1. Site specific field parameter screening requirements may be required per the QAPP.

10.4 References:

USEPA, 1996; "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures", EPA/540/S-95/504, April 1996.

Standard Operating Procedures 12
Sample Management

12.1 Purpose and Applicability

This Standard Operating Procedure (SOP) provides guidelines and procedures which apply to field investigation methods for sample management. This procedure applies to liquid and solid environmental and hazardous samples collected for analysis of physical or chemical properties.

12.2 Definitions

None.

12.3 Procedure

12.3.1 Sample Holding Times, Containers, and Preservatives

Based on expected sampling efforts, a supply of sample containers and field preservatives, if needed, will be delivered to the field sampling teams by the contracted laboratory. The containers must be certified clean by the laboratory. Required containers and preservatives for various sample types are listed in the site-specific work plan or quality assurance project plan (QAPP).

Sample containers and preservatives are obtained and used as follows:

1. The project manager requests sample containers from the laboratory no fewer than 14 working days in advance of each scheduled sampling event.
2. The laboratory supplies the sampling team with the appropriate clean containers, which contain the required preservatives and are labeled as to what preservatives are in each container. Containers should be delivered at least 2 working days before the scheduled sampling event. The project manager or designee checks the completeness of the shipment and the integrity of the containers.
3. Preservatives are added to sample containers by the laboratory before shipment or by field personnel as required during sampling. The type and quantity of preservatives added to the container are marked on the container label.

12.3.2 Sample Packaging and Management

12.3.2.1 Chain-of-Custody Forms

Samples shipped to the laboratory for analysis will be accompanied by a chain-of-custody form. These forms track the custody of the samples after they have been collected and verify the information contained on the bottle labels. Every sample bottle shipped to the laboratory for analysis will be listed on the chain-of-custody form. Other information contained on the form includes:

- Project number
- Project name and location
- Sample manager
- Date and time of sample collection
- Sample location Identification (ID) (field ID)
- Number of containers

- Analysis required
- Sample type and matrix
- Laboratory name
- Remarks
- Airbill number
- Relinquishing signatures, dates, and times

12.3.2.2 Sample Bottle Labels

Each bottle shipped to the laboratory for analysis will be identified with a sample label. This label will contain the following information:

- Project name
- Project number
- Sample location ID (including site)
- Date and time of sample collection
- Analysis required (method)
- Preservation
- Sampler
- Matrix
- Number of containers/analysis

When the sample label information has been completed, the label will be placed on the appropriate bottle and covered with clear tape to ensure the integrity of the sample label or per site-specific project work plan requirements.

12.3.2.3 Sample Packaging

Once the samples have been collected, the sample bottles will be prepared for shipment to the laboratory in the following manner:

- Ensure the caps of the containers are tightly sealed.
- Place containers in bubble pack, if required.
- Place all containers in a zipper-lock-type bag and seal.
- Place samples into an insulated cooler and cool to 4 ± 2 degrees Celsius using wet ice.
- Line insulated shipping cooler with a large trash bag and place samples in insulated shipping cooler with ice.
- Seal the completed chain-of-custody form in a zipper-lock-type plastic bag and tape to the inside of the cooler lid.
- Close trash bag and seal with tape.
- Securely seal the shipping container with packing tape and two custody seals.
- Ship to laboratory cooler and contents via overnight express.

APPENDIX 4
CITY OF LUDINGTON WASTEWATER DISCHARGE PERMIT

JOHN HENDERSON, MAYOR
JOHN E. SHAY, CITY MANAGER
DEBORAH L. LUSKIN, CITY CLERK
LINDA J. ROGERS, CITY TREASURER

CITY OF LUDINGTON
400 SOUTH HARRISON STREET
LUDINGTON, MICHIGAN 49431
PHONE (231) 845-6237
FAX (231) 845-1146

June 1, 2012

Mr. Brain Calhoun
Corporate Safety and Environmental Director
SSW Holding Company, Inc.
Coldwater, MI 49036

Mr. Ralph Raber
General Manager
902 North Rowe Street.
Ludington, MI 49431

RE: Discharge Permit Renewal, Industrial Pretreatment Permit #006

Dear Mr. Calhoun:

Enclosed please find the Industrial Pretreatment Permit for Straits Steel & Wire Company Permit No. 006, for the groundwater remediation pump station on Bryant Rd. The new permit expires on midnight May 31, 2017.

Please read the permit carefully, as it contains new requirements and reporting. I want to bring to your attention specifically page 5 "Certification Statement". This statement is required to accompany all reports made to the POTW. The certification is to be made by the authorized employee or officer of the company.

If you have any questions concerning this permit, the City of Ludington Sewer Ordinance, or any other related matter you can call me at 231-843-3190 or e-mail me at ludwwtp@t-one.net.

Sincerely,

Robert Allard Jr.
Superintendent

PC John Shay, City Manager

Ludington Wastewater Plant
Wastewater Discharge **Permit No. 006** Expiration Date **5/31/2017**

Issued to: Straits Steel & Wire Company
902 North Rowe Street
Ludington, Michigan 49431
231-843-3416

Contact: Mr. Brian Calhoun
Corporate Safety & Environmental
Director

In accordance with all terms and conditions of the Ludington, Michigan Sewer Use Ordinance (SUO), supplement for the Industrial Pretreatment Program, and any applicable provisions of Federal, State and City law or regulation: the above named permittee is hereby authorized to discharge from the groundwater pumping station located between Bryant Rd. and Beachwood Street on the North side of Bryant Road to the Ludington Michigan sewer system at: sewer tap into manhole on Bryant Road between beechwood Street and William Street. Discharges will be in accordance with effluent limitations, monitoring requirements, and all other conditions set forth within this permit.

This permit and authorization to discharge shall expire at midnight, May 31, 2017. In order to receive authorization to discharge beyond the date of expiration the permittee shall submit such information and forms as are required by the City no later than 180 days prior to the date of expiration.

Issued this 1st day of June 2012 for the City of Ludington, Michigan.

Robert Allard Jr.

Wastewater Plant Superintendent

Ludington Wastewater Plant
Wastewater Discharge Permit

Permit No.006 **SSW Holding Company, Inc.**

Permit Conditions

Article VI. Sewer System Discharge Restrictions and Pretreatment Requirements
City of Ludington Sewer Use Ordinance (SUO)

All referenced Articles and Sections are also in EPA 40 CFR 403

1. Article VI Sec. 62-475
   The Public Owned Treatment Works (POTW), will review the permit annually and reserves the right to re-open the permit, and to deny specific discharges as deemed harmful to the POTW.

2. Article VI. Sec. 62-475
   The permit to discharge to the POTW is non-transferable without the written consent of the POTW.

3. Article VI. Sec. 62-474 (9)
   The permit holder shall notify the POTW of any significant change to it's discharge.

4. Article VI. Sec. 62-474 (10)
   The permit holder shall notify the POTW as soon as it becomes aware of any (a) slug load discharge, (b) in the event of a un-contained spill, pretreatment upset, (d) any by-pass of the pretreatment system.

5. Article VI. Sec. 62-4745 2.286 (8)
   The permit holder is required to keep records as explained in the SUO.

6. Article VI. Sec 62-474 (4)
   Upon proper notification and identification the POTW reserves the right to enter, inspect and sample the permitted industry.

7. Article VI. Sec. 62-514 (b)
   The POTW will post in the local newspaper, at least annually, all permitted industrial users who are in significant non-compliance with the POTW as it pertains to violations of sampling requirements, periodic compliance reports and the failure to meet time requirements in submitting reports.

8. Article VI. Sec. 62-4046
   Permit violations are subject to civil and criminal penalties for violation of pretreatment standards, reporting requirements, periodic compliance reporting schedules. Current SUO fines as required by USEPA are $1000.00.

9. Article VI. Sec. 62-438 (a)
   The City shall require to be provided and operated, at the user's expense, monitoring facilities to allow the inspection, sampling and flow measurement of the building sewer or internal drainage systems.

Ludington Wastewater Plant
Wastewater Discharge Permit

Permit No.006 **SSW Holding Company, Inc.**

Part I: **Effluent limitations and monitoring requirements**

During the period beginning June 1, 2012 and lasting until May 31, 2017 effluent from the discharge from outfall 001, at sewer manhole on Bryant Rd between Beachwood and William St., shall be limited and monitored by the permittee as specified below.

(All sampling will be performed during normal plant operations)

Outfall 001

Effluent Characteristics	Discharge limitations Daily maximum	Monitoring Requirements Frequency	Sample	Location (1)
Total Cyainde	0.65 mg/l	Quarterly	composite	

All required analysis are per 40CFR Part 136

Ludington Wastewater Plant
Wastewater Discharge Permit

Permit No. 006 **SSW Holding Co. Inc.**

Part II: Schedule of Compliance

1. The permittee shall achieve compliance with the effluent limitations specified for contaminated groundwater cleanup in accordance with all parameters listed on page 3 of this permit.
2. Permittee shall mail to the POTW superintendent a copy of all required sampling within 30 days of receipt of analysis from their lab provider.
3. Permittee shall notify the POTW within 24 hours of identifying a violation and resample (and provide the results) within 30 days of the known violation. 40CFR403.12(g) (2)
4. All compliance monitoring reports shall contain a Statement of Certification as contained in 40CFR 403.8 (f), (I)(iii), (d)&403.12 (e)(g)(h)(I)(n). A copy of which in enclosed (page 5). The permittee's authorized representative must sign certification Statement.
5. Sampling Schedule:

   Sampling will be quarterly (four times per year, once each consecutive quarter) and continue until May 31, 2017

6. Permittee shall submit to the POTW periodic reports each quarter reporting the nature of the discharge including chemical analysis, and volumes of discharge in gallons for outfall 001.

Ludington Wastewater Plant
Wastewater Discharge Permit

Permit 006 **SSW Holdings Co. Inc.**

CERTIFICATION STATEMENT

The following certification statement must be signed by the industry representative and accompany any and all reports filed.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Permit No.006 SSW Holdings Company Inc.

General prohibitions.

(a) No user shall contribute or cause to be contributed, directly or indirectly, any pollutant or wastewater which will interfere with the operation or performance of the POTW. These general prohibitions apply to all such users of a POTW whether or not the user is subject to national categorical pretreatment standards or any other national, state or local pretreatment standards or requirements. A user may not contribute the following substances to any POTW:

(1) Any liquids, solids or gases which, because of their nature or quantity, are or may be sufficient, either alone or by interaction with other substances, to cause fire or explosion or be injurious in any other way to the POTW or to the operation of the POTW. At no time shall any single reading on an explosion hazards meter at the point of discharge into the system or at any point in the system be more than 20 percent of the lower explosive limit (LEL) of the meter. Prohibited materials include but are not limited to gasoline, kerosene, naphtha, benzene, toluene, xylene, ethers, alcohols, ketones, aldehydes, peroxides, chlorates, perchlorates, bromates, carbides, hydrides and sulfides, and any other substance which is a fire hazard or a hazard to the system.

(2) Solid or viscous substances which may cause obstruction to the flow in a sewer or other interference with the operation of the wastewater treatment facilities, such as but not limited to grease, garbage with particles greater than one-half inch in any dimension, animal guts or tissues, paunch manure, bones, hair, hides or fleshings, entrails, whole blood, feathers, ashes, cinders, sand, spent lime, stone or marble dust, metal, glass, straw, shavings, grass clippings, rags, spent grains, spent hops, wastepaper, wood, plastics, gas, tar, asphalt residues, residues from refining or processing of fuel or lubricating oil, mud, or glass grinding or polishing wastes.

(3) Any wastewater having a pH less than 5.5 or greater than 9.5, or wastewater having any other corrosive property capable of causing damage or hazard to structures, equipment and/or personnel of the POTW.

(4) Any wastewater containing toxic pollutants in sufficient quantity, either singly or by interaction with other pollutants, to injure or interfere with any wastewater treatment process, constitute a hazard to humans or animals, create a toxic effect in the receiving waters of the POTW, or to exceed the limitation set forth in a categorical pretreatment standard. A toxic pollutant shall include but not be limited to any pollutant identified pursuant to section 307(a) of the act.

(5) Any noxious or malodorous liquids, gases or solids which, either singly or by interaction with other wastes, are sufficient to create a public nuisance or hazard to life or are sufficient to prevent entry into the sewers for maintenance and repair.

(6) Any substance which may cause the POTW's effluent or any other product of the POTW, such as residues, sludges or scums, to be unsuitable for reclamation and reuse or to interfere with the reclamation process. In no case shall a substance discharged to the POTW cause the POTW to be in noncompliance with sludge use or disposal criteria,

guidelines or regulations developed under section 405 of the act, any criteria, guidelines or regulations affecting sludge use or disposal developed pursuant to the Solid Waste Disposal Act, the Clean Air Act, the Toxic Substances Control Act, or state criteria applicable to the sludge management method being used.

(7) Any substance which will cause the POTW to violate its NPDES and/or state disposal system permit or the receiving water quality standards.

(8) Any wastewater with objectionable color not removed in the treatment process, such as but not limited to dye wastes and vegetable tanning solutions.

(9) Any wastewater having a temperature which will inhibit biological activity in the POTW treatment plant resulting in interference, but in no case wastewater with a temperature at the introduction into the POTW which causes the treatment plant influent to exceed 104 degrees Fahrenheit.

(10) Any pollutants, including oxygen demanding pollutants (BOD, etc.) released at a flow rate or pollutant concentration that a user knows or has reason to know will cause interference to the POTW. In no case shall a slug load have a flow rate or contain concentration or qualities of pollutants that exceed, for any time period longer than 15 minutes, more than five times the user's average 24-hour concentration, quantities or flow during normal operation.

(11) Any wastewater containing any radioactive wastes or isotopes of such half-life or concentration as may exceed limits established by the superintendent in compliance with applicable state or federal regulations.

(12) Any wastewater which causes a hazard to human life or creates a public nuisance.
(b) When the superintendent determines that a user is contributing to the POTW any of the substances enumerated in subsection (a) of this section in such amounts as to interfere with the operation of the POTW, the superintendent shall:
(1) Advise the user of the impact of the contribution on the POTW; and

(2) Develop effluent limitations for such user to correct the interference with the POTW.

APPENDIX 5
FIELD SAMPLING FORMS

Monitoring Well Sample Collection Form

BB&E

LOCATION	Site: SSW Ludington	Sample ID:	Date:
	Project:	Project#:	Recorded by:
	Weather Conditions:		

EQUIPMENT	Well ID:	Water Level Indicator:	PID Type/ID#:
	Unit#:	Sampling Equipment:	Equipment Decon:

WELL INFO	Casing ID (in) [a]:	Immiscible Layer: Yes No	Initial Depth to Water (ft) [c]:
	Total Well Depth (ft):	Water Column Thickness (ft) [d-c]:	Well Volume (gal {[d-c] x b}:
	Ambient PID (ppm):	Well Mouth PID (ppm):	Condition of Well:
	Depth of Pump Intake (ft):	Water in Well Vault?	Total Volume Purged:
	Remarks:		

CASING INFO	Casing ID (in) [a]:	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
	Unit Casing Volume (gal/lin ft) [b]:	0.09	0.16	0.20	0.37	0.65	0.75	1.0	1.5	2.0	2.6

Date	Time (24 hr)	Water Level (FTOC)	Pumping Rate (mLpm)	Temp (C)	pH	Cond mS/cm	DO (mg/L)	Turb (NTU)	ORP (mv)	Remarks (odor, clarity, etc)

Pump Rate: <=0.5 L/min Drawdown: <0.33 ft Measurements: 3-5 min Stabilization: +/-3% Spec. Cond, +/-0.1 pH, +/-3% Temp., +/-10% DO (or +/-0.3 mg/L if < 1), ,+/-10 mV Eh, +/-10% Tub or < 20 NTU, for 3 consecutive readings or 45 minutes

Time(s)/Colorimeter Result(s)	# Containers/Volume/Type	Preserv.	Filter (Y/N)	Pump OR Bailer	Parameter(s)
	1 – 250 cc plastic	NA	Y	Pump	CrVI
	1 –250 cc amber glass	NaOH	Y	Pump	Available Cyanide

LOCATION	Site:	Sample ID:	Date:

Date	Time (24 hr)	Water Level (FTOC)	Volume Removed (lt)	Pumping Rate (Lpm)	Temp (C)	pH	Cond mS/cm	DO (mg/L)	Turb (NTU)	ORP (mv)	Remarks (odor, clarity, etc)

MONITOR WELL STATIC WATER LEVEL FORM

PROJECT NAME: Ludington SSW Quarterly YEAR GW Sampling DATE:___/___/___

WATER LEVEL INDICATOR ID # _____

LOCATION: __Ludington SSW_____ **PAGE # _1_OF_2**

Monitor Well Number	Date	Well Screen Length	Total Well Depth	Depth to Static Water Level	Comments
MW-44					
MW-61					
PW-1					
MW-59					
MW-306					
MW-304					
MW-58					
MW-57					
MW-56					
MW-54s					
PW-1					
MW-300					
MW-38					
MW-32					
MW-28					
MW-25					
MW-49					
MW-24					
MW-4R2					
MW-8					
MW-108					
MW-36					
MW-55					
MW-109S					
MW-109M					
MW-109D					
MW-110S					
MW-110M					
MW-110D					

MONITOR WELL STATIC WATER LEVEL FORM

PROJECT NAME: Ludington SSW Quarterly YEAR GW Sampling DATE:___/___/___

WATER LEVEL INDICATOR ID # _____

LOCATION: __Ludington SSW_____ **PAGE # _2_OF_2**

MW-111S					
MW-111M					
MW-111D					
MW-112					
MW-113					
MW-114					
MW-115					

Comments: _____

_____

_____

Sampler _____ Observer _____