

SUPPLEMENTAL WORK PLAN

**General Motors Corporation
Grand Rapids Metal Plant
Wyoming, Michigan**

**MARCH 2004
REF. NO. 17360 (8)**

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LIST OF ACRONYMS

COC	Chain of Custody
CRA	Conestoga-Rovers & Associates
DO	Dissolved Oxygen
DOT	Department of Transportation
GM	General Motors Corporation
HSA	Hollow Stem Auger
MDEQ	Michigan Department of Environmental Quality
ORP	Oxidation-Reduction Potential
PID	Photoionization Detector
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCI	Reactivity, Corrosively, and Ignitability
SOW	Scope of Work
SVE	Soil Vapor Extraction
SVOCs	Semi-Volatile Organic Compounds
TAT	Turn-Around-Time
TCLP	Toxicity Characteristic Leaching Procedure
TCL	Target Compound List
TOC	Total Organic Carbon
VAS	Vertical Aquifer Sampling
VOCs	Volatile Organic Compounds
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

This Supplemental Work Plan describes the Scope of Work (SOW) that is planned to be performed during the collection and analysis of groundwater and soil samples during the supplemental investigation conducted at the General Motors Corporation (GM) Grand Rapids Metal Plant located at 300 36th Street in Wyoming, Michigan (Site). Figure 1.1 presents the Site location.

1.1 SITE BACKGROUND

The Site background is presented in the Work Plan and the Data Report submitted to the Michigan Department of Environmental Quality (MDEQ) under separate cover on November 24, 2002 and March 2, 2004, respectively. A Site plan is presented on Plan 1.

1.2 PURPOSE OF SUPPLEMENTAL WORK PLAN

The purpose of this Supplemental Work Plan is to outline the activities planned to further evaluate and delineate chlorinated compound impacts to groundwater above the Michigan Act 451, Part 201 Residential Cleanup Criteria; to confirm and evaluate conditions relative to other potentially relevant exposure pathways; to further define hydrogeologic conditions at the Site; and evaluate and delineate current source area conditions in soil.

2.0 CURRENT CONDITIONS

2.1 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination is presented in the Work Plan and the Data Report submitted to the MDEQ under separate cover on November 24, 2002 and March 2, 2004, respectively. Plan 2 presents a summary of select Target Compound List (TCL) volatile organic compounds (VOCs) in groundwater at the Site, including the results from the June, September, and December 2003 Quarterly Groundwater monitoring events. The TCL VOCs were selected for reporting because they were detected in previous rounds of groundwater sampling and remain on the list as the chemicals of concern.

2.2 SITE GEOLOGY AND HYDROGEOLOGY

Information regarding the geologic conditions at the Site was collected during previous environmental investigations. Site geology and hydrogeology are presented in the Work Plan and the Data Report previously submitted to the MDEQ under separate cover on November 24, 2002 and March 2, 2004, respectively.

3.0 SCOPE OF WORK

The SOW for this Supplemental Work Plan includes the installation of 14 soil borings and 9 monitoring wells, and the collection and analysis of approximately 109 groundwater samples and 58 soil samples, including QA/QC samples. The investigation fieldwork will adhere to the methods and procedures specified in this Supplemental Work Plan and applicable Quality Assurance Project Plan (QAPP). The QAPP is presented under separate cover as Appendix A of the Work Plan dated November 2002, which was submitted to the MDEQ.

3.1 SOIL BORING AND MONITORING WELL INSTALLATION

Proposed monitoring well and soil boring locations for this Supplemental Work Plan are presented on Plans 3 and 4, and Figure 3.1, respectively. Soil borings and monitoring wells will be installed as outlined below.

3.1.1 SOIL BORING INSTALLATION/VERTICAL AQUIFER SAMPLING

Nine soil borings, HP8-04 through HP16-04, will be advanced at the Site during the implementation of this Supplemental Work Plan for vertical aquifer sampling and monitoring well placement.

Six of the borings, HP8-04 through HP13-04 will be installed downgradient of the former degreaser location to further delineate the extent of the chlorinated compound contamination. One soil boring, HP14-04 will be installed to the north of monitoring well 87-5 to further evaluate vinyl chloride contamination in groundwater. Two soil borings, HP15-04 and HP16-04, will be installed to the northwest and west of the plant, respectively to further define chlorinated compound contamination in groundwater and confirm conditions relative to local surface water.

Soil borings shall be advanced at the designated locations using a rotary drill rig equipped with a 4 ¼-inch inside diameter hollow stem auger (HSA). Concrete coring of approximately 10 to 12-inch thick concrete will be performed within the plant, as necessary. Concrete will be patched after completion of drilling activities.

Soil samples will be collected continuously using 2-foot long, 2-inch outside diameter split spoon samplers at each location, as presented in Section 4.1. Soil samples will be collected from the borings in accordance with the Standard Penetration Test Method,

ASTM D1586 and as presented in Section 4.1. The split spoon samples will be examined by a CRA geologist for visual/olfactory evidence of impact and screened with a photoionization detector (PID). If visual/olfactory evidence of impact or high PID readings are observed, at the discretion of CRA field personnel, soil samples will be collected and submitted to the laboratory for chemical analysis. Additionally, discrete groundwater samples will be collected from each soil boring utilizing vertical aquifer sampling (VAS) via a hydropunch, as presented in Section 4.2.

Soil cuttings will be screened with an 11.7 eV bulb PID and examined for visual/olfactory indication of contamination. All soil cuttings will be containerized in Department of Transportation (DOT) approved 55-gallon drums and labeled for future characterization.

Upon completion of discrete groundwater sample collection, each borehole will be abandoned. All soil borings will be abandoned using the tremie-method to backfill the borehole annulus with a high solids bentonite grout to ground surface.

3.1.2 MONITORING WELL INSTALLATION

Nine monitoring wells, MW8-04 through MW16-04, will be installed at the Site during the implementation of this Supplemental Work Plan.

Monitoring wells will be installed utilizing a 4 ¼-inch HSA adjacent to the locations of soil borings HP8-04 through HP16-04. Split spoon samples will not be collected during monitoring well installation. Monitoring wells will be installed adjacent to the soil borings and it can be assumed that the stratigraphy will be the same as that of the monitoring wells. A split spoon sample will be collected upon reaching depth during the installation of each monitoring well to confirm that the geology is the same.

Soil cuttings will be screened with an 11.7 eV bulb PID and examined for visual/olfactory indication of contamination. All soil cuttings will be containerized in DOT approved 55-gallon drums and labeled for future characterization.

Monitoring wells will be constructed using Schedule 40 polyvinyl chloride (PVC) risers and 5-foot long, 0.01-inch slot Schedule 40 PVC screen through the augers as a 2-inch diameter installation. During completion of the installation, the riser pipe shall be temporarily capped to prevent entrance of foreign materials during overburden monitoring well installation. The screen and casing will be joined utilizing flush threaded joints. The depths of the monitoring well screens will be determined based on

the analytical results from the VAS. Monitoring well screens will be set at the interval identified during the VAS sampling to exhibit the highest concentrations of the chemicals of concern. If no chemicals of concern are identified during the VAS, the monitoring well will be set to straddle the water table to further evaluate the groundwater flow regime across the Site.

An inert silica sandpack will be placed to a height of three vertical feet above the top of the screen using a flush-threaded 1-inch diameter tremie pipe as the augers are withdrawn from the borehole. If bridging of the silica sand occurs, the bridged material will be mechanically broken prior to the addition of more silica sand.

The remainder of the annulus will be filled with a high solids bentonite grout using a flush-threaded 1-inch diameter tremie pipe to within two feet of the ground surface. The grout will be set in one continuous operation with the entire amount placed before the initial set occurs. Once the grout has set, the remaining portion of the unfilled annulus will be filled with concrete and a flushmount protective surface casing will be installed at each well. The protective flushmounted casing will be centered over the riser and extend into the concrete collar 1-foot. The riser pipe will be capped with an expandable locking cap. Locks will be installed with one set of keys kept at the Site and one set kept by CRA.

Each monitoring well will be clearly labeled with a unique identification number. The number will be located on the well protector in an area where the number is protected from possible tampering.

The stratigraphic boring logs from newly installed monitoring wells will be used in conjunction with the stratigraphic boring logs from previous drilling activities to supplement previous data to further determine geologic conditions across the extent of the identified impacted areas.

3.1.3 MONITORING WELL DEVELOPMENT

Groundwater level measurements and corresponding bottom depths will be recorded for MW8-04 through MW16-04. The well volumes of MW8-04 through MW16-04 will be calculated and each well will be developed by surging the well with a stainless steel bailer for a minimum of five minutes and then purged with a submersible pump. Each well will be developed by removing a minimum of five well volumes until groundwater is developed to a silt-free condition, if possible, and the turbidity, pH, temperature, and conductivity of the groundwater have stabilized.

All generated development water will be visually examined and screened with a PID. Purge and development groundwater will be containerized in DOT approved 55-gallon drums and labeled for future characterization.

3.1.4 SOIL BORING INSTALLATION

Five soil borings, SB1-04 through SB5-04, will be advanced at the Site during the implementation of this Supplemental Work Plan to define current soil conditions at the historic VOC release area.

The five soil borings, SB1-04 though SB5-04, will be installed in the area surrounding air purge well 87-3, associated with the former SVE treatment system to vertically and horizontally determine the concentrations of chlorinated compounds in the vadose, or unsaturated zone.

Soil borings shall be advanced at the designated locations using a rotary drill rig equipped with a 4 ¼-inch inside diameter HSA drill rig. Concrete coring of approximately 10 to 12-inch thick concrete will be performed, as necessary. PID readings will be collected upon removal of concrete. Concrete will be patched after completion of drilling activities.

Soil samples will be collected continuously using split spoon samplers (or equivalent) at each location, as presented in Sections 3.1.1 and 4.1. Soil samples will be collected for laboratory analysis in two-foot intervals to define the vertical extent of impact.

Soil cuttings will be screened with an 11.7 eV bulb PID and examined for visual/olfactory indication of contamination. All soil cuttings will be containerized in DOT approved 55-gallon drums and labeled for future characterization.

Upon completion of soil sample collection, each borehole will be abandoned. All soil borings will be abandoned using the tremie-method to backfill the borehole annulus with a high solids bentonite grout to ground surface.

3.1.5 SVE SYSTEM WELL ABANDONMENT

The soil vapor extraction system (SVE) air extraction well and associated below grade pressure equipment will be properly abandoned after installation of soil borings SB1-04

through SB5-04. Additionally, all other equipment associated with the SVE system will be decommissioned, dismantled, and removed.

The air extraction well system consists of one 4-inch galvanized extraction well and four ½-inch pressure monitoring wells. Wells will be abandoned by either in place pressure grouting or overdrilling, based on available space and access in the plant. A CRA geologist will preform an on-Site survey of the SVE system, before well abandonment commences.

3.1.6 SURVEYING

A survey of the Site will be completed for all new soil boring and monitoring well locations. Soil boring locations and monitoring well locations and elevations will be surveyed, with elevations to the nearest 0.01-foot. These elevations will be referenced to a designated above mean sea level benchmark. Monitoring well elevations will be used to determine groundwater elevations, which will be used to develop Site groundwater contours, flow direction, and flow velocities.

3.1.7 DECONTAMINATION

Upon mobilization to the Site and prior to drilling commencement, the drill rig and all associated equipment will be thoroughly cleaned using a high pressure, low volume steam wash and inspected. Before initiating drilling at each subsequent location, the augers, drill rod, and other associated equipment will be decontaminated to prevent cross-contamination. Decontamination of sampling equipment is presented in Section 4.5.

All generated decontamination water will be visually examined and screened with a PID. All decontamination water will be containerized in DOT approved 55-gallon drums and labeled as to where it was generated and the initial accumulation date.

4.0 SAMPLING PROCEDURES

Proposed sample locations are presented on Plans 3 and 4, and Figure 3.1. All sampling will be performed in accordance with the procedures outlined below.

4.1 SOIL SAMPLE COLLECTION

Soil samples will be collected continuously utilizing 2-foot long, 2-inch diameter split spoon samplers from soil borings HP8-04 through HP16-04. Split spoon samples will be examined by a CRA geologist for visual/olfactory evidence of impact and screened with a PID meter. If visual/olfactory evidence of impact or high PID meter readings are observed, at the discretion of CRA field personnel, soil samples will be collected and submitted to the laboratory for chemical analysis.

Soil samples will be collected from soil borings SB1-04 through SB5-04, as described above. Soil samples will be collected at two-foot intervals until the water table is encountered. One soil sample will be collected for chemical analysis from each interval. Approximately 58 soil samples, including QA/QC samples, will be collected and analyzed for TCL VOCs on a standard turnaround time. Table 3.1 presents the Sampling and Analysis Plan.

4.2 DISCRETE GROUNDWATER SAMPLE COLLECTION

VAS will be conducted at HP8-04 through HP16-04 at 10-foot intervals beginning at the water table and continuing until the clay confining layer is encountered. Fifteen-foot intervals may be utilized at the discretion of the CRA field geologist, dependent upon conditions encountered in the field.

A 5-foot long, 2-inch diameter stainless steel hydropunch sampler with a 0.01-inch slotted screen and a well point will be driven through the undisturbed material through a 4 1/4-inch HSA. The well point will detach from the hydropunch sampler at the correct sample depth and groundwater will flow into, and fill the hydropunch sampler. The amount of time required to fill the hydropunch is dependent upon many factors including type of media (e.g., sand vs. clay) and depth below ground surface (i.e., increasing water pressure with increasing depth).

After sufficient time to fill the hydropunch sampler has passed, the sampler will be removed from the soil boring, the screen broken off, and the discrete groundwater sample will be collected from the sampler.

Approximately 56 discrete groundwater samples, including QA/QC samples, will be collected and analyzed for TCL VOCs on a 48-hour turnaround time. Table 3.1 presents the Sampling and Analysis Plan.

Discrete groundwater samples will be placed into pre-cleaned laboratory provided containers, labeled, and submitted to the laboratory under chain-of-custody (COC) protocol.

4.3 GROUNDWATER SAMPLE COLLECTION

One groundwater sample will be collected from each of the newly installed monitoring wells and from all existing monitoring wells, as presented in Table 4.1.

Low-flow groundwater purging and sampling methods will be used to sample the monitoring wells listed, excluding purge wells PWDSCH and 86-2, which are sampled through a valve located on the side of the purge well pipe.

Groundwater samples will be collected after low-flow purging indicates that the field parameters have stabilized. Field parameters will consist of pH, specific conductance, temperature, dissolved oxygen (DO), oxidation-reduction potential (ORP), and turbidity. Stabilization will be considered according to the tolerances listed below:

- pH = ± 0.1 s.u. of the average of three consecutive readings;
- Specific Conductance = ± 0.005 milliSiemen per centimeter (mS/cm) of the average of three consecutive readings less than 1 μ mhos/cm, and ± 0.010 mS/cm of the average of three consecutive readings for greater than 1 mS/cm;
- Temperature = ± 3 percent of the average of three consecutive readings;
- DO = $\pm 10\%$ of the average of three consecutive readings;
- ORP = ± 10 millivolts of the average of three consecutive readings; and
- Turbidity = < 5 NTU.

Fifty-three groundwater samples, including QA/QC samples, will be collected and analyzed for TCL VOCs and select natural attenuation parameters (total organic carbon (TOC), nitrate, nitrite, manganese, sulfate, sulfide, methane, alkalinity, calcium, carbonate hardness, hardness, magnesium, chloride, ethane, and ethene) on a 2-week turn-around-time (TAT). In addition, groundwater samples will be collected from monitoring wells 85-3, 85-5B, 85-6, and 86-1 and analyzed for TCL semi-volatile organic compounds (SVOCs) on a 2-week TAT. Table 3.1 presents the Sampling and Analysis Plan.

Groundwater samples will be placed into a pre-cleaned laboratory-provided container, properly labeled, and submitted under proper COC protocol to the laboratory.

4.4 DECONTAMINATION

All non-disposable sampling equipment will be decontaminated prior to each use by using an Alconox wash, potable water rinse, followed by a deionized water rinse and allowed to air dry. This includes split spoon samplers, the hydropunch, hand sampling tools, bailers, etc.

All generated decontamination water will be visually examined and screened with a PID. All decontamination water will be containerized in DOT approved 55-gallon drums and labeled as to where it was generated and the initial accumulation date.

4.5 WASTE CHARACTERIZATION

All generated soil cuttings and decontamination/development water will be visually examined and screened with a PID. All generated soil cuttings and decontamination/development water will be containerized in DOT approved 55-gallon drums and labeled as to where it was generated and the initial accumulation date.

Drum contents will be segregated, based on evidence of impact observed during field screening activities. Two soil waste characterization samples will be collected from the drums and analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, TCLP VOCs, TCLP SVOCs, reactivity, corrosivity, and ignitability (RCI), and total VOCs on a 2-week TAT for off-Site disposal. Table 3.1 presents the Sampling and Analysis Plan.

Based on the analytical results from the VAS, decontamination/development water will be discharged to the on-Site wastewater treatment plant (WWTP) or properly disposed of off-Site.

5.0 ANALYTICAL PROTOCOLS

Groundwater samples will be analyzed for TCL VOCs, TCL SVOCs, and/or natural attenuation parameters, and soil samples will be analyzed for TCL VOCs, as presented in the SOW and on Table 3.1. All samples will be analyzed using the United States Environmental Protection Agency approved methods set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, 3rd Edition and Promulgated Update, November 1986. Quality Control/Quality Assurance samples will be collected for data and sample quality assessment in accordance with the QAPP. The QAPP is presented in Appendix A of the Work Plan dated November 2002, which was submitted to the MDED.

Following receipt of final analytical data, a data quality assessment and validation will be prepared by a CRA chemist, in accordance with the QAPP presented in Appendix A of the Work Plan dated November 2002, which was submitted to the MDED.

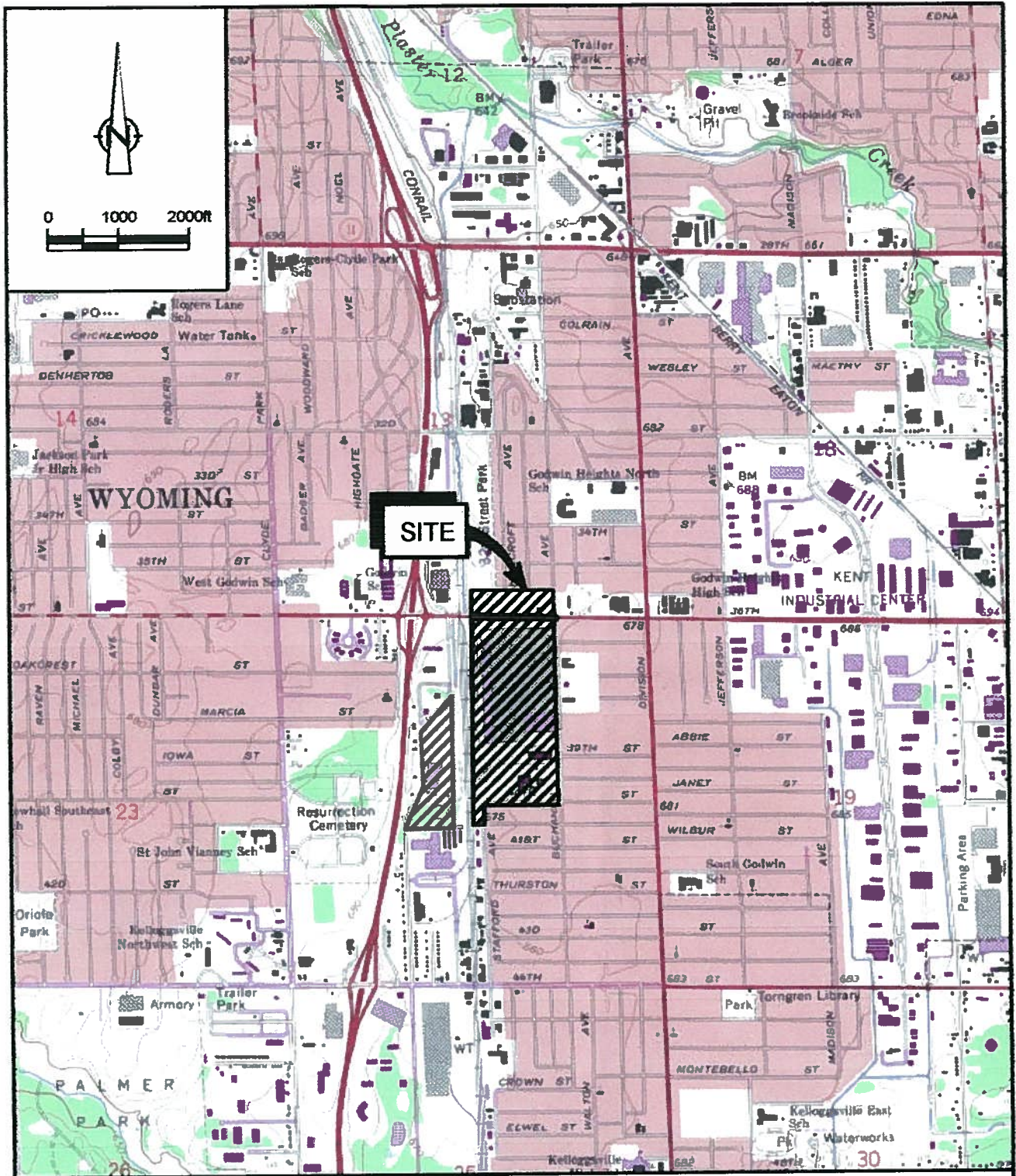
6.0 REPORTING

Upon completion of the field activities, receipt of final analytical results, and data quality assessment and validation, a report summarizing the results will be generated.

7.0 SCHEDULE

Access agreements for off-Site locations will be negotiated with off-Site property owners. It is anticipated that field activities will be initiated in June 2004, dependent upon weather conditions and procurement of access to off-Site locations. A generalized proposed schedule for the implementation of the field activities and reporting is presented below. A more detailed schedule will be provided upon verification of start date.

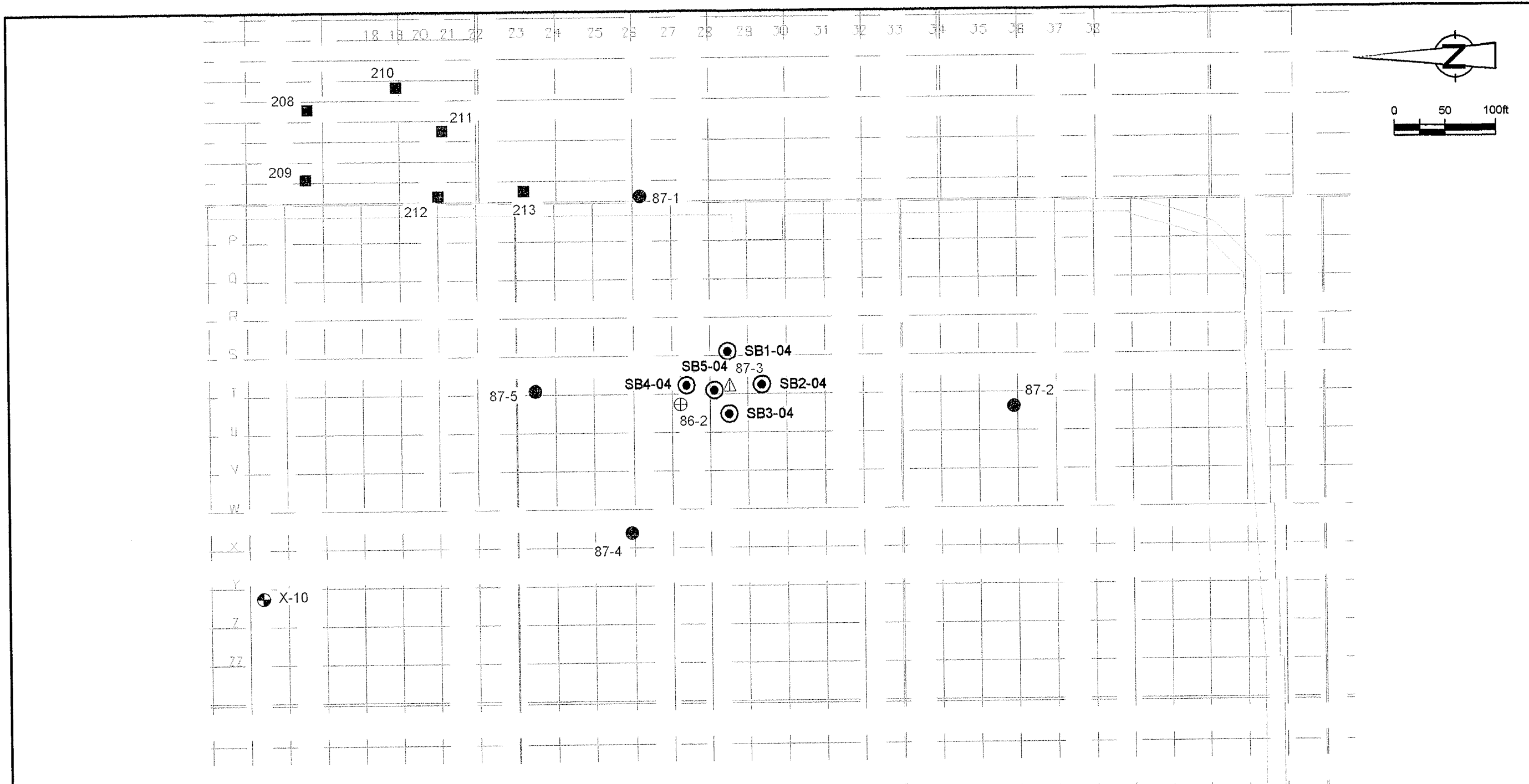
- Completion of Field Activities - Approximately 5 to 7 weeks from mobilization to the Site; and
- Submittal of Data Report - Approximately 13 to 15 weeks from completion of field activities.



SOURCE: USGS QUADRANGLE MAP;
GRAND RAPIDS WEST, MICHIGAN



figure 1.1
SITE LOCATION
GRAND RAPIDS METAL PLANT
Wyoming, Michigan



- LEGEND**
- 87-2 MONITORING WELL LOCATION
 - ⊕ 86-2 PURGE WELL LOCATION
 - 207 SOIL BORING LOCATION
 - ⊖ X-10 DESTROYED/REMOVED MONITORING WELL LOCATION
 - △ C-2 CULVERT LOCATION
 - ▲ 87-3 AIR PURGE WELL
 - ⊙ SB2-04 PROPOSED SOIL BORING LOCATIONS

SOURCE: EDI ENGINEERING & SCIENCE,
 JUNE 1987 AND JUNE 1988
 AND EARTH TECH, SEPTEMBER 2001.

figure 3.1

**PROPOSED SOIL BORING LOCATIONS
 GRAND RAPIDS METAL PLANT
 Wyoming, Michigan**



TABLE 3.1
 SAMPLING AND ANALYSIS PLAN
 SUPPLEMENTAL WORK PLAN NO. 1
 GENERAL MOTORS CORPORATION
 GRAND RAPIDS METAL PLANT
 WYOMING, MICHIGAN

<i>Proposed Investigation Activity</i>	<i>Reason for Activity</i>	<i>Quantity of Sample Locations</i>	<i>Quantity of Samples</i>	<i>Sample Matrix</i>	<i>Sample Interval</i>	<i>Analysis</i>
Vertical Aquifer Sampling	Vertical/horizontal delineation	9	56 ⁽¹⁾	groundwater	discrete vertical intervals of the water bearing unit	TCL VOCs
Collection of Groundwater Samples	Vertical/horizontal delineation	39	53 ⁽¹⁾	groundwater	--	TCL VOCs and Natural Attenuation Parameters
Collection of Soil Samples	Vertical/horizontal delineation	4	5 ⁽¹⁾	groundwater	--	TCL SVOCs
Collection of waste characterization samples	Disposal	5	58 ⁽¹⁾	soil	vertical intervals of 2 feet	TCL VOCs
		2 ⁽²⁾	2 ⁽²⁾	soil	--	TCLP metals, VOCs, SVOCs, RCI, total VOCs
		2 ⁽²⁾	2 ⁽²⁾	wastewater	--	TCLP metals, VOCs, SVOCs, RCI, total VOCs

Notes:

- (1) Number of samples includes Quality Assurance/Quality Control samples.
- (2) Number of samples to be determined in the field.
- TCL - Target Compound List
- VOCs - Volatile Organic Compounds
- TCLP - Toxicity Characteristic Leaching Procedure
- SVOCs - Semi-volatile Organic Compounds
- RCI - Reactivity, Corrosivity, and Ignitability

TABLE 4.1

MONITORING WELLS TO BE SAMPLED
SUPPLEMENTAL WORK PLAN NO. 1
GENERAL MOTORS CORPORATION
GRAND RAPIDS METAL PLANT
WYOMING, MICHIGAN

Monitoring Well Identification Number

85-1
85-2
85-3
85-5B
85-6
85-7
86-1
86-2
86-3
87-1
87-2
87-4
87-5
87-8
87-9
87-10
87-11
87-13
88-2
88-3
88-4
93-1
PWDISCH
MW1-03
MW2-03
MW3-03
MW4-03
MW5-03
MW6-03
MW7-03
MW8-04
MW9-04
MW10-04
MW11-04
MW12-04
MW13-04
MW14-04
MW15-04
MW16-04

