2005 INVESTIGATION WORK PLAN

GENERAL MOTORS CORPORATION
GRAND RAPIDS METAL PLANT
WYOMING, MICHIGAN

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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

The purpose of this 2005 Investigation Work Plan (Work Plan) is to present the protocol to be used for the implementation of the installation of soil borings and monitoring wells, and the collection and analysis of soil and groundwater samples 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 Figure 1.2.

1.2 PURPOSE OF 2005 INVESTIGATION WORK PLAN

The purpose of this Work Plan is to outline the activities proposed to further evaluate and delineate chlorinated compound impacts to groundwater above the Michigan Act 451, Part 201 Residential Cleanup Criteria, to further define hydrogeologic conditions at the Site, and evaluate current conditions in source area soil.

2.0 CURRENT CONDITIONS

2.1 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination is presented in the 2004 Data Report submitted to the MDEQ under separate cover on December 15, 2004. Additionally, quarterly sampling is conducted at the Site and the results are provided in individual reports submitted to the MDEQ under separate cover on a quarterly basis. Quarterly sampling for 2005 will be conducted consistent with the scope of work presented in the 2005 Quarterly Groundwater Monitoring Work Plan submitted to the MDEQ under separate cover on April 12, 2005. Target compound list (TCL) volatile organic compounds (VOCs) and TCL semi-volatile organic compounds (SVOCs) were selected for investigation and 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 2004 Data Report submitted to the MDEQ under separate cover on December 15, 2004.

3.0 SCOPE OF WORK

The SOW for this Work Plan includes the advancement of ten soil borings and the installation of two monitoring wells, and the collection and analysis of approximately eight groundwater samples and ninety soil samples, including QA/QC samples. The investigation fieldwork will adhere to the methods and procedures specified in this Work Plan and applicable Quality Assurance Project Plan (QAPP), with the exception of the soil samples, which will be collected consistent with the requirements set forth in the MDEQ Remediation and Redevelopment Division (RRD) Operational Memorandum No. 2 (October 22, 2004). 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 soil boring and monitoring well locations to further evaluate and delineate chlorinated compound impacts to groundwater above the Michigan Act 451, Part 201 Residential Cleanup Criteria and to further define hydrogeologic conditions at the Site are presented on Figure 3.1. Proposed soil boring locations to evaluate current conditions in source area soil are presented on Figure 3.2. Soil borings and monitoring wells will be installed as outlined below.

3.1.1 SOIL BORING INSTALLATION/VERTICAL AQUIFER SAMPLING

One soil boring, HP17-05, will be advanced on the west side of Cole Drain across from MW11-04 to evaluate potential chlorinated compound contamination in groundwater west of Cole Drain and confirm groundwater flow conditions relative to the Cole Drain.

The soil boring will be advanced at the designated location using a rotary drill rig equipped with a 4 ¼-inch inside diameter hollow stem auger (HSA).

Soil samples will be collected continuously using 2-foot long, 2-inch outside diameter split spoon samplers at HP17-05 during installation of the soil boring, 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 the 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, the 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

Two monitoring wells, MW11S-05 and MW17-05, will be installed to evaluate potential chlorinated compound contamination in groundwater adjacent to Cole Drain and confirm groundwater flow conditions relative to the Cole Drain.

The monitoring wells will be installed utilizing a 4 ¼-inch HSA. MW11S-05 will be installed adjacent to MW11-04 and MW17-05 will be installed directly across the Cole Drain. Split spoon samples will not be collected from MW11S-05 during monitoring well installation as the monitoring well will be installed adjacent to MW11-04 and it can be assumed that the stratigraphy will be the same as that of the MW11-04. Additionally, split spoon samples will not be collected from MW17-05 during monitoring well installation as the monitoring well will be installed adjacent to HP17-05 and it can be assumed that the stratigraphy will be the same as that of the HP17-05. A split spoon sample will be collected upon reaching depth during the installation of MW11-05 and MW17-05 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 depth of monitoring well MW11S-05 screen will be set to straddle the water table to further evaluate the vertical and horizontal groundwater flow regime adjacent to the Cole Drain. MW17-05 will be installed at a depth consistent with the maximum detected levels of VOCs during the VAS. If there are no VOCs detected during the VAS, the screen will be set to straddle the water table to further evaluate the groundwater flow regime adjacent to the Cole Drain.

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 the 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.

The 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 the 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 adjacent to the Cole Drain.

3.1.3 MONITORING WELL DEVELOPMENT

Groundwater level measurement and corresponding bottom depth will be recorded for MW11S-05 and MW17-05. The well volumes will be calculated and the wells will be developed by surging the wells with a stainless steel bailer for a minimum of five minutes and then purged with a submersible pump. The wells 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

Nine soil borings, SB6-05 through SB14-05, will be advanced at the Site within the plant to define the current soil conditions at the historic VOC release area. The soil borings will be installed in the area surrounding former air purge well 87-3, associated with the former soil vapor extraction (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 or a direct push Geoprobe, dependent upon Site conditions encountered. 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 determine VOC concentrations at multiple depths in the historic source area. If direct push methods are utilized, soil samples will be collected utilizing 4-foot long disposal polyethylene liners and a dual-tube system.

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 SURVEYING

A survey of the Site will be completed for all new soil borings, the VAS location, 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.

3.1.6 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 Figures 3.1 and Figure 3.2. 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 boring HP17-05. 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 SB6-04 through SB14-04, as described in Section 3.1.4. Soil samples will be collected at 2-foot or 4-foot intervals until the water table is encountered. One soil sample will be collected for chemical analysis from each interval. Approximately 90 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 HP17-05 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 ¼-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 groundsurface (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 eight 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

Groundwater samples will be collected and analyzed as directed by the 2005 Groundwater Monitoring Work Plan submitted under separate cover on April 12, 2005.

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

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, "Standards Methods for the Examination of Water and Wastewater", APHA, 19th Edition, 1995, and "Methods for Chemical Analysis of Water and Waste", EPA-600/4-79-020, revised March 1983. 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 MDEQ.

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 MDEQ.

6.0 REPORTING

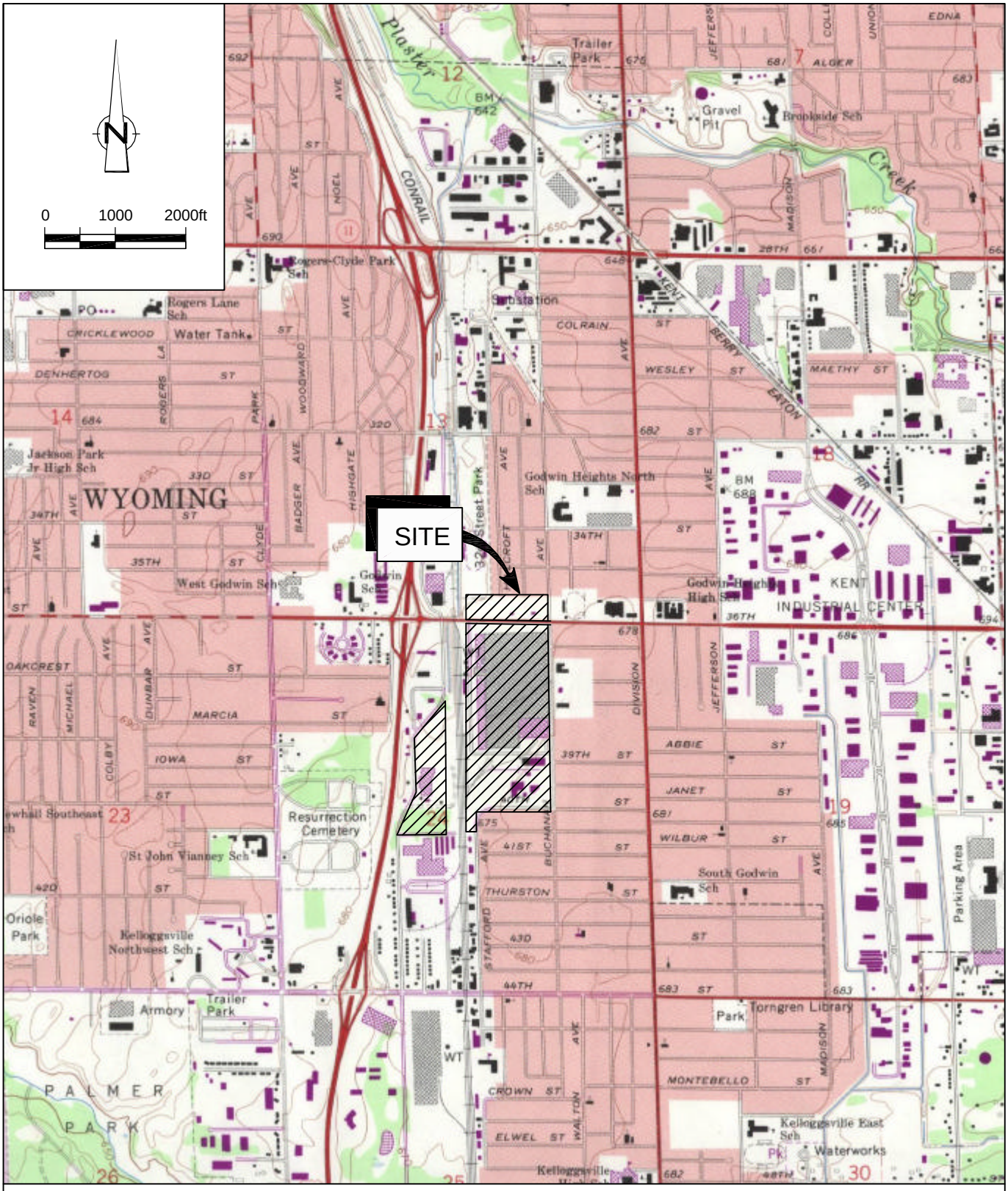
Upon completion of the field activities, receipt of final analytical results, and data quality assessment and validation, a report summarizing the results will be generated.

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 July 2005, 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 1 to 2 weeks from mobilization to.
- Submittal of Data Report - Approximately 8 to 12 weeks from completion of field activities.

FIGURES



SOURCE: USGS QUADRANGLE MAP;
GRAND RAPIDS WEST, MICHIGAN

figure 1.1

SITE LOCATION
GRAND RAPIDS METAL PLANT
Wyoming, Michigan

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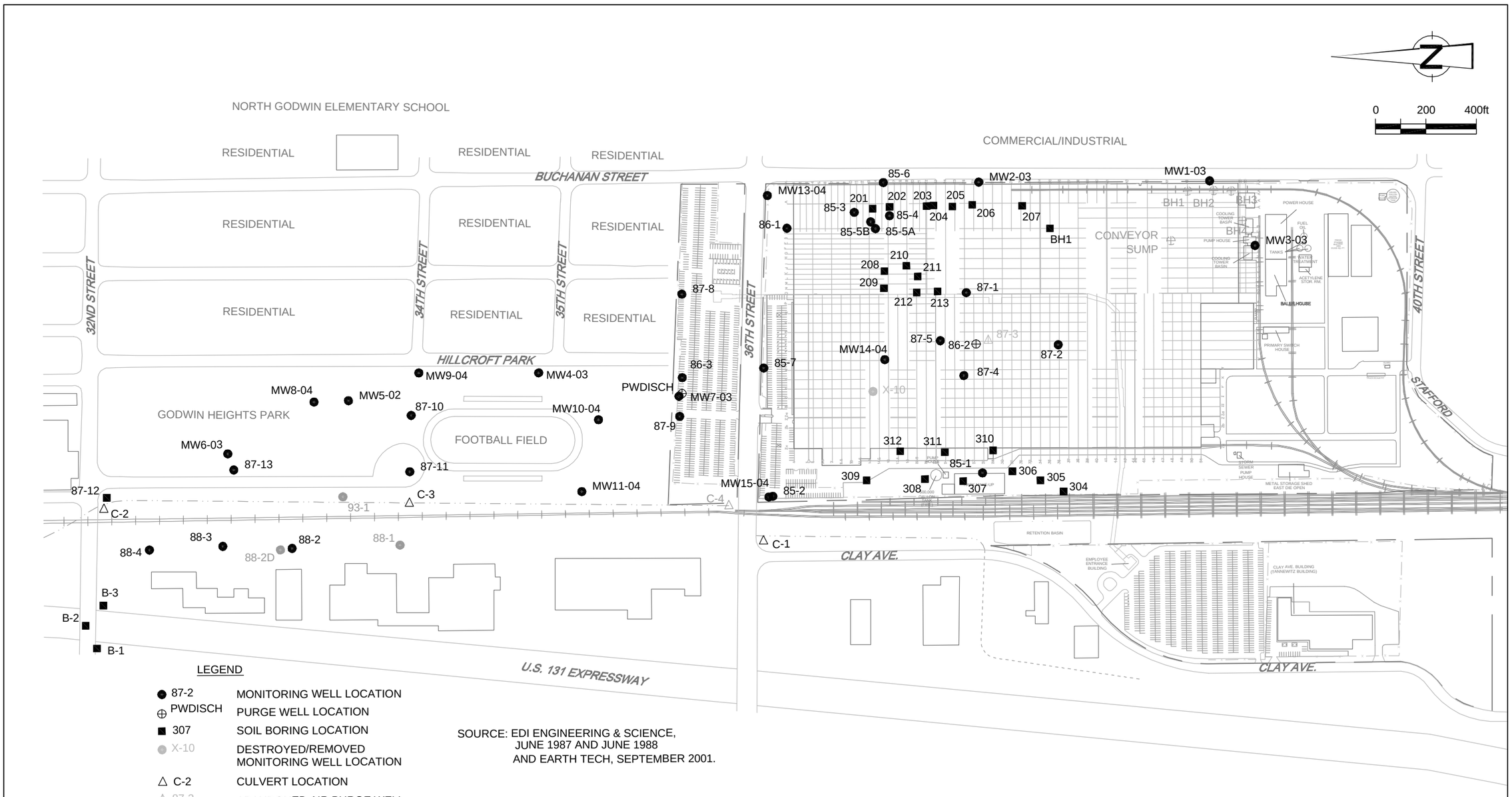

LEGEND

● 87-2	MONITORING WELL LOCATION
⊕ PWDISCH	PURGE WELL LOCATION
■ 307	SOIL BORING LOCATION
● X-10	DESTROYED/REMOVED MONITORING WELL LOCATION
△ C-2	CULVERT LOCATION
⚠ 87-3	ABANDONED AIR PURGE WELL
⊕ BH1	APPROXIMATE LOCATION OF DEWATERING WELLS
——— – ———	APPROXIMATE SITE BOUNDARY
—×—×—×—	FENCE
—+—+—+—	RAILROAD
—·—·—·—	COLE DRAIN

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

figure 1.2

SITE PLAN
GRAND RAPIDS METAL PLANT
Wyoming, Michigan

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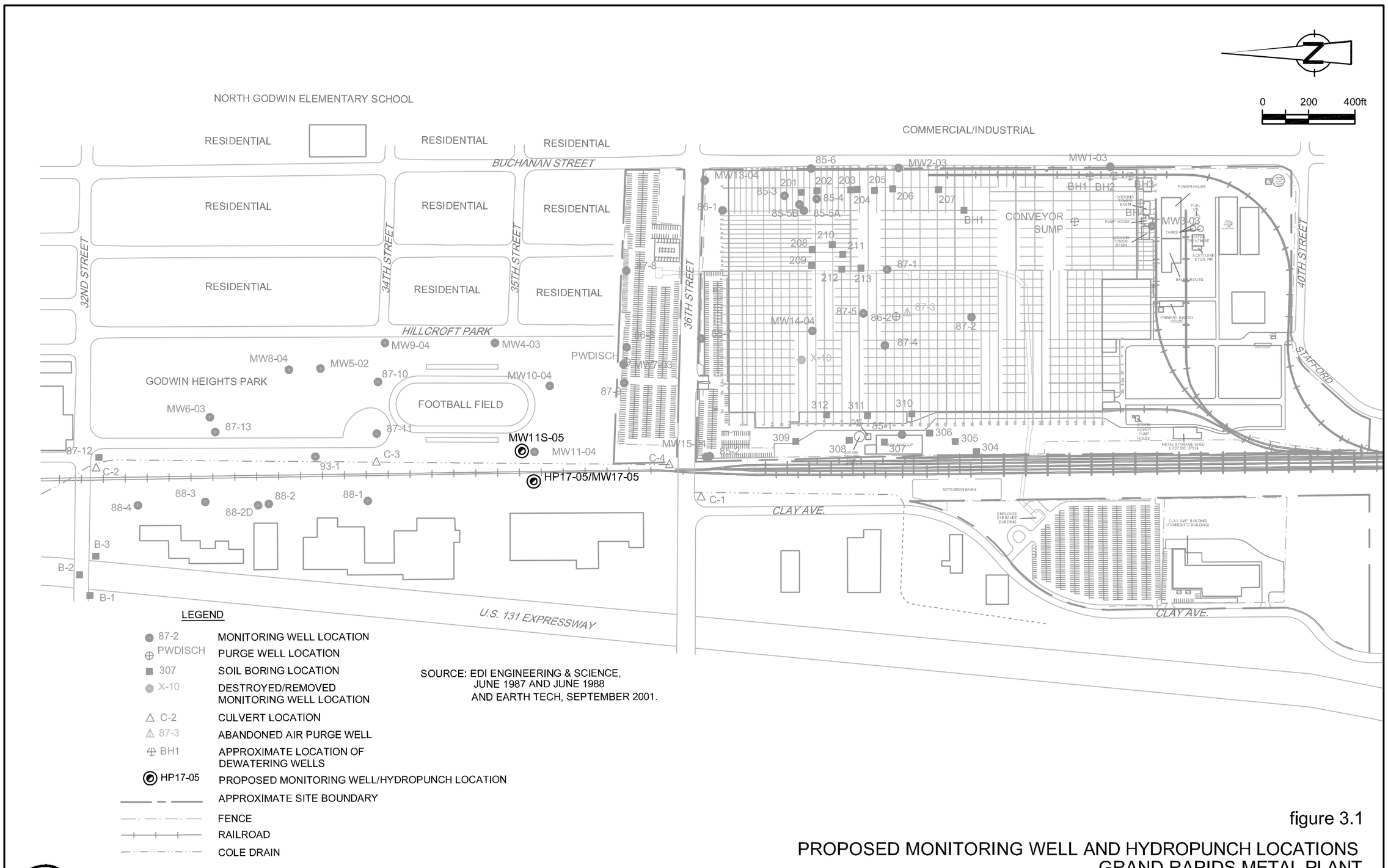

LEGEND

87-2	MONITORING WELL LOCATION
PWDISCH	PURGE WELL LOCATION
307	SOIL BORING LOCATION
X-10	DESTROYED/REMOVED MONITORING WELL LOCATION
C-2	CULVERT LOCATION
87-3	ABANDONED AIR PURGE WELL
BH1	APPROXIMATE LOCATION OF DEWATERING WELLS
HP17-05	PROPOSED MONITORING WELL/HYDROPUNCH LOCATION
	APPROXIMATE SITE BOUNDARY
	FENCE
	RAILROAD
	COLE DRAIN

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

figure 3.1

PROPOSED MONITORING WELL AND HYDROPUNCH LOCATIONS
GRAND RAPIDS METAL PLANT
Wyoming, Michigan

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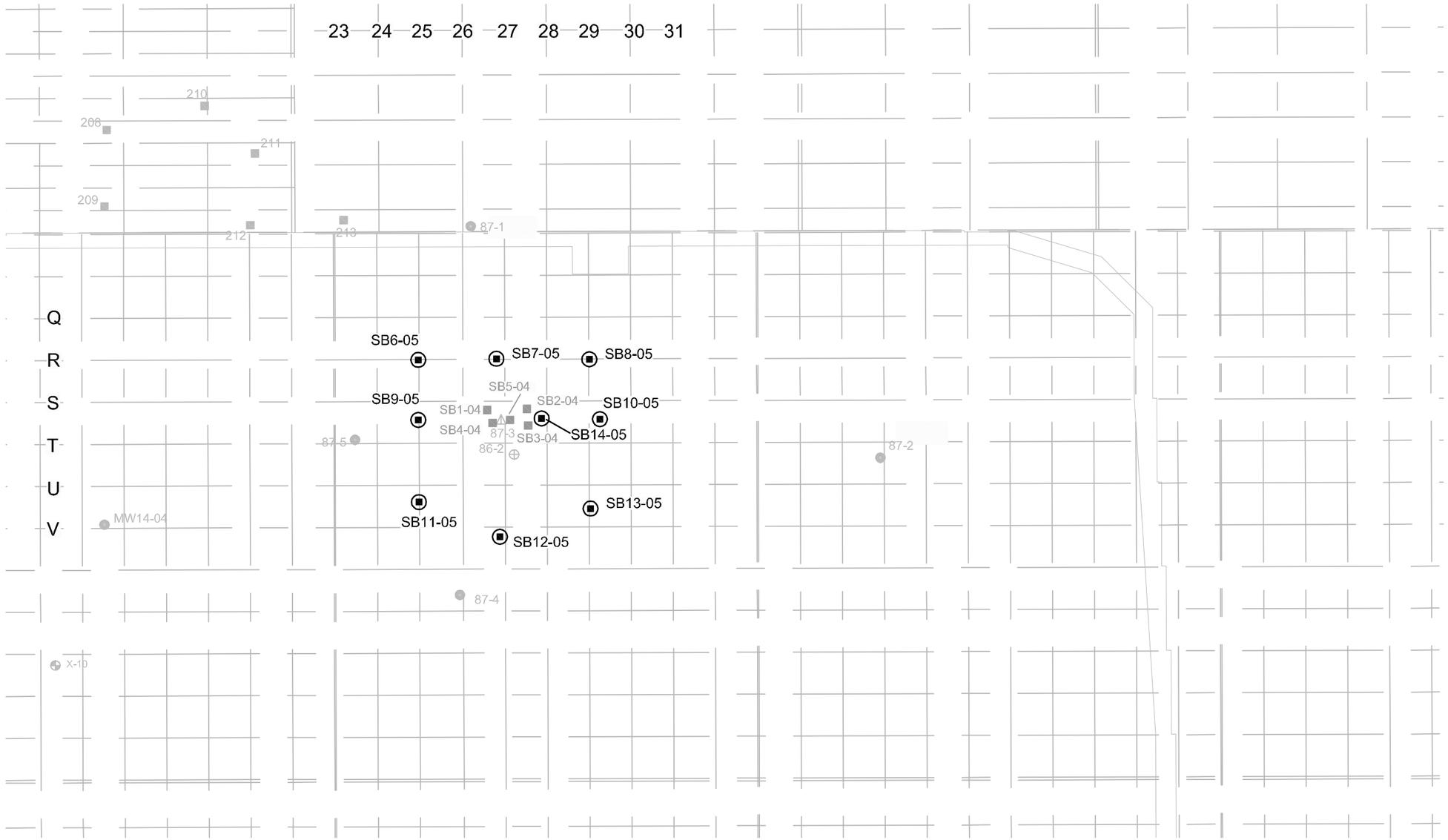

LEGEND

87-2	MONITORING WELL LOCATION
86-2	PURGE WELL LOCATION
307	SOIL BORING LOCATION
87-3	APPROXIMATE AIR PURGE WELL LOCATION
SB2-04	SOIL BORING LOCATIONS
SB11-05	PROPOSED SOIL BORING LOCATIONS
Q/23	ROW/COLUMN

N

0 50 100ft

figure 3.2

PROPOSED SOIL BORING LOCATIONS
GRAND RAPIDS METAL PLANT
Wyoming, Michigan

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TABLES

TABLE 3.1

SAMPLING AND ANALYSIS PLAN
2005 INVESTIGATION WORK PLAN
GENERAL MOTORS CORPORATION
GRAND RAPIDS METAL PLANT
WYOMING, MICHIGAN

Proposed Investigation Activity	*Reason for Activity*	*Quantity of Sample Locations*	*Quantity of Samples*	*Sample Matrix*	*Sample Interval*	*Analysis*
Vertical Aquifer Sampling	Vertical/horizontal delineation	1	8 [1]	groundwater	discrete vertical intervals of the water bearing unit	TCL VOCs
Collection of Soil Samples	Vertical/horizontal delineation	8	90[1]	soil	vertical intervals of 2 feet	TCL VOCs
Collection of waste characterization samples	Disposal	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