Sauer-Sundstrand Company

Construction Work Plan Sauer-Sundstrand Facility Ames, Iowa

September 1996

MONTGOMERY WATSON

CONSTRUCTION WORK PLAN

FOR

SAUER-SUNDSTRAND FACILITY
AMES, IOWA

Prepared for

SAUER-SUNDSTRAND COMPANY
AMES, IOWA

Project No. 8907.0343

September 1996

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Prepared by

Montgomery Watson
11107 Aurora Avenue
Des Moines, Iowa 50322
515-253-0830

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly Registered Professional Engineer under the laws of the State of Iowa.

Signature: _____

Name: Jeffrey L. Coon, P.E.

Date: 9/17/96 **Reg. No.:** 11975

My registration expires December 31, 1996.

JEFFREY L. COON
REGISTERED
11975
IOWA
PROFESSIONAL ENGINEER

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SECTION 1

INTRODUCTION

OBJECTIVE

This Construction Work Plan (CWP) has been prepared to document the overall management strategy, construction quality assurance procedures and schedule for implementing the approved corrective measure (groundwater interception trench) at the Sauer-Sundstrand site in Ames, Iowa (site).

As presented in the Corrective Measures Study (CMS) Report, the groundwater interception trench is being installed to achieve the following objectives:

- Prevent off-site migration of groundwater containing concentrations of volatile organic compounds (VOCs) above Maximum Contaminant Levels (MCLs).
- If an MCL has not been established for a VOC, prevent off-site migration of groundwater containing concentrations of VOCs that represent an unacceptable human health or environmental risk.
- Reduce the concentration of VOCs above MCLs in the on-site groundwater.

SITE DESCRIPTION

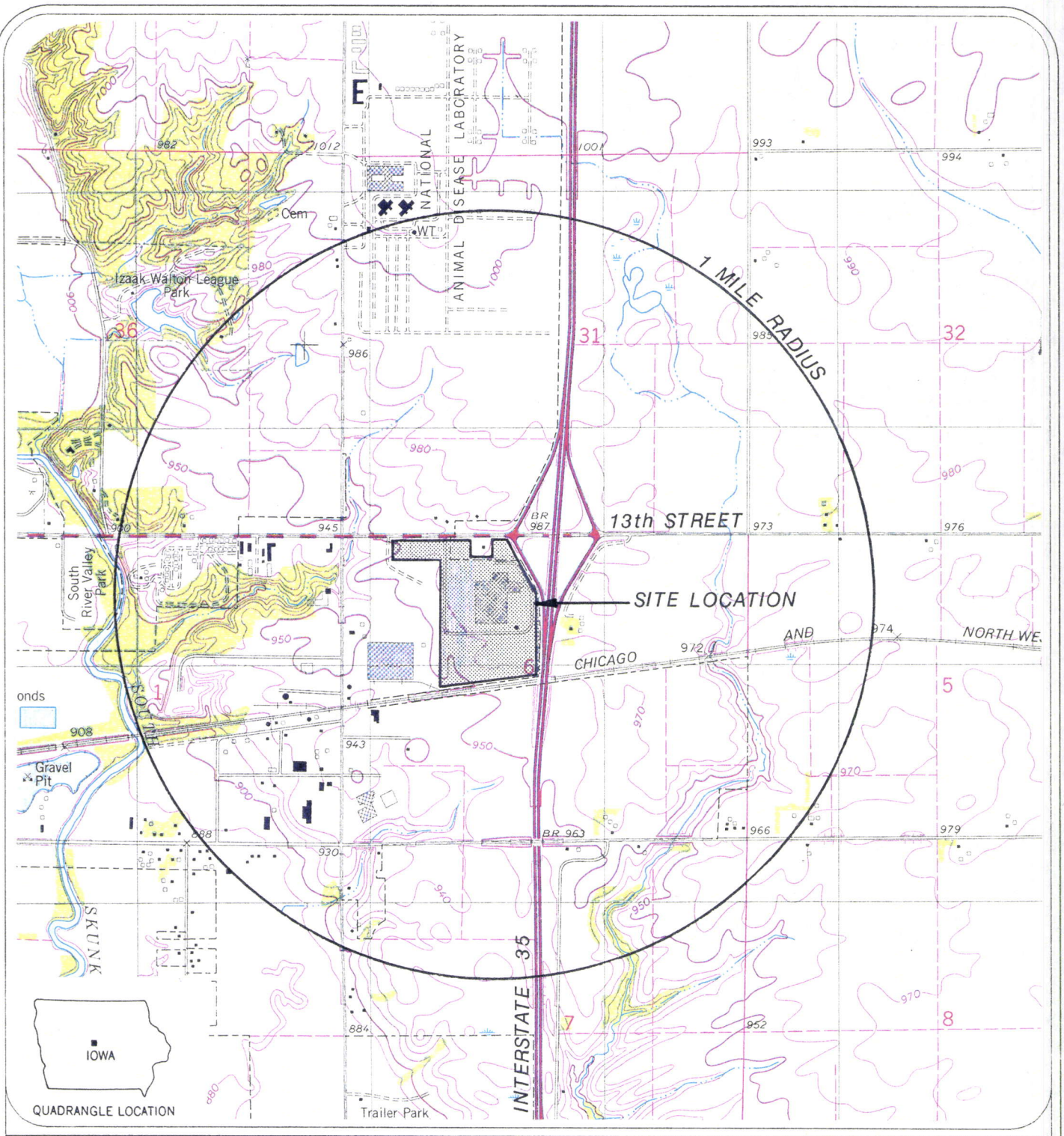
Site Location

The site is located in Ames, Iowa, within the Northeast 1/4 of the Northwest 1/4 of Section 6, Township 83 North, Range 23 West, Story County, Iowa (Figure 1-1). Land use near the site consists of general industrial use to the west and south. On the northern side of 13th Street, the land is zoned for general commercial use. Land further north is zoned for agricultural use. The land east of Interstate 35 is primarily used for agricultural purposes, and most of this eastern area is located outside the corporate limits of the City of Ames. Residential land use located within one mile of the site is limited.

Site Hydrogeology

As presented in the RCRA Facility Investigation (RFI) Report, the subsurface geology at the site consists mainly of dense, gray, clay-rich glacial till interbedded with numerous and discontinuous sand units. Two main water-bearing zones appear to exist in the unconsolidated sediments of the site. A shallow water-bearing zone occurs from the water table (generally encountered at approximately 4 to 6 feet below ground surface) to a depth of approximately 15 to 20 feet below ground surface where the geology changes from soft, sandy clay, containing numerous sand pockets of limited horizontal and vertical extent to a hard, gray, silty clay.

Underlying the shallow water-bearing zone is the intermediate water-bearing zone which consists of numerous sand lenses interspersed throughout a dense, gray, clay-rich glacial till.



MAP SOURCE: U.S.G.S. 7.5 MINUTE SERIES TOPOGRAPHIC MAP
AMES EAST QUADRANGLE

0 2000
SCALE IN FEET

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SITE VICINITY MAP

FIGURE 1-1

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Sand layers in the till have been encountered at depths ranging from approximately 15 to 50 feet below ground surface. The intermediate groundwater sand units are generally thicker than those encountered in the shallow water bearing zone; however, they too appear discontinuous. Based upon information presented in the RFI Report, it was concluded that the lower conductivity of the intermediate zone restricts vertical flow of water from the shallow sand units to those in the intermediate zone.

Extent of Groundwater Impacts

During the RFI, evidence of VOCs in groundwater were observed at monitoring well locations in the central and southwestern portions of the site (Figure 1-2). The highest concentrations of total VOCs in groundwater were detected at monitoring well locations MW-11, MW-R13 and MW-19. VOC concentrations in groundwater samples collected from downgradient monitoring well locations MW-21, MW-22 and MW-23 were generally below Method Detection Limits (MDLs). An isolated detection of acetone was observed in MW-23 at a concentration of 66 µg/L (Figure 1-2).

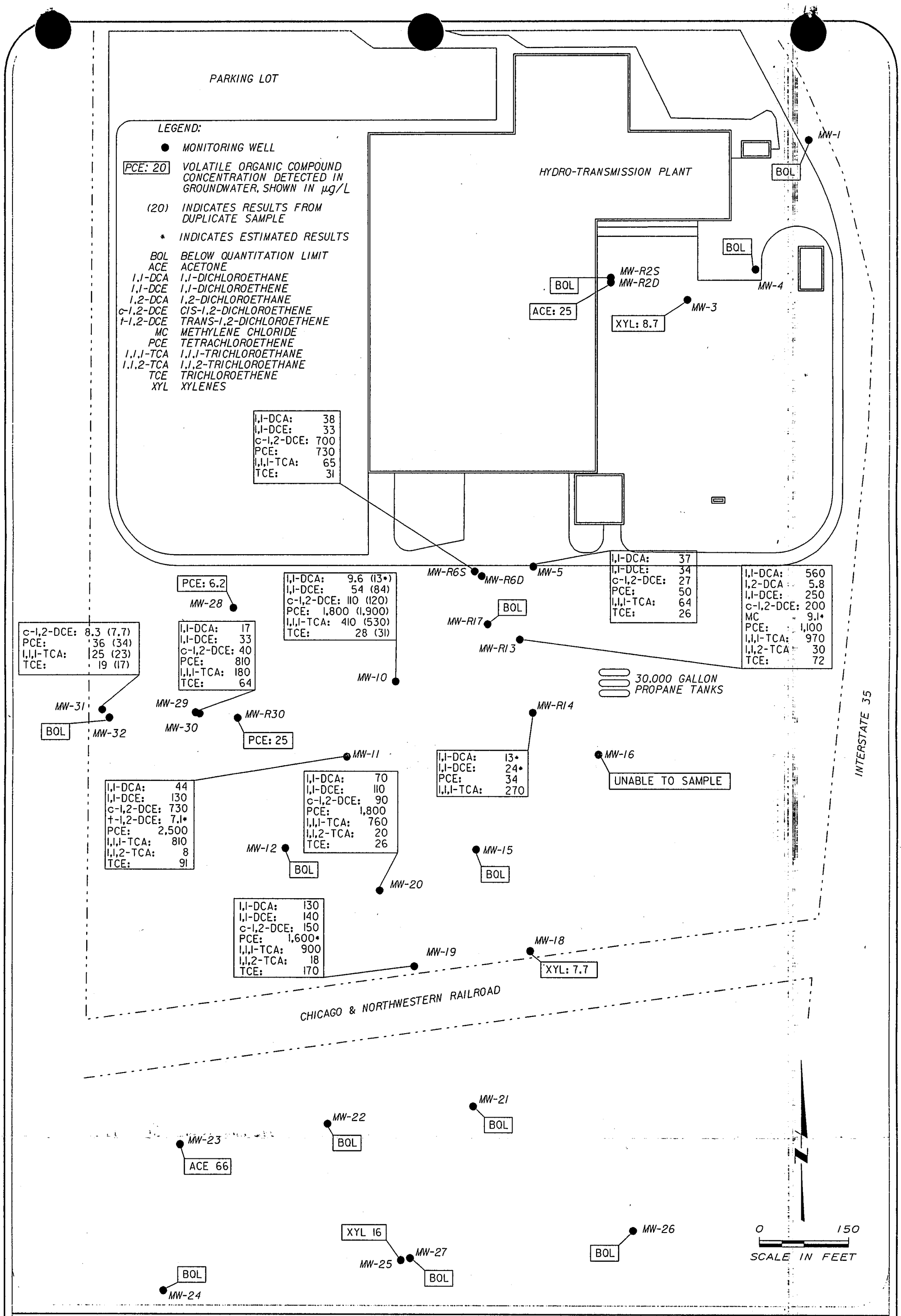
Historic groundwater monitoring data suggests the VOC plume is migrating in the direction of shallow groundwater flow toward the southwest. As presented in the RFI Report, results from a pre-RFI investigation conducted in January and February 1990 indicated the highest VOC concentrations were detected at MW-R13 (Figure 1-3). When results of the 1990 sampling event are compared with those resulting from the RFI (September and October 1994), the location of maximum VOC concentrations apparently shifted downgradient from the vicinity of MW-R13 to MW-11, located approximately 350 feet to the southwest.

Further comparison of the 1990 and 1994 sampling events indicates that VOC concentrations have generally decreased in the upgradient portion of the plume. Decreases were particularly notable in the vicinity of MW-10, MW-11, MW-R13, MW-R14 and MW-R17 (Figures 1-2 and 1-3). Concurrently, increases in constituent concentrations were noted at several downgradient monitoring locations including MW-28, MW-31, MW-18 and MW-19 (Figures 1-2 and 1-3). The observed shift in the center of the plume mass is consistent with interpretations of groundwater flow presented in the RFI Report. As presented in the RFI Report, some constituent concentrations were detected above MCLs at MW-19; however, none of the off-site monitoring locations contained concentrations above MCLs (Figures 1-2 and 1-3).

SITE HISTORY

Facility Operations

The Sauer-Sundstrand facility operates as a manufacturer of hydrostatic transmission power systems for use primarily in farm machinery and construction equipment. The facility began operations in 1972 under the ownership of Sundstrand Corporation. On January 1, 1987, Sundstrand entered into a joint venture with Sauer Getriebe AG (Sauer) and began operation as the Sundstrand-Sauer Company. When Sundstrand sold its interest in the joint venture to Sauer on March 31, 1989, ownership of the real estate was transferred to Susa Holding of Story County. Operations of the Sundstrand-Sauer Company continued until December 31, 1989 when an independent entity, Sauer-Sundstrand Company, was established. Sauer-Sundstrand has operated the facility since January 1, 1990.



NOTE: DATA TAKEN FROM HARDING LAWSON ASSOCIATES JUNE 1995 REPORT.

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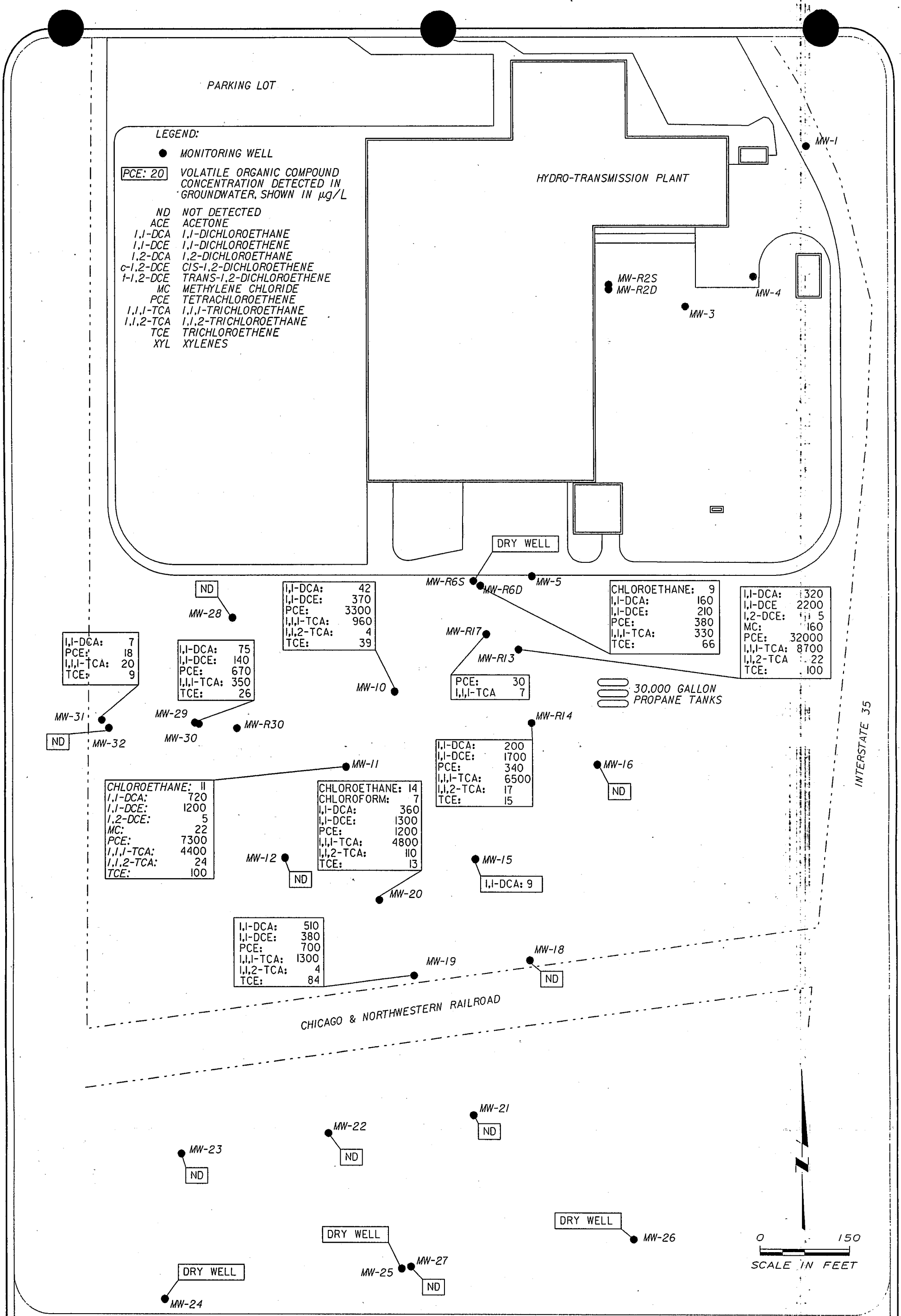
GROUNDWATER ANALYTICAL RESULTS SEPT.–OCT. 1994

FIGURE 1-2



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AREAL EXTENT OF VOCs IN GROUNDWATER JAN.–FEB. 1990

FIGURE 1–3

RCRA History

On March 29, 1991, an Administrative Order on Consent (Consent Order) Docket Number VII-91-H-0009 was entered into between the United States Environmental Protection Agency (USEPA), Sundstrand Corporation, Sauer-Sundstrand Company and Susa Holding Inc. (Respondents). An RFI was conducted pursuant to Section VI.B.6 of the Consent Order. The RFI was conducted in accordance with a set of project plans prepared by Harding Lawson Associates (HLA) including a Data Collection Quality Assurance Plan (DCQAP), as modified by the USEPA Notice of Approval with Modifications Letter dated August 3, 1993; a Health and Safety Plan (HSP); a Project Management Plan (PMP); a Data Management Plan (DMP); and a Community Relations Plan (CRP). The objective of the RFI was to assess impacts to soil and groundwater from the release, or potential release, of hazardous constituents from Solid Waste Management Units (SWMUs) at the facility.

Investigation activities were implemented at the site from September through October 1994 by HLA. Following the investigation, an RFI Report was prepared by HLA and submitted to the USEPA on June 9, 1995 in accordance with the Consent Order. The RFI Report defined the source, degree, and extent of constituents in the groundwater; and identified actual or potential receptors in the source area. On January 29, 1996, USEPA comments on the June 1995 RFI Report were received by HLA. A letter of Response to Technical Comments was submitted to the USEPA on March 18, 1996 to address these comments.

In March 1996, Montgomery Watson was retained to initiate the CMS phase of RCRA activities for the site. CMS activities at the site were conducted by Sauer-Sundstrand, voluntarily, in an effort to proactively address identified constituents in the groundwater at the site. A CMS Report was prepared and submitted to the USEPA on or about April 30, 1996. The CMS Report served to identify and evaluate potential remedial alternatives for the releases that had been identified at the site.

Comments on the April 1996 CMS Report were received by Montgomery Watson during a June 13, 1996, telephone conversation with the USEPA. A letter of response, which served as an addendum to the CMS Report, was submitted to the USEPA on July 5, 1996 to address these comments.

SECTION 2

PROJECT MANAGEMENT

This section describes the management approach including levels of authority and responsibility, lines of communication, and the qualifications of key parties who will direct the corrective measure design and the implementation effort. An organizational chart is included as Figure 2-1.

OWNER

Definition

The Owner is defined as Sauer-Sundstrand Company. The Owner may designate oversight personnel, as necessary, to coordinate daily activities regarding the Corrective Measure Implementation (CMI).

Responsibility and Authority

The Owner or Owner's designee is responsible for coordinating communications with the regulatory agency, Engineer, and General Contractor. The Owner or Owner's designee has the ultimate responsibility to ensure that the approved corrective measure (groundwater interception trench) is constructed in accordance with the design plans and specifications.

Qualifications

The designation of the Owner's representative is the direct responsibility of Sauer-Sundstrand Company.

ENGINEER

Definition

Montgomery Watson has designed the approved corrective measure for the site and will function as the Engineer during construction.

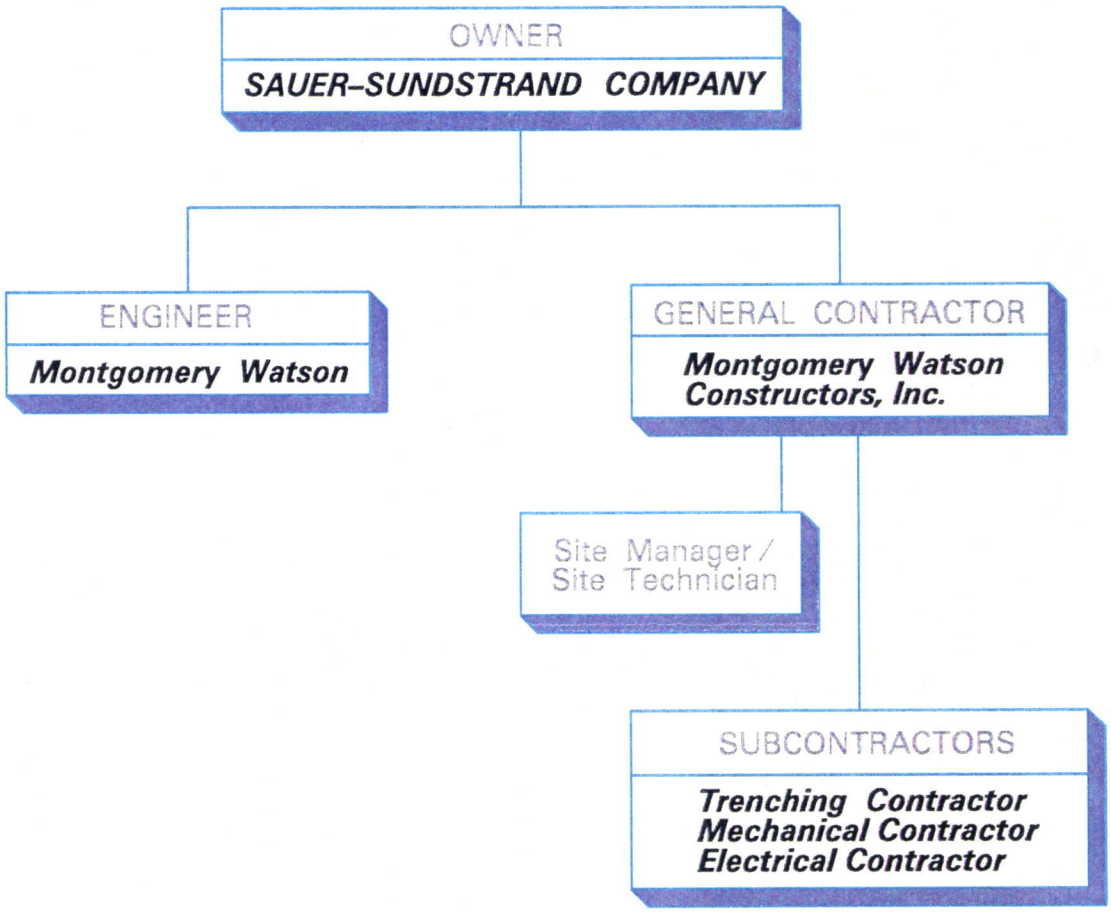
Responsibility and Authority

The Engineer is responsible for performing the engineering design and preparing the associated drawings, plans, specifications (including performance specification) and reports for the CMI. The Engineer is responsible for interpretation of the design, drawings, and specification; for approving all design and specification changes; and making design clarifications necessary during implementation of the corrective measure.

Qualifications

Montgomery Watson employs qualified professional engineers licensed in the State of Iowa. Montgomery Watson engineers are familiar with the following:

- Interception trench design methods and procedures.
- Groundwater conveyance system design and installation procedures.
- Applicable regulatory requirements.



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CONSTRUCTION MANAGEMENT ORGANIZATION

FIGURE 2-1

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GENERAL CONTRACTOR

Definition

Montgomery Watson Constructors Inc. (MWCI) will function as the General Contractor (GC) during construction of the corrective measure.

Responsibility and Authority

The GC is responsible for construction of the corrective measure. The required subcontractors, such as the trenching contractor and mechanical contractor, will be contracted with the GC. The GC will attend the preconstruction meeting, prefinal inspection, and final inspection. The GC reports directly to the Owner, Sauer-Sundstrand Company.

The GC will provide a Site Manager and Site Technician during construction of the corrective measure.

Site Manager/Site Technician.

Definition

The GC Site Manager/Site Technician will be responsible for coordinating construction activities performed on site. In addition, the Site Manager/Site Technician is responsible for the construction quality assurance work.

Responsibility and Authority

The Site Manager/Site Technician will be responsible for coordinating construction activities between subcontractors such as the trenching contractor and mechanical contractor. The Site Manager/Site Technician is responsible for the construction schedule and for ensuring that the corrective measure is constructed in accordance with the design plans and specifications.

The Site Manager/Site Technician is responsible for observing and documenting activities related to the corrective measure construction, in sufficient detail and with sufficient continuity, to provide a high level of confidence that the corrective measure construction complies with the design plans and specifications. The Site Manager/ Site Technician will also verify that installation requirements are met and that all submittals are provided.

The Site Manager/Site Technician will maintain daily reports of quality control activities. These reports will include, at a minimum, visual observations, test results and summaries of significant events. In addition, problems encountered and resolved will be documented.

Qualifications

The Site Manager/Site Technician will be experienced in the construction of groundwater interception systems and will have previously demonstrated management ability on similar projects.

SUBCONTRACTORS

Trenching Contractor

Definition. The trenching contractor is the firm responsible for trenching activities including dewatering, trench construction, sump placement, and placement and grading of cover soils on top of the trench.

Responsibility and Authority. The trenching contractor is responsible for constructing the trench and collection sump components of the corrective measure in conformance with the design plans and specifications. The trenching contractor will be under contract with the GC.

Qualifications. The trenching contractor will be approved by the Owner and will be qualified based on previously demonstrated experience and management ability. The trenching contractor will provide qualified personnel to meet the demands of the project.

Mechanical Contractor

Definition. The mechanical contractor is the firm responsible for installing the groundwater conveyance system which will transport intercepted groundwater from the trench sump to the wastewater treatment facility.

Responsibility and Authority. The mechanical contractor is responsible for constructing the groundwater conveyance system, including conducting limited excavation activities, in conformance with the design plans and specifications. The mechanical contractor will be under contract with the GC.

Qualifications. The mechanical contractor will be approved by the Owner and will be qualified based on previously demonstrated experience and management ability. The mechanical contractor will provide qualified personnel to meet the demands of the project.

Electrical Contractor

Definition. The electrical contractor is the firm responsible for providing electrical connections and controls required for implementation of the corrective measure.

Responsibility and Authority. The electrical contractor is responsible for providing electrical connections and controls in conformance with the design plans and specifications. The electrical contractor will be under contract with the GC.

Qualifications. The electrical contractor will be approved by the Owner and will be qualified based on previously demonstrated experience and management ability. The electrical contractor will provide qualified personnel to meet the demands of the project.

SECTION 3

PROJECT SCHEDULE

CONSTRUCTION SCHEDULE

Installation of the interception trench and discharge piping will take approximately four to six weeks, with an additional week required for system startup. The start date is dependent upon approval from the EPA Region VII. A tentative schedule is provided below, and a detailed schedule will be provided following US EPA approval of the Construction Work Plan.

• Start of Construction	Early November 1996
• Completion of Construction	Early to Mid-December 1996
• System Startup	Mid- to Late December 1996
• System Operation and Maintenance	Ongoing, Beginning Late December 1996 to Early January 1997

REMEDIAL SYSTEM SAMPLING SCHEDULE

Remedial system startup samples will be collected at the conclusion of the first week of the remedial system operation. Ongoing sampling will be conducted on a monthly basis in order to establish the concentration pattern of each of the constituents expected to be discharge to the sanitary sewer. The monitoring frequency requirements may be reduced in the future, depending on the initial results obtained.

GROUNDWATER SAMPLING SCHEDULE

Groundwater samples will be collected on an annual basis. The first annual sampling event will be conducted during the third quarter of 1997; annual sampling will proceed accordingly. Sampling will continue for a period of up to five years, at which time the effectiveness of the remedial system will be reevaluated to determine whether CMS objectives have been fulfilled.

ANNUAL SITE SAMPLING REPORT SCHEDULE

Annual site sampling reports will be prepared and submitted to the US EPA no later than March 1, following each annual sampling event.

SECTION 4

REMEDIAL DESIGN

A groundwater interception trench and conveyance system will be installed at the site to collect impacted groundwater for discharge to the City of Ames sanitary sewer system. Details regarding the remedial design are presented in the following paragraphs. Design Drawings, Performance Specification and Technical Specifications are included in Appendices A, B and C, respectively.

PREDESIGN STUDIES

Groundwater VOC Concentrations

Groundwater analytical data included in the June 9, 1995 RFI Report was used as a basis for the remedial design. Results from analysis of groundwater samples collected on September 14 and 15, 1994 are presented in Figure 4-1. Design concentrations were assumed to be two thirds of the maximum concentration of each VOC constituent detected in the groundwater samples. This is a conservative assumption since the upgradient side of the trench will intercept the groundwater plume, while the downgradient portion of the trench will receive drawdown from nonimpacted groundwater. The maximum measured concentration of each VOC constituent is highlighted in Figure 4-1, and the maximum measured and expected VOC constituent concentrations are summarized in Table 4-1.

Water Quality Parameters

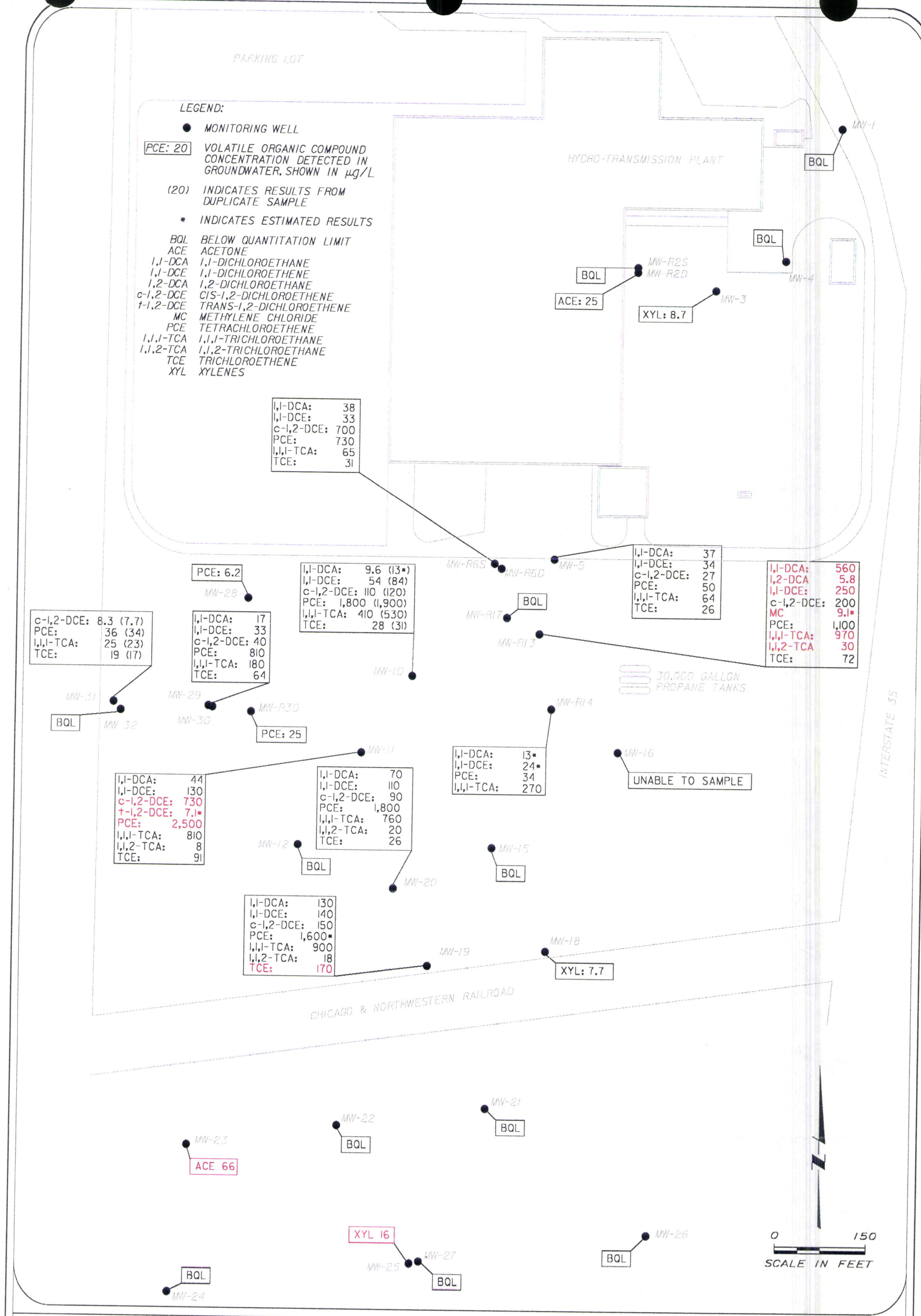
Expected concentrations of water quality parameters were calculated using a weighted average of results from analysis of groundwater samples collected from select monitoring wells on May 13, 1996. Analytical results and anticipated concentrations are summarized in Table 4-2.

Anticipated Flow Rate

The estimated yield from the interception trench was calculated using slug test data, groundwater elevation data, and an assumed distribution of sand and clay throughout the aquifer based on soil cross section and bore log data. The initial yield was calculated to be 133 gallons per minute (gpm). However, groundwater yield is expected to decrease over time in response to dewatering, the corresponding thinning of the saturated thickness, and decreased hydraulic head. After two to four weeks of collection system operation, the anticipated yield decreases to 30 gpm, and the long-term yield is anticipated to be approximately 7 gpm. The actual groundwater yield will vary from the estimated yield, based on the actual conditions encountered and the effects of precipitation recharge on the saturated zone. Calculations are detailed in Appendix D.

DESIGN CRITERIA

The interception trench was designed to prevent off-site migration of groundwater constituents and reduce the concentration of VOCs in the on-site groundwater. Groundwater at the Site flows



NOTE: DATA TAKEN FROM HARDING LAWSON ASSOCIATES JUNE 1995 REPORT.

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GROUNDWATER ANALYTICAL RESULTS SEPT.–OCT. 1994

FIGURE 4-1

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TABLE 4-1

MAXIMUM CONCENTRATIONS

Constituent	Maximum Measured Concentration (µg/L)	Maximum Expected Discharge Concentration (µg/L)[a]
Acetone	66	44
1,1-Dichloroethane	560	370
1,2-Dichloroethane	5.8	3.9
1,1-Dichloroethylene	250	170
cis-1,2-Dichloroethylene	730	490
trans-1,2-Dichloroethylene	7.1	4.7
Methylene Chloride	9.1	6.1[b]
Perchloroethylene	2,500	1,700
1,1,1-Trichloroethane	970	650
1,1,2-Trichloroethane	30	20
Trichloroethylene	170	110
Total Xylenes	16	11

[a] Assumes 1/3 from nonimpacted groundwater and 2/3 from groundwater plume.

[b] Suspect laboratory artifact.

TABLE 4-2

WATER QUALITY PARAMETERS
ANALYTICAL RESULTS AND ANTICIPATED CONCENTRATIONS

Constituent		MW-11	MW-12	MW-R13	MW-20	MW-29	MW-31	Total Anticipated Concentration
Total Alkalinity ($CaCO_3$)	Analytical Data (mg/l)	460	320	380	490	440	330	
	Weighted Average (mg/l)	77	80	43	99	98	15	412
Carbonaceous Biochemical Oxygen Demand - Five Day	Analytical Data (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
	Weighted Average (mg/l)	<0.8	<1.3	<0.6	<1.0	<1.1	<0.2	<5.0
Chemical Oxygen Demand, Low Level	Analytical Data (mg/l)	5.7	6.8	<5.0	<5.0	<5.0	<5.0	
	Weighted Average (mg/l)	1.0	1.7	<0.6	<1.0	<1.1	<0.2	<5.6
Total Hardness ($CaCO_3$)	Analytical Data (mg/l)	950	550	750	1200	600	550	
	Weighted Average (mg/l)	160	138	84	242	134	25	782
Calcium Hardness ($CaCO_3$)	Analytical Data (mg/l)	650	260	400	780	320	300	
	Weighted Average (mg/l)	109	65	45	157	72	13	461
Ammonia Nitrogen	Analytical Data (mg/l)	<0.20	1.8	0.91	0.49	0.98	0.53	
	Weighted Average (mg/l)	<0.03	0.5	0.10	0.10	0.22	0.02	<0.93
Oil and Grease	Analytical Data (mg/l)	7.0	3.8	5.0	4.3	12	9.0	
	Weighted Average (mg/l)	1.2	1.0	0.6	0.9	3	0.4	6.6
Total Suspended Solids	Analytical Data (mg/l)	1200	450	170	240	380	400	
	Weighted Average (mg/l)	202	113	19	48	85	18	485
Total Iron	Analytical Data (mg/l)	24	12	18	14	6.8	9.6	
	Weighted Average (mg/l)	4	3	2	3	1.5	0.4	14
Dissolved Iron	Analytical Data (mg/l)	<0.10	0.63	<0.10	0.59	<0.10	<0.10	
	Weighted Average (mg/l)	<0.02	0.16	<0.01	0.12	<0.02	<0.00	<0.33
Total Manganese	Analytical Data (mg/l)	0.994	4.5	1.9	0.750	0.163	0.249	
	Weighted Average (mg/l)	0.167	1.1	0.2	0.151	0.036	0.011	1.703
Dissolved Manganese	Analytical Data (mg/l)	0.028	4.1	0.249	0.073	0.063	<0.010	
	Weighted Average (mg/l)	0.005	1.0	0.028	0.015	0.014	<0.000	<1.087

toward the southwest. Because the interception trench will be installed across the southwestern corner of the Site along the leading edge of the plume, the groundwater will be intercepted before it migrates from the site. As groundwater is collected and removed, VOC concentrations in the on-site groundwater will be reduced.

Given the expected VOC concentrations in the collected groundwater, the City of Ames Water Pollution Control Department (WPCD) determined that VOC discharge limits are not required. However, the water quality parameter discharge limits established for the existing Sauer-Sundstrand wastewater treatment facility apply to discharge of the collected groundwater. These limits are shown in Table 4-3, along with expected concentrations.

As shown in Table 4-3, discharge from the collection system is expected to meet the discharge requirements. However, temporarily elevated total suspended solids (TSS) and iron levels are anticipated upon startup of the collection system, as dislodged sediments resulting from installation of the interception trench are flushed from the system. Initial TSS and total iron levels are assumed to be 980 mg/L (remaining below the discharge limit) and 28 mg/L, respectively. The City of Ames WPCD has agreed to accept iron levels up to 28 mg/L during the first three months of collection system operation. If iron concentrations continue to be above the discharge limit of 15 mg/L, a filter or other iron removal equipment will be installed.

The City of Ames WPCD has limited the discharge rate to 30 gpm. As required, flows will be reduced to 20 gpm during the first few weeks of system operation, to allow the City of Ames WPCD facility's biological treatment processes to acclimate to the wastewater parameters being discharged. Following the first few weeks of operation, the flow rate will be increased, as appropriate, to maintain a steady flow through the system while maintaining hydraulic control over the Site.

DESIGN DESCRIPTION

Interception Trench

A groundwater interception trench will be installed along the western, southern, and a small portion of the eastern boundaries of the defined contaminant plume using a special trenching machine that excavates the trench, inserts a drainage pipe, and backfills the trench with granular backfill material in one operation. The trench will be installed to an approximate depth of 25 feet and will consist of two legs with a total length of approximately 750 linear feet. A drainage pipe consisting of 4-inch perforated, corrugated high density polyethylene (HDPE) pipe will be installed at the base of the trench, approximately 6 inches above the trench bottom. Perforations in the drainage pipe will allow infiltration of 30 gpm along the length of the pipe. A central sump will be installed near MW-20 which will be physically connected to the trench drainage pipe. Each leg of the trench will be constructed at a slope of 0.5 percent towards the sump, to facilitate drainage; cleanouts will be included at the end of each leg. The interception trench will be backfilled with granular backfill material to within 5 feet of the ground surface; backfilling to grade level will be completed with native soil to mitigate seepage of surface water into the trench.

TABLE 4-3

WATER QUALITY PARAMETER
DISCHARGE LIMITS AND ANTICIPATED CONCENTRATIONS

Wastewater Parameter	Discharge Limit: (mg/l)		Anticipated Concentration (mg/l)
	Maximum	Average	
Carbonaceous Biochemical Oxygen Demand - Five Day	1500	1000	<5.0
Total Suspended Solids	1500	1000	485
Ammonia Nitrogen	240	180	<0.93
Chemical Oxygen Demand	1500	1000	<5.6
Oil and Grease	300	200	6.6
Total Iron	15	NA	14

Sump

The sump will consist of an 18-inch HDPE well screen installed to a depth of 20 feet. The bottom 10 feet of the sump will be screened. The sump will be completed with a stick-up approximately 2 feet above grade and sealed with a lockable, liquid tight cover. The sump will be equipped with a submersible pump to transfer the collected groundwater to a standpipe located in the existing wastewater treatment room. Pump design calculations are included in Appendix D. The pump will be controlled by a level transmitter installed at the base of the pump so that the pump will start at a set high water level and stop at a set low water level. The sump will be backfilled with granular material to the top of the well screen perforations, followed by a 2-foot bentonite seal and native soil to grade level.

Conveyance Piping

The conveyance piping from the sump to the treatment room will be constructed of single wall 2-inch HDPE pipe buried to a depth of 5 feet below grade. The conveyance piping will be connected to the sump using a standard pitless adapter installed in the sump, and the piping will enter the treatment room through a wall penetration. To prevent freezing during cold weather, heat tracing will be installed on the section of pipe running from 5 feet below grade to 1 foot inside the building. A temperature probe will be installed in the aboveground section of pipe so water temperature can be monitored.

Once inside the treatment room, the conveyance pipe will transition to schedule 80 polyvinyl chloride (PVC) and will be placed at approximately 2 feet above the finished floor elevation. An in-line totalizing flow meter will be installed inside the treatment room to measure water flow, with the flowmeter readout located in the electrical panel. A sample tap will be installed for sample collection. The conveyance piping will discharge into a 4-inch PVC standpipe connected to the sanitary sewer discharge from the existing treatment facility. Conveyance pipe connection to the standpipe will be elevated to prevent backflow of water from the treatment facility into the collection system. A check valve will also be installed upstream of the discharge for further backflow protection. The standpipe will be vented through the roof of the treatment facility. A high level indicator will be installed in the discharge standpipe to disable the pump should the standpipe become obstructed.

Electrical/Control System

Electrical work installed within the sump will be rated as Explosion Proof. All the locations are considered nonhazardous. Electrical conduit necessary to supply power to the sump will be installed in the same trench as the conveyance piping. A duplex service outlet/receptacle will be installed adjacent to the sump.

The electrical panel will be installed in the wastewater treatment room. Panel lights will signal pump operation, low and high sump water levels and high standpipe water level. System operation will be tied into a Programmable Logic Controller (PLC), with inputs consisting of 1) the sump water level, 2) total water flow and flow rate, 3) water temperature, 4) indication of current flow to the pump, and 5) indication of a high level condition in the standpipe. Outputs

from the PLC will be signals to 1) activate/deactivate the pump; and 2) activate/deactivate the pump operation, sump low water level, sump high water level and standpipe high water level panel lights.

Site Restoration

Areas disrupted during construction activities will be graded so that slopes promote natural drainage across the Site. Disturbed areas will be seeded with prairie flower seed to establish a vegetative cover for erosion control.

Pretreatment

Although pretreatment is not required by the City of Ames WPCD prior to discharge, valves and blind tees will be included in the conveyance piping so that, if pretreatment is required in the future, additional piping can be installed to reroute flow through the treatment equipment.

SECTION 5

WASTE MANAGEMENT PROCEDURES

LIQUID WASTE

Description of Potential Wastes Generated During Construction

Dewatering activities may be required during excavation of the groundwater interception trench to facilitate construction. Additional liquid waste will be generated during equipment decontamination.

Management of Potential Wastes Generated

Any water pumped during construction will be discharged to the City of Ames sanitary sewer at a rate no greater than 20 gallons per minute. The quantity of water discharged will be recorded. Prior to discharge, water will be settled or filtered as necessary so that TSS and iron concentrations do not exceed 1,500 mg/L and 28 mg/L, respectively. Samples will be collected and analyzed to ensure that constituent concentrations are below those detailed in Table 5-1.

As requested by the City of Ames, a grab sample will be collected midway through the excavation and analyzed for TSS and total iron.

SOLID WASTE

Description of Potential Wastes Generated During Construction

It is assumed there will be no contact with impacted soils during construction activities; however, procedures for accommodating this unlikely occurrence are included in this section.

Management of Potential Wastes Generated

Visual observation and field screening will be utilized to verify no contact with impacted soils occurs during construction. Field personnel will observe trenching activities and note any suspect characteristics such as visible discoloration or odor.

If warranted by visual inspection, field screening will be conducted. Additionally, routine field screening will be conducted at a frequency of approximately once per 50-foot interval of trench construction. A soil sample will be collected and sealed in the Whirl-Pak® plastic sample bag. Each soil sample will remain in the sample bag for a minimum of 10 minutes prior to field screening, to encourage volatilization of any VOCs which may be present. The headspace of each sample bag will then be field screened for organic vapors using an HNU Model 101 photoionization detector (PID) or comparable instrument.

TABLE 5-1

MAXIMUM EXPECTED DISCHARGE CONCENTRATIONS

Constituent	Maximum Expected Concentration (µg/L)
Acetone	44
1,1-Dichloroethane	370
1,2-Dichloroethane	3.9
1,1-Dichloroethylene	170
cis-1,2-Dichloroethylene	490
trans-1,2-Dichloroethylene	4.7
Methylene Chloride	6.1[a]
Perchloroethylene	1,700
1,1,1-Trichloroethane	650
1,1,2-Trichloroethane	20
Trichloroethylene	110
Total Xylenes	11

[a] Suspect laboratory artifact.

If a reading of 10 parts per million or greater is detected by the instrument soil samples will be collected and submitted for analysis. Suspect soil will be collected, covered with protective 4-mil plastic sheeting, and stockpiled in the area south of the propane tank farm pending the receipt of analytical results. Disposal of the stockpiled soil will be dependent on the analytical results. Profiling of the material for disposal will be conducted by Montgomery Watson in accordance with applicable state and federal regulations.

As mentioned above, it is anticipated that no detections of impacted soil will occur. Prior to trenching, a subcut approximately 15 feet wide by 3 feet deep will be made along the entire trench alignment. The subcut will provide containment for excavated soil. Upon trench completion, the excavated soil will be leveled off and capped with material removed during the initial subcut. Any remaining soil will be transferred to the on-site soil storage pile which is used for testing equipment.

SECTION 6

PROJECT SUPPORT PLANS

The following section explains the purpose and provides a brief description of the following project support plans: Construction Quality Assurance Plan (CQAP) (Appendix E), Sampling and Analysis Plan (SAP) (Appendix F), Site Safety Plan (SSP) (Appendix G), and the Operation and Maintenance Manual Outline (O&M Outline) (Appendix H).

CONSTRUCTION QUALITY ASSURANCE PLAN (CQAP)

The purpose of the CQAP is to ensure, with a reasonable degree of certainty, that the completed corrective measure will meet or exceed all design criteria, plans, and specifications. Procedures for confirming material quality, confirming construction procedures, and conducting, testing and inspections are outlined in the CQAP.

SAMPLING AND ANALYSIS PLAN (SAP)

The SAP was developed to ensure that all information, data and resulting decisions are technically sound, statistically valid, and properly documented. The SAP provides a summary of the site background, outlines sampling activities to be conducted, and discusses data quality objectives. A Quality Assurance Project Plan (QAPP) was also developed as an integral component of the SAP. The QAPP was developed to document all sampling procedures, field measurements and sample analysis to be performed in accordance with the SAP.

SITE SAFETY PLAN (SSP)

The SSP was developed for both sampling and construction activities to be conducted at the site. The SSP describes the goals and objectives of the health and safety program, provides a hazard assessment, specifies procedures for utilizing personal protection and monitoring equipment, and identifies the site organization and emergency contacts.

OPERATION AND MAINTENANCE MANUAL OUTLINE (O&M OUTLINE)

The O&M Manual Outline provides an outline of system components requiring long-term maintenance. The O&M Manual will include procedures for conducting maintenance activities.

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA.

JEFFREY L. COON, P.E. | 11975 REG. NO. | 9/17/96 DATE

MY REGISTRATION EXPIRES DECEMBER 31, 1996

JEFFREY L. COON
REGISTERED
11975
IOWA
PROFESSIONAL ENGINEER

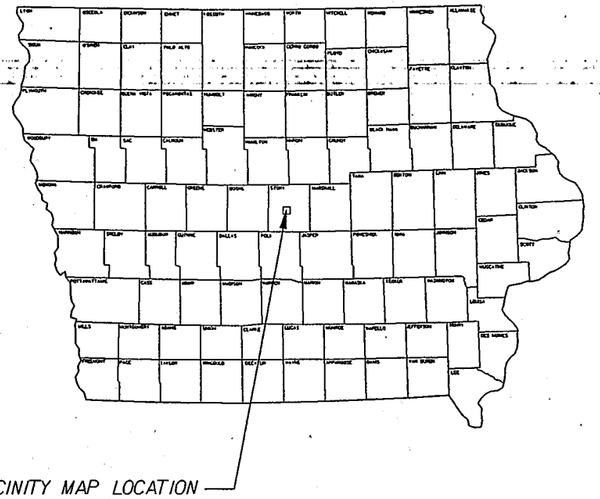
SAUER SUNDSTRAND COMPANY
AMES, IOWA

GROUNDWATER INTERCEPTION SYSTEM DESIGN

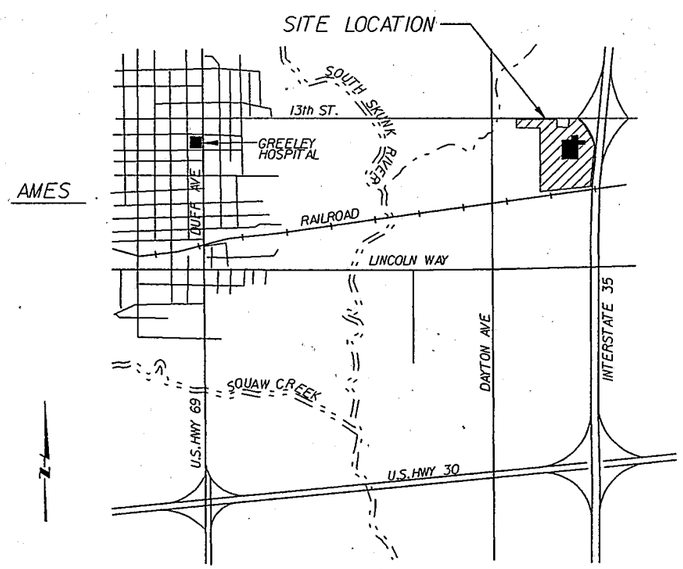
SEPTEMBER 1996

MONTGOMERY WATSON

Des Moines, Iowa



PROJECT LOCATION MAP



VICINITY MAP

SHEET INDEX

SHEET		DESCRIPTION
GENERAL	G-01	COVER SHEET
	G-02	LOCATION MAPS, SHEET INDEX AND DETAIL IDENTIFICATION
CIVIL	C-01	EXISTING CONDITIONS
	C-02	INTERCEPTION TRENCH PLAN AND PROFILE
	C-03	CONVEYANCE PIPING PLAN AND PROFILE
	C-04	TREATMENT BUILDING MODIFICATIONS
	C-05	DETAILS AND SECTIONS
ELECTRICAL	E-01	ELECTRICAL PLAN VIEW
	E-02	DIAGRAMS AND SCHEMATICS
	E-03	CONDUIT DEVELOPMENT, SCHEDULES & DETAILS

SECTION AND DETAIL IDENTIFICATION

SECTION IDENTIFICATION

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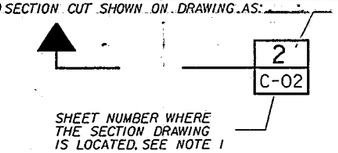
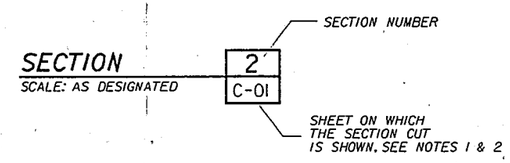


(2) ON SHEET NUMBER C-02 THIS SECTION IS IDENTIFIED AS:



DETAIL IDENTIFICATION

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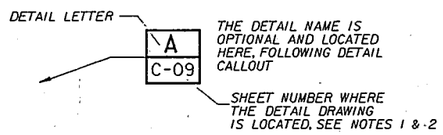
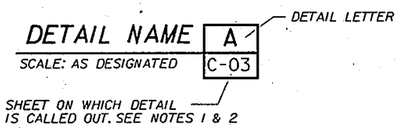
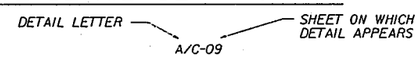


(2) ON SHEET NUMBER C-09 THIS DETAIL IDENTIFIED AS:



NOTE DETAIL IDENTIFICATION



NOTES:

(1) IF PLAN AND SECTION (OR DETAIL CALL-OUT AND DETAIL) ARE SHOWN ON SAME SHEET, THE SHEET NUMBER IS REPLACED BY A HORIZ. LINE.

(2) IF DETAIL OR SECTION IS CALLED OUT ON NUMEROUS SHEETS THE DRAWING NUMBER MAY BE REPLACED BY "VAR".

REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

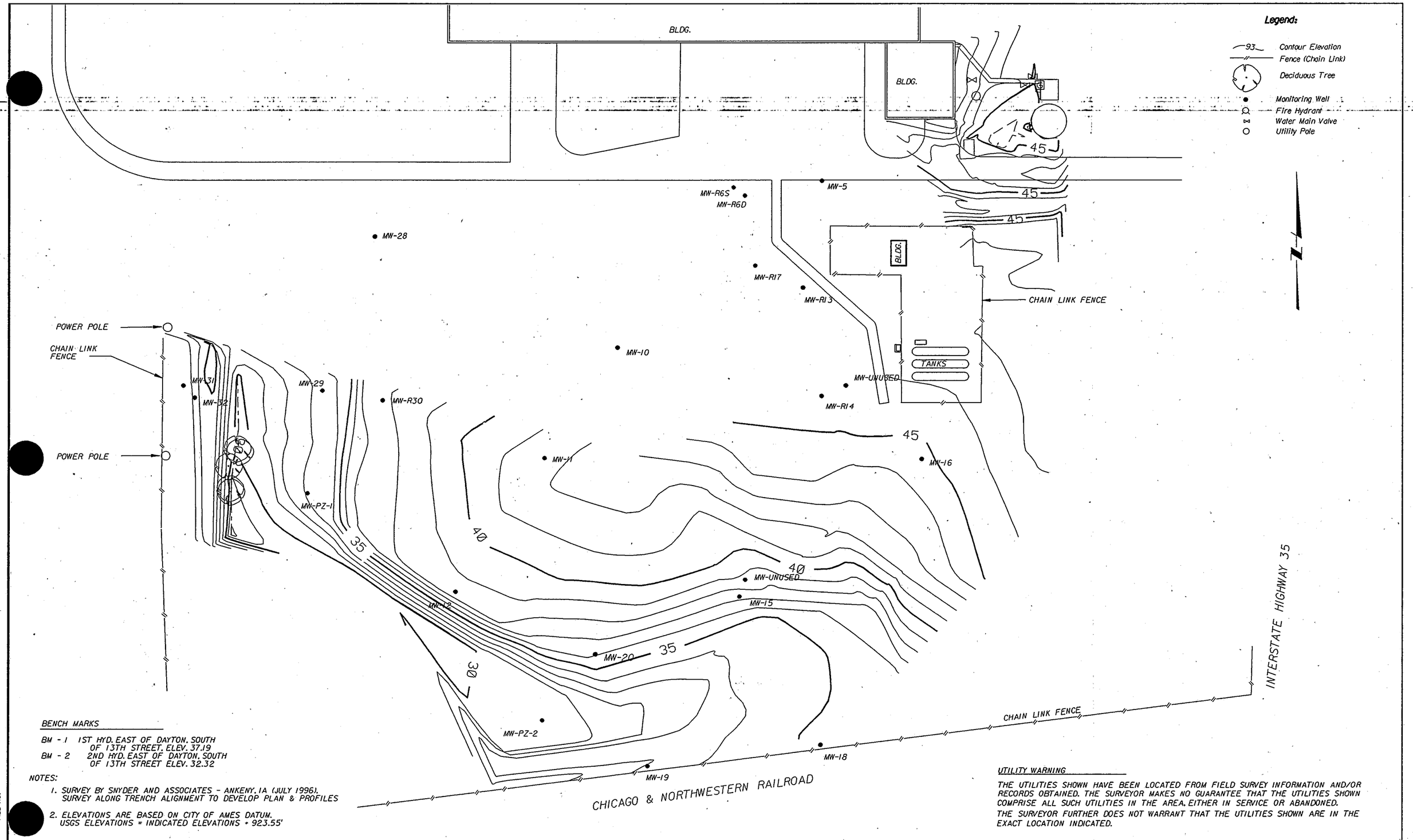
SUBMITTED
PROJECT ENGINEER REG. NO. DATE
MONTGOMERY WATSON REG. NO. DATE

MONTGOMERY WATSON
Des Moines, Iowa

SAUER SUNDSTRAND COMPANY AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
LOCATION MAPS, SHEET INDEX AND DETAIL IDENTIFICATION

SHEET G-02

JOB NO. FILE NO.



BENCH MARKS

BM - 1 1ST HYD. EAST OF DAYTON. SOUTH OF 13TH STREET, ELEV. 37.19
BM - 2 2ND HYD. EAST OF DAYTON. SOUTH OF 13TH STREET ELEV. 32.32

NOTES:

1. SURVEY BY SNYDER AND ASSOCIATES - ANKENY, IA (JULY 1996). SURVEY ALONG TRENCH ALIGNMENT TO DEVELOP PLAN & PROFILES
2. ELEVATIONS ARE BASED ON CITY OF AMES DATUM. USGS ELEVATIONS = INDICATED ELEVATIONS + 923.55'

UTILITY WARNING

THE UTILITIES SHOWN HAVE BEEN LOCATED FROM FIELD SURVEY INFORMATION AND/OR RECORDS OBTAINED. THE SURVEYOR MAKES NO GUARANTEE THAT THE UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE SURVEYOR FURTHER DOES NOT WARRANT THAT THE UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED.

REV	DATE	BY	DESCRIPTION

SCALE: 1" = 50'

WARNING 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

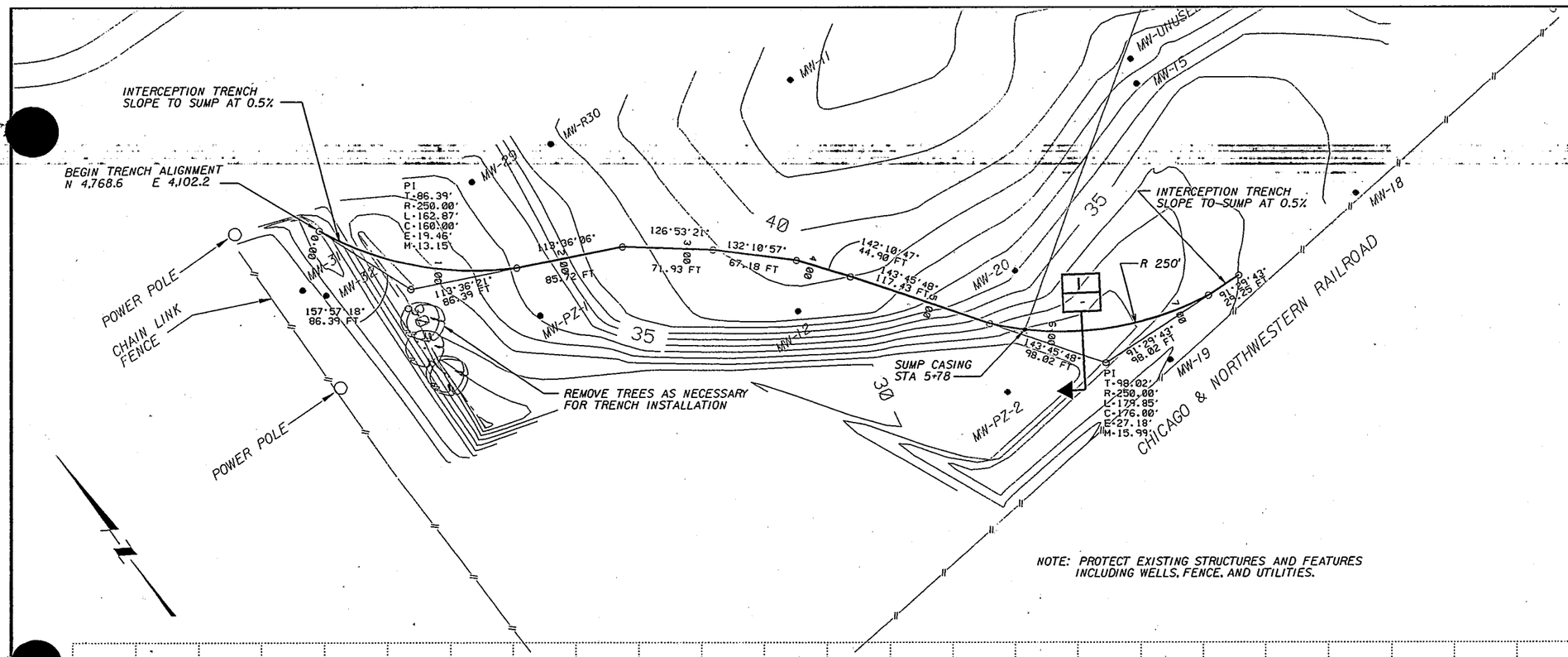
SUBMITTED
PROJECT ENGINEER REG. NO. DATE
MONTGOMERY WATSON REG. NO. DATE

MONTGOMERY WATSON
Des Moines, Iowa

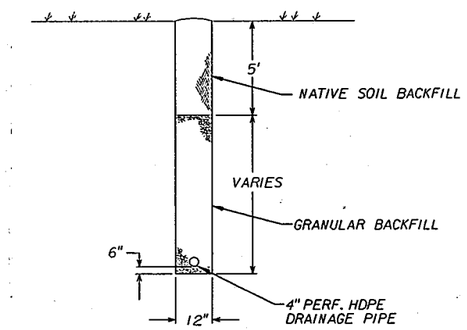
SAUER SUNDSTRAND COMPANY AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
EXISTING CONDITIONS

SHEET C-01

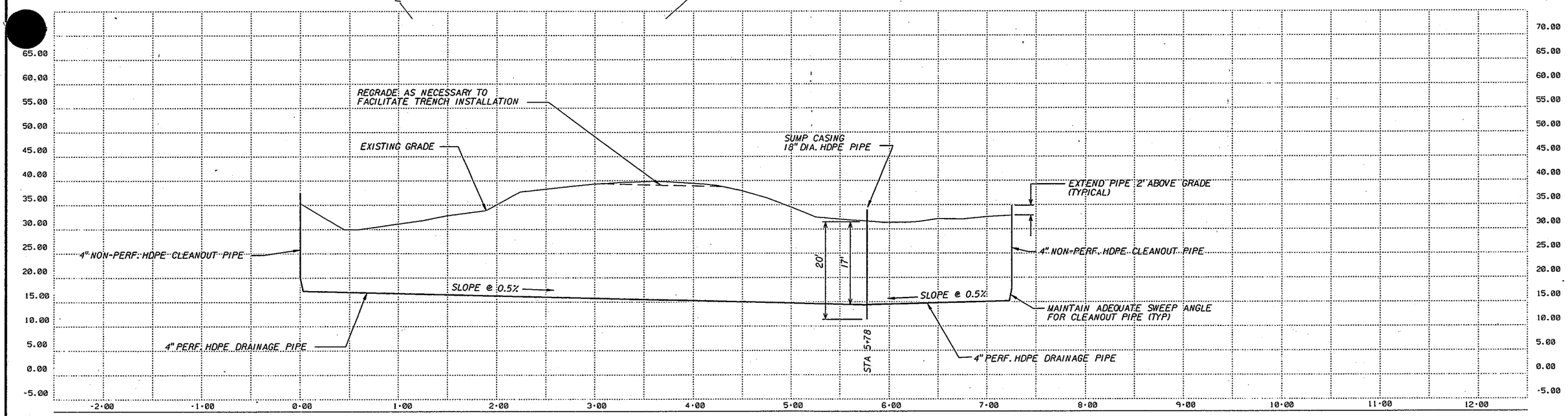
JOB NO. FILE NO.



NOTE: PROTECT EXISTING STRUCTURES AND FEATURES INCLUDING WELLS, FENCE, AND UTILITIES.



INTERCEPTION TRENCH TYPICAL SECTION — 1
NOT TO SCALE — -



REV	DATE	BY	DESCRIPTION

SCALE: HORIZ. 1" = 50' VERT. 1" = 10' V.E. = 5x

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

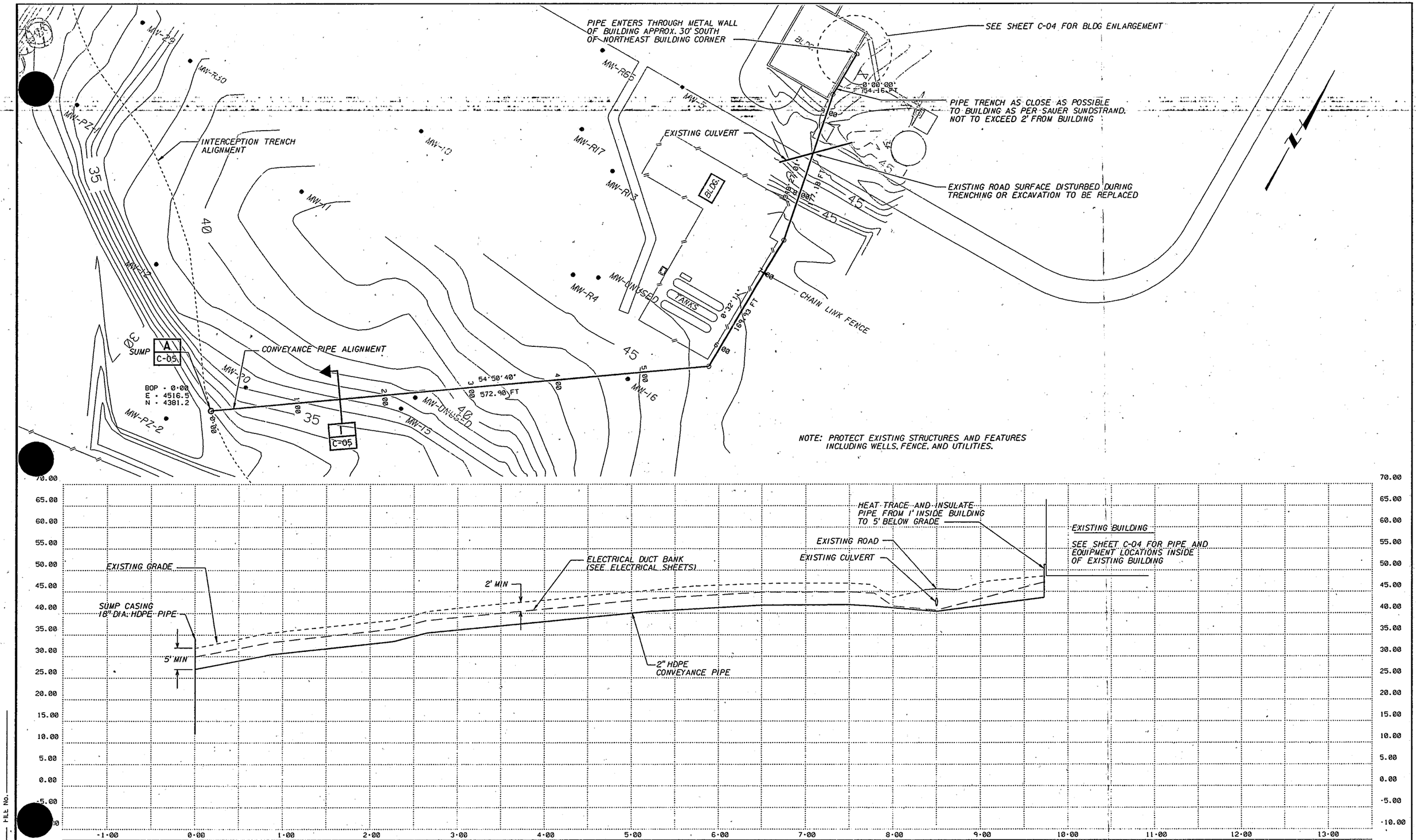
SUBMITTED
PROJECT ENGINEER — REG. NO. — DATE
MONTGOMERY WATSON — REG. NO. — DATE

MONTGOMERY WATSON
Des Moines, Iowa

SAUER SUNDSTRAND COMPANY AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
INTERCEPTION TRENCH PLAN AND PROFILE

SHEET C-02

JOB NO. ____ FILE NO. ____



REV	DATE	BY	DESCRIPTION

SCALE: HORIZ: 1" = 50' VERT: 1" = 10' V.E. = 5x

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

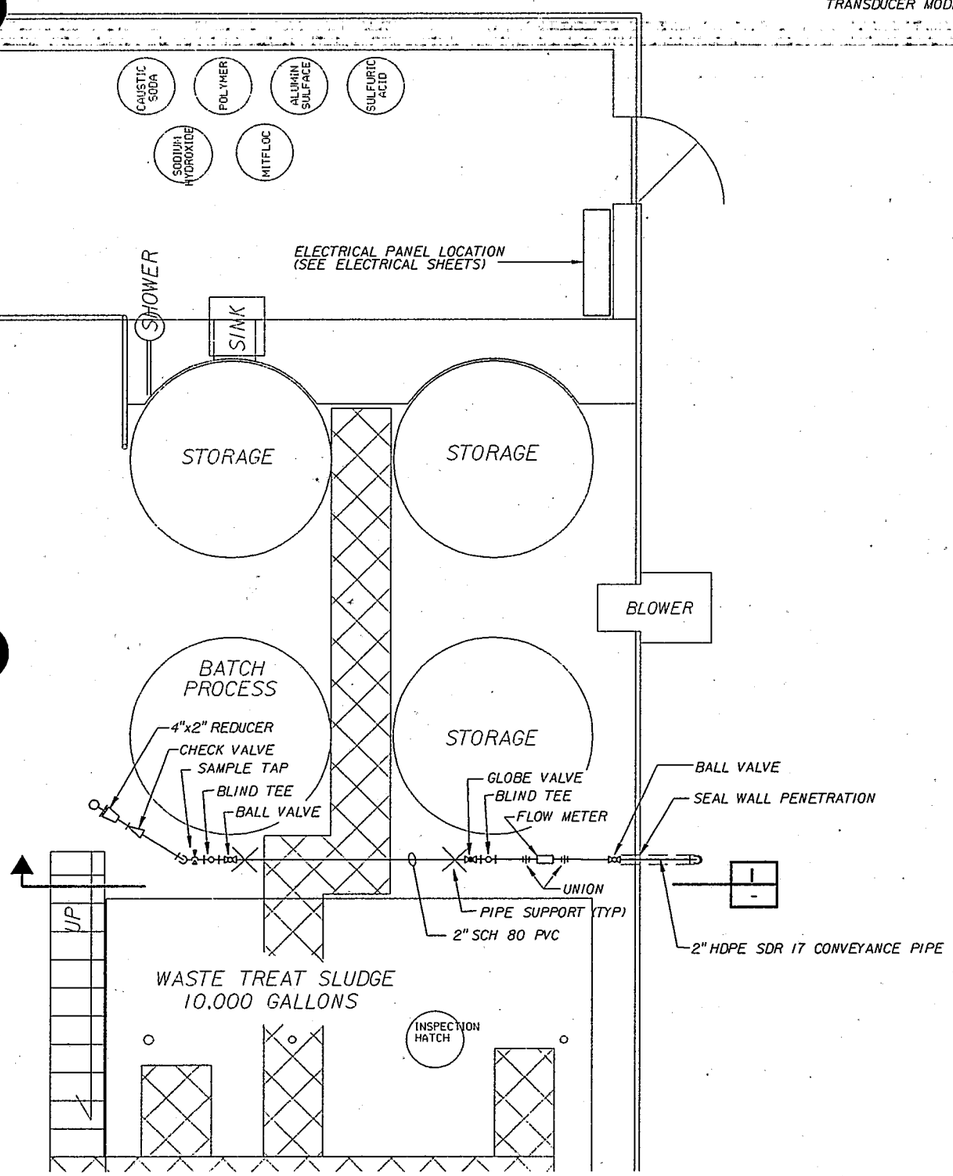
SUBMITTED
PROJECT ENGINEER REG. NO. DATE
MONTGOMERY WATSON REG. NO. DATE

MONTGOMERY WATSON
Des Moines, Iowa

SAUER SUNDSTRAND COMPANY AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
CONVEYANCE PIPING PLAN AND PROFILE

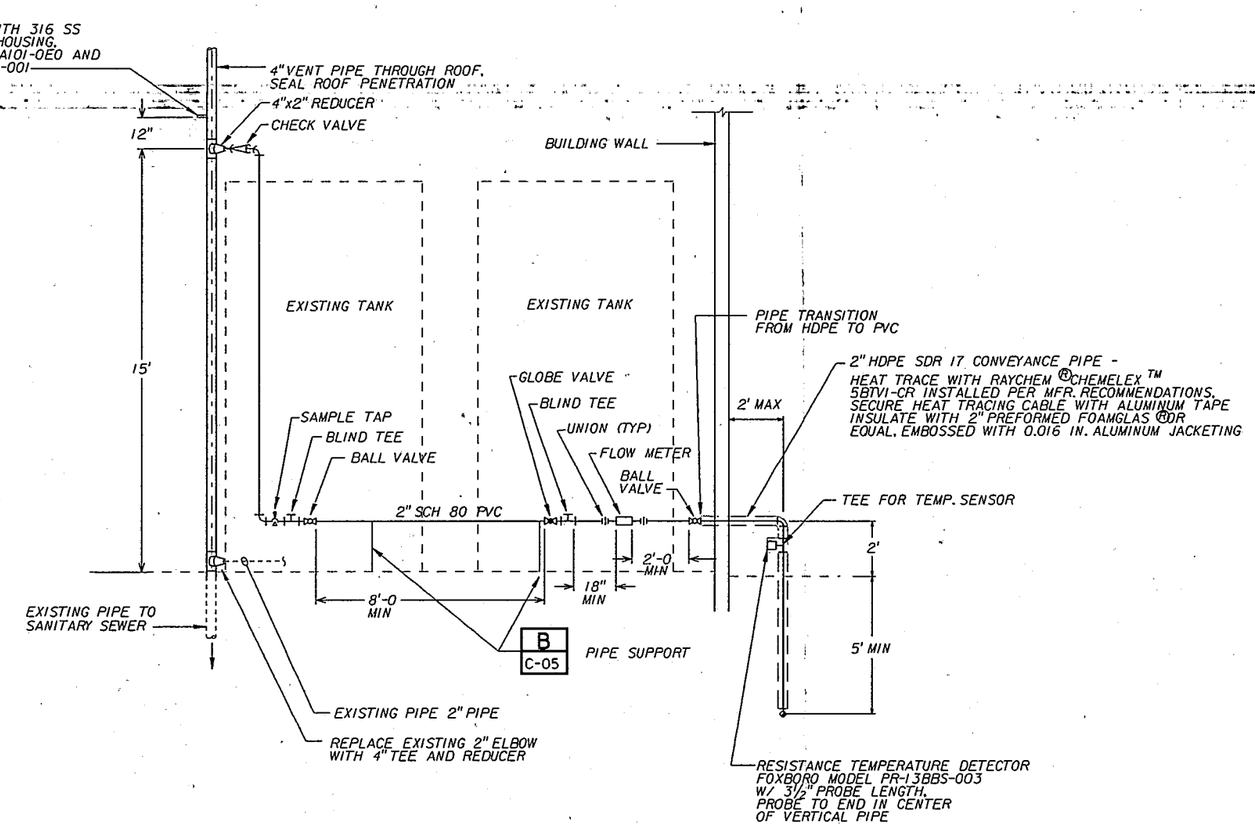
SHEET C-03

JOB NO. FILE NO.



TREATMENT BUILDING - PLAN VIEW

3/8" = 1'-0"



SECTION 1

3/8" = 1'-0"

NOTES:

1. CONVEYANCE PIPE TO BE HDPE SDR-17 OUTSIDE BUILDING AND SCH 80 PVC INSIDE BUILDING (SIZE AS SHOWN)

REV	DATE	BY	DESCRIPTION

SCALE: AS SHOWN

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

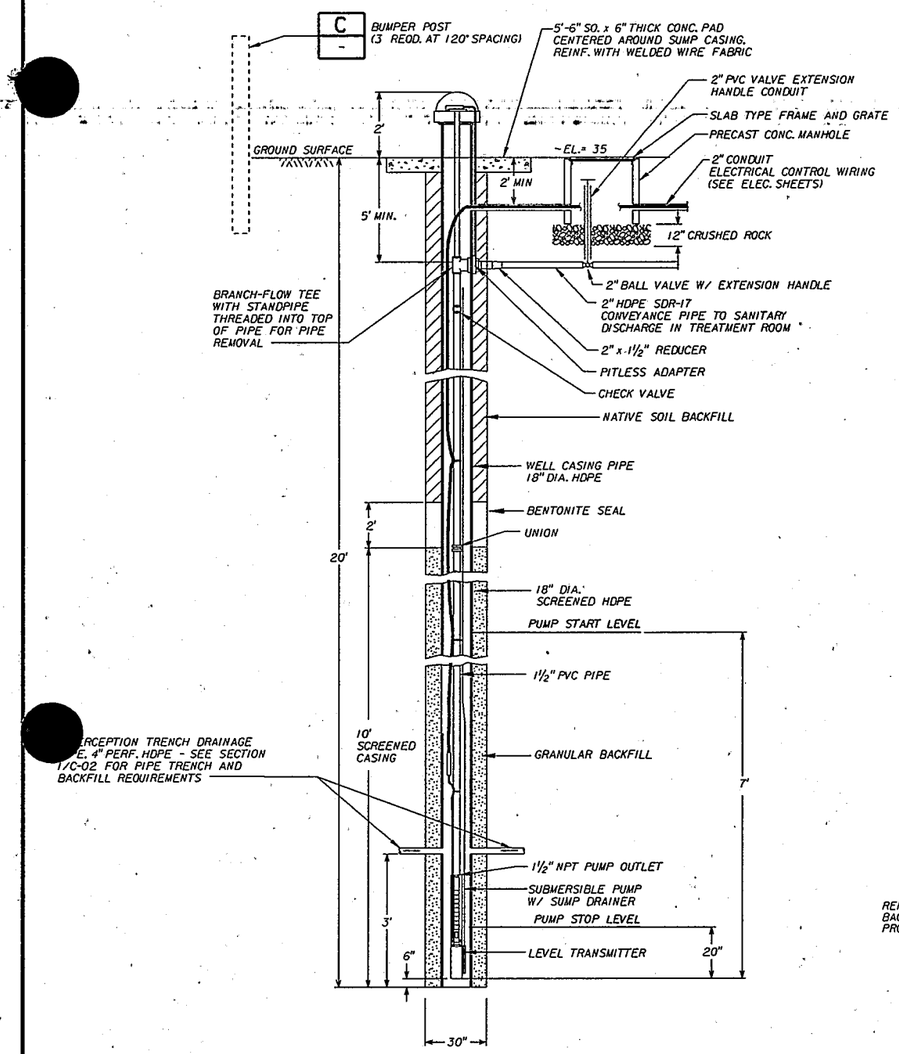
SUBMITTED
PROJECT ENGINEER REG. NO. DATE
MONTGOMERY WATSON REG. NO. DATE

MONTGOMERY WATSON
Des Moines, Iowa

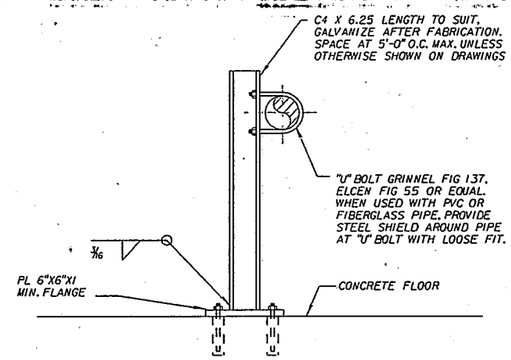
SAUER SUNDSTRAND COMPANY AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
TREATMENT BUILDING MODIFICATIONS

SHEET C-04

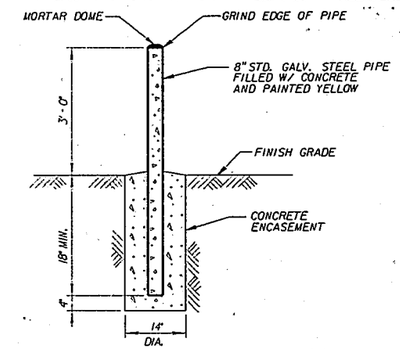
JOB NO. FILE NO.



EXTRACTION SUMP — A / C-03
NOT TO SCALE



PIPE SUPPORT — B / C-04
NOT TO SCALE



BUMPER POST DETAIL — C / -
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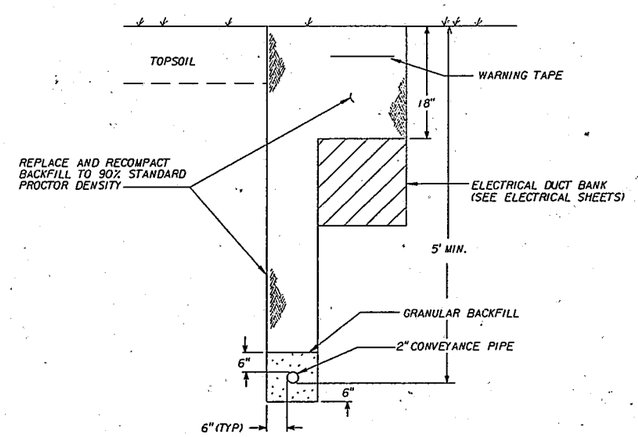


TRANSPORT PIPE TRENCH SECTION — I / C-03
NOT TO SCALE

REV	DATE	BY	DESCRIPTION

SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

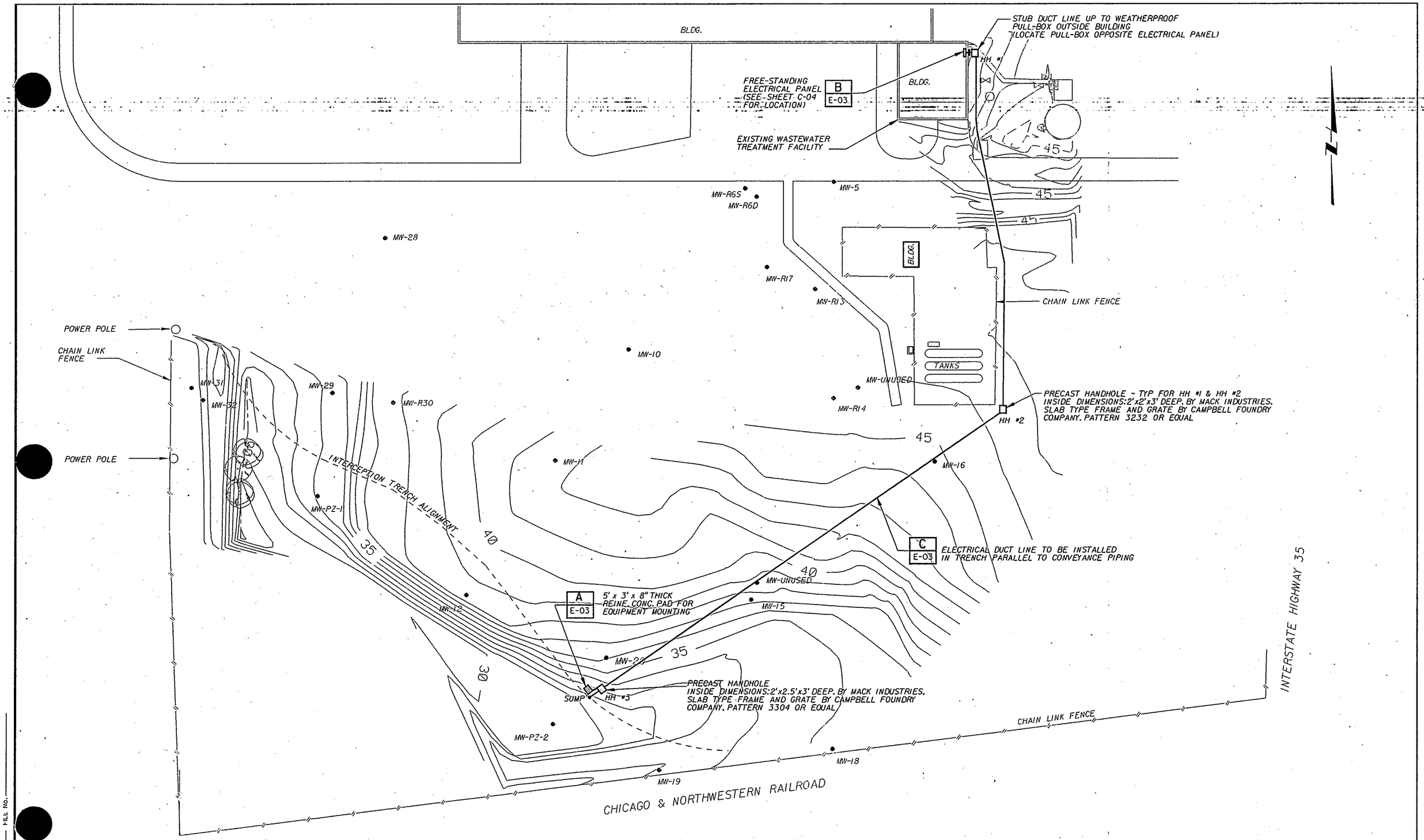
SUBMITTED
PROJECT ENGINEER — REG. NO. — DATE
MONTGOMERY WATSON — REG. NO. — DATE

MONTGOMERY WATSON
Des Moines, Iowa

SAUER SUNDSTRAND COMPANY AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
DETAILS AND SECTIONS

SHEET C-05

JOB NO. ____ FILE NO. ____



REV	DATE	BY	DESCRIPTION

JOB NO. ____ HILL NO. ____

SCALE: 1" = 50'

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

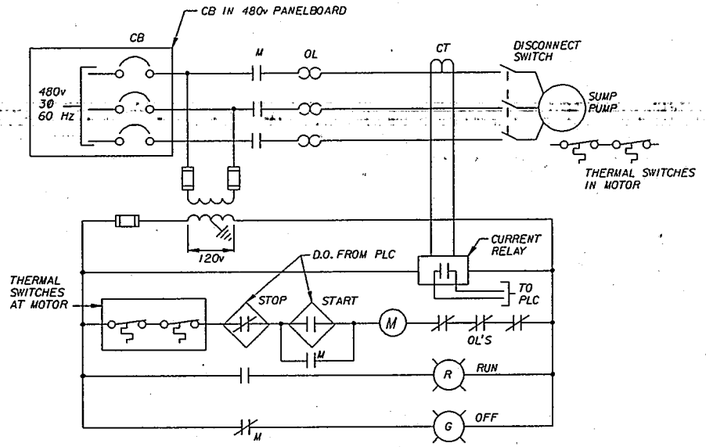
DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

SUBMITTED
PROJECT ENGINEER — REG. NO. — DATE
MONTGOMERY WATSON — REG. NO. — DATE

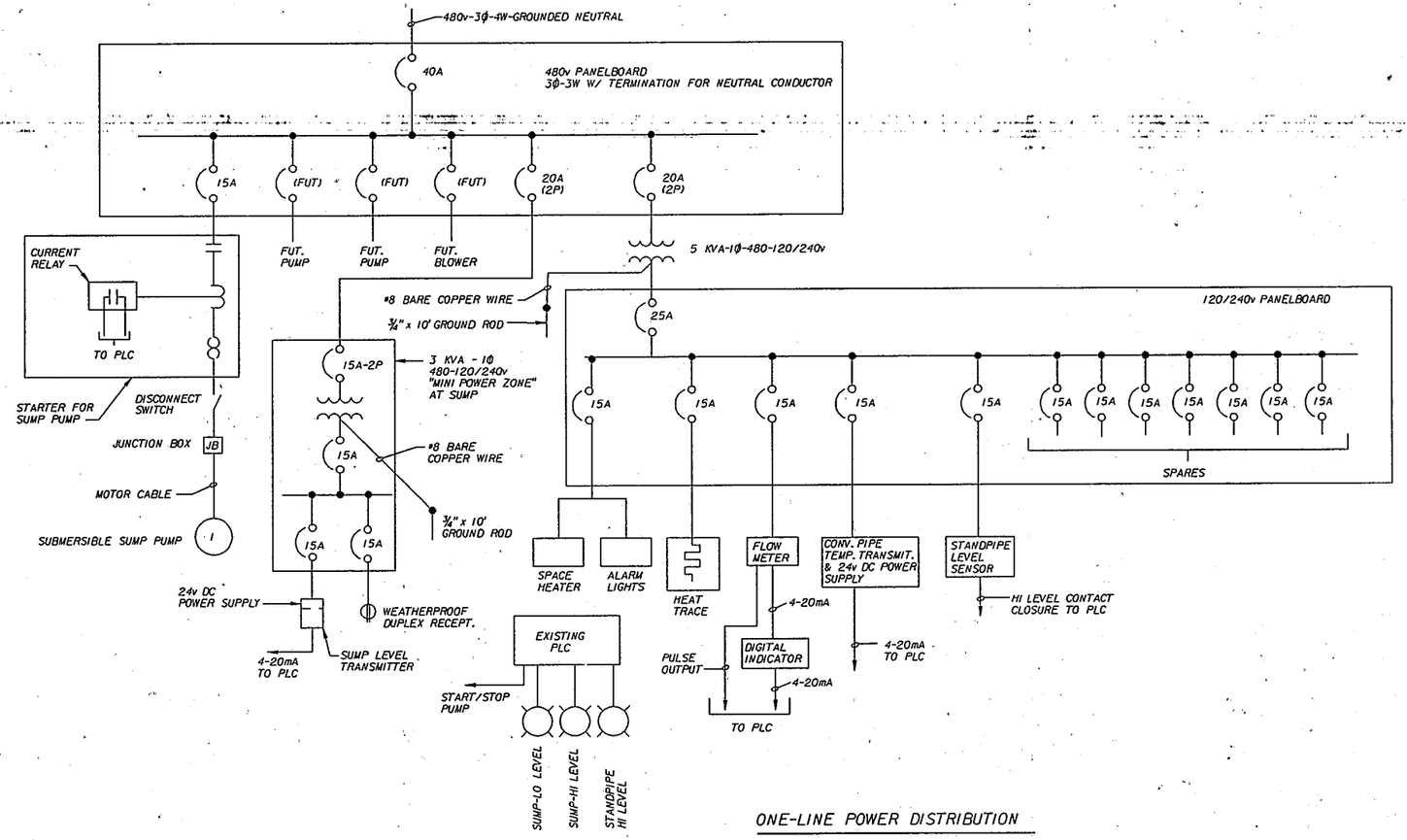
MONTGOMERY WATSON
Des Moines, Iowa

SAUER SUNDSTRAND COMPANY · AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
ELECTRICAL - PLAN VIEW

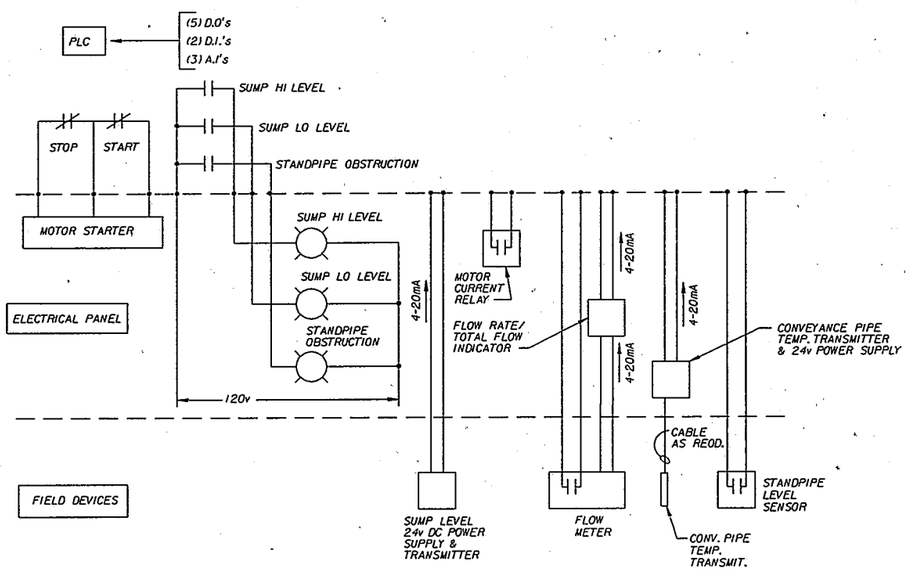
SHEET E-01



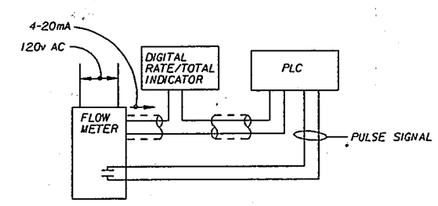
ELEMENTARY SCHEMATIC - SUMP PUMP



ONE-LINE POWER DISTRIBUTION



PLC INTERFACE DIAGRAM



FLOW METER SCHEMATIC

REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING: 0 1/2 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

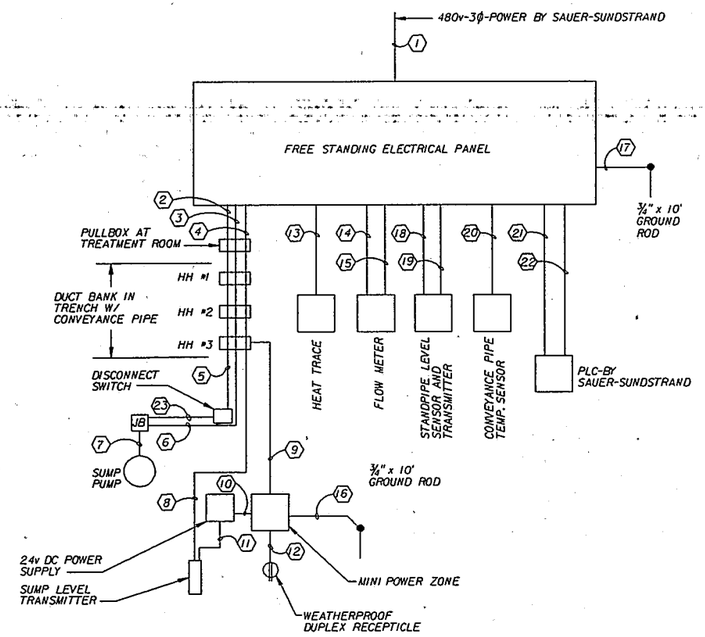
SUBMITTED
PROJECT ENGINEER REG. NO. DATE
MONTGOMERY WATSON REG. NO. DATE

MONTGOMERY WATSON
Des Moines, Iowa

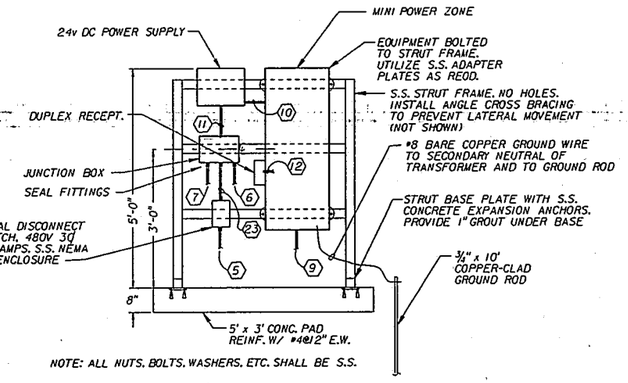
SAUER SUNDSTRAND COMPANY AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
DIAGRAMS AND SCHEMATICS

SHEET E-02

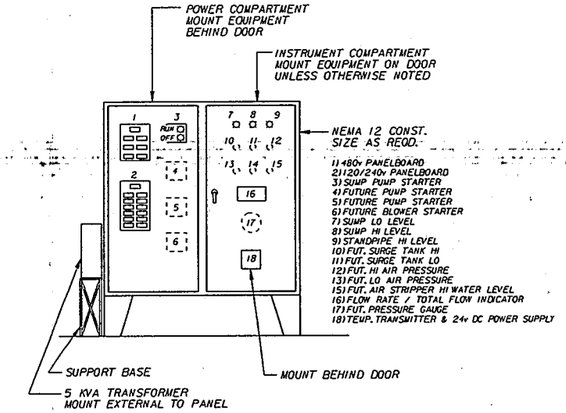
JOB NO. ____ FILE NO. ____



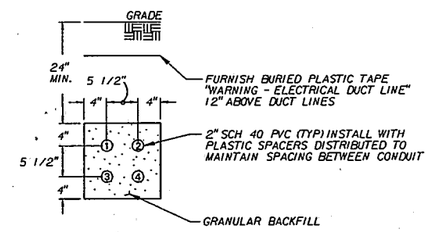
CONDUIT DEVELOPMENT



EQUIPMENT MOUNTING DETAIL AT SUMP — A / E-01



ELECTRICAL PANEL - LAYOUT — B / E-01



DUCT BANK DETAIL — C / E-01

DUCT NO.	FILL	REMARKS
1	3#8, 2#10, 2#12 GND	480V POWER
2	2#12	MOTOR THERMAL SW.
3	2.C #16 SH	4-20mA SUMP LEVEL
4	-	SPARE

CONDUIT NO.	CONDUIT SIZE	FILL	FROM	TO	REMARKS
1	-	-	SAUER-SUNDSTRAND	480v PANELBOARD	INCOMING 480v POWER
2	1"	3#8, 2#10, 2#12 GND	ELECTRICAL PANEL	PULL-BOX	480v POWER
3	¾"	2#12	ELECTRICAL PANEL	PULL-BOX	MOTOR THERMAL SWITCHES
4	¾"	2/c #16 SH	ELECTRICAL PANEL	PULL-BOX	4-20mA SUMP LEVEL
5	¾"	3#8, 1#12 GND	HH #3	DISCONNECT SWITCH	480v POWER (3 PHASE)
6	¾"	2#12	HH #3	JB FOR MOTOR CABLE	MOTOR THERMAL SWITCHES
7	-	MOTOR CABLE	SUMP PUMP	JB FOR MOTOR CABLE	BY MOTOR SUPPLIER
8	¾"	2/c #16 SH	SUMP LEVEL TRANSMITTER	HH #3	4-20mA SUMP LEVEL
9	¾"	2#10, 1#12 GND	HH #3	MINI POWER ZONE	480v POWER (1 PHASE)
10	¾"	2#12, 1#12 GND	MINI POWER ZONE	24v DC POWER SUPPLY	120v POWER
11	-	TRANS. CABLE	LEVEL TRANSMITTER	24v DC POWER SUPPLY	BY TRANSMITTER SUPPLIER
12	¾"	2#12, 1#12 GND	MINI POWER ZONE	DUPLEX RECEPTICLE	120v POWER
13	¾"	2#12, 1#12 GND	ELECTRICAL PANEL	HEAT TRACE	120v POWER
14	¾"	4#12, 1#12 GND	ELECTRICAL PANEL	FLOW METER	120v POWER/PULSE SIGNAL
15	¾"	2/c #16 SH	ELECTRICAL PANEL	FLOW METER	4-20mA FLOW SIGNAL
16	-	1#8 BARE COPPER	MINI POWER ZONE-SEC. NEUT.	GROUND ROD	GROUND
17	-	1#8 BARE COPPER	5 KVA TRANSFORMER-SEC. NEUT.	GROUND ROD	GROUND
18	¾"	2#12, 1#12 GND	120/240v PANELBOARD	STANDPIPE LEVEL SENSOR	120v POWER
19	¾"	2#12	120/240v PANELBOARD	STANDPIPE LEVEL SENSOR	HI LEVEL CONTACT CLOSURE
20	¾"	AS REQD.	CONV. PIPE TEMP. SENSOR	TEMP. TRANSMITTER	AS REQD. BY MFG.
21	¾"	11#14, 1#12 GND	120/240v PANELBOARD	PLC	PLC (5) DO's - (2) DI
22	1¼"	(3) 2/c #16 SH	120/240v PANELBOARD	PLC	PLC AI's (4-20mA)
23	¾"	3#8, 1#12 GND	DISCONNECT SWITCH	JB FOR MOTOR CABLE	480v POWER (3 PHASE)

CONDUIT SCHEDULE

CIRCUIT	DESCRIPTION	DIRECTORY	DIRECTORY	DESCRIPTION	CIRCUIT
-	2 POLE-25A	MAIN	-	-	-
1	1 POLE-15A	SP. HTR./AL. LGTS.	HEAT TRACE	1 POLE-15A	2
3	1 POLE-15A	FLOW METER	TEMP. SENSOR	1 POLE-15A	4
5	1 POLE-15A	LEVEL SENSOR	SPARE	1 POLE-15A	6
7	1 POLE-15A	SPARE	SPARE	1 POLE-15A	8
9	1 POLE-15A	SPARE	SPARE	1 POLE-15A	10
11	1 POLE-15A	SPARE	SPARE	1 POLE-15A	12

SCHEDULE: 120/240v, 1PHASE PANELBOARD - ELECTRIC PANEL

NOTE: ALL FEEDER CIRCUIT BREAKERS SHALL BE GFI TYPE.

CIRCUIT	DESCRIPTION	DIRECTORY	DIRECTORY	DESCRIPTION	CIRCUIT
-	2 POLE-15A	MAIN	-	-	-
1	1 POLE 15A	LEVEL SENSOR	RECEPTICLE	1 POLE-15A	2
3	BLANK	-	-	BLANK	4
5	BLANK	-	-	BLANK	6
7	BLANK	-	-	BLANK	8

SCHEDULE: 120/240v, 1PHASE PANELBOARD - SUMPS

NOTE: ALL FEEDER CIRCUIT BREAKERS SHALL BE GFI TYPE.

CIRCUIT	DESCRIPTION	DIRECTORY	DIRECTORY	DESCRIPTION	CIRCUIT
-	3 POLE-40A	MAIN	-	-	-
1	3 POLE-15A	SUMP PUMP	FUTURE	PUMP	2
3					4
5					6
7	FUTURE	PUMP	FUTURE	BLOWER	8
9					10
11					12
13	2 POLE-20A	5 KVA TRANSFORMER	SUMP MINI POWER ZONE	2 POLE-15A	14
15					16
17	BLANK	-	-	BLANK	18

SCHEDULE: 480v, 3PHASE - 3WIRE PANELBOARD

REV	DATE	BY	DESCRIPTION

SCALE: NONE

WARNING 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED K. LEWIS
DRAWN J. DRISCOLL
CHECKED T. BLAIR

SUBMITTED
PROJECT ENGINEER — REG. NO. — DATE
MONTGOMERY WATSON — REG. NO. — DATE

MONTGOMERY WATSON
Des Moines, Iowa

SAUER SUNDSTRAND COMPANY AMES, IOWA
GROUNDWATER INTERCEPTION SYSTEM DESIGN
CONDUIT DEVELOPMENT, SCHEDULES & DETAILS

SHEET E-03

JOB NO. ____ HILL NO. ____

INTERCEPTION TRENCH AND SUMP

1.0 GENERAL PURPOSE

A groundwater interception trench will be installed across the southwestern corner of the Sauer-Sundstrand Company property (Site), south of the main facility building and north of the Chicago & Northwestern Railroad as designated on the attached drawings, in accordance with this performance-based specification. The northwest and southeast legs of the trench will slope to a sump, and cleanouts will be included at the end of each leg. The interception trench and sump will collect groundwater from the Site, for subsequent discharge to the City of Ames sanitary sewer system.

1.1 Submittals

Prior to the start of construction, the SUBCONTRACTOR shall submit to Montgomery Watson, evidence demonstrating that all materials to be used meet the requirements of this specification. Prior to the start of construction, the SUBCONTRACTOR shall submit to Montgomery Watson, a detailed installation plan that will include the following:

- The sequence and schedule of installation of the interception trench.
- The method of controlling the depth of installation.
- The materials and method to be used to install the sump.
- The method of controlling the placement of the drainage pipe, sump and granular backfill.
- The method of disposing liquid generated during installation of the interception trench.
- Proposed granular backfill gradation and drainage pipe specifications.

Prior to the start of construction, the SUBCONTRACTOR shall successfully demonstrate the techniques for the installation of the interception trench, drainage pipe, granular backfill, sump, and cleanouts to the satisfaction of Montgomery Watson.

1.2 Health and Safety

The SUBCONTRACTOR is responsible for developing their own Site-Specific Health and Safety Plan. All work shall be conducted in accordance with the health and safety requirements defined in the SUBCONTRACTOR's Site-Specific Health and Safety Plan and applicable Occupational Health and Safety Administration (OSHA) rules. The SUBCONTRACTOR shall submit to Montgomery Watson a Site-Specific Health and Safety Plan prior to the start of construction.

The SUBCONTRACTOR may review the groundwater analytical data, available from Montgomery Watson, to become familiar with the characteristics of the groundwater associated with the interception trench installation activities.

1.3 Environmental Protection

The SUBCONTRACTOR shall take all precautions as may be required to prevent debris from spreading off site or uncontrolled beyond the vicinity of the interception trench alignment. Temporary barriers shall be used, if necessary. As required, the SUBCONTRACTOR shall implement dust control measures and shall keep piles of excavated material covered when work is not ongoing. Additionally, the SUBCONTRACTOR shall maintain the integrity of utilities, monitoring wells, roadways, and off-site property.

All water removed from the excavation shall be disposed through the City of Ames sanitary sewer system. Water shall be discharged at a rate no greater than 20 gallons per minute (gpm) and the quantity of water discharged shall be recorded. Prior to discharge, water shall be settled or filtered as necessary so that total suspended solids (TSS) and total iron concentrations do not exceed 1,500 mg/L and 28 mg/L, respectively. Samples shall be collected and analyzed to ensure constituent concentrations are below those listed in Table 1. A grab sample shall be collected midway through the excavation and analyzed for TSS and total iron.

2.0 PERFORMANCE

2.1 Interception Trench

The drainage pipe shall consist of 4-inch perforated, corrugated high density polyethylene (HDPE) pipe, placed approximately 6 inches above the trench bottom. Perforations in the drainage pipe shall be adequate to allow an infiltration rate of 30 gpm along the length of the pipe while preventing clogging from the granular backfill material. Not more than 5% by weight of the granular backfill material shall pass through the pipe perforations. The design of the drainage pipe and granular backfill shall minimize transport of silt and sediment into the interception trench, while still providing adequate flow as defined above. The drainage pipe must be able to withstand all that will be encountered during installation, including a pressure of 4 kips per square foot atop the pipe, which is equivalent to 25 feet of granular backfill at a unit weight of 110 pounds per cubic foot (including a safety factor of 1.45), and any equipment loads necessary during the installation. All materials (O-rings, bushings, couplings, fittings, etc.) used in joints shall be compatible with groundwater from the Site, which has been analyzed and contains chlorinated hydrocarbons in the parts-per-million range. Analytical results from soil and groundwater at the Site are available from Montgomery Watson. A factor of safety of 5 shall be used when determining chemical compatibility of the drainage pipe and materials with the Site soils and groundwater.

Granular backfill material shall be clean sand sized to provide an adequate filter medium between the Site soils and the drainage pipe, such as an approved Iowa Department of Transportation concrete sand. Clean sand shall consist of hard, durable mineral aggregate particles free of silt, shale, coal, organic matter or other objectionable material. Granular backfill material shall be placed at an adequate thickness below and on both sides of the drainage pipe and to within 5 feet of the ground surface. Backfilling to grade shall be completed with native soils. Filter material shall protect the drainage pipe perforations with no more than 5% by weight of the granular backfill material passing through the perforations.

TABLE 1

MAXIMUM DISCHARGE CONCENTRATIONS

Constituent	Maximum Concentration
Acetone	44 µg/l
1,1-Dichloroethane	370 µg/l
1,2-Dichloroethane	3.9 µg/l
1,1-Dichloroethylene	170 µg/l
cis-1,2-Dichloroethylene	490 µg/l
trans-1,2-Dichloroethylene	4.7 µg/l
Methylene Chloride	6.1 µg/l
Perchloroethylene	1,700 µg/l
1,1,1-Trichloroethane	650 µg/l
1,1,2-Trichloroethane	20 µg/l
Trichloroethylene	110 µg/l
Total Xylenes	11 µg/l

The interception trench shall be installed with methods capable of controlling the depth of excavation and placement of all materials within the trench, including drainage pipe, granular backfill material, sump, and cleanouts, to within 0.2 feet of the design elevation. The slope of the interception trench shall be a minimum of 0.5% to maintain positive drainage to the sump. Alignment of the interception trench shall be controlled to an acceptable tolerance of the design alignment. Cleanouts shall be provided with liquid tight covers and shall incorporate adequate sweep angles to permit cleaning activities.

All clean soil excavated during trenching activities shall be spread on the Site, graded and compacted in the general vicinity of the interception trench. The graded area shall be sloped to promote natural drainage across the Site, away from the building. Materials excavated from below the groundwater table shall be allowed to drain before spreading by placing in approved staging areas so that runoff flows back into the trench. Clean soils not used during regrading shall be placed on the existing soil pile east of the propane tank farm. Damaged soil shall be stockpiled on site in the area south of the propane tank farm and covered with 4-mil plastic sheeting for disposal according to all applicable local, state, and federal regulations. All disturbed areas shall be seeded with prairie flower seed, provided by the OWNER, to establish a vegetative cover for erosion control.

2.2 Sump

The sump shall be constructed of 18-inch HDPE well casing and screen. The sump shall be installed to a depth of 20 feet and shall be completed approximately 2 feet above grade with a lockable, liquid tight cover. The sump shall be physically connected to the interception trench drainage pipe. The bottom 10 feet of the sump shall be well screen, and the top 12 feet shall be well casing. Backfill material shall be granular backfill placed below and surrounding the sump as indicated in the Construction Drawings, extending to the top of the well screen. A 2-foot thick bentonite or similar well plug shall be installed atop the clean sand. Backfilling to grade level shall be completed with native soils. Well screen and granular backfill shall be sized to allow the desired infiltration rate while allowing no more than 5% of the granular backfill material to pass through the well screen slots. The sump shall be installed with methods capable of controlling the depth of installation to within 0.2 feet of the design elevation.

2.3 Testing

Following installation, the drainage pipe and sump shall be jetted to remove finer particles from the backfill immediately surrounding the pipe and sump. Jetting shall continue until the water turbidity visually stabilizes. The SUBCONTRACTOR shall clean out the interception trench drainage pipe and remove all accumulated sediment from the sump. The interception trench drainage pipe shall then be pigged. Any faulty joints, collapsed pipe, or other problems that affect the integrity of the drainage pipe, backfill or trench shall be repaired by the SUBCONTRACTOR at their expense.

-- END OF SECTION --

SECTION 02200

EARTHWORK

INDEX

PART 1 -- GENERAL

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1.2 References
1.3 Submittals
1.4 Quality Assurance

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2.2 Unsuitable Material
2.3 Use of Material Types

PART 3 -- EXECUTION

3.1 Pipeline and Utility Trench Excavation
3.2 Disposal of Excavated Material
3.3 Placing and Spreading of Backfill Materials
3.4 Compaction Requirements
3.5 Sampling and Testing
3.6 Final Grades

SECTION 02200 - EARTHWORK

PART 1 -- GENERAL

1.1 Summary

A. This section includes all Site preparatory earthwork required for construction of the project. Such earthwork shall include, but not be limited to, the loosening, removing, loading, transporting, depositing, and compacting, in its final location, of all materials wet and dry, as required for the purposes of completing the project specified in the Contract Documents. This earthwork will include, but not be limited to, furnishing, placing, and removing sheeting and bracing necessary to safely support the sides of all excavations; all pumping, ditching, draining, and other required measures for the removal or exclusion of water from the excavation; supporting structures above and below the ground; all backfilling around structures and all excavation, backfilling, and compaction of trenches and pits; stockpiling excess excavated materials; borrow of materials to make up deficiencies for fills; and all other incidental earthwork, all in accordance with the requirements of the Contract Documents.

1.2 References

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. **American Society for Testing and Materials (ASTM)**

ASTM C 136	Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	Method for Particle-Size Analysis of Soils.
ASTM D 698	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-pound (lb) (2.49-kilogram) Rammer and 12-inch (304.8-millimeter (mm) Drop.
ASTM D 854	Test Method for Specific Gravity of Soils
ASTM D 1140	Test Method for Amount of Material in Soils Finer than the No. 200 (75 mm sieve)
ASTM D 1556	(1990) Density of Soil in Place by the Sand-Cone Method
ASTM D 2167	(1984; R 1990) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	(1990) Classification of Soils for Engineering Purposes

ASTM D 2922	(1981; R 1990) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4253	(1993) Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D 4254	(1991) Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4318	(1984) Test Method for liquid limit, plastic limit and plasticity index of soils.

C. **Unified Soil Classification System:** References in these Specifications to soil classification types and standards are as set forth in ASTM D 2487. The CONTRACTOR shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.

D. The CONTRACTOR's attention is directed to the provisions of subpart P, Section 1926.652 of the OSHA Safety and Health Standards for Construction, which require that all banks and trenches over 5 feet high shall be shored or sloped to the angle of repose.

1.3 Submittals

A. ENGINEER approval is required for the following submittals prior to full scale Site construction. The following shall be submitted in accordance with Section 01300 - "Contractor Submittals."

1. Certified test reports and analysis certifying that the suitable materials proposed for use at the project Site conform to the specified requirements.

B. The following submittals are required during and following placement and compaction of materials at the Site. These submittals shall be submitted in accordance with Section 01300 - "Contractor Submittals."

1. All test results for in-place field density testing conducted by the CONTRACTOR.

2. Certified weight tickets for all materials brought from off site (only if pay item is per ton).

1.4 Quality Assurance

A. **General:** On-site soils density testing shall be completed by a testing laboratory of the ENGINEER's choice and at the ENGINEER's expense except as specified herein. Where soils or aggregate testing is specified, said testing will be in accordance with the requirements of these Specifications.

B. All tests conducted prior to construction to demonstrate compliance with the soil and aggregate specifications shall be submitted by the CONTRACTOR to the ENGINEER

prior to acceptance of any soil or aggregate for use. The CONTRACTOR is responsible for costs associated with this soil and aggregate testing.

C. The ENGINEER shall be responsible for costs associated with testing on-site soils. Should off-site soils be required, the CONTRACTOR shall be responsible for the costs associated with the testing of said soil.

D. In case the tests of the fill or backfill show noncompliance with the required compaction specifications, the CONTRACTOR shall accomplish such remedy as may be required to ensure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the OWNER and shall be at the CONTRACTOR's expense.

E. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content shall be determined in accordance with ASTM D 698. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density shall be determined in accordance with ASTM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 1556, ASTM D 2922, or by such other means acceptable to the ENGINEER.

F. Atterburg limits of soils shall be performed according to ASTM D4318; particle size analysis of soils and aggregates shall be performed using ASTM D 422.

PART 2 -- PRODUCTS

2.1 Suitable Materials

A. **General:** Backfill shall be suitable selected or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other vegetation.

B. **Suitable Materials:** Soils not classified as unsuitable pursuant to Paragraph 2.2, below, are suitable materials and may be used in backfilling subject to the specified limitations.

C. Suitable materials may be obtained from on-site excavations, or may be imported from off site. If off-site materials are required to meet the requirements of this Section or to meet the quantity requirements of the Project, the CONTRACTOR shall provide the imported materials at no additional expense to the OWNER, unless a unit price item is included for off-site materials in the bidding schedule.

D. The following types of suitable materials are designated and defined as follows:

1. **On-Site Backfill Material:** Clean soil from the on-site excavation area. The material shall be relatively free from grass, roots, brush, or other organic materials.

2. **Off-Site General Fill Material:** Soils from an off-site borrow area approved by the ENGINEER for the specified intended use. The material shall be free from grass, roots, brush, or other organic materials. The material shall contain no rocks or unbroken masses of earth materials larger than 6 inches in diameter.

3. **Pipe Bedding:** Pipe Bedding (for discharge pipe only) material shall be select granular fill with a maximum P200 content of 20% or more than 90% passing the No. 4 U.S. sieve size, generally classified as sand. Maximum particle size ≤ 1 inch.

2.2 Unsuitable Material

A Unsuitable backfill material shall include damaged soil, general trash, debris, or any soils classified as unsuitable by the ENGINEER. Damaged soil will be defined as soil exhibiting 10 ppm organic vapors in the headspace of a closed container or as otherwise determined by the ENGINEER. Materials shall be classified as unsuitable if the materials cannot be sufficiently compacted to achieve the required density requirements, as defined herein.

2.3 Use Of Material Types

A. The CONTRACTOR shall use the types of materials as designated herein for all required backfill.

B. Backfill types shall be used in accordance with the following provisions:

1. Excavations shall be backfilled with On-Site Backfill Material. Off-Site General Fill Material shall be used to supplement On-Site Backfill Material as required.

2. Discharge piping shall be surrounded with Pipe Bedding material within 6 inches of the outside walls of the pipe.

PART 3 -- EXECUTION

3.1 Pipeline and Utility Trench Excavation

A. **General:** Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the CONTRACTOR, but shall have a minimum width at the bottom of the trench equal to that dimension shown in the Drawings for mechanical compaction methods. The maximum width at the top of the pipe shall also be as shown on the Drawings.

B. **Open Trench:** The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights meeting OSHA and other applicable safety requirements shall be provided and maintained.

C. **Dewatering:** All water removed from the excavation shall be discharged through the City of Ames sanitary sewer system at a rate no greater than 20 gallons per minute. The quantity of water discharged shall be recorded. Prior to discharge, water shall be settled or filtered as necessary so that total suspended solids (TSS) and total iron concentrations do not exceed 1500 mg/L and 28 mg/L, respectively. Water shall be tested to ensure constituent concentrations are below those listed below. A grab sample shall be collected midway through the excavation and analyzed for TSS and total iron.

Constituent	Maximum Concentration
Acetone	44 µg/L
1,1-Dichloroethane	370 µg/L
1,2-Dichloroethane	3.9 µg/L
1,1-Dichloroethylene	170 µg/L
cis-1,2-Dichloroethylene	490 µg/L
trans-1,2-Dichloroethylene	4.7 µg/L
Methylene Chloride	6.1 µg/L
Perchloroethylene	1,700 µg/L
1,1,1-Trichloroethane	650 µg/L
1,1,2-Trichloroethane	20 µg/L
Trichloroethylene	110 µg/L
Total Xylenes	11 µg/L
Total Suspended Solids	1500 mg/L
Total Iron	28 mg/L

3.2 Disposal of Excavated Material

A. **Excess Clean Material:** All clean, excess, excavated material shall be spread on site in the general vicinity of the collection trench and conveyance piping and shall be regraded and compacted as specified herein. Clean soils not used during regrading shall be placed on the existing soil pile east of the propane tank farm. General trash, debris (including removed pavement) and soils containing excessive grass, roots, brush or other organic materials shall be disposed off the Site at a location selected by the CONTRACTOR and approved by the OWNER.

B. **Damaged Soil:** Damaged soil encountered during excavation will be stockpiled in the area south of the propane tank farm and covered with 4-mil plastic sheeting for disposal according to all applicable local, state and federal regulations.

The CONTRACTOR shall take care that hazardous wastes (such as petroleum products) are not spilled anywhere on the site during construction. In the event of a spill, the CONTRACTOR shall notify the ENGINEER and OWNER, and then promptly clean up the spilled material in accordance with local, state, and Federal regulations.

3.3 Placing and Spreading of Backfill Materials

A. Backfill shall not be dropped directly upon any structure or pipe.

B. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that when compacted each layer shall not exceed 6 inches in thickness.

C. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe Bedding shall be manually spread around the pipe so that, when compacted, the Pipe Bedding fills all voids surrounding the pipe and provides uniform bearing and side support.

D. The CONTRACTOR shall not place pipe bedding until the trench subgrade has been approved by the ENGINEER.

E. Where the backfill material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.

F. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried until the moisture content is satisfactory.

3.4 Compaction Requirements

A. Compaction shall be accomplished by means specified and to the following densities for various parts of the WORK. Deficiencies in construction shall be corrected by the CONTRACTOR at their own expense. Where agency or utility company requirements govern, the highest compaction standards shall apply.

B. **On-Site Backfill Material/Off-Site General Fill Material:** Each lift shall be compacted to a density of at least 90% of the maximum standard Proctor density as determined by the corresponding material tests in accordance with ASTM D 698. Backfill beneath paved areas or structures shall be compacted to a density of at least 95% of the maximum standard Proctor density. Fill material shall be placed and compacted at -1 to +3% of optimum moisture content, as determined by ASTM D 698.

C. **Pipe Bedding:** Pipe bedding materials shall be placed and compacted at -3% to +3% of the optimum moisture content to 90% of maximum index density, as determined by ASTM D4253 and D4254. Each layer shall be compacted by means of at least 2 passes from a flat plate vibratory compactor.

3.5 Sampling and Testing

A. Quality control sampling and testing shall be performed by the ENGINEER in accordance with Section 01440 - "Quality Control" and as specified herein. Check tests for acceptance may be made by and at the expense of the CONTRACTOR, at the CONTRACTOR's discretion. Test results indicating nonconformance with the specifications shall be rectified and retested by the ENGINEER, at the CONTRACTOR's expense.

B. **Classification Determinations:** A soils classification per the Unified Soils Classification System shall be obtained by the CONTRACTOR for each principal type of off-site material or combination of materials utilized. The classification testing shall include Atterberg limits, grain size determination (sieve and hydrometer analyses) and specific gravity. These tests are described in ASTM D 4318, ASTM D 1140, ASTM D 422 and ASTM D 854, respectively. Samples shall be representative of the material placed. Copies of all tests for classification shall be furnished to the ENGINEER for approval prior to placement of the material.

C. **Density-Moisture Requirements:** Tests for determination of maximum density and optimum moisture shall be performed by the CONTRACTOR in accordance with the requirements of ASTM D 698. Samples shall be representative of the materials to be placed. An optimum moisture-density curve shall be determined for each principal type of on-site or off-site material or combination of materials encountered or utilized. Results of these tests shall be the basis of control for compaction. A copy of these tests shall be furnished to the ENGINEER for approval prior to material placement.

D. **Density Control:** The CONTRACTOR shall adequately control his compaction operations by tests made by the ENGINEER in accordance with any of the following methods: ASTM D 1556, ASTM D 2167, or ASTM D 2922 and ASTM D 3017 to insure placement of materials within the limits of densities specified. When ASTM D 2922 is used, the calibration curves shall be checked, and adjusted if necessary, using the sand cone method as described in paragraph "Calibration" of ASTM D 2922. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with the density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the ENGINEER. One test shall be made for each 150 lineal feet of pipe trench or less for each lift of material placed. Additional tests shall be made as necessary at the discretion of the ENGINEER. All test results will be made available to the CONTRACTOR. Acceptance tests may be made by the CONTRACTOR for verification of compliance; however, the ENGINEER's test results of earthwork shall be the basis for compaction control. Deficiencies in construction shall be corrected by the CONTRACTOR at their expense.

3.6 Final Grades

A. Final grades of all areas disturbed shall be approximately equal to the original elevations and slopes. The resulting slopes shall promote natural drainage across the Site, away from the building.

B. All disturbed areas shall be seeded with prairie flower seed, provided by the OWNER, to establish a vegetative cover for erosion control. The CONTRACTOR shall provide initial watering of the seeded area.

C. All paved areas disturbed during the excavation shall be restored to their original condition.

-- END OF SECTION --

SECTION 02646

HDPE PRESSURE PIPE

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SECTION 02646 - HDPE PRESSURE PIPE

PART 1 -- GENERAL

1.1 The Requirement

A. The CONTRACTOR shall furnish and install 2-inch pressure-rated high density polyethylene (HDPE) pipe as the discharge pipe from the collection trench sump to the existing water treatment room, all in accordance with the requirements of the Contract Documents and as shown on the Drawings. The piping system shall be complete with all necessary fittings, and accessories to provide a functional installation.

1.2 Commercial Standards:

ASTM D3350	Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM D1248	Polyethylene Plastic Moldings and Extraction Materials
ASTM D3261	Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D3035	Polyethylene (PE) Plastic Pipe, (SDR-PR) Based on Controlled Outside Diameter
ASTM D2683	Socket Type Polyethylene Fittings for Outside Diameter Polyethylene Pipe and Tubing
ASTM D2774	Standard Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D2412	Test method for External Loading Properties of Plastic Pipe by Parallel-Plate Loading
ASTM D2444	Test method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

1.3 Contractor Submittals

A. **Shop Drawings:** The CONTRACTOR shall submit shop drawings illustrating details of all pipe, fittings, connections, valves, joining systems and appurtenances in accordance with the requirements of the Section 01300 - "Contractor Submittals."

B. **Certifications:** The CONTRACTOR shall provide manufacturer's certification for all materials indicating conformance with the requirements of the Contract Documents.

1.4 Quality Assurance

A. **Testing:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this section of the Specifications, as specified in the referenced standards, as applicable. The cost of all such testing shall be borne by the CONTRACTOR.

B. The CONTRACTOR shall perform said material tests in accordance with the requirements of the Contract Documents. The ENGINEER shall have the right to witness all testing conducted by the CONTRACTOR, provided that the CONTRACTOR's schedule is not delayed for the convenience of the ENGINEER.

C. In addition to those tests specifically required, the ENGINEER may request additional samples of any material for testing. The additional samples shall be furnished at no additional cost to the ENGINEER, but the CONTRACTOR will not be responsible for costs associated with the requested additional tests.

PART 2 -- PRODUCTS

2.1 General

A. All pressure pipe, fittings, appurtenances and adhesives shall be chemically compatible with the Site groundwater to the extent necessary for use as conveyance piping. Groundwater from the Site has been analyzed and contains chlorinated hydrocarbon compounds in the parts-per-million range. Groundwater analytical results are available from the ENGINEER.

B. Polyethylene compounds used in the manufacture of the pipe shall be designated PE 3408 according to ASTM D 1248 and PE 3453C, according to ASTM D3350.

2.2 Pipe Design Criteria

A. **General:** Pipe shall be designed in accordance with the requirements of the referenced specifications, codes, and standards, as applicable, and the supplemental requirements specified in this section.

2.3 Pipe

A. Pipe shall be SDR-17 HDPE pipe, as per ASTM D 3035.

B. The HDPE pipe shall be furnished complete with all special fittings as required in the Contract Documents.

C. All joints shall be sealed using a butt fusion bonding process, in accordance with ASTM D 3261, using equipment that meets the standards as specified in ASTM D 3261.

2.4 Fittings

A. The HDPE fittings shall be butt-fusion-bonded SDR 17 fittings, as defined by ASTM D 3261.

B. The strength of the fittings shall be equal to or greater than that of the pipe.

PART 3 -- EXECUTION

3.1 General

A. All laying, jointing, and testing for defects and leakage shall be performed in the presence of the ENGINEER and shall be subject to the ENGINEER's approval before acceptance. All material found to have defects shall be rejected, and the CONTRACTOR shall promptly remove such defective materials from the site of the WORK.

B. Installation shall conform to the instructions furnished by the pipe manufacturer and to the supplementary requirements or modifications specified herein. Wherever the provisions of this section and the aforementioned requirements are in conflict, the more stringent provisions shall apply.

3.2 Handling and Storage

A. **Handling:** Pipe, fittings and accessories shall be carefully inspected before and after installation, and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches.

B. **Storage:** Pipe and fittings shall be stored, if possible, at the job Site in unit packages provided by the manufacturer and shall be protected from exposure to direct sunlight. Pipe shall be stored in such a way as to prevent sagging or bending. No pipe or fittings shall be stored in standing water or in an area subject to puddling.

3.3 Trenching and Backfill

A. Trench excavation and backfill shall conform to the requirements of Section 02200 - "Earthwork."

3.4 Installation

A. All tools and equipment used for installation of pipe shall be as recommended by the manufacturer.

B. ASTM D2774 and the additional specifications herein shall be followed for underground installations.

C. Pipe shall not be installed when weather conditions are unsuitable.

D. Joints shall be installed according to manufacturer's recommendations and ASTM D3261. Trenches shall be kept free of water until joints have been properly made and cured.

E. Pipe shall be cut using a saw and miter box or a chop saw with a fine tooth blade to ensure a square cut. All cut pipe ends shall be deburred prior to installation.

3.5 Field Testing

A. Field testing shall conform to the requirements of Section 02730 - " Pipeline Testing."

-- END OF SECTION --

SECTION 02647

PVC PRESSURE PIPE

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SECTION 02647 - PVC PRESSURE PIPE

PART 1 -- GENERAL

1.1 The Requirement

A. The CONTRACTOR shall furnish and install 2-inch and 4-inch pressure-rated polyvinyl chloride (PVC) pipe inside the existing water treatment room, all in accordance with the requirements of the Contract Drawings. The piping system shall be complete with all necessary fittings and accessories to provide a functional installation.

1.2 Commercial Standards:

1.	ASTM D 1784	Specification for Rigid PVC Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds
2.	ASTM D 1785	Specification for PVC Pressure-Rated Pipe, (Schedules 40 and 80)
3.	ASTM D 2321	Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
4.	ASTM D 2584	Test Method for Ignition Loss of Cured Reinforced Resins
5.	PPI Technical Report TR 3/4	Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
6.	AWWA Manual M23	PVC Pipe - Design and Installation

1.3 Contractor Submittals

A. **Shop Drawings:** The CONTRACTOR shall submit shop drawings illustrating details of all pipe, fittings, connections, valves, joining systems and appurtenances in accordance with the requirements of the Section 01300 - "Contractor Submittals."

B. **Certifications:** The CONTRACTOR shall provide manufacturer's certification for all materials indicating conformance with the requirements of the Contract Documents.

1.4 Quality Assurance

A. **Testing:** Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this section of the Specifications, as specified in the referenced standards, as applicable. The cost of all such testing shall be borne by the CONTRACTOR.

B. The CONTRACTOR shall perform said material tests in accordance with the requirements of the Contract Documents. The ENGINEER shall have the right to witness all testing

conducted by the CONTRACTOR, provided that the CONTRACTOR's schedule is not delayed for the convenience of the ENGINEER.

C. In addition to those tests specifically required, the ENGINEER may request additional samples of any material for testing. The additional samples shall be furnished at no additional cost to the ENGINEER, but the CONTRACTOR will not be responsible for costs associated with the requested additional tests.

PART 2 -- PRODUCTS

2.1 General

A. All pressure pipe, fittings, appurtenances and adhesives shall be chemically compatible with the Site groundwater to the extent necessary for use as conveyance piping. Groundwater from the Site has been analyzed and contains chlorinated hydrocarbon compounds in the parts-per-million range. Groundwater analytical results are available from the ENGINEER.

2.2 Pipe Design Criteria

A. **General:** Pipe shall be designed in accordance with the requirements of the referenced specifications, codes, and standards, as applicable, and the supplemental requirements specified in this section.

2.3 Pipe

A. The PVC pipe shall be Schedule 80 and shall be furnished complete with all special fittings as required in the Contract Documents.

B. All joints for the PVC pipe shall be separate couplings joined by the solvent weld method. The coupling shall be the same or greater thickness as that of the pipe barrel.

C. Deflection at the joint shall not exceed 1.5 degrees or the maximum deflection recommended by the manufacturer.

2.4 Fittings

A. All fittings for PVC pipe shall conform to the requirements of ASTM D1785 for Schedule 40 and Schedule 80 pipe.

B. The strength of the fittings shall be equal to or greater than that of the pipe.

PART 3 -- EXECUTION

3.1 General

A. All laying, jointing, and testing for defects and leakage shall be performed in the presence of the ENGINEER and shall be subject to the ENGINEER's approval before acceptance. All material found to have defects shall be rejected, and the CONTRACTOR shall promptly remove such defective materials from the site of the WORK.

B. Installation shall conform to the instructions furnished by the pipe manufacturer and to the supplementary requirements or modifications specified herein. Wherever the provisions of

this section and the aforementioned requirements are in conflict, the more stringent provisions shall apply.

3.2 Handling and Storage

A. **Handling:** Pipe, fittings and accessories shall be carefully inspected before and after installation, and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches.

B. **Storage:** Pipe and fittings shall be stored, if possible, at the job Site in unit packages provided by the manufacturer and shall be protected from exposure to direct sunlight. Pipe shall be stored in such a way as to prevent sagging or bending. No pipe or fittings shall be stored in standing water or in an area subject to puddling.

3.3 Installation

A. All tools and equipment used for installation of pipe shall be as recommended by the manufacturer.

B. Joints shall be installed according to manufacturer's recommendations.

C. Pipe shall be cut using a saw and miter box or a chop saw with a fine tooth blade to ensure a square cut. All cut pipe ends shall be deburred prior to installation.

3.4 Field Testing

A. Field testing shall conform to the requirements of Section 02730 - " Pipeline Testing."

-- END OF SECTION --

SECTION 02730

PIPELINE TESTING

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3.1 General
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SECTION 02730 - PIPELINE TESTING

PART 1 -- GENERAL

1.1 The Requirement

A. The CONTRACTOR shall perform all pipeline testing, as specified herein and in accordance with the requirements of the Contract Documents.

B. If necessary, the CONTRACTOR shall be responsible for procuring test water suitable for use in the testing operations. The CONTRACTOR shall also be responsible for disposal of such water following testing procedures.

1.2 Contractor Submittals

A. The CONTRACTOR shall submit minimum 48-hour advance written notice of its proposed testing schedule and a proposed testing plan for review and concurrence of the ENGINEER. The CONTRACTOR's proposed testing plan shall include provisions for testing and for water conveyance, control, and disposal.

PART 2 -- PRODUCTS

2.1 Materials Requirements

A. Temporary valves, plugs, bulkheads, and other pressure testing and water control equipment and materials shall be provided by the CONTRACTOR subject to the ENGINEER's review. No materials shall be used which would be injurious to pipeline structure and future function. Air test gages shall be laboratory-calibrated test gages and shall be recalibrated by a certified laboratory at the CONTRACTOR's expense prior to the leakage test, if required by the ENGINEER.

PART 3 -- EXECUTION

3.1 General

A. Unless otherwise specified, water for testing shall be furnished by the CONTRACTOR. The CONTRACTOR shall make all necessary provisions for conveying the water from the source to the points of use.

B. Release of water from pipelines, after testing has been completed, shall be performed in accordance with the ENGINEER-approved CONTRACTOR's proposed testing plan.

C. All testing operations shall be performed in the presence of the ENGINEER or ENGINEER's designee.

3.2 Testing of Piping

A. **General:** All pipeline shall be tested for exfiltration as specified. All pipe trenches shall be partially backfilled prior to testing. When leakage exceeds the amount allowed by the Specifications, the CONTRACTOR, at its expense, shall locate the leaks and make the necessary repairs or replacements, to reduce the leakage to the specified limits. Any individually detectable leaks shall be repaired, regardless of the results of the tests.

B. The discharge piping shall be tested in two sections: 1) from the sump pitless adapter to the building penetration and 2) from the building penetration to the standpipe connection.

C. Pipe shall be tested for leakage as follows:

1. Each section of pipe shall be installed prior to testing.
2. Each section of pipe shall be tested as a single unit using plugs or valves.
3. Trapped air shall be purged from each test section of pipe prior to testing.
4. Water shall be introduced into the isolated test section until the internal pressure stabilizes between 40 and 45 psi.
5. Following pressure stabilization, the ENGINEER shall start a timing device for a period of 3 hours. The pressure within the pipe shall not deviate (considering no applicable change in atmospheric conditions) by more than 2 percent during test period.
6. If pressure deviation within the pipe exceeds the test limits as established herein, the test shall be completed again by the CONTRACTOR at their own expense.
7. Isolated test sections found to fail pressure testing shall be repaired and retested by the CONTRACTOR at their own expense.

D. All testing plugs, valves and fittings shall be subsequently removed from the discharge piping following testing.

-- END OF SECTION --

SECTION 11209

SUBMERSIBLE PUMPS

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SECTION 11209 - SUBMERSIBLE PUMPS

PART 1 -- GENERAL

1.1 The Requirement

A. The CONTRACTOR shall furnish and install one submersible sump pump with enclosed, submersible electric motor and all appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents.

1.2 Contractor Submittals

A. **Shop Drawings:** The CONTRACTOR shall submit complete Shop Drawings of all pumps for review in accordance with the Section 01300 - "Contractor Submittals."

B. **O & M Manuals:** The CONTRACTOR shall furnish to the ENGINEER three identical copies of complete operation and maintenance instructions for all pumps including instrumentation and controls, as specified under paragraph "Operation and Maintenance Manual" of Section 01300 - "Contractor Submittals."

C. **Spare Parts:** The CONTRACTOR shall provide a list of manufacturer's recommended spare parts and after the ENGINEER's approval, shall furnish all spare parts suitably packaged and labeled for each pump.

D. **Special Tools:** A list of special tools required shall be submitted to the ENGINEER for approval. After approval the CONTRACTOR shall supply these tools suitably wrapped and identified for application.

PART 2 -- PRODUCTS

2.1 Collection Trench Sump Pumps

A. **General:** The sump pump shall be provided with a sump drainer. The sump pump shall conform to the following requirements:

1. Number of pumping units - 1
2. Location - Interception Trench Sump
3. Service - Groundwater

B. **Operating Conditions:** The pump operating conditions shall be as follows:

1. System Curve Range
   a) Capacity (gpm) - gpm
   b) Pump Total Dynamic Head (ft)

gpm	10	20	30*	40
Head (ft)	54	61	73	89

* Indicates nominal design operating point.

2. Specific Gravity of Liquid - 1.0 - 1.5
3. Liquid Temperature (degrees F) - 50 - 65
4. Pump Size-Minimum (hp) - 1.0

C. **Materials of Construction:** The major pump components shall be made of 304 stainless steel. Seals and bearings shall be made of Teflon®. The pump impeller shall be closed and shall be manufactured from 304 stainless steel.

D. **Pump Motor:** The motor shall be a submersible, hermetically sealed Franklin motor in 316 stainless steel construction. The motor shall be designed for continuous duty, capable of sustaining up to 480 starts per day. The motor shall be connected to the pump via a motor adapter and coupling in 304 stainless steel.

The pump motor shall be three phase, 480 volt service, with built-in thermal overload motor protection and auto reset as well as thermal protection located in the control panel which is to be manually reset. The pump motor and cable shall be rated for service in a Class I Division 2 area.

E. **Level Transmitter:** The pump shall be furnished with a submersible level transmitter that is capable of transmitting a 4-20 mA signal.

F. **Pump Warranty:** The pump manufacturer shall warrant the pumps being supplied to the Company against defects in workmanship and materials for a minimum period of five (5) years or 10,000 operating hours, under normal use, operation, and service for both parts and labor on a prorated basis. The warranty shall be in published form and apply to all similar units.

G. **Manufacturer**

1. EPG Companies, Model TSP8-3.

2.2 Spare Parts and Tools

A. There shall be no special tools required for proper servicing of the equipment.

B. There shall also be supplied with each pump, the manufacturer's standard set of spare parts including at least the following:

1. Complete set of O-rings for each pump model
2. One set of mechanical seals for each pump model
3. One set of bearings per model

C. All pump units shall be factory filled with lubricant. There shall be supplied sufficient lubricant for each pump unit and the first scheduled maintenance.

PART 3 -- EXECUTION

3.1 Installation

A. **General:** Pumping equipment shall be installed in accordance with approved procedures submitted with the Shop Drawings and as shown, unless otherwise approved by the Engineer.

B. **Alignment:** Equipment shall be field tested to verify proper alignment, operation as specified, and freedom from binding, scraping, vibration, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

C. **Lubricants:** The installation work shall include furnishing the necessary oil and grease for initial operation.

-- END OF SECTION --

SECTION 15100

VALVES

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SECTION 15100 - VALVES

PART -- GENERAL

1.1 The Requirement

A. The CONTRACTOR shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, installing, adjusting, and testing of all valves and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Where buried valves are shown, the CONTRACTOR shall furnish and install valve boxes to grade, with covers, valve extensions, and levers or hand wheels position indicators.

B. The provisions of this section shall apply to all valves and valve operators specified on the Drawings and in the Contract Documents.

1.2 Reference Specifications, Codes, and Standards

A. **Codes:** All codes, as referenced herein, are specified in Section 01090 - "Reference Standards."

B. **Commercial Standards:**

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys
ASTM A 36	Specification for Structural Steel
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile

1.3 Contractor Submittals

A. **Shop Drawings:** Shop Drawings of all valves and operators including associated wiring diagrams and electrical data, shall be furnished as specified in Section 01300 - "Contractor Submittals."

PART 2 -- PRODUCTS

2.1 Valves

A. **General:** The CONTRACTOR shall furnish all valves, gates, valve-operating units, stem extensions, and other accessories as shown or specified. All valves and gates shall be new and of current manufacture.

B. **Valve Flanges:** The flanges of valves shall be constructed according to manufacturer's recommendations and as shown on the Drawings.

C. **Nuts and Bolts:** All nuts and bolts on valve flanges and supports shall be as follows:

1. All bolts and nuts shall be steel, galvanized after fabrication. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise specified herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A 307 Grade A or B, or threaded parts of ASTM A 36.

2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

3. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2 inch beyond the nut.

2.2 Plastic Swing Check Valves

A. **General:** Plastic swing check valves, in sizes up to 8 inches, may be used for horizontal or vertical upflow conditions.

B. **Construction:** The valve bodies and discs shall be of PVC construction. They shall have flanged ends conforming to ANSI B16.5, class 150 and flanged top access covers, and they shall shut positively at no-flow conditions. The seats and seals shall be of, Teflon, or Viton. The PVC valves shall be rated for a maximum non-shock working pressure of 150 psi at 73° F.

2.3 Plastic Ball Valves

A. **General Requirements:** Plastic ball valves shall be made of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), or polyvinylidene fluoride (PVDF), as recommended by the manufacturer for any specific applications. All valves shall have manual operators, unless otherwise specified or shown.

B. **Construction:** All plastic ball valves shall have union ends or flanged ends conforming to ANSI B 16.5, class 150, for easy removal. The balls shall have full size ports and Teflon seats. All body seals, union O-ring seals, and stem seals shall be Viton. The valves shall be suitable for a maximum working nonshock pressure of 150 psi at 73 degrees F for PVC, with decreasing ratings for higher temperatures and other plastics.

C. **Manufacturers, or Equal:**

1. ASAHI-America.

2. G F Plastic Systems, Inc.

3. NIBCO Inc., (Chemtrol).

4. Watts Regulator Company.

2.4 Globe Valves

A. Globe valves shall be designed of PVC to serve as a rate-of-flow control device, and shall be suitable for on/off service as well. Seals and seats shall be Teflon® or Viton. Operators shall be hand-tightened screw-type wheels.

PART 3 -- EXECUTION

3.1 Valve Installation

A. **General:** All valves, operators, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and in accordance with the Contract Documents. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. **Access:** All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or piping access.

-- END OF SECTION --

SECTION 15156

MAGNETIC FLOW METER

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2.1 Meters
2.2 Basic Materials

PART 3 -- EXECUTION

3.1 Installation

SECTION 15156 - MAGNETIC FLOW METER

PART 1 -- GENERAL

1.1 The Requirement

A. The CONTRACTOR shall furnish and install a magnetic flow meter and all appurtenant work suitable for the service listed, at ambient temperatures, complete and operable, and capable of continuous operation with minimum error due to pipe deposits, in accordance with the requirements of the Contract Documents.

1.2 Contractor Submittals

A. **Shop Drawings:** The CONTRACTOR shall submit complete Shop Drawings of all meters for review in accordance with Section 01300 - "Contractor Submittals."

B. **O & M Manuals:** The CONTRACTOR shall furnish to the ENGINEER three identical copies of complete operation and maintenance instructions for all the metering systems including instrumentation and controls, as specified under paragraph "Operation and Maintenance Manual" of Section 01300 - "Contractor Submittals."

C. **Spare Parts:** The CONTRACTOR shall provide a list of manufacturer's recommended spare parts and after the ENGINEER's approval, shall furnish all spare parts suitably packaged and labeled for each meter device.

D. **Special Tools:** A list of special tools required shall be submitted to the ENGINEER for approval. After approval the CONTRACTOR shall supply these tools suitably wrapped and identified for application.

1.3 Quality Assurance

A. **Accuracy Requirements:** Unless otherwise specified herein, the flow meters shall be guaranteed to register flow to an accuracy of ±2 percent of actual flow throughout the range specified.

1.4 Manufacturer's Service Representative

A. **Start-Up Assistance:** During start-up the CONTRACTOR shall obtain all necessary assistance from an experienced factory service representative to ensure a correct and first class installation, in accordance with the manufacturer's instructions.

B. **Instruction of Company's Personnel:** After completion of the installation and during startup of the plant, the CONTRACTOR shall instruct the Company's personnel in the proper operation, maintenance and repair of all metering equipment.

1.5 Cleanup

A. After completion and testing of its WORK, the CONTRACTOR shall remove all debris from the Site, clean all meters, controls, cabinets, and other metering appurtenances, to hand over each system in perfect operating condition.

1.6 Guarantees, Warranties

A. After completion the CONTRACTOR shall furnish to the ENGINEER the manufacturer's written guarantees that the metering systems will operate within the published accuracies and flow ranges and meet these Specifications. The CONTRACTOR shall also furnish the manufacturer's warranties as published in its literature and as specified.

PART 2 -- PRODUCTS

2.1 Meters

A. **General:** The magnetic flow meter shall utilize characterized electromagnetic induction to produce a voltage linearly proportional to the average flow rate. The metering system shall consist of a sensor with field coils, signal converter and interconnecting cables to make a complete operating flow metering system. The meter shall be capable of remote flow and totalization readout.

B. **Schedule of Magnetic Flow Meters:** The CONTRACTOR shall furnish the following magnetic flow meter with analog 4-20 mA and pulse output:

I.D. No.	Service	Size (inches)	Flow Range (gpm)	Pressure Rating (psi)	Liner Material
1	Flow from Sump	1-1/2	0-50	150	Neoprene

2.2 Basic Materials

A. **Construction:** The sensor shall be a flanged tube with non-conductive liner. The signal converter shall include a positive zero feature for periods when the metering portion of the process pipe is not full. The power supply shall be 117-volt ac ±10 percent, 60-Hz ±5 percent. Power consumption shall not exceed 42 watts regardless of size. Minimum accuracy of the flow meter system shall be ±2 percent of the flow rate from 10 to 100 percent of scale. External surfaces shall be factory-finished with a corrosion resistant coating.

B. **Grounding:** Grounding flanges of the same material as the sensing electrodes shall be furnished mounted on each end of all meters.

C. The safety classification of the sensing element shall be Factory Mutual approved for General Purpose and Class 1, Division 2, Groups B, C and D hazardous locations.

PART 3 -- EXECUTION

3.1 Installation

A. All magnetic flow meter sensors and all appurtenant work shall be installed in strict accordance with the manufacturer's printed instructions. All meters shall be properly grounded to the grounding flanges and located in such a way to assure a full pipe at all times.

B. All magnetic flow meter signal converters shall be panel-mounted in NEMA 4x enclosures at locations shown on the Drawings, and as recommended by the manufacturer.

-- END OF SECTION --

SECTION 16050

ELECTRICAL GENERAL PROVISIONS

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2.10 120/240 Volt Transformers
2.11 Mini-Power Zone

PART 3 -- EXECUTION

3.1 Grounding
3.2 Raceways
3.3 Wires and Cables

SECTION 16050 - ELECTRICAL GENERAL PROVISIONS

PART 1 -- GENERAL

1.1 The Requirement

A. The CONTRACTOR shall provide all tools, supplies, materials, equipment, and all labor necessary for the furnishing, construction, installation, testing, and operation of all electrical work and appurtenant work necessary to provide a complete and operable electrical system, all in accordance with the requirements of the Contract Documents.

B. The CONTRACTOR shall make all field connections and terminations to all motors, switchgear, panels, control equipment and devices, instruments, and to all vendor-furnished packaged equipment as required by these Specifications. The provisions of this Section shall apply to all electrical items specified in these Specifications, except for where otherwise specified or shown in the Contract Documents and to meet field conditions and to interface with existing facilities. The CONTRACTOR shall be responsible for understanding requirements of all Sections for interfacing equipment provided under Division 16 to non-Division 16 equipment.

C. The CONTRACTOR shall furnish and install all materials and incidentals required to complete the electrical work as specified herein. Typical materials which may be incidentals shall not be limited to terminal lugs not furnished with vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and all control wires required by vendor-furnished equipment to interconnect with other equipment all specifically shown on the Contract Documents.

1.2 Reference Specifications, Codes, and Standards

A. All work specified herein shall conform to or exceed the applicable requirements of the referenced portions of the following publications to the extent that the provisions thereof are not in conflict with other provisions of these specifications.

B. **Codes and Standards:**

NFPA 70 (N.E.C.)	National Electrical Code, latest edition

C. **Government Standards:**

FS W-C-596E/GEN(1)	Connector, Plug, Receptacle and Cable Outlet, Electrical Power
FS W-S-896E/GEN(1)	Switches, Toggle (Toggle and Lode), Flush Mounted (ac)
FS WC1094A	Conduit, Nonmetallic, Rigid
FS WW-C-581D, E	Conduit, Metal, Rigid, And Coupling, Elbow, and Nipple, Electrical Conduit: Steel, Zinc Coated

D. **Commercial Standards:**

ANSI C80.1	Zinc Coated, Rigid Steel Conduit, Specification for
ANSI C80.4	Fittings for Rigid Metal Conduit, Specifications for
NEMA 7C-2	Conduit, Nonmetallic, Rigid
ANSI/UL 467	Grounding and Bonding Equipment, Safety Standard for
ASTM B3	Soft or Annealed Copper Wire
IPCEA S-61-402	Thermoplastic - Insulated Wire and Cable
IPCEA S-66-524, NEMA WC7	Cross-Linked, Thermosetting, Polyethylene Wire and Cable
IPCEA S-68-516, NEMA WC8	Ethylene Propylene Rubber Insulated Wire and Cable
NEMA 250	Enclosures for Electrical Equipment (1,000 volts maximum)
NEMA PB-1	Panelboards
UL 6	Rigid Metal Electrical Conduit
UL 651	Rigid Non-Metallic Conduit
UL 44	Rubber - Insulated Wire and Cable.
UL 514	Electrical Outlet Boxes and Fittings

E. All equipment furnished by the CONTRACTOR shall be listed by and shall bear the label of Underwriters' Laboratories, Incorporated, (UL) or of an independent testing laboratory acceptable to the local Code-enforcement agency having jurisdiction unless otherwise specifically indicated in the specifications or drawings.

F. The construction and installation of all electrical equipment and materials shall comply with all applicable provisions of the OSHA Safety and Health Standards (29CFR1910 and 29CFR1926, as applicable), State Building Standards, and applicable local codes and regulations.

1.3 Contractor Submittals

A. **Shop Drawings and Catalog Data:** Shop drawings and catalog data submittals shall be in accordance with Section 01300, "Contractor Submittals."

B. The CONTRACTOR shall submit complete material lists for the work of this Section. Such lists shall state manufacturer and brand name of each item or class of material. The CONTRACTOR shall also submit shop drawings for all grounding work not specifically shown.

C. Shop drawings are required for materials and equipment listed in other sections. Shop drawings shall provide sufficient information to evaluate the suitability of the proposed material or equipment for the intended use, and for compliance with these Specifications. The following shall be included:

1. Front, side, rear elevations and top views with dimensional data.

2. Location of conduit entrances and access plates.

3. Component data.

4. Custom elementary and connection diagrams, including terminal numbers, internal wiring diagrams, conductor size, and cable numbers. Drawings shall be custom to this project. Drawings showing items as "optional," "where required," or similar will not be acceptable unless clearly marked as to what is to be furnished.

5. Method of anchoring, weight.

6. Types of materials and finish.

7. Nameplates.

8. Temperature limitations, as applicable.

9. Voltage requirement, as applicable.

10. Front and rear access requirements. Include space required by applicable codes.

11. Standard and specific test reports.

D. Catalog data shall be submitted to supplement all shop drawings. Catalog cuts, bulletins, brochures, or the like or photocopies of applicable pages thereof shall be submitted for mass produced, non-custom manufactured material. These catalog data sheets shall be stamped to indicate the project name, applicable Specification section and paragraph, model number, and options. This information shall be marked in spaces designated for such data in the stamp.

E. **Materials and Equipment Schedules:** The CONTRACTOR shall deliver to the OWNER within 30 days after notice to proceed, a complete list of all major materials, equipment, apparatus, and fixtures which it proposes to use. The list shall include type, sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.

F. **Manuals:** The CONTRACTOR shall furnish manuals as part of the shop drawing submittals specified under Paragraph 1.7, "Operational and Maintenance Manual" of Section 01300, "Contractor Submittals."

G. **Record Drawings:** In addition to the Record Drawings as a part of the record drawing requirements specified in paragraph 1.8, "Record Drawing Submittals" of Section 01300 - "Contractor Submittals," the CONTRACTOR shall show depths and routing of all duct bank concealed below-grade electrical installations. Said set of record drawings shall be available to the ENGINEER during construction. After final inspection, the

CONTRACTOR shall transfer all record drawing information using a red pen to a set of bluelines reproducible tracings which shall then be delivered to the ENGINEER. In addition, the Record Drawings shall show all variations between the work as actually constructed and as originally shown on the Drawings, based upon information supplied by the CONTRACTOR.

1.4 Quality Assurance

A. **Field Control of Location and Arrangement:** The Drawings diagrammatically show interconnection wiring by means of a Conduit Development and Conduit Schedule. Intermediate pull or junction boxes are not shown and shall be installed as required to meet applicable codes or to facilitate cable pulling. Pull boxes and junction boxes shall be located to drain freely by gravity. Exact locations shall be determined by the CONTRACTOR in the field based on the physical size and arrangement of equipment, finished elevations, and other obstructions. Conduits shall be installed exposed within the existing water treatment room and through underground rigid galvanized conduit to the remote facilities. Unless otherwise shown, the CONTRACTOR shall route the conduits at his discretion in strict accordance with the N.E.C. and shall be responsible for avoiding obstructions from existing as well as new equipment and coordinating his routings with the work under Divisions of this Contract.

B. All conduit and equipment shall be installed in such a manner as to avoid all obstructions and to preserve head room and keep openings and passageways clear. Where the Drawings do not indicate exact locations, such locations shall be obtained from the OWNER. Where equipment is installed without instruction and must be moved, it shall be moved without additional cost to the OWNER.

C. **Workmanship:** All materials and equipment shall be installed in accordance with printed recommendations of the manufacturer which have been reviewed by the ENGINEER. The installation shall be accomplished by workmen skilled in this type of work and installation shall be coordinated in the field with other trades so that interferences are avoided.

D. All work, including installation, connection, calibration, testing, adjustment, and paint touch-up, shall be accomplished by qualified, experienced personnel working under continuous, competent supervision. The completed installation shall display competent work, reflecting adherence to prevailing industrial standards and methods.

E. **Protection of Equipment and Materials:** The CONTRACTOR shall provide adequate means for and shall fully protect all finished parts of the materials and equipment against damage from any cause during the progress of the work and until acceptable by the OWNER.

F. All materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, foam, plaster, or paint. All moving parts shall be kept clean and dry.

G. The CONTRACTOR shall replace or have refinished by the manufacturer, all damaged materials or equipment, including face plates of panels and switchboard sections, at no expense to the OWNER.

H. **Tests:** The CONTRACTOR shall make all tests required by the ENGINEER or other authorities having jurisdictions. The OWNER shall have the option of witnessing all such tests and shall be notified at least 2 weeks prior to any test. Shorter notice may be provided with the approval of the OWNER. The CONTRACTOR shall furnish all necessary testing equipment and pay all costs of tests, including all replacement parts and labor necessary due to damage resulting from damaged equipment or from test and correction of faulty installation. The following testing shall be accomplished:

1. Testing for the ground resistance value specified under "Grounding," herein.
2. Insulation resistance tests as specified under "Wire and Cable," herein.
3. Operational testing of all equipment furnished and/or connected under Division 16, Electrical, including furnishing of support labor for testing.

I. Standard test reports for mass-produced equipment shall be submitted along with the shop drawing for such equipment. Test reports on testing specifically required for individual pieces of equipment shall be submitted to the OWNER for review prior to final acceptance of the project.

J. Any test failure shall be corrected in accordance with the industry practices and in a manner satisfactory to the OWNER.

1.5 Area Designations

A. **General:** For purposes of delineating electrical enclosure and electrical installation requirements of this project, certain areas have been classified in the Contract Documents as defined herein. Electrical enclosures shall include, but not be limited to pull boxes, junction boxes, local control stations, disconnect switches and circuit breakers, starters, control panels, and packaged controls. Electrical installations within these areas shall conform to the referenced code requirements for the area involved. All enclosures shall be as denoted below:

1. Electrical Work Within Sump - Explosion Proof
2. Sump Level Transmitter - NEMA-4X
3. Mini Power Center at Sump - NEMA-3R
4. Receptacle at Sump - Weatherproof
5. Flow Meter - NEMA 4X
6. Conveyance Pipe Temperature Sensor - NEMA-1
7. Stand Pipe Level Sensor - NEMA-4X
8. Free-Standing Electrical Panel - NEMA-12

B. **Outdoor and Damp or Wet Locations:**

1. In outdoor locations, raceway shall be galvanized rigid conduit; entrances shall be threaded; and fittings shall have gasketed covers. Provisions shall be made to drain the fitting or conduit system. Threaded fastening hardware shall be stainless steel. Attachments or welded assemblies shall be galvanized after fabrication. Instruments and control cabinets, and panel enclosures shall be NEMA Type 4. Enclosures shall be mounted 1-inch from walls to provide an air space, unless specifically shown otherwise.

2. All indoor, exposed conduits and fittings, except where specifically noted, shall be rigid, copper free aluminum.

1.6 Cleanup

A. All parts of the materials and equipment shall be thoroughly cleaned. Exposed parts shall be thoroughly clean of cement, plaster, and other materials. All oil and grease spots shall be removed with a non-flammable cleaning solvent. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Paint touch-up shall be applied to all scratches on panels and cabinets. Electrical cabinets or enclosures shall be vacuum-cleaned before final acceptance.

B. During the progress of the work, the CONTRACTOR shall clean the premises and shall leave the premises and all portions of the site free of debris.

PART 2 -- PRODUCTS

2.1 General

A. All equipment and materials shall be new, shall be listed by UL, and shall bear the UL label, where UL requirements apply. Where the specifications are more stringent and negates a UL testing, the specification requirements shall apply. All equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the project shall be products of the same manufacturer. All equipment and materials shall be of industrial grade and standard of construction.

2.2 Grounding

A. **General:** All components of the electrical system included in the work under this Contract shall be tied to the existing grounding system in the existing water treatment room in conformance to the applicable requirements of National Electrical Code Article 250 and local codes, and also to ground rods at the existing treatment room and at the sump.

B. Grounding cable shall be copper. Ground wires shall be insulated and sized as shown.

C. Ground rods shall conform to ANSI/UL 467 and shall be 3/4-inch diameter, 10 feet long, copper-clad steel, sectional type, joined by threaded copper alloy couplings.

1. Grounding connectors shall be high-strength copper alloy suitable for direct burial.
2. Welded connections shall be exothermic weld by **Cadweld of Erico Products, or equal.**
3. Manufacturers of grounding materials shall be **Copperweld, Blackburn, Burndy, or equal**.

2.3 Raceways

A. **General:** Raceway shall be manufactured in accordance with UL and ANSI standards and shall bear UL label as applicable.

B. **Galvanized Rigid Steel (GRS) Conduit:**

1. Rigid steel conduits and fittings shall be full weight, mild steel, hot-dip galvanized inside and outside.

2. Rigid steel conduit shall be manufactured in accordance with UL Standard No. 6 and ANSI 80-1.

3. Rigid steel conduit shall be manufactured by **Triangle PWC, LTV Steel, or equal.**

C. **Rigid Aluminum Conduit:**

1. Rigid aluminum conduits and fittings shall be manufactured of 6063 allow, temper T-1.

2. Rigid aluminum conduit shall be manufactured in accordance with ANSI C80.5 and UL-6.

D. Electrical metallic tubing (EMT) and fittings will not be permitted on this project.

E. All flexible conduits shall be liquid-tight. Liquid-tight flexible metallic conduit shall have an extruded PVC covering over the flexible steel conduit. For conduit sizes 3/4-inch through 1-1/4 inch, flexible conduits shall have continuous built-in copper ground conductor. Flexible conduit shall be **American Brass, Anaconda, Electroflex, or equal.**

2.4 Wire and Cable

A. **General:** All conductors, including ground conductors, shall be copper. Insulation shall bear UL label and the manufacturer's trademark, type, voltage and temperature rating, and conductor size. Wire and cable shall be products of **American, Rome Cable, Okonite, Cablec, or equal**.

B. **Control Cables:** All control cables shall be rated for 600 volts and shall meet the following requirements:

1. Control wires shall consist of No. 14 or No. 12 gauge stranded copper conductors and shall be type XHHW.

2. Control wires at panels and cabinets shall be machine tool grade type MTW, UL approved, rated for 90° C at dry locations, No. 14 gauge minimum.

3. Pull taped control conductor assemblies may be used in conduits as approved by the OWNER.

C. **Instrumentation Cables:** Shielded instrumentation cables shall be rated at 600 volts and shall comply with the following requirements:

1. Single pair shielded wire shall be #16 AWG twisted shielded pairs, with .030" minimum insulation and rated for 600 volt service. Cable shall be **Belden #8719, or equal** (UL No. 2106).

2. All instrumentation wiring shall be shielded and shall be grounded at one end only, preferably the receiving end of a 4-2O mA system. Instrumentation wiring shall not be run in the same conduit with power cable, and shall only be run with control wiring where specifically shown. Where run through a common pullbox

with power or control, provide metallic dividers and individual access covers with the box for isolation of power, control, and instrumentation wiring.

3. Where required for metering conduits, the CONTRACTOR shall furnish the necessary shielded wire in conformance with the manufacturer's recommendations whether or not shown on the drawings or specified under those items, at no extra cost.

D. **Building Wire and Cable:** Building wires and cables shall be rated at 600 volts and shall meet the following requirements:

1. Building wire shall be single conductor copper cable listed by UL as Type XHHW rated 75° C.

2. Building wire in all sizes shall be stranded.

3. No wire smaller than No. 12 AWG shall be used.

E. **Cable Terminations:** Cable terminations shall be in accordance with the following:

1. Compression connectors shall be **Burndy "Hi Lug", Thomas & Betts "Shure Stake," or equal.** Threaded connectors shall be split bolt type of high strength copper alloy.

2. Pressure type, twist on connectors (wire nuts) will not be acceptable.

3. Pre-insulated fork tongue lugs shall be **"Thomas & Betts" RC Series, Burndy, or equal.**

4. General purpose insulating tape shall be **Scotch No. 33, Plymouth "Slip-knot", or equal.** High temperature tape shall be polyvinyl by **Plymouth, 3M, or equal.**

2.5 Wiring Devices

A. All wiring devices shall conform to Specification Grade. Devices shall be as manufactured by **General Electric, Crouse-Hinds, Hubbell, or equal.** Receptacles and switches shall conform to Federal Specifications W-C-596E and W-S-896E, respectively.

1. Receptacles:

a. The duplex receptacle to be installed at the sump shall be weatherproof, rated 120 volts, twenty (20 amperes), shall be polarized three (3) wire type for use with three (3) wire cord with grounded lead and one (1) designated stud shall be permanently grounded to the conduit system (NEMA 5-20R). Duplex 120 volt receptacles shall be **G.E. 5362, Hubbell 5362, or equal.** Single receptacles shall be **G.E. 4102, Hubbell 4102, or equal.**

2.6 Cabinets And Enclosures

A. **General:** All electrical cabinets and enclosures housing control relays and terminal blocks shall be manufactured in accordance with NEMA Publications 250, UL Standards 50 and 508. Enclosures shall meet designated NEMA classification prior to modification by the CONTRACTOR.

1. The free-standing electrical panel in the existing water treatment room shall be

NEMA 12. The CONTRACTOR shall provide sufficient terminal blocks to terminate 25 percent more conductors than are shown. Interior and exterior of the control panel cabinets shall be painted. Internal back mounting plate shall be white painted steel.

B. All terminal block requirements shall be as manufactured by **Square D,** designed for flanged fork or ring lug terminations.

2.7 Electrical Panels

A. The Electrical Panel shall be free-standing, mounted in the existing water treatment room as shown on the Contract Drawings.

B. The Panel shall be housed in a NEMA 12 steel enclosure with gasketed door. Internal control components shall be mounted on removable mounting pans. Mounting pans shall be finished white.

C. The panels shall include 480 volt, 3 phase and 120/240 volt, 1 phase panelboards, one FVNR, NEMA Size 1 starter, control components, wired as shown on the Drawings, and space provisions for future equipment.

D. The magnetic starter shall meet the following requirements:

1. NEMA rated. IEC or dual NEMA/IEC rated type are not acceptable.
2. FVNR type.
3. Control transformer shall be provided, with primary and secondary fuses, 120 VAC maximum control voltage.
4. NEMA-1 enclosure.

E. Pilot lights shall be of the heavy-duty, oil-tight type sized to 30 mm. Miniature style devices are not acceptable. Devices shall be as manufactured by **Square D.**

1. Lens colors shall be red for "run," "open," or "on;" green for "stopped," "closed," or "off;" amber for alarm.
2. Pilot lights shall be full voltage LED cluster style.

F. Controller to monitor load current of submersible sump pump and to operate a relay when the current exceeds a preset level of current flow to the pump motor. The current relay shall be Catalog No. D60LA1, as manufactured by **Cutler-Hammer**.

G. Level and flow sensors located in the existing water treatment room and remotely at the sump shall be designed for operation from 120 volt AC power, and wired to the Electrical Panel under Division 16 of this Contract. A 24 volt DC power supply shall be provided at the mini power center for the level sensor located in the sump.

H. The conveyance pipe temperature transmitter shall be **Foxboro RTT20-I1BNQOFA-D1L1, calibrated to 0-150° F,** mounted in the Electrical Panel and shall be provided with a 24 volt DC power supply for operating from 120 volt AC power. Connections to the temperature sensor in the conveyance pipe shall be as required by the manufacturer.

I. A digital indicator shall be mounted on the front panel of the Electrical Panel to

selectively indicate flow rate or total flow. The indicator shall accept a 4-20 mA input signal from the flow meter and shall operate from 120 volt AC power. The unit shall have the capability to scale both flow rate and total flow via separate scales and in engineering units. The flow rate/total indicator shall be **Newport Model INF7000, or equal.**

J. Control and monitoring of the new groundwater collection system shall be implemented by an existing Programmable Logic Controller (PLC) with inputs and outputs as shown on the Contract Drawings. Sauer-Sundstrand shall be responsible for the programming, startup, and debugging of the PLC-based control system.

2.8 Electrical Identification

A. **Nameplates:** Nameplates shall be fabricated from white-letter, black-face laminated plastic engraving stock, **Formica Type ES-1, or equal.** Each shall be fastened securely, using fasteners of brass, cadmium plated steel, or stainless steel, screwed into inserts or tapped holes, as required. Engraved characters shall be block style with no characters smaller than 1/8-inch high.

B. **Conductor and Equipment Identification:** Conductor and equipment identification devices shall be either imprinted plastic-coated marking devices such as manufactured by **Brady, Thomas & Betts, or equal,** or shall be heat-shrink plastic tubing, imprinted split-sleeve markers cemented in place, or equal.

C. **Identification Tape:** Identification tape for protection of buried electrical installation shall be a 6-inch wide red polyethylene tape imprinted "WARNING-ELECTRIC DUCT LINE" installed 12 inches above the buried duct line.

2.9 Lighting and Power Distribution Panelboards

A. **General:** The panelboards in the existing water treatment room shall be dead front factory assembled, provided as part of the free-standing Electrical Panel. The panelboard shall comply with NEMA PB-1 as well as the applicable provisions. The power panelboard shall be rated for 480-volt 3-phase, 3-wire operation. Lighting panelboard shall be rated for 120/240-volt 1-phase, 3 wire operation as shown.

1. Interiors shall have solderless, anti-turn connectors and shall be constructed so that branch circuit breaker can be replaced without disturbing adjacent units or resorting to field drilling and tapping. Bus bars and connecting drops shall be tin plated copper. Neutral bar for the 120/240 volt panelboard shall be full-sized and shall have one terminal screw for each branch circuit; main bus bar shall be full-sized for entire length. Spaces shown shall have cross connections for the maximum sized device that can be fitted.

B. **Lighting and Power Panelboards:**

1. The panelboards shall be sized per NEMA and N.E.C.

2. The number of circuit breakers and the ampere ratings shall be in accordance with panel schedules as shown. Main circuit breaker shall be provided as indicated on the Drawings. The panelboard circuit breakers shall be group mounted and shall be molded case with 2-pole or 3-pole main breaker and 1-pole, 2-pole, or 3-pole branch circuit breakers with 10,000 AIC.

C. Panelboard shall be as manufactured by **Square D.**

2.10 120/240 Volt Transformers

A. Construction of the transformer at the existing water treatment room shall be dry type, indoor/outdoor, 115° C insulation, utilizing copper windings.

B. Transformer shall be rated 480-120/240 volt single phase.

C. Transformers shall have four 2-1/2 percent taps, two above and two below 480 volts. Transformers shall be by **Square D.**

2.11 Mini-Power Zone

A. Construction shall be indoor/outdoor, NEMA-3R.

B. Mini-power zone shall include primary main breaker, encapsulated dry-type transformers, secondary main breaker, and feeder breakers, factory assembled and interconnected in a single enclosure.

C. U.L listed.

D. Mini-power zone shall be rated 3 KVA, 480 volts to 120/240 volts, single phase, 2-5% full capacity taps, **Square D.**

PART 3 -- EXECUTION

3.1 Grounding

A. **Equipment Ground:** Ground continuity throughout the facility shall be maintained by a groundwire to be installed in all conduits, tied to the ground of the existing power distribution system in the existing water treatment room and to a 3/4-inch x 10-foot ground rod at the sump.

1. Metallic raceway shall be installed with Myers hub or double, sealed lock-nuts.

B. **Shield Grounding:**

1. Shielded instrumentation cable shall be grounded at one end only; this shall typically be at the "receiving" end of the signal carried by the cable.

2. Termination of each instrumentation shield wire shall be on its own terminal screw. All of these terminal screws in one rack shall be jumpered with No. 16 solid tinned bare copper wire; connection to ground shall be accomplished with a No. 12 green insulated conductor to the main ground bus.

3.2 Raceways

A. **General:** Raceways shall be installed as shown, however, conduit routings shown are diagrammatic. Adjust routings per field conditions and install additional boxes, fittings, etc., where required to facilitate pulling or to meet applicable codes. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends

and offsets shall be smooth and symmetrical, and shall be accomplished with tools designed for the purpose intended. All installations shall be in accordance with the latest edition of the National Electrical Code.

B. Raceways shall be installed in accordance with the following schedule, to include control, power, and data hi-way and communications.

1. PVC schedule 40 conduit shall be used for outdoor, underground installations.

2. Outdoor exposed conduits shall be rigid galvanized steel.

3. Rigid aluminum conduits shall be used on exposed indoor installations.

4. Electrical metallic (EMT) conduit shall not be used.

C. **Conduit Terminations:** In general, exposed raceway shall be installed perpendicular or parallel to buildings. Conduit stubbed up for floor-standing equipment shall be placed in accordance with approved shop drawings.

D. **Conduit Installations:**

1. The existing water treatment room has been classified as a nonhazardous area.

2. The sump has been classified as hazardous, requiring that the electrical cables to the submersible sump pump and to the level sensor be rated for use in a hazardous area and that seal fittings be installed in the conduits leading from the sump to the junction box, as shown on the Contract Drawings and in accordance with the N.E.C.

3. Flexible liquid-tight conduit shall be used for the connection of equipment such as motors, transformers, instruments, valves, or pressure switches subject to vibration or movement during normal operation or servicing. The maximum length of flexible conduit shall be as limited by the N.E.C.

4. Equipment subject to vibration or movement which is normally provided with wiring leads, such as solenoid valves, shall be installed with a cast junction box for the make-up of connections. Flexible conduits shall be as manufactured by **American Brass, Electroflex, or equal.**

5. Conduit penetrations on walls and concrete structures shall be performed in accordance with the following:

   a. Seal all raceways entering structures at the first box or outlet with oakum or suitable plastic expandable compound to prevent the entrance into the structure of gases, liquids, or rodents.

   b. Dry pack with nonshrink grout around raceways that penetrate concrete walls, floors, or ceilings aboveground, or use one of the methods specified for underground penetrations.

3.3 Wires and Cables

A. **Wire and Cables:**

1. Pulling tensions on the cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where needed, shall be UL approved.

2. Wire in panels, cabinets, and gutters shall be neatly grouped using nylon tie straps, and shall be fanned out to terminals.

3. Wire fills shall conform to NEC.

4. Provide insulated ground conductor in each power conduit.

B. **Splices and Terminations:**

1. The CONTRACTOR shall provide, install, and terminate the conductors required for power and controls to electrical equipment and to interconnect incoming annunciator, control and instrumentation equipment specified in any section of these specifications except as may be otherwise specified in other sections. Cable splices shall be minimized as follows:

2. Control conductors shall not be spliced. For the purposes of the various Sections of Division 16 of the Specifications, "control conductors" are defined as conductors operating at 120-volts or less in circuits that indicate equipment status or that control the electric energy delivered to a power consuming device.

3. 120/240-volt and 480-volt branch circuit conductors may not be spliced.

4. Control devices, such as solenoid operated valves, that are normally supplied with conductor pigtails, shall be terminated as described for control conductors.

C. **Cable Assembly and Testing:** Cable assembly and testing shall comply with applicable requirements IPCEA Publication No. S-68-516 and other relevant IPCEA publications. Factory test results shall be submitted in accordance with Section 01300 - Contractor Submittals, prior to shipment of cable. The following tests shall be the minimum requirements:

1. All cables rated at 600 volts shall be tested for insulation resistance between phases and from each Phase to a ground using a megohmeter.

-- END OF SECTION --

MONTGOMERY WATSON

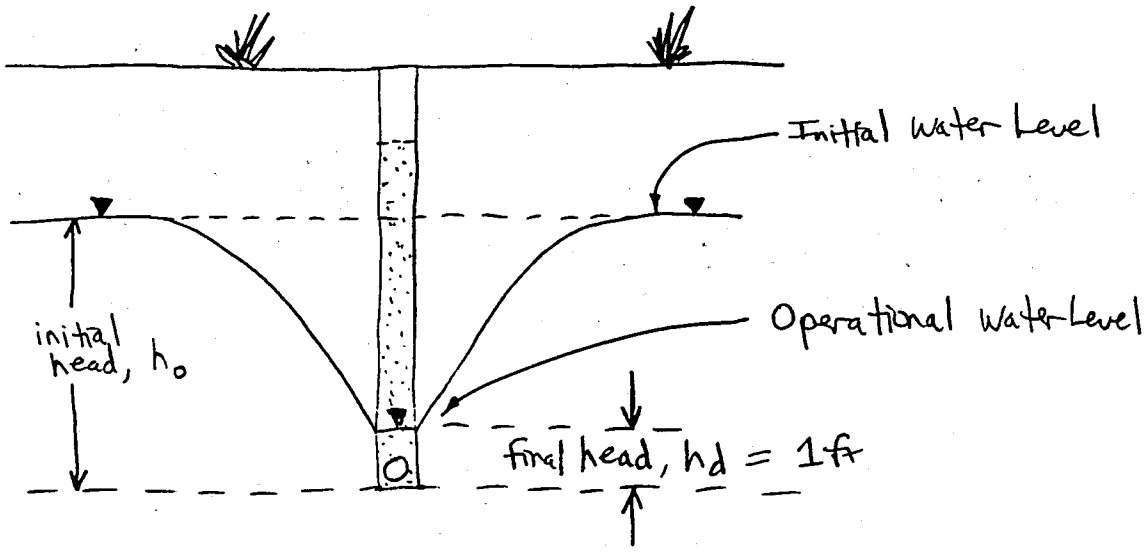
BY SMP DATE 8-12-96 CLIENT Saver – Sundstrand SHEET 1 OF 5
CHKD. BY _____ DESCRIPTION Estimate of Groundwater Flow into Trench JOB NO. 8907.0330

1. Factors Affecting Rate of Flow into Trench and Total Volume of Groundwater Recovered

- Proportion of sand vs. clayey materials encountered in trench alignment. (More sand = more water)
- Connectedness of conductive zones. (Sand layers vs. sand stringers)
- Hydraulic conductivities and specific yields of the various geologic materials encountered. (continuum of values possible from all sand with high conductivities and large specific yields, to clay till will very low values)
- Hydraulic head will vary based on topography and in response to stresses. (Pumping / dewatering from trench, infiltration of precipitation)
- Elapsed time since start of pumping. (Transient rather than steady-state system due to recharge of precipitation)

2. Trench Dimensions and Saturation Conditions

- Assume 800 ft. long, 20 ft deep from ground surface, 1 ft of saturated materials remain during operation (water level 1 ft above base of trench)
- Schematic trench cross section



- h_o varies with location + topography

MONTGOMERY WATSON

BY SMP DATE 8-12-96 CLIENT Sauer-Sundstrand SHEET 2 OF 5
CHKD. BY _____ DESCRIPTION Est. of GW Flow into Trench JOB NO. 8907.0330

3. Equations and Parameters

- Assumes infinite aquifer with no recharge (neither assumption is true, but they may partially offset each other)

$$V = 4 S_y h_o (h_o - h_d) \sqrt{\frac{\beta}{\pi}}, \text{ where}$$

$$\beta = \frac{T_a t}{S_y h_o^2}, \text{ and } T_a = \frac{K(h_o + h_d)}{2}.$$

V = total volume of water that has flowed into the trench after elapsed time, t, per unit length of trench.

S_y = specific yield (0.07 for sandy clay till; 0.2 for sand)

h_o = initial head (base of trench to initial water level)

h_d = operational head (base of trench to operational water level = 1 ft)

T_a = average transmissivity of initial and final saturated thickness

t = elapsed time since initiating water removal

K = hydraulic conductivity of geologic materials forming walls of trench

β = unitless symbol

Average flow rate estimate over time, t = $\frac{V}{t}$

EN 1S (10/78)

MONTGOMERY WATSON

BY SMP DATE 8-12-96 CLIENT Sauer-Sundstrand SHEET 4 OF 5
CHKD. BY _____ DESCRIPTION Est. of GW Flow into Trench JOB NO. 8907.0330

5. (cont.) Trench Segment Data

Segment	Corresponding well #	Depth to Water (ft)	Ft of Sat. Sand	Ft of Sat. clay	K (ft/day)	Feet of Trench
1	MW-19	3	6	11	0.0372	128
2	PZ-2	~0	2	18	0.9811	90
3	MW-20	5.5	0.5	14	0.4125	45
4	MW-12	7.5	0	12.5	0.029	240
5	PZ-1	1.5	0	18.5	0.07	217
6	MW-29	1	4	15	26.345	80
						800 ft

- Depths to water 5-13-96.
- Saturated sand and clay thicknesses based on HLA crosssections and bore logs for the selected wells, adjusted for 5-13-96 DTWs.
- K values either HLA slug test data, or estimated based on % sand and clay and average site K's for sand and clay.
- Trench segment lengths chosen based on positioning/proximity of nearby wells and topography

6. Calculation of Estimated Flow Rates

- The noted equations and data were keyed into Excel spreadsheets to calculate the estimated flow rates.
- Included is a summary of the estimated flow rates into the trench (and each of the six segments) for t = 1, 7, 14, 30, 60, 90, 180, and 365 days.
- The spreadsheets showing the calculations for each of the six segments at t = 14 days are also included.

4. Parameter Values and Units

V = calculated, gallons

S_y = from published tables, 0.07 for clayey matls., 0.2 for sand, unitless

h_o = varies with location, 12.5 to 20 ft

h_d = set at operational level of 1 ft

T_a = calculated, ft^2/day

t = variable, set from 1 to 365 days

K = site average for clayey materials = 0.11338 ft/day
Site average for sand = 8.787 ft/day; used if no slug test data available, otherwise used slug test data. Range from 0.029 ft/day at MW-12 to 26.3 ft/day at MW-31.

$\frac{V}{t}$ = gallons/day ÷ 1440 = gpm

5. Flow Rate Estimate Methodology

- The 800 feet of trench was evaluated in six sections. Each section was assigned parameter values based on K and h_d data from adjacent or nearby monitoring wells or piezometers, and best estimates of S_y were selected based on materials encountered in the wells. A total flow rate estimate (V/t) for the sum of the six segments was calculated for various t's.

- The trench segment data are presented in the following table:

MONTGOMERY WATSON

BY SMP DATE 8-12-96 CLIENT Saver - Sundstrand SHEET 5 OF 5

CHKD. BY _____ DESCRIPTION _____ JOB NO. _____

7. Discussion

- The estimated flow rates decrease from ~ 133 gpm initially to ~7 gpm after one year.
- The flow rates are expected to decrease in response to dewatering and the corresponding thinning of the saturated thickness and decreased hydraulic head.
- The actual flow rates will vary from these estimates based on actual conditions encountered, the final statuses of the factors listed on page 1, and the effects of precipitation recharge on the saturated zone.

Sauer-Sundstrand

GW Flow Estimate Summary (t in days; flow in gpm)

Segment	Flow Estimate	t =	1	Segment	Flow Estimate	t =	60
1	3.7			1	0.5		
2	18.2			2	2.3		
3	3.4			3	0.4		
4	3.8			4	0.5		
5	9.7			5	1.3		
6	94.1			6	12.2		
Total	132.9			Total	17.2		

Segment	Flow Estimate	t =	7	Segment	Flow Estimate	t =	90
1	1.4			1	0.4		
2	6.9			2	1.9		
3	1.3			3	0.4		
4	1.4			4	0.4		
5	3.7			5	1.0		
6	35.6			6	9.9		
Total	50.2			Total	14.0		

Segment	Flow Estimate	t =	14	Segment	Flow Estimate	t =	180
1	1.0			1	0.3		
2	4.9			2	1.4		
3	0.9			3	0.3		
4	1.0			4	0.3		
5	2.6			5	0.7		
6	25.2			6	7.0		
Total	35.5			Total	9.9		

Segment	Flow Estimate	t =	30	Segment	Flow Estimate	t =	365
1	0.7			1	0.2		
2	3.3			2	1.0		
3	0.6			3	0.2		
4	0.7			4	0.2		
5	1.8			5	0.5		
6	17.2			6	4.9		
Total	24.3			Total	7.0		

Sauer-Sundstrand							
GW Flow Estimate							
Segment 1 (MW-19)							
elapsed time, t	14	days					
specific yield, Sy	0.07						
initial head, ho	17	ft					
final head, hd	1	ft					
hydraulic conductivity, K	0.0372	ft/day					
Average Transmissivity, Ta	0.3348	sq ft/day					
Beta	0.2316955						
Volume Estimate	154.72	gal/ft		19804	gal	**0.98**	**gal/min**
	Trench Length	128.0	ft				

Sauer-Sundstrand							
GW Flow Estimate							
Segment 2 (PZ-2)							
elapsed time, t	14	days					
specific yield, Sy	0.08						
initial head, ho	20	ft					
final head, hd	1	ft					
hydraulic conductivity, K	0.9811	ft/day					
Average Transmissivity, Ta	10.30155	sq ft/day					
Beta	4.50692813						
Volume Estimate	1089.51	gal/ft		98056	gal	**4.86**	**gal/min**
	Trench Length	90.0	ft				

Sauer-Sundstrand							
GW Flow Estimate							
Segment 3 (MW-20)							
elapsed time, t	14	days					
specific yield, Sy	0.07						
initial head, ho	14.5	ft					
final head, hd	1	ft					
hydraulic conductivity, K	0.4125	ft/day					
Average Transmissivity, Ta	3.196875	sq ft/day					
Beta	3.04102259						
Volume Estimate	403.39	gal/ft		18153	gal	**0.90**	**gal/min**
	Trench Length	45.0	ft				

Sauer-Sundstrand							
GW Flow Estimate							
Segment 4 (MW-12)							
elapsed time, t	14	days					
specific yield, Sy	0.07						
initial head, ho	12.5	ft					
final head, hd	1	ft					
hydraulic conductivity, K	0.029	ft/day					
Average Transmissivity, Ta	0.19575	sq ft/day					
Beta	0.25056						
Volume Estimate	85.03	gal/ft		20407	gal	**1.01**	**gal/min**
	Trench Length	240.0	ft				

Sauer-Sundstrand							
GW Flow Estimate							
Segment 5 (PZ-1)							
elapsed time, t	14	days					
specific yield, Sy	0.07						
initial head, ho	18.5	ft					
final head, hd	1	ft					
hydraulic conductivity, K	0.07	ft/day					
Average Transmissivity, Ta	0.6825	sq ft/day					
Beta	0.39883126						
Volume Estimate	241.61	gal/ft		52430	gal	**2.60**	**gal/min**
	Trench Length	217.0	ft				

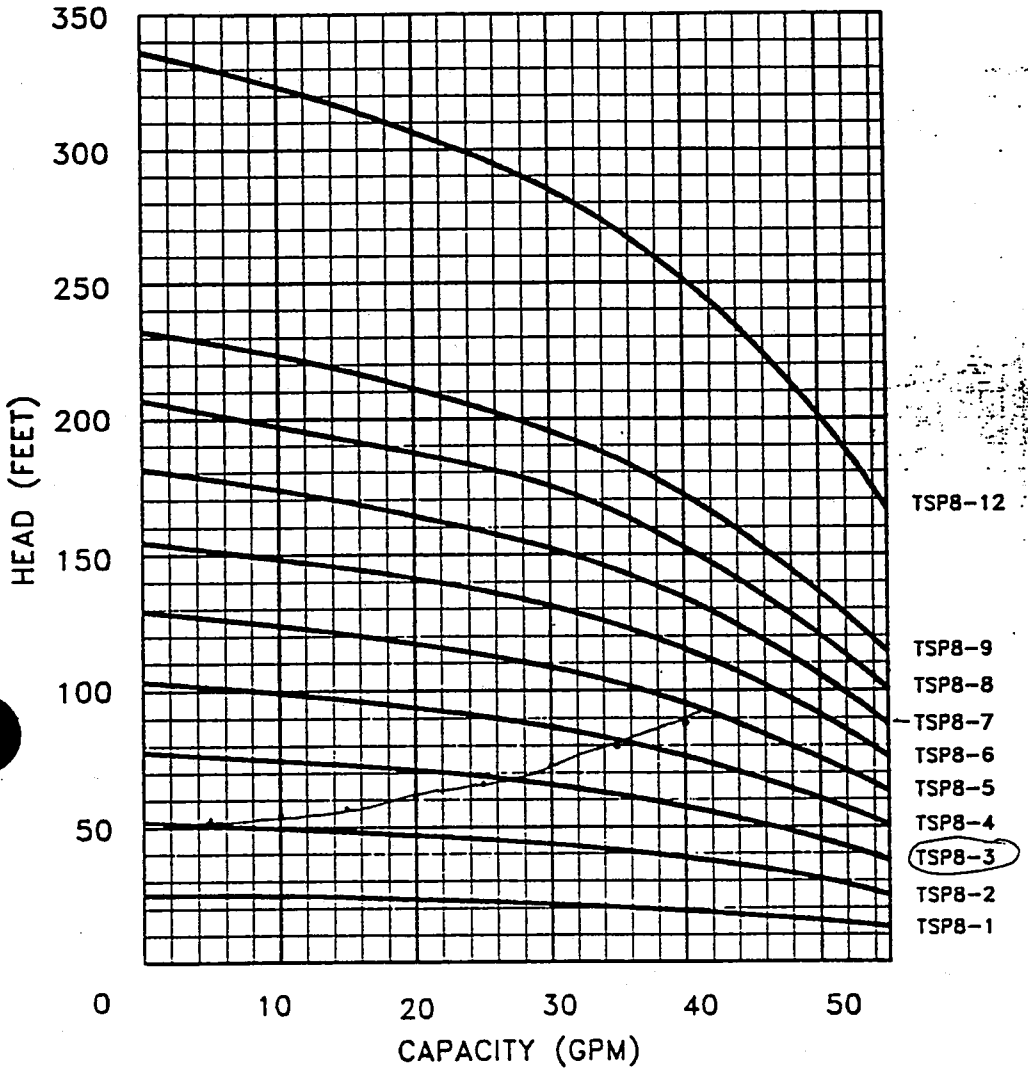
Sauer-Sundstrand							
GW Flow Estimate							
Segment 6 (MW-31)							
elapsed time, t	14	days					
specific yield, Sy	0.2						
initial head, ho	16	ft					
final head, hd	1	ft					
hydraulic conductivity, K	26.345	ft/day					
Average Transmissivity, Ta	223.9325	sq ft/day					
Beta	61.231543						
Volume Estimate	6340.81	gal/ft		507265	gal	**25.16**	**gal/min**
	Trench Length	80.0	ft				

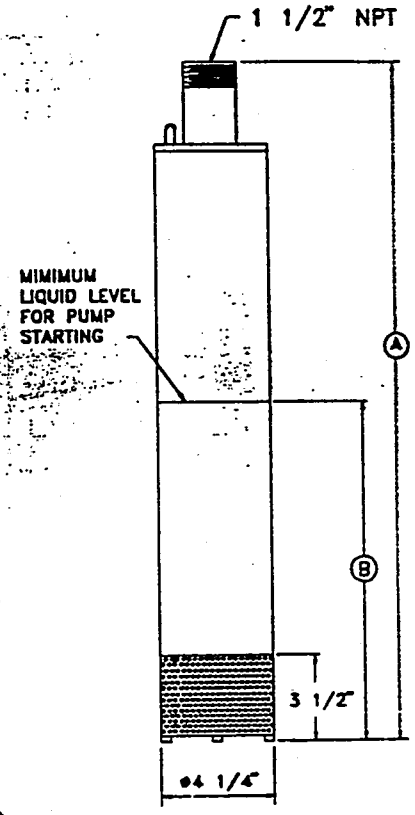
Sauer Sundstrand
Sump Pump

Flowrate	Hydraulic Lift	Length 1.75" Horizontal Pipe	Pipe Diameter	Hf	Hm	TDH	
(gpm)	(ft)	(ft)	(inch)	(ft)	(ft)	(ft)	
5	51	1100	2	0.73	0.06	51.79	
10	51	1100	2	2.63	0.24	53.87	
15	51	1100	2	5.56	0.55	57.11	
20	51	1100	2	9.47	0.97	61.45	
25	51	1100	2	14.32	1.52	66.84	
30	51	1100	2	20.06	2.19	73.25	
35	51	1100	2	26.68	2.98	80.66	
40	51	1100	2	34.16	3.89	89.05	
Hf = 0.002083 * (Length of Pipe) * (100/C)^1.85 * (Flow Rate)^1.85/(Diameter of Pipe) ^4.8655; C=150							
Hm = k * v^2/2g; k assumed to be 15							
TDH = Hf + Hm + Hydraulic lift							

kal
9/12/96

TSP8 SurePump™
VERTICAL





PUMP MODEL	SINGLE PHASE			THREE PHASE			SHIPPING WEIGHT (LBS)	
	MOTOR HP	A (in)	B (in)	MOTOR HP	A (in)	B (in)	1ø	3ø
TSP8-1	0.50	26.25	15.00	0.50	26.25	15.00	38.0	38.0
TSP8-2	0.75	29.25	16.25	0.75	29.25	16.25	41.6	41.6
TSP8-3	1.00	31.75	17.25	1.00	31.75	17.25	46.5	46.5
TSP8-4	1.00	33.50	17.25	1.00	33.50	17.25	48.0	48.0
TSP8-5	1.50	37.00	19.25	1.50	36.00	18.00	56.0	51.6
TSP8-6	1.50	38.75	19.25	1.50	37.50	18.00	57.5	53.1
TSP8-7	2.00	41.75	20.75	2.00	40.50	19.25	62.4	58.0
TSP8-8	2.00	43.50	20.75	2.00	42.50	19.25	64.4	60.0
TSP8-9	3.00	53.50	31.25	3.00	50.75	28.50	88.8	79.0
TSP8-12	5.00	64.50	37.25	5.00	58.50	31.25	112.0	94.3

MONTGOMERY WATSON

BY KAL DATE 8/26/96 CLIENT Sauer Sundstrand SHEET 1 OF 2
CHKD. BY _____ DESCRIPTION Pump Size JOB NO. _____

• Use Hazen and Williams formula to calculate friction loss:

$$h_f = 0.002083\, L \left(\frac{100}{C}\right)^{1.85} \times \frac{gpm^{1.85}}{d^{4.8655}}$$

L = length of pipe, ft
C = friction factor
gpm = fluid flow, gal per min
d = inside pipe diameter, in

L ⇒

length of pipe in sump	23 ft
length of underground piping =	1000 ft
length of heat traced piping =	10 "
length of horizontal internal piping =	18
length of vertical internal piping =	15
	1062 ft = TOTAL

↳ batch process tank = 3000 gal
diameter = 7 ft

$$3000\,gal \times \frac{ft^3}{7.481\,gal} \times \frac{1}{\pi\left(\frac{7}{2}\right)^2 ft^2} = 10.4\,ft$$

(assume 11.0 ft)

C ⇒ C = 150 for HDPE and PVC pipe

d ⇒ d = 2"

for flow rate of 20 gpm,

$$h_f = 0.002083\,(1100\,ft)\left(\frac{100}{150}\right)^{1.85} \frac{(20\,gpm)^{1.85}}{(2)^{4.8655}}$$

$$\boxed{h_f = 9.47\,ft}$$

• Friction loss, fittings: — per Omega catalog, pressure loss for electromagnetic flow meter is none. For pitot tube, using K (resistance similar to temperature probe). Therefore, assume pressure loss from flow meter & pitot is negligible.

fitting	#	K	total K
elbow	8	0.57	4.6
gate valve	1	0.5	0.5
check valve	2	1.0	2.0
ball valve	2	0.06	0.12
		TOTAL	13.2

(assume 15)

$$H_m = \frac{K v^2}{2g}$$

at 20 gpm: $H_m = (15)\left(\frac{20\,gal}{min} \times \frac{ft^3}{7.481\,gal} \times \frac{min}{60\,sec} \times \frac{1}{\pi\left(\frac{2}{2\cdot 12}\right)^2}\right)^2 \Big/ (2)(32.2\,ft/sec^2)$

$$\boxed{H_m = 0.97\,ft}$$

EN 1S (10/78)

MONTGOMERY WATSON

BY KAL DATE 9/12/96 CLIENT Lower Sundstrand SHEET 2 OF 2

CHKD. BY _____ DESCRIPTION Pump Size JOB NO. _____

. Hydraulic lift:

lift from sump to building penetration:

elevation of sump bottom = 12 ft

minimum water level above sump bottom = 26" = 2.17 ft

elevation = 14.17 ft

elevation building penetration = 52 ft

total lift = 52 - 14.7 = 37.8 ft

lift to standpipe connection:

14 ft tank + 1 ft - 1.8 ft pipe elevation above floor = 13.2 ft

Total lift = 37.8 + 13.2
= 51.0 ft

EN 1S (10/73)

CONSTRUCTION QUALITY ASSURANCE PLAN

FOR THE

SAUER-SUNDSTRAND FACILITY
AMES, IOWA

Prepared for

SAUER-SUNDSTRAND COMPANY
AMES, IOWA

Project No. 8907.0343

September 1996

Prepared by

Montgomery Watson
11107 Aurora Avenue
Des Moines, IA
(515) 253-07830

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SECTION 1

INTRODUCTION

This Construction Quality Assurance Plan (CQAP) addresses quality assurance activities that will be taken to ensure quality during all phases of construction at the Sauer-Sundstrand Company property (site). These activities include inspection, sampling and testing, corrective action, and documentation. Quality control, which refers to those actions taken to provide for materials and workmanship meeting requirements of the design plans and specifications, will be provided by the manufacturers and installers of the various components of the groundwater collection system and is not addressed in this CQAP.

SECTION 2

INTERCEPTION TRENCH/SUMP

The interception trench will be installed across the southwestern corner of the site, south of the main facility building and north of the Chicago & Northwestern Railroad. The northwest and southeast legs of the trench will slope to a sump, and cleanouts will be included at the end of each leg. The interception trench and sump will be constructed and installed in accordance with the Interception Trench and Sump performance specification. Field modifications will be documented in as-built drawings, etc.

CONFIRMATION OF MATERIAL QUALITY

As specified in the Interception Trench and Sump performance specification, the Subcontractor will submit to the Engineer, for approval, evidence such as material and equipment shop drawings demonstrating that all construction materials meet the requirements of the specification. On-site observation and inspection by the Site Manager/ Site Technician and the Engineer will also serve to confirm material quality.

CONFIRMATION OF CONSTRUCTION PROCEDURE

Prior to the start of construction, the Subcontractor will submit to the Engineer the information required by the Interception Trench and Sump performance specification. The Subcontractor will also submit a detailed installation plan that will include methods for 1) controlling the depth of the installation; 2) controlling placement of the drainage pipe, sump and granular backfill; and 3) disposing liquid generated during installation of the interception trench, as well as proposed granular backfill gradation and drainage pipe perforations. The subcontractor will demonstrate the techniques for installation of the collection trench, drainage pipe, sump and cleanouts to the satisfaction of the Engineer.

OBSERVATION AND INSPECTION

The Site Manager/Site Technician will be on site and the Engineer will conduct periodic site visits during installation of the interception trench and sump, to confirm that they are constructed in accordance with the Interception Trench and Sump performance specification. The Site Manager/Site Technician will maintain daily field notes and a photographic record to document construction activities.

Prior to construction, the General Contractor will survey and stake the interception trench alignment and sump location, and the alignment will be approved by the Engineer before construction activities are initiated. During construction, the Site Manager/Site Technician and Engineer will visually confirm the alignment of the interception trench. The Site Manager/Site Technician will spot-sample backfill materials, and will visually observe backfill placement.

Following installation of the interception trench, the drainage pipe and sump will be jetted to remove finer particles from the backfill immediately surrounding the pipe and sump. The Subcontractor will clean out the drainage pipe and remove all accumulated sediment from the sump. The drainage pipe will then be pigged to confirm the absence of collapsed pipe, or other problems that may affect the integrity of the drainage pipe. The Subcontractor will repair all deficiencies noted.

SECTION 3

CONVEYANCE PIPING

Conveyance piping will be installed between the sump and the sanitary sewer discharge located in the existing wastewater treatment room. The conveyance piping will be connected to the sump using a standard pitless adapter installed in the sump, and the piping will enter the treatment room through a wall penetration. The conveyance piping will be constructed and installed in accordance with the Construction Specifications.

CONFIRMATION OF MATERIAL QUALITY

Conveyance Pipeline

The Subcontractor will submit shop drawings and certifications for pipeline components including pipe, fittings and valves, to the Engineer for approval as specified in the Construction Specifications. On-site observation and inspection by the Site Manager/Site Technician and the Engineer will also serve to confirm material quality.

Backfill Material

The Subcontractor will submit certified test reports and analysis certifying that the suitable materials proposed for use at the site conform to the specified requirements. The Site Manager/Site Technician will visually observe the backfill material to ensure that unsuitable soil is not used for these activities and that maximum particle size is as specified in these materials.

CONFIRMATION OF CONSTRUCTION PROCEDURE

Conveyance Pipeline

The Subcontractor will submit a proposed plan for testing the conveyance piping for review and concurrence of the Engineer. The proposed testing plan will include provisions for testing and for water conveyance, control and disposal.

OBSERVATION AND INSPECTION

The Site Manager/Site Technician will be on site and the Engineer will conduct periodic site visits during installation of the conveyance piping to confirm that it is constructed in accordance with the Construction Specifications. The Site Manager/Site Technician will maintain daily field notes and a photographic record to document construction activities.

Conveyance Pipeline

The Subcontractor will conduct nondestructive testing of the conveyance piping in the presence of the Site Manager/ Site Technician and the Engineer to demonstrate that the piping system is

free of leaks. Each section of pipe will be installed prior to testing, and each section of pipe will be tested as a single unit using plugs or valves. Pipe trenches will be partially backfilled prior to testing. The pipe will be hydrostatically tested by purging trapped air from each test section, introducing water into the test section until the internal pressure stabilizes between 65 and 70 psi, and maintaining the test pressure for three hours. If the pressure deviates by more than 2 percent during the test period, the test will be repeated. Sections which fail pressure testing will be repaired.

Backfill

The Subcontractor will obtain a soils classification per the Unified Soils Classification System for each principal type of off-site material or combination of materials utilized, using samples that are representative of the material placed. Testing will include Atterberg limits, grain size determination (sieve and hydrometer analyses) and specific gravity. Copies of all tests for classification will be furnished to the Engineer for approval prior to placement of the material.

The Subcontractor will perform tests for determination of maximum density and optimum moisture for each principal type of material in accordance with the requirements of ASTM D 698, using samples that are representative of the materials to be placed. An optimum moisture density curve will be obtained for each principal type of material encountered or utilized. Results of these tests will be the basis of control for compaction. A copy of these tests will be furnished to the Engineer for approval prior to material placement.

Compaction requirements are detailed in the Construction Specifications. The Subcontractor will adequately control its compaction operations, and compaction will be confirmed by the Engineer by tests made in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922 and ASTM D 3017.

SECTION 4

EQUIPMENT

All equipment associated with the groundwater collection system, including the submersible pump, level transmitter, heat tracing, temperature probe, flow meter, level sensor and electrical system, will be installed in accordance with the Construction Specifications.

CONFIRMATION OF MATERIAL QUALITY

The Subcontractor(s) will submit equipment shop drawings to the Engineer for approval, as specified in the Construction Specifications. On-site observation and inspection by the Site Manager/Site Technician and the Engineer will also serve to confirm material quality.

OBSERVATION AND INSPECTION

The Site Manager/Site Technician will be on site and the Engineer will conduct periodic site visits during installation of the equipment to confirm that it is installed in accordance with the Construction Specifications. The Site Manager/Site Technician will inspect the equipment, and the Subcontractor(s) will test the equipment in the presence of the Site Manager/Site Technician to demonstrate proper operation. The Site Manager/Site Technician will maintain daily field notes and a photographic record to document equipment installation.

SAMPLING AND ANALYSIS PLAN

FOR THE

SAUER-SUNDSTRAND FACILITY
AMES, IOWA

Prepared for

SAUER-SUNDSTRAND COMPANY
AMES, IOWA

Project No. 8907.0343

September 1996

Prepared by

Montgomery Watson
11107 Aurora Avenue
Des Moines, Iowa 50322
515-253-0830

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SECTION 1

INTRODUCTION AND SITE DESCRIPTION

This Sampling and Analysis Plan (SAP) has been prepared by Montgomery Watson for the Sauer-Sundstrand facility (site) in Ames, Iowa. This SAP describes groundwater and remedial system sampling and analysis activities to be conducted subsequent to the construction of the approved corrective measure (groundwater interception trench).

This document is not intended to be used alone, but in conjunction with the Site Safety Plan (SSP) and the Quality Assurance Project Plan (QAPP). The SSP defines the safety procedures to be followed to ensure protection of site personnel during field operations. The SSP is included as Appendix G of the Construction Work Plan. The QAPP is included as Attachment A of this SAP. The QAPP describes the project organization, functional activities, and quality assurance/quality control (QA/QC) activities to be followed.

SITE DESCRIPTION

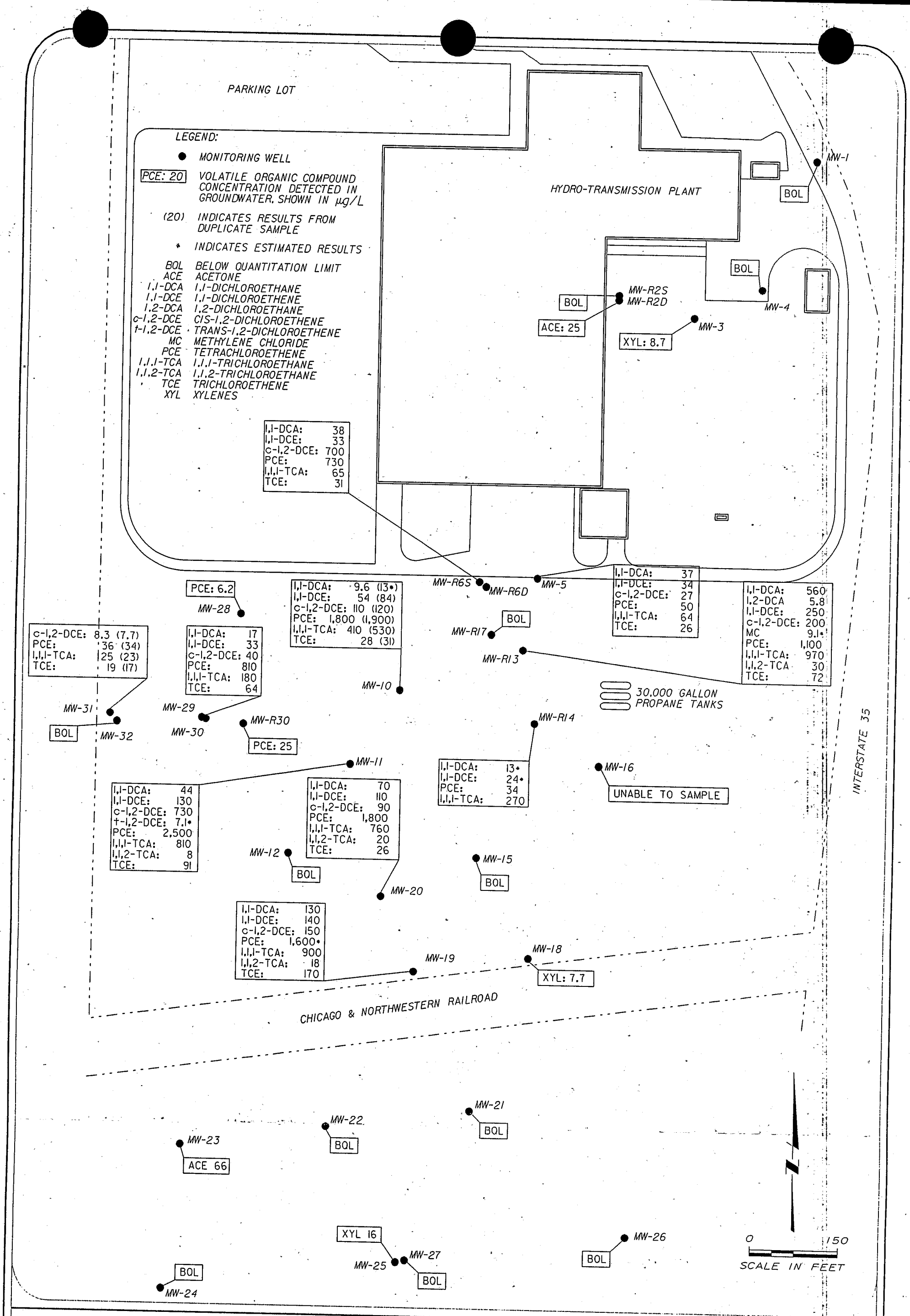
Site Hydrogeology

As presented in the RCRA Facility Investigation (RFI) Report, the subsurface geology at the site consists mainly of dense, gray, clay-rich glacial till interbedded with numerous and discontinuous sand units. Two main water-bearing zones appear to exist in the unconsolidated sediments of the site. A shallow water-bearing zone occurs from the water table (generally encountered at approximately 4 to 6 feet below ground surface) to a depth of approximately 15 to 20 feet below ground surface where the geology changes from soft, sandy clay, containing numerous sand pockets of limited horizontal and vertical extent to a hard, gray, silty clay.

Underlying the shallow water-bearing zone is the intermediate water-bearing zone which consists of numerous sand lenses interspersed throughout a dense, gray, clay-rich glacial till. Sand layers in the till have been encountered at depth ranging from approximately 15 to 50 feet below ground surface. The intermediate groundwater sand units are generally thicker than those encountered in the shallow water bearing zone; however, they too appear discontinuous. Based upon information presented in the RFI Report, it was concluded that the lower conductivity of the intermediate zone restricts vertical flow of water from the shallow sand units to those in the intermediate zone.

Extent of Groundwater Impacts

During the RFI, evidence of volatile organic compounds (VOCs) in groundwater were observed at monitoring well locations in the central and southwestern portions of the site (Figure 1-1). The highest concentrations of total VOCs in groundwater were detected at monitoring well locations MW-11, MW-R13 and MW-19. VOC concentrations in groundwater samples collected from downgradient monitoring well locations MW-21, MW-22 and MW-23 were



NOTE: DATA TAKEN FROM HARDING LAWSON ASSOCIATES JUNE 1995 REPORT.

MONTGOMERY WATSON

SAUER-SUNDSTRAND FACILITY
AMES, IOWA

GROUNDWATER ANALYTICAL RESULTS SEPT.-OCT. 1994

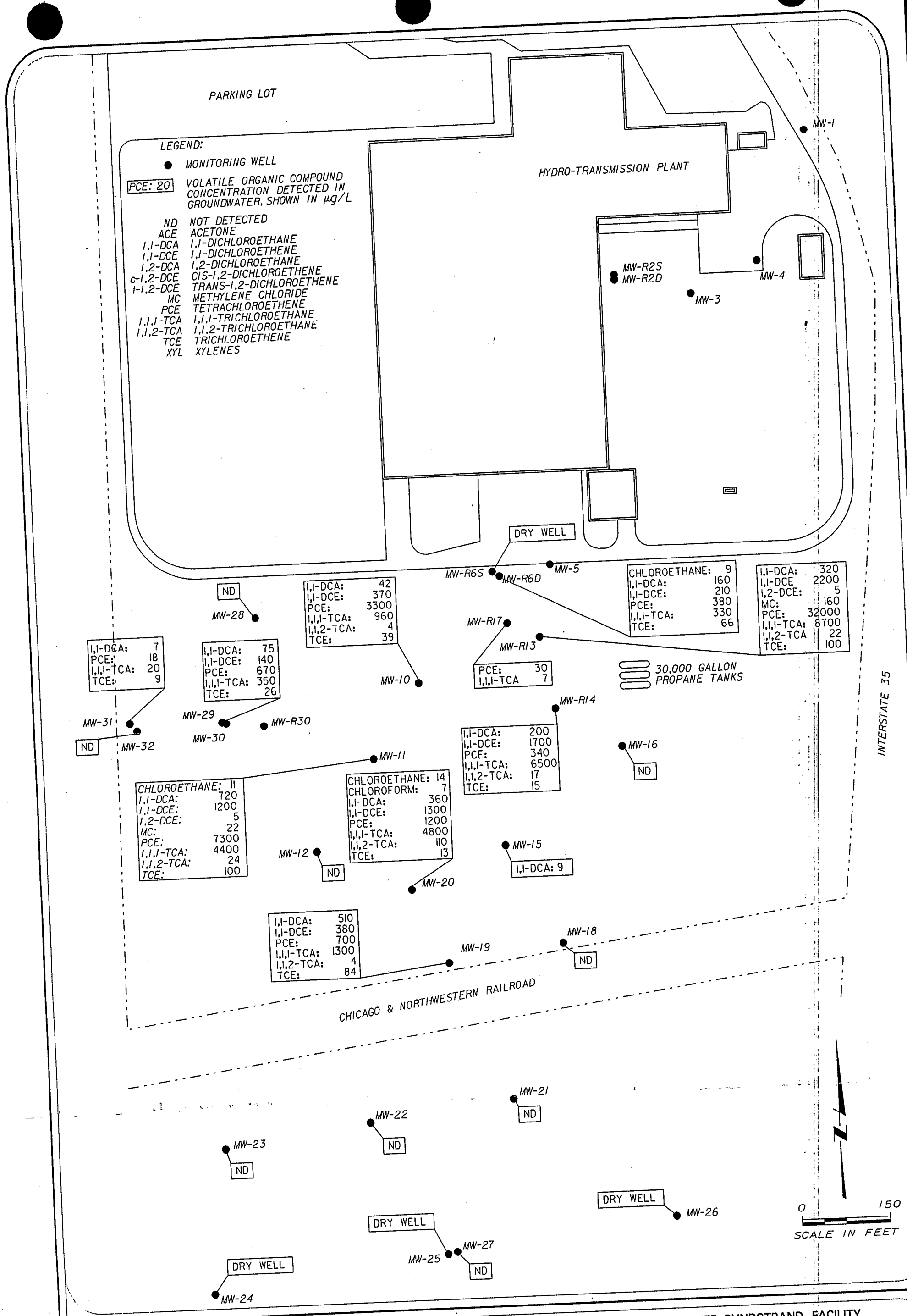
FIGURE 1-1

AU259

generally below Method Detection Limits (MDLs). An isolated detection of acetone was observed in MW-23 at a concentration of 66 µg/L (Figure 1-1).

Historic groundwater monitoring data suggests that the VOC plume is migrating in the direction of shallow groundwater flow toward the southwest. As presented in the RFI Report, results from a pre-RFI investigation conducted in January and February 1990 indicated that the highest VOC concentrations were detected at MW-R13 (Figure 1-2). When results of the 1990 sampling event are compared with those resulting from the RFI (September and October 1994), the location of maximum VOC concentrations apparently shifted downgradient from the vicinity of MW-R13 to MW-11, located approximately 350 feet to the southwest.

Further comparison of the 1990 and 1994 sampling events indicates that VOC concentrations have generally decreased in the upgradient portion of the plume. Decreases were particularly notable in the vicinity of MW-10, MW-11, MW-R13, MW-R14 and MW-R17 (Figures 1-1 and 1-2). Concurrently, increases in constituent concentrations were noted at several downgradient monitoring locations including MW-28, MW-31, MW-18 and MW-19 (Figures 1-1 and 1-2). The observed shift in the center of the plume mass is consistent with interpretations of groundwater flow presented in the RFI Report. As presented in the RFI Report, some contaminant concentrations were detected above Maximum Contaminant Levels (MCLs) at MW-19; however, none of the off-site monitoring locations contained concentrations of contaminants above MCLs (Figures 1-1 and 1-2).



NOTE: DATA TAKEN FROM HARDING LAWSON ASSOCIATES JUNE 1995 REPORT.

SAUER-SUNDSTRAND FACILITY
AMES, IOWA

AREAL EXTENT OF VOCs IN GROUNDWATER JAN.–FEB. 1990

FIGURE 1–2

MONTGOMERY WATSON

SECTION 2

DATA QUALITY OBJECTIVES

Integral to this SAP, Data Quality Objectives (DQOs) have been developed which specify the quality and type of data required for the evaluation of groundwater and remedial system discharge monitoring results. The general sampling objectives at the site are as follows:

- Obtain environmental data that are representative of the sampled media.
- Provide information on current conditions at the site.
- Provide a means of tracking the performance of the groundwater interception system over time.

ENVIRONMENTAL PROTECTION AGENCY ANALYTICAL LEVEL

A brief summary of each Environmental Protection Agency (EPA) Analytical Level is as follows:

EPA Analytical Level	Definition
I	Field screening or analysis using portable instruments. Results are often not compound-specific or quantitative, but are available in real-time.
II	Field analysis using more sophisticated portable analytical instruments. Results available in real-time or several hours.
III	Analyses performed in an off-site analytical laboratory employing standard EPA-approved methods.
IV	Analyses performed in an off-site Contract Laboratory Program (CLP) laboratory utilizing CLP routine analytical services. Level IV is characterized by rigorous QA/QC protocols and documentation.
V	Analyses performed in an off-site analytical laboratory which may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits.

Generally, EPA Analytical Level I will be employed for in-field measurements performed in accordance with this SAP. Level III will be utilized for laboratory analyses and data evaluation.

SITE-SPECIFIC DQOs

Objectives for data quality reflect the anticipated uses of the data and the available analytical and sampling resources. Specific DQOs for the site have been identified as follows:

No.	Data Quality Objective
1	Monitor the horizontal and vertical extent of contaminants of concern (COCs) in groundwater at the site.
2	Monitor hydrogeologic conditions following construction of the groundwater interception trench.
3	Monitor the performance of the groundwater remedial system in removing impacted groundwater from the site.
4	Evaluate field and laboratory sampling and analytical procedures through the analysis of QC samples.

Specific tasks have been developed which will enable each of the DQOs to be achieved. One task may serve to satisfy or partially satisfy more than one DQO. The following subsections discuss in more detail the DQOs and associated tasks or activities.

Groundwater Monitoring (DQO No. 1)

In order to monitor the horizontal and vertical extent of COCs in groundwater at the site, select wells will be sampled at specified intervals. Samples will be obtained from the following locations:

- Shallow Groundwater Monitoring Wells: MW-10, MW-11, MW-12, MW-R13, MW-18, MW-19, MW-20, MW-31 (Figure 2-1).
- Deep Groundwater Monitoring Well: MW-32 (Figure 2-1).

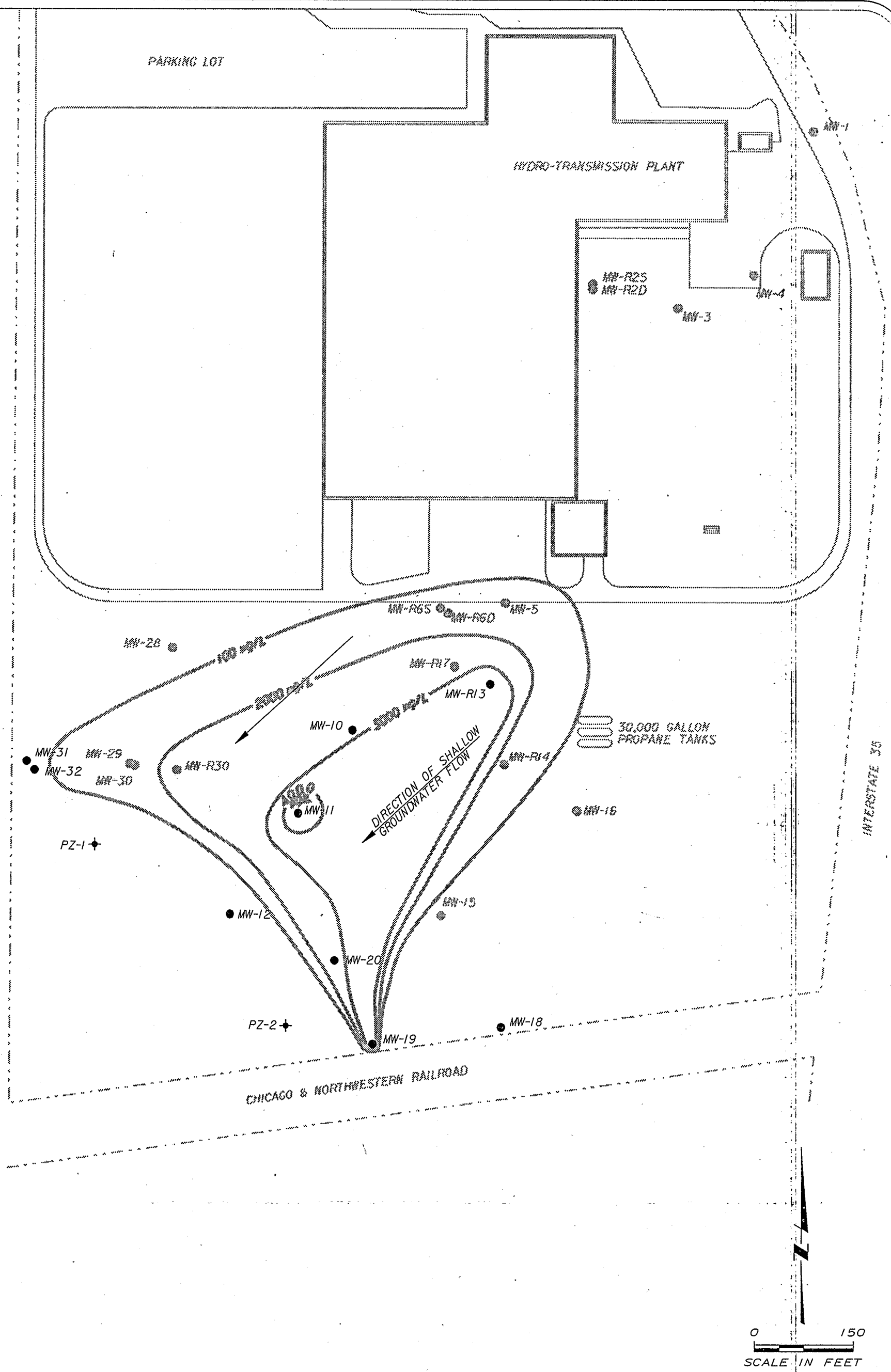
To meet DQO No. 1, EPA Analytical Level I will be employed for in-field measurements. Level III will be utilized for laboratory analyses and data evaluation.

Hydrogeologic Monitoring (DQO No. 2)

Potential changes in groundwater levels and flow directions proximal to, and resulting from, construction of the groundwater interception trench will be assessed through the following tasks:

- Measurement of groundwater elevations at monitoring wells routinely sampled as part of the groundwater monitoring plan.
- Measurement of groundwater elevations at piezometers PZ-1 and PZ-2 (Figure 2-1).

EPA Analytical Level I will be employed to meet DQO No. 2.



LEGEND:

- ● MONITORING WELL
- ✦ PIEZOMETER

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MONITORING LOCATIONS

FIGURE 2–1

Groundwater Remedial System Monitoring (DQO No. 3)

The concentration of COCs in the intercepted groundwater will be monitored through the following tasks:

- Water samples will be collected from the groundwater remedial system which discharges to the City of Ames Water Pollution Control Department (WPCD) facility.

- A flow meter will be utilized to measure remedial system discharge. Flow measurements will be recorded during sampling events.

To meet DQO No. 3, EPA Analytical Level I will be employed for in-field measurements. EPA Analytical Level III will be utilized for laboratory analyses and data evaluation.

Sampling and Analysis Evaluation (DQO No. 4)

The following tasks will be performed in order to evaluate the effectiveness of sampling and analysis procedures:

- The collection and analysis of field duplicate samples.

- The collection and analysis of field rinsate blanks when nondedicated equipment is used.

- The analysis of laboratory quality control (QC) samples.

- Performance of periodic audits of field activities, procedures, and record keeping.

To meet DQO No. 4, EPA Analytical Level I will be employed for in-field measurements. Level III will be utilized for laboratory analyses and data evaluation.

SECTION 3

GROUNDWATER MONITORING PROCEDURES

General sampling objectives at the site are to obtain environmental data that: 1) are representative of the sampled media, 2) provide information on current conditions at the site, and 3) provide a means of tracking the performance of the groundwater remedial system over time.

Specific DQOs have been determined for this project, as presented in Section 3 of this SAP. This section outlines general procedures associated with completion of DQO Numbers 1, 2 and 4. Groundwater sampling locations and the rationale for their selection are also identified below.

GROUNDWATER SAMPLING

Shallow Groundwater

Monitoring wells MW-10, MW-11, MW-12, MW-R13, MW-18, MW-19, MW-20 and MW-31 will comprise the shallow groundwater sampling network due to the presence of VOCs detected above MCLs at several of these locations during the RFI (Figure 2-1), and due to their location relative to the identified plume. These wells will be sampled to monitor the horizontal extent of COCs in groundwater at the site and to track the performance of the remedial system in removing COCs from groundwater.

Water samples from downgradient wells MW-12, MW-18, MW-19, MW-20 and MW-31 will be collected on an annual basis and analyzed for the constituents listed in Table 3-1. Monitoring wells MW-10, MW-11 and MW-R13, located in the central portion of the identified plume, will be monitored on an alternate year basis. The first annual sampling event will be conducted during the third quarter of 1997; annual and alternate year sampling will proceed accordingly for up to five years.

Deep Groundwater

Monitoring well MW-32 will be sampled to monitor the vertical extent of COCs in groundwater proximal to the downgradient portion of the identified VOC plume (Figure 2-1). Water samples from this location will be collected on an alternate year basis and analyzed for the constituents listed in Table 3-1. The first sampling event will be conducted during the third quarter of 1997; alternate year sampling will proceed accordingly.

Well Purging

Each monitoring well will be purged prior to sampling, in an effort to remove stagnant water from the well and ensure a representative groundwater sample is collected. It is anticipated that each well will be purged using a dedicated Waterra inertial pump. The Waterra inertial pump has proven to be an effective tool for monitoring well development and sample collection due to its simple design and operation. Its design consists of a self-tapping foot valve which threads

TABLE 3-1

CONSTITUENTS RECOMMENDED FOR ANALYSIS
SAUER-SUNDSTRAND FACILITY - AMES, IOWA

Constituent
1,1-Dichloroethene
1,1-Dichloroethane
cis-1,2-Dichloroethene
1,1,1-Trichloroethane
Trichloroethene
1,1,2-Trichloroethane
Tetrachloroethene

onto virgin 1/2-inch inside diameter by 5/8-inch outside diameter high density polyethylene tubing. The foot valve is constructed of durable "Delrin" Acetal thermoplastic which has excellent resistance to organics and good silt handling capabilities. Its operation consists of inserting the foot valve end of the tubing to the bottom of the well. The tubing is then oscillated up and down by hand or a mechanical pump. This draws water through the tubing to the surface where it can be discharged into an appropriate container.

An effort will be made to purge three well volumes of water from each well before sample collection. However, if a monitoring well is purged dry prior to removing three volumes of water, it will be sampled after the water level in the well recovers to a level sufficient for sample collection. Every effort will be made to collect a groundwater sample on the same working day in which a well is purged dry. If a well which is purged dry fails to recover sufficiently during that same working day, it will be sampled on the following day.

The volume of water to be purged from each well (a minimum of three well volumes, if possible) will be based on depth-to water and total depth measurements. The volume of water to be purged will be calculated as follows:

Desired Purge Volume (gallons) = (3 well volumes) x (water column height) x (cross sectional area of well) x (7.48 gallons/cubic foot)

Where:

Water Column Height (ft) = total well depth (ft) - depth to water (ft)

Cross Section Area for 2-Inch Well = 0.02182 square feet

The volume of water removed from each well will be measured by collecting the purge water in a 5-gallon pail or equivalent container.

Temperature, pH and specific conductance measurements will be collected periodically during the purging of each well. Field personnel will ensure these parameters have stabilized to within 10 percent over three consecutive measurements before purging activities are terminated. The stabilization parameters will be recorded in the field book.

Personal protective equipment specified in the SSP will be worn during purging activities. Care will be taken to prevent purging equipment from coming into contact with the ground or other potentially contaminated surfaces. The purge and equipment decontamination water generated during field activities will be discharged to the sanitary sewer immediately following the sampling event.

Groundwater Sample Collection

Groundwater from each well will be sampled following the purging of that well. Dedicated Waterra inertial pumps will be used for sampling respective monitoring wells. Groundwater

sampled from each monitoring well will be carefully transferred to the appropriate laboratory-supplied containers described in Section 3 of the QAPP.

Personal protective equipment identified in the SSP will be worn while sampling, and all appropriate equipment (i.e., gloves) will be changed between sampling each well to minimize the potential for cross contamination. All information pertaining to groundwater sampling will be recorded in the field book. Detailed sample analysis, handling and documentation procedures are addressed in Section 5 and the QAPP.

Groundwater Collection Documentation

All sample collection activities will be documented in the bound project field book. The field book will contain the following information:

- Sampling Location
- Sample Identification Number
- Date and Time of Collection
- Total Depth of Well
- Depth to Water
- Length of Water Column
- Volume of Water in Well
- Volume of Water Purged
- Field Parameter Measurements
- Field Observations (weather, odor, etc.)
- Name of Sampling Personnel

All samples will be accompanied by a completed chain of custody record. A copy of an equivalent chain of custody record to be used for the Sauer-Sundstrand facility sampling activities is presented in Attachment C of the QAPP.

Groundwater Purging and Sampling Equipment Decontamination

The equipment used for groundwater sampling will be decontaminated initially and between monitoring wells as follows:

- Wash with water and nonphosphate detergent.
- Triple-rinse with distilled water.

All water generated during decontamination activities will be collected and stored in 55-gallon drums or equivalent containers. It is anticipated the decontamination water ultimately will be discharged to the sanitary sewer following receipt of analytical results from the sampling event.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) SAMPLES

QA/QC groundwater samples will be collected in the field, in order to ensure laboratory quality and the absence of cross contamination effects. Duplicate s amples, field/equipment blanks and trip blanks samples will be collected and analyzed during the activities specified in this SAP.

The procedures and frequency of collecting these samples are included in the QAPP (Attachment A).

HYDROGEOLOGIC MONITORING

Depth-to-water measurements will be collected and recorded by field personnel at each piezometer or monitoring well prior to purging and sampling activities. The total depth of each monitoring well will also be measured and recorded. Measurements will be recorded to the nearest 0.01 foot from the top of the monitoring well casing using a Solonist Model 101 electronic water level indicator or equivalent. The wetted portion of the water level indicator will be rinsed with distilled water prior to use in another well. Water level measurements, and the time and date of their collection, will be recorded in the project field book. This information will be utilized to assess and monitor the hydraulic impact of the groundwater interception trench.

REPORTING

An annual site sampling report will be prepared and submitted to the EPA which will include a summary of the results of groundwater sampling and hydrogeologic monitoring. This report will be submitted no later than March 1, following each annual sampling event. Results of the monitoring program will be periodically reviewed and, if appropriate, modifications to the program will be recommended. Sampling will continue for a period of five years at which time the effectiveness of the remedial system will be reevaluated to determine whether CMS objectives have been fulfilled.

SECTION 4

REMEDIAL SYSTEM MONITORING

Specific DQOs have been determined for this project, as presented in Section 2 of this SAP. This section outlines general procedures associated with DQO No. 3. The selected remedial system sampling location and sampling schedule are identified below.

REMEDIAL SYSTEM SAMPLING

Sampling of the groundwater remedial system will occur in two phases: 1) startup and 2) maintenance. The startup phase will commence following completion of the groundwater interception trench construction. At the conclusion of the first week of the remedial system operation, system samples will be collected from an in-line sample tap and analyzed for the constituents listed in Table 4-1.

Following system startup, maintenance sampling will be conducted in accordance with requirements specified in Sauer-Sundstrand facility's Non-Domestic Wastewater Discharge Permit No. 6593-3 (Permit No. 6593-3) issued by the City of Ames, Iowa Water and Pollution Control Department (Attachment B). Remedial system samples will be collected and analyzed for the constituents listed in Table 4-1. As required by Permit No. 6593-3, remedial system samples will initially be collected on a monthly basis in order to establish the concentration pattern of each of the constituents expected to be discharged to the sanitary sewer. The monitoring frequency requirements may be reduced in the future, depending on the initial results obtained.

Remedial System Sample Collection

Water samples will be collected from an in-line sample tap installed in remedial system piping which ties into the sanitary sewer inlet located in the existing wastewater treatment facility. Water sampled from the tap will be directly collected in appropriate laboratory-supplied containers described in Section 3 of the QAPP.

Personal protective equipment identified in the SSP will be worn while sampling. All information pertaining to remedial system sampling will be recorded in the field book. Detailed sample analysis, handling and documentation procedures are addressed in Section 5 and the QAPP.

Remedial System Sample Collection Documentation

All sample collection activities will be documented in the bound project field book. The field book will contain the following information:

- Sample Location
- Sample Identification Number
- Date and Time of Collection
- Field Observations (odor, etc.)
- Name of Sampling Personnel

TABLE 4-1

MAXIMUM EXPECTED DISCHARGE CONCENTRATIONS

Constituent	Maximum Expected Concentration (µg/L)
Acetone	44
1,1-Dichloroethane	370
1,2-Dichloroethane	3.9
1,1-Dichloroethylene	170
cis-1,2-Dichloroethylene	490
trans-1,2-Dichloroethylene	4.7
Methylene Chloride	6.1[a]
Perchloroethylene	1,700
1,1,1-Trichloroethane	650
1,1,2-Trichloroethane	20
Trichloroethylene	110
Total Xylenes	11
Total Suspended Solids[b]	1,500,000
Total Iron[b]	15,000

Note: Total suspended solids and iron will be sampled during the startup phase only.

[a] Suspect laboratory artifact.

[b] Anticipated start value for total iron = 28,000 µg/L.

All samples will be accompanied by a completed chain of custody record. A copy of an equivalent chain of custody record to be used for the Sauer-Sundstrand facility sampling activities is presented in Attachment C of the QAPP.

FLOW MEASUREMENT

During the first four weeks of operation, flow measurements as recorded by the system flow meter will be monitored daily and recorded to ensure compliance with the initial flow limitation of 15 to 20 gpm, as requested by the City of Ames. This initial limitation was requested to allow the City of Ames WPCD facility's biological treatment processes to acclimate to the constituents being discharged. Following this startup period, flow measurements will be monitored and reported to the City of Ames, in accordance with Permit No. 6593-3. Flow measurements will also be observed during system sampling events and recorded in the bound project field book.

REPORTING

Remedial system monitoring results will be submitted in a monthly report to the City of Ames WPCD as required by Permit No. 6593-3. A copy of these reports and a summary of the observed system performance will be included in the annual site sampling report, to be submitted to the USEPA, as described in Section 4.

SECTION 5

SAMPLE ANALYSIS, HANDLING AND DOCUMENTATION

Once a desired sample is retrieved and logged by field personnel, the sample will be prepared for transport or shipment to the laboratory. Handling procedures presented in this section include identification of appropriate sample containers, sample packaging, sample transport/shipping and laboratory requirements. Additional information on sample handling, sample analysis and laboratory methods is provided in the QAPP.

LABORATORY CRITERIA

National Environmental Testing, Inc. (NET) of Cedar Falls, Iowa will be the laboratory used for the project. All groundwater and remedial system samples collected for laboratory analysis will be analyzed using EPA-approved methods outlined in this section and in the latest version of EPA Manual SW-846, "Methods for Chemical Analysis of Water and Waste." The laboratory will conduct analyses in accordance with the QAPP to ensure the accuracy and consistency of reporting results. Modifications to the analytical methods, method detection limits, preservatives, holding times, etc., must be approved by the EPA prior to implementation. A copy of the quality assurance plan/manuals for the project laboratory is presented as Attachment A of the QAPP.

SAMPLE DESIGNATION

The sample identification scheme will provide each sample with a unique number through collection, analysis, validation and data reduction. All samples collected by field personnel will have a unique number. Each sample will have a unique sample location type; the specific samples are designated as follows:

SS-nn

Where:

SS is the sample location type:

- MW = Monitoring Well
- RS = Remedial System

nn designates the specific sample location:

- for MW prefixes, nn is the one- or two-digit number of a monitoring well.

Duplicate samples will be submitted blind to NET. Blind duplicates will be labeled in order to appear as samples from an additional well or sampling location. The correct identity of the sample will be recorded in the field log book.

SAMPLE HANDLING

Immediately after collection, samples will be placed in coolers with cold packs, or the equivalent. Cold packs will be packed with the samples in order to maintain sample temperatures at 4° C. If ice is to be used for cold packs, the ice will be sealed within two Ziploc™ bags. Samples collected during subfreezing temperatures will be protected from freezing. In preparation for shipment, samples will be packed in coolers in such a way as to prevent breakage of sample containers.

Samples will be shipped via overnight express to the laboratory after collection. Custody transfer will be noted on the chain of custody form as being between the Montgomery Watson personnel relinquishing the sample and the air express company receiving the samples. The airbill number should be noted at the top of the chain of custody for tracking purposes. The original copy of the completed chain of custody will be sealed in a Ziploc™ bag and placed inside the cooler. A copy of the signed chain of custody will be retained by the sampler. The cooler will then be sealed with packaging tape and the airbill attached. Any drain plug at the bottom of the cooler will be taped shut for shipment.

SAMPLE CONTAINERS, PRESERVATION AND HOLDING TIMES

A summary of analyses, methods, and container requirements is presented in Section 3 of the QAPP. All sample containers will be provided by the laboratory. Some of the parameters that will be measured or evaluated are not chemically stable under some conditions. In these cases, sample preservation will be required. Methods of sample preservation are relatively simple and are generally intended to: 1) retard biological action, 2) retard hydrolysis, and 3) reduce sorption effects. Preservation methods for the analytes of interest at the site are also presented in Section 3 of the QAPP. Samples will be held for no longer than the specified maximum allowable holding times. Laboratory data sheets for the samples will be reviewed by Montgomery Watson personnel to ensure allowed holding times are not violated.

ATTACHMENT A

QUALITY ASSURANCE PROJECT PLAN

SAUER-SUNDSTRAND FACILITY
AMES, IOWA

Prepared For

SAUER-SUNDSTRAND COMPANY
AMES, IOWA

Project No. 8907.0343

September 1996

Prepared by

Montgomery Watson
11107 Aurora Avenue
Des Moines, Iowa 50322
515-253-0830

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SECTION 1

PROJECT DESCRIPTION AND ORGANIZATION

INTRODUCTION

This Quality Assurance Project Plan (QAPP) was prepared on behalf of Sauer-Sundstrand Company (Sauer-Sundstrand) by Montgomery Watson. It is presented as an integral part of the Sampling and Analysis Plan (SAP) developed for the Sauer-Sundstrand site located in Ames, Iowa (site). The contents and organization of this QAPP are consistent with the QAPP format and guidelines outlined in the United States Environmental Protection Agency (EPA) document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, 1988." The intent of this QAPP is to adequately describe project organization, functional activities and quality assurance/quality control (QA/QC) procedures necessary to achieve the Data Quality Objectives (DQOs) of the SAP.

QAPP Objective

The objective of the SAP is to describe the methods and procedures which will be used to conduct groundwater and remedial system sampling at the site subsequent to construction of the approved corrective measure (groundwater interception trench). Support or associated activities such as well purging and decontamination are also fully described in the SAP. Related QA/QC procedures for these sampling and support activities are presented in this QAPP.

PROJECT ORGANIZATION AND RESPONSIBILITIES

The purpose of this section is to identify key personnel and organizations assigned to various project activities. The following provides a brief description of their roles and responsibilities relating to sampling and analysis activities.

Project Manager

The Project Manager (PM) is responsible for overall review and tracking of the project schedule and budget, coordination of field and office activities, management of subcontractors and development of report documents. The PM is also the primary point of contact for client and regulatory agency communications.

Project Engineer

The Project Engineer (PE) will be responsible for oversight and technical implementation of SAP tasks, implementation of field tasks and preparation of documents under the direction of the PM.

Field Supervisor

The Field Supervisor (FS) is responsible for the day-to-day oversight and technical implementation of SAP tasks. The FS will also be responsible for budget and schedule tracking of individual project components. As FS, this person is responsible for managing all field

investigation efforts. This includes ensuring the proper sample collection, handling and chain of custody procedures are followed; collection of appropriate quality control samples; and execution of the sampling procedures outlined in the SAP. Additional responsibilities include assuring that all field personnel are properly briefed and trained; maintaining field logs, project files and other information; communicating field activity information to the PM; and documenting and communicating any field decisions that result in a deviation from the SAP. The role of the FS and PE may be assigned to the same individual.

Project Quality Assurance Officer

The Project Quality Assurance Officer (PQAO) is responsible for the review and approval of this QAPP and any necessary revisions to the plan. The PQAO is also charged with coordinating site audits and data validations as outlined in this QAPP and reporting the findings of such activities to the PM. Additional responsibilities include review of interim project deliverables and technical correspondence.

Project Site Safety Manager

The Project Site Safety Manager will be responsible for the review and approval of the Site Safety Plan (SSP), monitoring field activities to ensure compliance with the SSP, and documenting and communicating any changes required in the SSP.

Subcontractors and Subcontractor Qualifications

All subcontractors retained for SAP activities (i.e., laboratory analytical services) are responsible for following the procedures outlined in this QAPP, the SSP, and other procedures deemed appropriate by the PM. The PE has the responsibility of providing copies of the pertinent procedural documents to the subcontractors for the work, and ensuring that subcontractor personnel are familiar with the requirements.

Laboratory. National Environmental Testing, Inc. (NET) located in Cedar Falls, Iowa will serve as the primary analytical laboratory for this project. NET will perform volatile organic compound (VOC) and general water quality analyses on water samples collected as part of the SAP. The laboratory will meet the data quality objectives set forth in this QAPP. The Quality Assurance (QA) Plan/Manual for this laboratory is provided in Attachment A.

SECTION 2

DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of data required to support specific decisions or regulatory actions. They are established to ensure the quantity and quality of the data collected is sufficient for their intended use. The three-stage DQO development process outlined in EPA Guidance (1987) includes:

Stage 1 - Identifying decision types and project objectives.

Stage 2 - Defining data uses and specifying data types needed to meet project objectives.

Stage 3 - Specifying the methods by which data of acceptable quality and quantity will be obtained to support required decisions.

All three stages of the DQO development process are addressed in the SAP. While some Stage 3 elements such as descriptions of specific field techniques (e.g., well purging and sampling procedures) are presented in the SAP, the purpose of this QAPP is to describe the Stage 3 QA objectives for data measurement regarding precision, accuracy, representativeness, completeness and comparability (PARCC) parameters. A summary description of laboratory analytical methods and detection limits is also included in this section.

QUALITY ASSURANCE OBJECTIVES FOR DATA MEASUREMENT

A summary of DQOs, data use and data types selected is presented in Section 3 of the SAP. Data quality assurance objectives are determined based on the intended use of the data, available laboratory procedures and available resources. As discussed in the SAP, all data used for evaluation of the performance of the selected remedial alternative are equivalent to EPA Analytical Level III. Limited field characterization efforts during implementation of the SAP will be equivalent to EPA Analytical Level I.

PARCC Criteria and Assessment of Data Quality

PARCC parameters are critical indicators of project data quality. Objectives for PARCC indicators have been developed for the Sauer-Sundstrand SAP activities based on past experience and on project objectives. Field procedures, analytical methods and the project quality assurance program were selected and developed to meet these objectives. QC data generated through the analysis of a sample set will be reviewed and evaluated as part of data validation. Statistical assessment of data quality will supplement data validation activities. Laboratory results for each parameter analyzed will be evaluated based on precision, accuracy and completeness criteria. The assessment procedures for each of these criteria are also described in this section. Representativeness and comparability are qualitative assessments.

Precision. Precision refers to the reproducibility of measurements under a given set of conditions. For large data sets, precision is expressed as a measure of variability of a group of

measurements compared to their average value (i.e., standard deviation). For duplicate measurements, precision is expressed as the relative percent difference (RPD) of the pair.

Precision of SAP field measurements (e.g., conductivity and pH) will be evaluated based on the results of duplicate measurements. At least 10 percent of the field measurements will be obtained in duplicate and the results will be compared to the established acceptance criteria presented in Table 2-1.

The precision of laboratory chemical analyses will be assessed through the analysis of QC samples including blind duplicate samples, matrix spike duplicate (MSD) samples and laboratory control samples. Each QC sample type will provide unique information regarding the precision of the program. Blind field duplicate samples will provide data on overall measurement precision (sampling and intralaboratory precision), while MSD samples will provide data on analytical precision. Analytical precision, as expressed in terms of RPD, will be calculated using the following equation:

$$RPD(\%) = \frac{|D_1 - D_2|}{1/2\,(D_1 + D_2)} \times 100$$

where:

D_1 = Concentration of analyte in the field sample
D_2 = Concentration of analyte in the duplicate/replicate sample

General laboratory and field precision goals for duplicate and MSD samples are included in Attachment B of this QAPP. Laboratory QA/QC procedures for NET are presented in their QA Plan/Manual. A copy of the laboratory QA Plan/Manual is provided in Attachment A. When an analyte is present in a sample at a concentration near the method detection limit (MDL) or substantially above the MDL, precision criteria may not be met. If precision objectives are not met, other QC measures will be evaluated to determine the validity of the data. DQOs for field duplicates are presented in Section 5.

Accuracy. Accuracy refers to the degree of agreement of a measurement to the true value. The accuracy of a measurement system is impacted by errors introduced through such factors as the sampling process, field contamination, preservation, handling, sample matrix, sample preparation and analytical techniques. Sampling accuracy will be evaluated based on analytical results obtained for field/equipment blank and VOC trip blank samples. DQO criteria for blank samples are presented in Section 5. The accuracy of field measurements will be evaluated based on the daily calibration of analytical field instrumentation. The accuracy of field screening analyses will be within one percent of the meter scale. Laboratory analytical accuracy will be evaluated on the basis of MSD samples, surrogate compounds, method blank samples and performance evaluation samples. DQO criteria for laboratory samples are presented in Section 5.

Analytical results for blank samples (expressed in the units of measurement of µg/L) will provide information on positive bias. Blank samples should not contain analytes of interest above background levels, preferably not above MDLs. Accuracy of analytical results for spiked samples and reference standards will be expressed as percent recovery and will provide

TABLE 2-1

PRECISION GOALS FOR FIELD PARAMETERS

Parameter	Method	Precision
pH	pH Meter	±0.1 unit
Specific Conductance	Specific Conductivity Meter	±10 µmhos/cm
Temperature	Mercury Thermometer	±1°C
Water Level	Electric Sounder	±0.01 foot

information on a positive and negative bias. Percent recovery will be calculated using the following equation:

$$\% \text{ Recovery} = \frac{\text{Measured Spike Value} - \text{Unspiked Value}}{\text{Known Spike Value}} \times 100$$

Objectives for reference standards will be based on the type analyzed. Accuracy goals for MSD samples and surrogate compounds (expressed in percent recovery) are presented in Attachment B of this QAPP. General laboratory QA/QC objectives are included in the laboratory QA Plan/Manual provided in Attachment A.

Representativeness. Representativeness is a qualitative expression of the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point or an environmental condition. Representativeness is maximized by ensuring that the number and location of sampling points, sample collection techniques and the analytical techniques are appropriate for providing information which reflects "true" site conditions. The SAP presents the procedures selected to provide representative data for the project.

Completeness. Completeness is defined as the percentage of measurements made which are judged to be valid. The project completeness value will be determined at the conclusion of the data validation phase (see Section 7) and will be calculated by dividing the number of complete sample results by the total number of sample analyses listed in the SAP. Complete results refer to results which meet all QC criteria such as holding times and acceptable surrogate recoveries. Incomplete results may be used as part of the SAP; however, these data will not be considered defensible.

The completeness objective for laboratory samples (Level III analytical technique) is 90 percent for this project. The completeness of Level I data will be ensured by daily calibration of field instruments and multiple measurements of field parameters.

Comparability. Comparability is a qualitative parameter which expresses the confidence that one data set can be compared with another. Comparable data is achieved through the use of standardized techniques for sample collection and analysis and reporting analytical results in appropriate units. Precision and accuracy parameters will be used to evaluate comparability of project data sets.

LABORATORY ANALYTICAL PROCEDURES AND REPORTING LIMITS

Previous investigation work performed at the site has provided ample data to limit laboratory analysis of the environmental samples to a target list of constituents (see Tables 4-1 and 5-1 in the SAP). Analyses to be performed on samples collected at the site as part of the SAP, expected reporting limits, and analytical methods are presented in Table 2-2. A description of any modifications to the analytical methods presented in this QAPP will be amended, when necessary.

TABLE 2-2

SUMMARY OF VOLATILE ORGANIC ANALYSIS - METHOD 8260

Analyte	Method Detection Limit for Water (μg/L)
Acetone	20.0
1,1-Dichloroethane	1.0
1,1-Dichloroethene	2.0
cis-1,2-Dichloroethene	1.0
Tetrachloroethene	1.0
1,1,1-Trichloroethane	1.0
1,1,2-Trichloroethane	1.0
Trichloroethene	1.0
Xylenes, Total	3.0

Detection limits presented in Table 2-2 for laboratory analyses of groundwater and remedial system samples are consistent with the SAP DQOs. The detection limits for water samples are below potential federal health standards such as the maximum contaminant level (MCL). Higher detection limits may be obtained in some samples for such reasons as high concentrations of contaminants of interest and matrix interference. Detection limit goals for the constituents of interest are presented in Attachment B.

SECTION 3

SAMPLE HANDLING AND CUSTODY PROCEDURES

SAMPLE HANDLING PROCEDURES

The purpose of this section is to describe sample handling and custody procedures which will be used to ensure sample quality, from sample collection to delivery to the laboratory for analysis.

Specific sampling procedural items addressed in this section include:

- A summary description of laboratory sample containers, sample volumes required for analysis, sample preservatives and holding times.
- A description of sample custody and chain of custody procedures and forms.
- A description of sample transport and storage procedures.

Sample Container and Handling Requirements

A summary of the sample container, volume, preservative and holding time requirements for laboratory analyses to be performed in accordance with the SAP is presented in Table 3-1. As shown, Table 3-1 also presents the EPA Methods which will be used for analyses of groundwater and remedial system samples collected.

Sample Custody

Documentation during sampling activities is essential to ensure proper sample identification. Standard sample custody procedures will be used during the activities specified in the SAP to maintain and document sample integrity during collection, transportation, storage and analyses. The Field Supervisor is responsible for ensuring proper sample handling and documentation that will allow for tracking possession and handling of individual samples from the time of collection to laboratory receipt. As presented in the laboratory QA Plan/Manual in Attachment A, the laboratory quality assurance coordinator is responsible for establishing a sample control system which allows for tracking sample possession from laboratory receipt to final sample disposition.

Field Sample Custody and Documentation Procedures

The following project sample custody and field documentation material will be completed in ink by field personnel. Corrections will be made by drawing one line through the incorrect entry, entering the correct information, initialing and dating the change.

Sample Label. A sample label will be affixed to all sample containers submitted to the laboratory. Each identification label will be completed with the following information:

- Project Name and Location
- Sample Location
- Field Identification Number
- Date and Time of Sample Collection

TABLE 3-1

SAMPLE CONTAINER AND HANDLING REQUIREMENTS

Parameter	Method	Minimum Volume Required	Container[a]	Preservative	Maximum Holding Time[b]
Volatile Organics	SW-8260	40 ML (3X)	G, Teflon®-Lined Septum	HCl to pH<2, Cool, 4°C	14 Days
Iron	236.1	1,00 mL	P	$HN0_3$ - pH <2	6 Months
Total Suspended Solids (TSS)	160.2	500 mL	P, G	Cool, 4°C	7 Days

[a] Plastic (P) or glass (G).

[b] Holding duration is from time of collection for all methods.

- Preservative Used
- Initials of Sampler
- Analyte(s) of Interest

If a sample is split with another party, each sample container will be labeled with identical information.

Chain of Custody Records. Chain of custody records will be used to document samples collected and submitted for laboratory analyses and the analyses requested for each sample. A chain of custody record equivalent to the example chain of custody record provided in Attachment C will be used for the project. Information recorded by field personnel on the chain of custody record will include the following:

- Project Name
- Sampling Location
- Signature of Sampler(s)
- Sample Identification Number
- Date and Time of Collection
- Sample Designation (grab or composite)
- Sample Matrix
- Signatures of individuals Involved in Custody Transfer Including Date and Time of Transfer
- Container Sizes
- Number of Containers

Samples will be shipped via overnight mail to the laboratory after collection. Custody transfer will be noted on the chain of custody form as being between the Montgomery Watson personnel relinquishing the sample and the air express company receiving the samples. The airbill number should be noted at the top of the chain of custody for tracking purposes. The original copy of the completed chain of custody will be sealed in a Ziploc™ bag and placed inside the cooler. A copy of the signed chain of custody will be retained by the sampler. The cooler will then be sealed with packaging tape and the airbill attached. Any drain plug at the bottom of the cooler will be taped shut for shipment.

Custody Seals. Custody seals will be placed on coolers used for shipping samples to the laboratory to ensure no tampering of samples occurs. Any custody seals used during the course of the project will consist of security tape labeled with the date and initials of the sampler. A seal will be placed on each sample cooler so that it must be broken to gain access to the contents.

SAMPLE STORAGE AND TRANSPORT REQUIREMENTS

Following their collection and until their delivery to the laboratory, samples will be stored and transported in the following manner in order to meet custody requirements:

- Following their collection and labeling, each sample will be placed in a cooler for storage and transport to the laboratory. Appropriate packing material will be used

to prevent contact and breakage of sample containers in the cooler during storage and transport. Cold packs of the equivalent will also be placed in the cooler to maintain sample temperatures at 4° C. If ice is to be used for cold packs, the ice will be sealed within two Ziploc™ bags.

LABORATORY PROCEDURES

Upon receipt of the sample cooler, laboratory personnel will sign and retain the chain of custody record following their review of the cooler's contents. Information recorded on the chain of custody record, or another appropriate document, at the time of sample receipt will include the following:

- Status of custody seals.
- Identification numbers of any broken sample containers.
- A description of discrepancies between the chain of custody record, sample labels and requested analyses.
- Notes of any visible headspace in VOC sample vials indicating inadequate sample collection.

Laboratory personnel will also communicate discrepancies in paperwork and sample preservation to project field personnel or the PM. Laboratory personnel will document nonconformances and corrective actions according to the laboratory Standard Operating Procedures (SOPs) on file at the laboratory. Once samples have been accepted by the laboratory, checked and logged in, they must be maintained in a manner consistent with custody and security requirements. Specific laboratory chain of custody procedures are described in the laboratory QA Plan/Manual presented in Attachment A and in the SOPs available on file at the laboratory.

SECTION 4

CALIBRATION PROCEDURES AND PREVENTATIVE MAINTENANCE

The purpose of this section is to identify calibration and preventative maintenance procedures to be used on project field and laboratory equipment. General requirements for the calibration and maintenance of instruments are established in various EPA documents and in manufacturer's specifications. As an activity which affects data quality, instrument calibration and maintenance must be done in accordance with the formal written procedures specified therein and by manufacturer's operation manuals. It is also required that instruments be calibrated and maintained to operate within manufacturer's specifications by trained personnel.

FIELD EQUIPMENT

The calibration and maintenance history of general field equipment used to make measurements at hazardous waste sites is an important part of the QA/QC program of a project and is the responsibility of the field sampling team. An equipment status report sheet is kept for each piece of equipment (where applicable). If the calibration schedule is not adequately maintained, or accuracy as reported in the specifications cannot be attained, that instrument is labeled "HOLD" and is unavailable for use until the specifications are met. Relevant SOPs and frequency of calibration for the equipment are provided in Table 4-1. The field equipment maintenance schedule is presented in Table 4-2. Table 4-3 presents a list of critical spare parts and equipment that will be maintained in the field or available to field personnel on short order.

To ensure the quality of sampling equipment and instruments on this project, the following QC tasks will be conducted by the Field Supervisor:

- Select and control the equipment inventories.
- Ensure personnel training for field equipment operation and maintenance.
- Ensure that on-site equipment is functioning and has been calibrated prior to its use in the field.
- Ensure that calibration will take place prior to sampling.
- Ensure that necessary calibration adjustments are recorded in the field log book or equipment calibration log.

LABORATORY EQUIPMENT

All analytical work will be performed by NET, in accordance with methods identified in this QAPP. The laboratory's instrument calibration and maintenance procedures are identified in their QA Plan/Manual (Attachment A).

TABLE 4-1

FIELD EQUIPMENT CALIBRATION CHECKLIST

Instrument	SOP	Task	Frequency
Cole-Parmer Model 1489-04 Myron L. Company pH/Conductivity Meter (or equivalent)	Manufacturer's Literature	Calibrate the pH meter by immersing the electrode in a buffer solution of pH 7.00 and adjusting meter to proper reading. Rinse electrode and immerse in pH 4.00 or 10.00 buffer solution and adjust to proper reading. Repeat this sequence until readings are within 0.05 pH units of the buffer solution pH. During calibration maintain all buffers and rinse water at the same temperature. Calibrate meter for conductivity by following above methodology and adjust to meter reading of 16.65 using appropriate, prepared calibration solution.	Prior to each sampling event.

TABLE 4-2

FIELD EQUIPMENT MAINTENANCE SCHEDULE

Equipment	Maintenance
Temperature/Conductivity/pH Meters	Check battery daily.
Waterra Inertial Pumps	Inspect prior to use and clean, or replace, if required.

TABLE 4-3

LIST OF CRITICAL SPARE PARTS AND EQUIPMENT

- Electronic Water Level Indicator
- pH Probe
- Batteries for all Meters

SECTION 5

INTERNAL QUALITY CONTROL (QC) CHECKS AND FREQUENCY

The purpose of this section is to describe the internal QC checks developed to assess the accuracy and precision of field sampling, field measurements and laboratory analyses. As described below, field checks will be conducted on a regularly scheduled basis. Laboratory checks will be conducted according to referenced analytical method protocols.

FIELD QC SAMPLES

Field QC samples are collected for laboratory analysis to check sampling and analytical accuracy and precision. The QC samples for this project include the samples described below. Field QC sample frequency and criteria are presented in Table 5-1.

Duplicate Samples

A duplicate sample is collected at the same time and from the same source as the original sample, but submitted to the laboratory separately to assess the consistency of the overall sampling and analytical system. Groundwater VOC duplicate samples will be collected (using the sampling procedures outlined in the SAP) by alternately filling a duplicate sample laboratory purge vial and an original sample laboratory purge vial.

Field duplicate samples will be submitted to NET as described below. Analytical results obtained for each duplicate sample will be presented in the annual site sampling report, along with analytical results for the original sample. Field duplicates to be submitted to NET will be collected and analyzed on a frequency of 1 duplicate sample for every 10 samples collected or 1 per event, whichever is greater. Groundwater duplicates will be collected from locations suspected of having the greatest potential for contamination. These samples will be collected, numbered, packaged and sealed in the same manner as other samples for submittal to the laboratory. Duplicate samples will be submitted blind (i.e., labeled with a fictitious sampling location) to the laboratory.

MSD Samples

MSD samples will be selected by the laboratory in coordination with the FS. MSD pairs will be analyzed at a rate of one pair per 20 samples of similar matrix or one pair per analytical event. Additional sample volumes will be collected for MSD water samples. The MSD samples will be placed in bottles, labeled appropriately and identified as such on the chain of custody records.

MSD samples will be spiked in the laboratory with appropriate analytes and analyzed according to the referenced method. Results from the analysis of MSD samples will be used to evaluate the effect of the sample matrix on precision and accuracy. The percent recoveries will be calculated for each of the analytes and used to assess analytical accuracy. The RPD between samples will be calculated and used to assess analytical precision.

Field/Equipment Blanks

Field/equipment blanks are water samples used to assess contamination effects on accuracy due to the combined activities of sampling and analysis. One field/equipment blank sample will be

TABLE 5-1

QUALITY CONTROL SAMPLE FREQUENCY AND CRITERIA

	FIELD QC SAMPLES (frequency / criteria)			LABORATORY QC SAMPLES (frequency / criteria)	
Parameter	**Trip Blanks**	**Field/ Equipment Blanks**	**Field Duplicates**	**Method Blanks**	**Matrix Spike Duplicates**
Volatile Organics	1/Shipment Container / <DL	1/15 Field Samples/ 1/Day Per Procedure / <2xDL	1/10 Field Samples or 1/Batch/Event RPD ≤50%-100%[a]	1/20 Samples or 1/Batch/Event / <DL	1/20 Samples or 1/Batch/Event / [b]

[a] Field duplicates should have a relative percent difference (RPD) less than or equal to 50% when both the sample and duplicate are greater than or equal to five times the method detection limit or less than or equal to 100% when the sample and/or duplicate is less than five times the method detection limit but greater than the detection limit.

[b] Compound-specific criteria; laboratory QA/QC plan (Attachment A)

DL = Detection Limit

RPD = Relative Percent Difference

collected and analyzed for every 15 samples collected or one per day for each sampling event. Field/equipment blanks will be prepared by routing distilled water (the same distilled water used for sampling activities) through groundwater sampling equipment into a sample container(s) from the same lot or source as those used for sample collection. Field/equipment blanks should contain no parameter of interest above two times the MDL. If a field/equipment blank exceeds this criterion, then the source of the contamination will be investigated for future work and appropriate corrective action instituted. Analytical results obtained for field/equipment blanks will be presented along with other data in the annual site sampling report.

Trip Blanks

Trip blanks are water samples used to identify possible sample contamination originating from sample transport, shipping or site conditions. Trip blanks are sealed samples prepared in the laboratory using organic-free water. They are shipped with sample containers to the field, stored with the field samples and returned to the laboratory with VOC water samples. One trip blank will accompany each cooler containing water VOC samples and will only be analyzed for VOCs. Trip blanks should contain no parameters of interest above the MDLs. Analytical results for trip blank samples will be presented in the annual site sampling report along with other groundwater quality data.

FIELD MEASUREMENT QC PRACTICES

Field measurements will be conducted as part of the sampling program. These measurements and associated QC practices will include:

- pH, conductivity and temperature; 10 percent will be measured in duplicate.
- Water levels; 10 percent will be measured in duplicate.

Results from field measurements and QC checks will be compared to the criteria presented in Section 2. If the results fail to meet the objectives set for data quality, calibration of the instrument in question will be conducted as described in Section 4. Should discrepancies continue, general maintenance tasks listed in Section 4 will be performed. If the instrument still fails to meet the QC criteria, it will be removed from service and replaced.

LABORATORY QC SAMPLES

Laboratory QC samples will be analyzed at the frequency specified in this QAPP. Laboratory QC sample frequency and criteria are presented in Table 5-1. The following laboratory QC samples will be analyzed as appropriate:

- Method Blanks
- Surrogate Compounds
- MSD Samples
- Laboratory Control Samples
- Initial and Continuing Calibration Checks

The specific schedule for the analysis of laboratory QC samples is included in the laboratory QA Plan/Manual provided in Attachment A.

SECTION 6

DATA REDUCTION, VALIDATION AND REPORTING

Accurate data reduction, validation and reporting methods are essential in summarizing information to support conclusions. Proper techniques for both field and laboratory activities are described in this section.

DATA REDUCTION

Data reduction methods can include the computation of summary statistics, their standard errors and confidence intervals or limits. Field and laboratory data reduction techniques are presented below.

Field Data

No data reduction will be necessary for field chemical and physical measurements. All readings will be recorded directly from the instruments. The following units will be used when recording the data:

- Water Levels: Reported to the nearest 0.01 foot after two measurements agree.
- Water Temperature: Reported to 0.1 degree unit (centigrade).
- pH: Digital reading rounded to 0.1 pH unit.
- Electrical Conductivity: Reported to 100 micromhos per centimeter.

Laboratory Data

Reduction of analytical data will be performed and placed in tables for presentation into reports. Laboratory reports will be placed in appendices of reports.

DATA VALIDATION

Data validation techniques include screening, accepting, rejecting or qualifying data on the basis of sound criteria. Data validation is based on the following criteria:

- Holding Times
- Blank Sample Results
- Other QC Sample Results

Data values that are significantly different from the population are referred to as "outliers." A systematic effort will be made to identify any outliers or errors prior to reporting data. Outliers can result from improper sampling or analytical methodology, matrix interference, errors in data transcription and real but extreme changes in analytical parameters. Outliers resulting from errors found during data validation will be identified and corrected. Those that cannot be attributed to analytical, calculation or transcription errors will be retained in the data base for

further evaluation. The validation methods for field and laboratory activities are presented below.

Field Data

Field personnel will validate field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved immediately, if possible, by seeking clarification from those personnel responsible for following the sampling and documentation procedures described in the SAP, to ensure that defensible data are obtained.

Laboratory Data

At a minimum, laboratory data will be validated according to the criteria outlined in the following document:

- Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses, (EPA, 1988).

All analytical data from groundwater and remedial system samples will be validated by NET as part of their required analytical service. Final data validation will be performed by the PQAO or a validation subcontractor independent from the project laboratory.

DATA REPORTING

Following data validation, both field and laboratory data will be reported according to procedures described below.

Field Data

Field data recorded during the sampling activities will be reduced to tables or arrays for review and verification. Once verified, the data will be compiled and reported in summary tables. Correct codes and/or units will also be provided to accurately reflect field conditions.

Laboratory Data

Laboratory data for VOCs will be reported with associated detection limits for each analyte. Detection limits are matrix dependent and could vary from sample to sample. Sample collection dates and analysis dates will be included on analytical reports to check holding times. Analysis methods and resultant analysis flags (if necessary) will be included on all reports. Field duplicates, MSD samples and surrogate recoveries will also be included in analytical reports on a frequency consistent with this QAPP and laboratory QA/QC practices.

ATTACHMENT A

NATIONAL ENVIRONMENTAL TESTING, INC.

NET, Inc. - Cedar Falls Division
Quality Assurance Plan
for
Routine Analytical Services

OCEAN GROUP

NATIONAL ENVIRONMENTAL TESTING, INC.
CEDAR FALLS DIVISION
QUALITY ASSURANCE PLAN
FOR
ROUTINE ANALYTICAL SERVICES

Approved By:

Michael K. McGee
Division Manager

Shirley J. Thompson
Quality Assurance Coordinator

Robert N. Bucaro
Executive Director of Data Quality

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3. PROJECT DESCRIPTION

INTRODUCTION

This document describes the essential elements of the Quality Assurance Program at NET and the quality control procedures utilized by NET to ensure a national standard of quality at all NET laboratories.

SCOPE

NET believes that quality is the key to maintaining leadership in the environmental analytical industry.

The Quality Assurance (QA) program at NET includes a National Quality Assurance Plan (NQAP), which each division must adhere to; a division specific Quality Assurance Project Plan (QAP) which details the specific quality control procedures for each laboratory; and, as needed, project specific Quality Assurance Project Plans (QAPP).

NET subscribes to the following policies as its standard of quality in its analytical procedure program:

It is our policy to maintain a national QA program throughout all NET laboratories, thereby providing our clients with consistent data of high, known quality;

It is our policy to communicate the scope and content of our QA program internally to our employees and to train each employee in the application of our program;

It is our policy that no data will be reported to our clients that has not met our full QA requirements;

It is our policy to remove from commercial offering any analysis offered by a NET laboratory when that laboratory fails to demonstrate that it can consistently perform that analysis to NET's high standard of quality based on NET's Interlaboratory Testing Program (ITP);

It is our policy to resolve to the client's full satisfaction any questions concerning the validity or accuracy of analytical data reported by NET to the client; and

It is our policy that any employee aware of misrepresentation of facts regarding analytical results be required to notify his/her immediate supervisor, or if this is not feasible, another representative of the management of the company immediately.

4. PROJECT ORGANIZATION AND RESPONSIBILITY

NATIONAL ORGANIZATION

NET's Corporate office is located in Bartlett, IL NET currently operates fifteen laboratories nationwide.

NET's locations are as follows:

NET, Inc. - Auburn Hills Division, Auburn Hills, MI
NET, Inc. - Austin Customer Support Center, Austin, TX
NET, Inc. - Bartlett Division, Bartlett, IL
NET, Inc. - Burbank Division, Burbank, CA
NET, Inc. - Cambridge Division, Bedford, MA
NET, Inc. - Cedar Falls Division, Cedar Falls, IA
NET, Inc. - Chicago Division, Chicago, IL
NET, Inc. - Dallas Division, Carrolton, TX
NET, Inc. - Dayton Division, Dayton, OH
NET, Inc. - Indianapolis Division, Indianapolis, IN
NET, Inc. - Portland Division, Portland, OR
NET, Inc. - Quad Cities Customer Support Center, Davenport, IA
NET, Inc. - Rockford Division, Rockford, IL
NET, Inc. - Santa Rosa Division, Santa Rosa, CA
NET, Inc. - Thorofare Division, Thorofare, NJ
NET, Inc. - Watertown Division, Watertown, WI

DIVISIONAL ORGANIZATION

The divisional organization is outlined in Figure 4.1. Specific duties of the individuals listed are outlined in the following section.

PERSONNEL QUALIFICATIONS AND TRAINING

The Cedar Falls Division of NET, Inc., is staffed with people of varying levels and types of education.

Each employee is provided with a position description which outlines his/her duties and areas of responsibilities. Each employee is held accountable for the quality of his/her work. Personnel training records document education and completed training procedures for each employee and are kept in the employee's training file. Each time an employee is trained in a new procedure, a training outline is completed for the employee and he/she must, at a minimum, successfully analyze a set of single blind performance evaluation samples.

RESPONSIBILITIES

The responsibilities of the individuals involved in this Quality Assurance Plan are as follows:

General Manager

The General Manager shall ensure that sufficient personnel and resources are available at the Division to implement this plan.

The General Manager shall require that the Divisions reporting to him/her comply with and provide input on Standard Operating Procedures and Quality Assurance Plans used at the Divisions.

The General Manager shall restrict any Division from performing analyses that cannot be consistently and successfully performed based on NET's Interlaboratory Testing Program (ITP) performance.

Executive Director of Data Quality

The Executive Director of Data Quality shall administer the National Quality Assurance Plan (NQAP) so that the data quality produced by NET laboratories is of known and consistently high quality.

Management of NET's Interlaboratory Testing Program, Data Quality Audit Program and conducting system audits of the various NET laboratories are all responsibilities of the Executive Director of Data Quality.

The Executive Director of Data Quality writes the biannual report to the Corporate Officers and General Managers regarding the implementation of the NQAP.

Review and approval of NET Standard Operating Procedures (SOPs) and QA Plans (QAPs) to ensure that these documents are complete, technically correct and meet the requirements of the NQAP and any applicable regulatory requirements is a responsibility of the Executive Director of Data Quality.

The Executive Director of Data Quality shall be the repository for all Division QAPs, all external performance evaluation (PE) and audit results in which NET Divisions participate and monitor certification and accreditation status and assist Divisions with certification activities.

Assisting with the updating of the NQAP, as necessary, is a function of the Executive Director of Data Quality.

Providing the divisions of NET information regarding EPA and state regulations as they pertain to data quality is also a function of the Executive Director of Data Quality.

Division Manager

In the temporary absence of a division's Quality Assurance Coordinator, assume all responsibilities of the division Quality Assurance Coordinator.

The Division Manager shall ensure that the operational requirements of the plan and supporting programs are met and approve and implement SOPs, QAPs, and QAPPs.

Ensuring that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits is a responsibility of the Division Manager along with the review and submittal corrective action reports to the Executive Director of Data Quality.

The Division Manager shall have in place a system to ensure all sample holding times are met.

Ensuring that all analysts and supervisors have received adequate training to properly carry out the duties assigned to them and ensure that this training has been documented is a function of the Division Manager.

Pursuing and maintaining appropriate laboratory certification and contract approvals and arranging for the analysis of Performance Evaluation samples necessary to satisfy certification requirements is the responsibility of the Division Manager.

The Division Manager shall ensure that client specific reporting and quality control requirements are known before that client's samples have arrived in the lab for analysis.

The Division Manager shall represent or designate an alternate individual to represent the Division during client and/or regulatory audits, with the support, as needed, from the Division and/or Corporate Quality Assurance personnel.

Division Quality Assurance Coordinator

The Division Quality Assurance Coordinator administers the National and the Divisional Quality Assurance Program.

He/She ensures that a Divisional Quality Assurance Plan is in place that accurately reflects the Quality Assurance and Quality Control procedures of the laboratory and coordinates the revision of the Division's Quality Assurance Plan as necessary.

The Division Quality Assurance Coordinator assists in the development of SOPs and prepares Project Specific Quality Assurance Project Plans (QAPPs). Also, they maintain a repository of original copies of SOPs, QAPs and QAPPs and the distribution of these documents. Also, the Division Quality Assurance Coordinator maintains all audit summaries, performance evaluation sample results and certification documentation.

Internal audits are conducted by the Division Quality Assurance Coordinator to ensure that SOPs are being followed, new instrumentation has been properly validated, analyst training has been completed, corrective action has been successfully implemented, quality control processes are being documented and implemented and the good laboratory practices are being used throughout the laboratory.

The Division Quality Assurance Coordinator advises the Division Manager of areas requiring corrective action and assists the Division Manager and Corporate Director of Data Quality in issues of data quality.

The Division Quality Assurance Coordinator assists the analyst and supervisors with the use of control charts and statistical methods to monitor the analytical performance in the laboratory.

The preparation of a monthly Quality Assurance report is the responsibility of the Division Quality Assurance Coordinator. This monthly report is distributed to the Executive Director of Data Quality, Division Manager and Operations Managers.

Operations Managers/Supervisors

All training is the responsibility of the operations managers and supervisors.

The operations managers and supervisors shall ensure compliance with SOPs, the National QAP, Divisional QAP, and project specific QAPPs. They shall also assist in the development and revision of SOPs as needed; ensuring that they are representative of how a procedure is done in the laboratory, technically correct, complete and contain sufficient detail to serve as a training document.

It is the operations managers and supervisor's responsibility to investigate and assist in correcting an out of control analysis and to document this to the Division Manager and the Division Quality Assurance Coordinator.

Operations managers and supervisors shall guarantee that sample hold times are met or immediately notify the Division Manager and any other appropriate personnel if the sample holding time cannot be met.

Operations managers and/or supervisors shall review data produced by analysts prior to reporting the data to the client.

Communication of staff and equipment needs is also a responsibility of the operations managers and supervisors.

Analysts

The analyst shall adhere to analytical and quality control protocols prescribed by the SOPs, National QAP, Divisional QAP and project specific QAPPs.

Primary data review (including QC) is the analyst's responsibility.

Analysts shall correct out of control analyses if possible, otherwise seek the Supervisor's help immediately and then document the out of control situation and its resolution.

Maintenance of control charts as appropriate to monitor the analytical performance is the responsibility of the analyst.

Meeting sample hold times or immediately informing their supervisor if it is not possible is the responsibility of the analyst.

The analyst shall suggest improvements for methods to their Supervisors and the Quality Assurance Coordinator. These improvements, if approved, will be incorporated into the SOPs.

Sample Custodian

The sample custodian signs for the incoming field samples and verifies the data entered on the chain of custody forms.

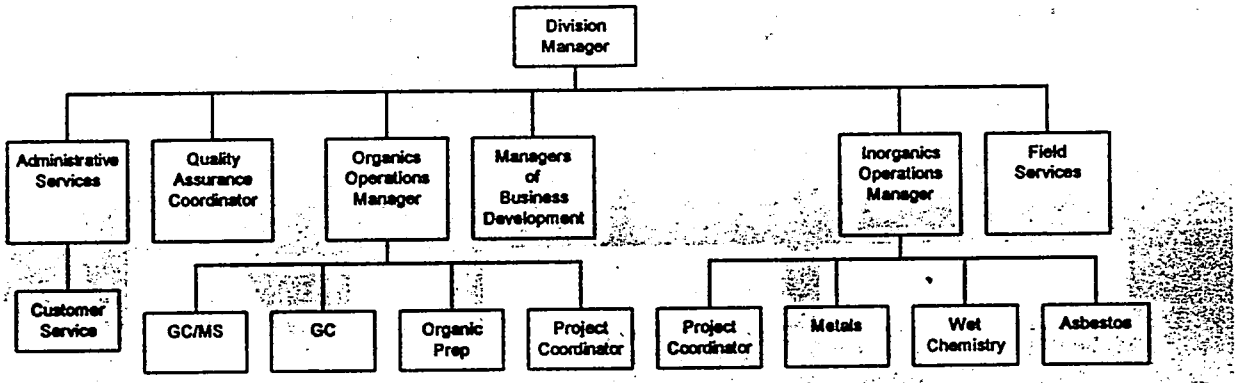
Entry of the sample information into the Laboratory Information Management System (known as LABSYS2) for tracking and reporting is the responsibility of the sample custodian. He/she is also responsible for the generation of the sample tracking forms from LABSYS2.

The sample custodian transfers samples and tracking information to the laboratory.

Clerical

The clerical personnel are responsible for accurately and promptly entering data to produce reports, documents and invoices.

Figure 4.1. Organizational Structure of NET, Inc. - Cedar Falls Division.



5. QA OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, COMPARABILITY AND REPRESENTATIVENESS

INTRODUCTION

The quality assurance objectives are to provide analytical data of known and documented quality, to produce defensible analytical data and to produce data which meets the client's specific needs for the data in a cost effective manner.

Data quality is defined in terms of data quality objectives. Data Quality Objectives are the qualitative and quantitative statements which specify the required data quality based on the end use of the data to be collected. Data quality is assessed by precision, accuracy, representativeness and comparability. To accomplish its data quality objectives, NET Cedar Falls will:

- Maintain an effective, on-going Quality Assurance and Quality Control Program that measures and verifies laboratory performance
- Provide sufficient flexibility to allow controlled changes in routine methodology to meet project specific data requirements
- Recognize as soon as possible and provide correction for any factors which may adversely affect data quality
- Monitor operational performance of the laboratory on a routine basis and provide corrective action as needed
- Maintain complete records of sample submittal, raw data, laboratory performance and complete analysis to support reported data.

LEVEL OF QUALITY CONTROL AND QUALITY ASSURANCE EFFORTS

NET maintains a well defined internal Quality Control (QC) program. A system of specific activities are in use in the laboratory to ensure that the analytical data generated is of consistently high quality. Blanks, Calibration Verification Standards, Laboratory Control Samples, Spikes, Duplicates and Matrix Spikes are analyzed and monitored at regular frequencies, to ensure that the data quality objectives for the project are met.

ACCURACY

Accuracy is defined as how close an analysis value is to the actual concentration of analyte in the sample. Accuracy is evaluated through the analysis of Laboratory Control Samples (LCS). Matrix Spikes may also be used to assess accuracy. Accuracy goals are outlined in Table 5.1 through 5.17.

PRECISION

Precision is defined as the repeatability of a measurement. It is measurement of the variability of a measurement. Precision is evaluated through the use of matrix spike/ matrix spike duplicates (MS/MSD) or through duplicate analysis when matrix spiking is not possible. Precision is expressed in terms of relative percent difference (RPD). Precision goals are outlined in Table 5.1 through 5.17.

COMPLETENESS

Completeness is a measure of the amount of data from an analysis which is considered valid. Completeness is expressed as a percentage of the number of valid measurements that have been achieved and the total number of analyses planned.

Completeness will be determined by the client. Ideally, all of the analyses will be valid. However, some samples may be lost in laboratory accidents or some results may be deemed questionable based on internal quality control. Due to the variable nature of the completeness value, NET will make every attempt to have analytical data completeness as high as possible for all samples.

REPRESENTATIVENESS

Representativeness is a measure of how closely the analytical results reflect the actual concentration of analytes in the sample. For any project, sampling will be performed by the customer or the customer's contractor (the customer may contract with NET for sampling services). Sample handling protocols (i.e., storage and preservation) have been developed to preserve the representativeness of the collected samples. Proper documentation will establish that the protocols have been followed and that the sample identification and integrity have been maintained. Every attempt will be made to ensure that the aliquots taken for analysis are representative of the sample received. NET will notify the client if samples received in the laboratory have any of the following conditions: improper preservation, broken sample containers, chain of custody discrepancies, broken or missing custody seals (if required) and NET will document such deviations. All other measures of representativeness will be determined by the client.

COMPARABILITY

The generation of comparable data is the goal of any analytical program. This characteristic implies strict adherence to published analytical protocols and use of standard reporting units. NET's QC program is structured to ensure adherence to the proper analysis protocols and to fully document these procedures. The QA objective is that all data resulting from these analyses be comparable with other measurements made by NET or another organization. All judgments of comparability will be made by the client.

Table 5.1. Quality Control Measures and Frequency for Wet Chemistry.

Quality Control Measure	Analyte	Control Limit	Frequency
Calibration Curve	All*	Correlation Coefficient of the calibration curve must be equal to or greater than 0.995	Daily before sample analysis
Initial Calibration Verification (ICV)	All* Cyanide	The percent recovery must be 90 - 110 % The percent recovery must be 85 - 115 %	Immediately after calibration
Reagent Blank (RB)	All*	The concentration of analyte in the reagent blank should be less than the reporting limit	One per 20 samples
Procedure Blank (PB)	All*	The concentration of analyte in the procedure blank should be less than the reporting limit	One per digestion batch
Continuing Calibration Verification (CCV)	All* Cyanide	The percent recovery must be 90 - 110 % The percent recovery must be 85 - 115 %	One per 10 samples
Laboratory Control Sample (LCS)	All* Cyanide	The percent recovery should be 80 - 120% The percent recovery must be 85 - 115 %	One per digestion batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All*	Spike recovery should be 75 - 125% and the RPD should be less than 20 (for waters, soils should be less than 35%) unless the sample concentration exceeds the spike concentration by a factor of 4 or more, then spike recovery and RPD limits do not apply	One per digestion batch per matrix (soil and water)
Duplicate (Dup)	All*	The RPD should be less than 20 for waters, RPD should be less than 35 for soils	One per 10 samples or per batch

*Not all analyses are ameanable to all QC Measures

Table 5.2. Quality Control Measures and Frequency for Bacterial Analyses.

Quality Control Measure	Analyte	Control Limit	Frequency
Blank	All	Sample must be negative or have no growth	Daily
Positive Control Sample	All	Sample must show bacterial growth	Monthly

Table 5.3. Quality Control Measures and Frequency for Metals by Flame or Graphite Furnace Atomic Absorption.

Quality Control Measure	Analyte	Control Limits	Frequency
Inital Calibration Verification (ICV)	All Analytes	+/- 10% of true value	1 per calibration curve
Continuing Calibration Verification (CCV)	All Analytes	+/- 10% of true value	1 per 10
Reagent Blank	All Analytes	< Reporting Limit	1 per 10 samples analyzed undigested
Method Blank	All Analytes	< Reporting Limit	1 per 20 samples digested
Laboratory Control Sample (LCS)	All Analytes	80-120%	1 per 20 samples digested
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All Analytes	Spike recovery should be 75 - 125% and the RPD should be less than 20 % (waters, soils should be less than 35%) unless the sample concentration exceeds the spike concentration by a factor of 4 or more, then spike recovery and PRD limits do not apply	1 per 20 samples digested
Duplicates	All Analytes	RPD ≤20 for waters	1 per 20 samples analyzed undigested
Analytical Spike	All Analytes	75 - 125% (FLAA) 80 - 120% (GFAA)	1 per 20 samples analyzed undigested

Table 5.4. Quality Control Measures and Frequency for Metals by Inductively Coupled Argon Plasma Emmision Spectroscopy (ICAP-AES) EPA Method 200.7.

Quality Control Measure	Analyte	Control Limit	Frequency
Interference Check Standard (SIC)	All	The percent recovery must be 90 - 110%	Daily
Initial Calibration Verification (ICV)	All	The percent recovery must be 95 - 105 %	Immediately after calibration
Reagent Blank (RB)	All	The concentration of analyte in the reagent blank should be less than the reporting limit	One per 20 samples per matrix
Procedure Blank (PB)	All	The concentration of analyte in the procedure should be less than the reporting limit	One per digestion batch
Continuing Calibration Verification (CCV)	All	The Percent recovery must be 90 - 110 %	One per 10 samples
Laboratory Control Sample (LCS)	All	The percent recovery should be 85 - 115%	One per digestion batch (20 samples)
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All	Spike recovery should be 75 - 125% and the RPD should be less than 20 % (waters, soils should be less than 35%) unless the sample concentration exceeds the spike concentration by a factor of 4 or more, then spike recovery and PRD limits do no apply	One per digestion batch per matrix (soil and water)
Analytical Spike (AS)	All	Spike recovery should be 85 - 115%. Generally used only on undigested samples	One per 10 samples or per batch (undigested samples)
Duplicate (Dup)	All	The RPD should be less than 20	One per 10 samples or per batch (undigested samples)

Table 5.5. Quality Control Measures and Frequency for Metals by Inductively Coupled Argon Plasma Emmision Spectroscopy (ICAP-AES) SW 846 Method 6010A.

Quality Control Measure	Analyte	Control Limit	Frequency
Interference Check Standard (ICS)	All	The percent recovery must be 90 - 110%	Daily
Initial Calibration Verification (ICV)	All	The percent recovery must be 90 - 110 %	Immediately after calibration
Reagent Blank (RB)	All	The concentration of analyte in the reagent blank should be less than the reporting limit	One per 10 samples
Procedure Blank (PB)	All	The concentration of analyte in the procedure should be less than the reporting limit	One per digestion batch
Continuing Calibration Verification (CCV)	All	The Percent recovery must be 90 - 110 %	One per 10 samples
Laboratory Control Sample (LCS)	All	The percent recovery should be 80 - 120%	One per digestion batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All	Spike recovery should be 75 - 125% and the RPD should be less than 20 % (waters, soils should be less than 35%) unless the sample concentration exceeds the spike concentration by a factor of 4 or more, then spike recovery and PRD limits do no apply	One per digestion batch per matrix (soil and water)
Analytical Spike (AS)	All	Spike recovery should be 75 - 125%. Generally used only on undigested samples	One per 10 samples or per batch
Duplicate (Dup)	All	The RPD should be less than 20	One per 10 samples or per batch

Table 5.6. Quality Control Measures and Frequency for Volatiles by GC/MS EPA Method 624.

Quality Control Measure	Compound	Control Limits	Frequency
Initial Calibration Verification	All	± 25% of the true value (ADVISORY Control Limits)	One Per Calibration Curve
Tune Check	4-Bromofluorobenzene	Must meet the EPA specific ion criteria	At the beginning of each 12 hours of operations
Continuing Calibration Verification	All target analytes	Same Limits as LCS	Every 24 hours
Holding Blank	Toluene, Methylene Chloride, Acetone, Chloroform All Other Compounds	< 5X the Reporting Limit < Reporting Limit	1 per week
Method Blank	Same as Holding Blank	Same as Holding Blank	1 per 20 samples or per batch
Laboratory Control Sample (LCS)	Benzene Bromodichloromethane Bromoform Bromomethane Carbon Tetrachloride Chlorobenzene Chloroethane Chloroform Chloromethane Dibromochloromethane 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,1-Dichloroethane 1,2-Dichloroethane 1,1-Dichloroethene trans-1,2-Dichloroethene 1,2-Dichloropropane cis-1,3-Dichloropropene trans-1,3-Dichloropropene Ethyl Benzene Methylene Chloride 1,1,2,2-Tetrachloroethane Tetrachloroethene Toluene 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethene Trichlorofluoromethane Vinyl chloride	37-151% 35-155% 45-169% detect-242% 70-140% 37-160% 14-230% 51-138% detect-273% 53-149% 18-190% 59-156% 18-190% 59-155% 49-155% detect-234% 54-156% detect-210% detect-227% 17-183% 37-162% detect-221% 46-157% 64-148% 47-150% 52-162% 52-150% 71-157% 17-181% detect-251%	1 per 20 samples or per batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Same compounds as LCS	Same Recovery Limits as the LCS and the RPD should be ≤ 20 for waters and ≤ 35 for solis (except if the sample concentration exceeds the spiking concentration by a factor of 4 or more, then there are no control limits)	1 per 20 samples per matrix or per batch
Surrogates (Surr.)		Water / Soil	Every Sample Analyzed
	1,2-Dichloroethane-d_4	76-114% / 70-121%	
	Toluene-d_8	88-110% / 81-117%	
	4-Bromofluorobenzene	86-115% / 74-121%	
	Ethylbenzene-d_{10}	85-108% / 91-105%	

Table 5.7. Quality Control Measures and Frequency for Volatiles by GC/MS SW 846 Method 8240A.

Quality Control Measure	Compound	Control Limits	Frequency
Initial Calibration Verification	All	± 25% of the true value (ADVISORY Control Limits)	One Per Calibration Curve
Tune Check	4-Bromofluorobenzene	Must meet the EPA specific ion criteria	At the beginning of each 12 hours of operations
Continuing Calibration Verification	All target analytes	± 25% RSD	Every 12 hours
Holding Blank	Toluene, Methylene Chloride, Acetone, Chloroform All Other Compounds	< 5X the Reporting Limit < Reporting Limit	1 per week
Method Blank	Same as Holding Blank	Same as Holding Blank	1 per 20 samples or per batch
Laboratory Control Sample (LCS)	Benzene Bromodichloromethane Bromoform Bromomethane Carbon Tetrachloride Chlorobenzene Chloroethane Chloroform Chloromethane Dibromochloromethane 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,1-Dichloroethane 1,2-Dichloroethane 1,1-Dichloroethene trans-1,2-Dichloroethene 1,2-Dichloropropane cis-1,3-Dichloropropene trans-1,3-Dichloropropene Ethyl Benzene Methylene Chloride 1,1,2,2-Tetrachloroethane Tetrachloroethene Toluene 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethene Trichlorofluoromethane Vinyl chloride	37-151% 35-155% 45-169% detect-242% 70-140% 37-160% 14-230% 51-138% detect-273% 53-149% 18-190% 59-156% 18-190% 59-155% 49-155% detect-234% 54-156% detect-210% detect-227% 17-183% 37-162% detect-221% 46-157% 64-148% 47-150% 52-162% 52-150% 71-157% 17-181% detect-251%	1 per 20 samples or per batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Same compounds as LCS	Same Recovery Limits as the LCS and the RPD should be ≤ 20 for waters and ≤ 35 for solis (except if the sample concentration exceeds the spiking concentration by a factor of 4 or more, then there are no control limits)	1 per 20 samples per matrix or per batch
Surrogates (Surr.)		Water / Soil	Every Sample Analyzed
	1,2-Dichloroethane-d_4	76-114% / 70-121%	
	Toluene-d_8	88-110% / 81-117%	
	4-Bromofluorobenzene	86-115% / 74-121%	
	Ethylbenzene-d_{10}	85-108% / 91-105%	

Table 5.8. Quality Control Measures and Frequency for Volatiles by GC/MS SW 846 Method 8260.

Quality Control Measure	Compound	Control Limits	Frequency
Initial Calibration Verification	All	± 25% of the true value (ADVISORY Control Limits)	One Per Calibration Curve
Tune Check	4-Bromofluorobenzene	Must meet the EPA specific ion criteria	At the beginning of each 12 hours of operations
Continuing Calibration Verification	Chloromethane 1,1-Dichloroethane Bromoform Chlorobenzene 1,1,2,2-Tetrachloroethane 1,1-Dichloroethene Chloroform 1,2-Dichloropropane Toluene Ethyl benzene Vinyl Chloride Methylene Chloride	min. response factor of 0.1 min. response factor of 0.1 min. response factor of 0.25 min. response factor of 0.3 min. response factor of 0.3 ± 30 % of the true value ± 30 % of the true value ± 30 % of the true value ± 30 % of the true value ± 30 % of the true value ± 30 % of the true value ± 100% of the true value	Every 12 hours
Holding Blank	Toluene, Methylene Chloride, Acetone, Chloroform All Other Compounds	< 5X the Reporting Limit < Reporting Limit	1 per week
Method Blank	Same as Holding Blank	Same as Holding Blank	1 per 20 samples or per batch
Laboratory Control Sample (LCS)	All target compounds	70 - 130% recovery	1 per 20
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Same compounds as LCS	Same Recovery Limits as the LCS and the RPD should be ≤ 20 for waters and ≤ 35 for solis (except if the sample concentration exceeds the spiking concentration by a factor of 4 or more, then there are no control limits)	1 per 20 samples per matrix or per batch
Surrogates (Surr.)		Water / Soil	Every Sample Analyzed
	Dibromofluoromethane	86-118% / 80-120%	
	Toluene-d8	88-110% / 81-117%	
	4-Bromofluorobenzene	86-115% / 74-121%	

Table 5.9. Quality Control Measures and Frequency for Semi-Volatiles by GC/MS SW 846 Method 8270.

Quality Control Measure	Analyte	Control Limits	Frequency
Initial Calibration Verification	All Calibration Compounds	± 25% of the true value (Advisory)	One per calibration curve
Tune Check	Decafluorotriphenyl-phosphine (DFTPP)	Must Meet EPA Specific Ion criteria	Every 12 Hours
Method Blank	All Target Compounds Phthalates	≤ RL ≤ 5 x RL	One per 20 samples extracted or per batch
Surrogates		Water Soil	
	d_5-Nitrobenzene	35-114% 23-120%	Every standard and sample analyzed
	2-Fluorobiphenyl	43-116% 30-115%	
	Terphenyl-d_{14}	33-141% 18-137%	
	Phenol- d_6	10-94% 24-113%	
	2-Fluorophenol	21-100% 21-121%	
	2,4,6-Tribromophenol	10-123% 19-122%	
Continuing Calibration Verification	All calibration compounds	RF ≤30% difference from initial calibration	Every 12 hours
Laboratory Control Sample (LCS)	Acenaphthene	47-145%	One per 20 samples extracted or per batch
	Acenaphthylene	33-145%	
	Anthracene	27-133%	
	Benzo(a)anthracene	33-143%	
	Benzo(b)fluoranthene	24-159%	
	Benzo(k)fluoranthene	11-162%	
	Benzo(a)pyrene	17-163%	
	Benzo(g,h,i)perylene	detected-219%	
	Benzyl butyl phthalate	detected-152%	
	Bis(2-chloroethyl)ether	12-158%	
	Bis(2-chloroethoxy)methane	33-184%	
	Bis(2-chloroisopropyl)ether	36-166%	
	Bis(2-ethylhexyl)phthalate	8-158%	
	4-Bromophenyl phenyl ether	53-127%	
	2-Chloronapthalene	60-118%	
	4-Chlorophenyl phenyl ether	25-158%	
	Chrysene	17-168%	
	Dibenzo(a,h)anthracene	detected-227%	
	Di-n-butyl phthalate	1-118%	
	1,2-Dichlorobenzene	32-129%	
	1,3-Dichlorobenzene	detected-172%	
	1,4-Dichlorobenzene	20-124%	
	3,3'-Dichlorobenzidine	detected-262%	
	Diethyl phthalate	detected-114%	
	Dimethyl phthalate	detected-112%	
	2,4-Dinitrotoluene	39-139%	
	2,6-Dintrotoluene	50-158%	
	Di-n-octylphthalate	4-146%	
	Fluoranthene	26-137%	
	Hexachlorobenzene	detected-152%	
	Hexachlorobutadiene	24-116%	
	Hexachloroethane	40-113%	
	Indeno(1,2,3-cd)pyrene	detected-171%	
	Isophorone	21-196%	
	Napthalene	21-133%	
	Nitrobenzene	35-180%	
	n-Nitrosodi-n-propylamine	detected-230%	
	Phenanthrene	54-120%	
	Pyrene	51-115%	
	1,2,4-Trichlorobenzene	44-142%	
	4-Chloro-3-methylphenol	22-147%	
	2-Chlorophenol	23-134%	

Table 5.9(Cont.). Quality Control Measures and Frequency for Semi-Volatiles by GC/MS SW 846 Method 8270.

Quality Control Measure	Analyte	Control Limits	Frequency
Laboratory Control Sample (LCS) (Cont.)	2-Chlorophenol 2,4-Chlorophenol 2,4-Dimethylphenol 2,4-Dinitrophenol 2-Methyl-4,6-dinitrophenol 2-Nitrophenol 4-Nitrophenol Pentachlorophenol Phenol 2,4,6-Trichlorophenol	23-134% 39-135% 32-119% detected-191% detected-181% 29-182% detected-132% 14-176% 5-112% 37-144%	One per 20 samples extracted or per batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All compounds listed for the LCS	The recovery limits are the same as the LCS and the RPD for the MS/MSD pair should be less than 20 for waters and less than 35 for solids	One per 20 samples per matrix extracted or one per batch.

Table 5.10. Quality Control Measures and Frequency for Semi-Volatiles by GC/MS EPA Method 625.

Quality Control Measure	Analyte	Control Limits	Frequency
Initial Calibration Verification	All Calibration Compounds	± 25% of the true value (Advisory)	One per calibration curve
Tune Check	Decafluorotriphenyl-phosphine (DFTPP)	Must Meet EPA Specific Ion criteria	Every 12 Hours
Method Blank	All Target Compounds Phthalates	≤ RL ≤ 5 x RL	One per 20 samples extracted or per batch
Surrogates		Water Soil	
	d_5-Nitrobenzene	35-114% 23-120%	Every standard and sample analyzed
	2-Fluorobiphenyl	43-116% 30-115%	
	Terphenyl-d_{14}	33-141% 18-137%	
	Phenol- d_6	10-94% 24-113%	
	2-Fluorophenol	21-100% 21-121%	
	2,4,6-Tribromophenol	10-123% 19-122%	
Continuing Calibration Verification	All calibration compounds	RF ≤20% difference from initial calibration	Every 24 hours
Laboratory Control Sample (LCS)	Acenaphthene	47-145%	One per 20 samples extracted or per batch
	Acenaphthylene	33-145%	
	Anthracene	27-133%	
	Benzo(a)anthracene	33-143%	
	Benzo(b)fluoranthene	24-159%	
	Benzo(k)fluoranthene	11-162%	
	Benzo(a)pyrene	17-163%	
	Benzo(g,h,i)perylene	detected-219%	
	Benzyl butyl phthalate	detected-152%	
	Bis(2-chloroethyl)ether	12-158%	
	Bis(2-chloroethoxy)methane	33-184%	
	Bis(2-chloroisopropyl)ether	36-166%	
	Bis(2-ethylhexyl)phthalate	8-158%	
	4-Bromophenyl phenyl ether	53-127%	
	2-Chloronapthalene	60-118%	
	4-Chlorophenyl phenyl ether	25-158%	
	Chrysene	17-168%	
	Dibenzo(a,h)anthracene	detected-227%	
	Di-n-butyl phthalate	1-118%	
	1,2-Dichlorobenzene	32-129%	
	1,3-Dichlorobenzene	detected-172%	
	1,4-Dichlorobenzene	20-124%	
	3,3'-Dichlorobenzidine	detected-262%	
	Diethyl phthalate	detected-114%	
	Dimethyl phthalate	detected-112%	
	2,4-Dinitrotoluene	39-139%	
	2,6-Dintrotoluene	50-158%	
	Di-n-octylphthalate	4-146%	
	Fluoranthene	26-137%	
	Hexachlorobenzene	detected-152%	
	Hexachlorobutadiene	24-116%	
	Hexachloroethane	40-113%	
	Indeno(1,2,3-cd)pyrene	detected-171%	
	Isophorone	21-196%	
	Napthalene	21-133%	
	Nitrobenzene	35-180%	
	n-Nitrosodi-n-propylamine	detected-230%	
	Phenanthrene	54-120%	
	Pyrene	51-115%	
	1,2,4-Trichlorobenzene	44-142%	
	4-Chloro-3-methylphenol	22-147%	
	2-Chlorophenol	23-134%	

Table 5.10(Cont.). Quality Control Measures and Frequency for Semi-Volatiles by GC/MS EPA Method 625.

Quality Control Measure	Analyte	Control Limits	Frequency
Laboratory Control Sample (LCS) (Cont.)	2-Chlorophenol 2,4-Chlorophenol 2,4-Dimethylphenol 2,4-Dinitrophenol 2-Methyl-4,6-dinitrophenol 2-Nitrophenol 4-Nitrophenol Pentachlorophenol Phenol 2,4,6-Trichlorophenol	23-134% 39-135% 32-119% detected-191% detected-181% 29-182% detected-132% 14-176% 5-112% 37-144%	One per 20 samples extracted or per batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All compounds listed for the LCS	The recovery limits are the same as the LCS and the RPD* for the MS/MSD pair should be less than 20 for waters and less than 35 for solids	One per 20 samples per matrix extracted or one per batch.

Table 5.11. Quality Control Measures and Frequency for Alcohols by GC/FID SW 846 Method 8015.

Quality Control Measure	Analyte	Control Limits	Frequency
Continuing Calibration Verifcation (CCV)	All Target Analytes	± 15 % RSD	1 per 20 samples
Method Blank	All Target Analytes	< Reporting Limit	1 per 20 samples
Laboratory Control Sample (LCS)	All Target Analytes	80 - 120% Recovery	1 per 20 samples
Matrix Spike/ Matrix Spike Duplicate	All Target Analytes	75 - 125% Recovery	1 per 20 samples

Table 5.12. Quality Control Measures and Frequency for Volatiles by GC/PID SW 846 Method 8020A.

Quality Control Measure	Analyte	Control Limits	Frequency
Initial Calibration Verification (ICV)	All Target Analytes	± 25% RSD	1 per calibration curve
Continuing Calibration Verifcation (CCV)	All Target Analytes	± 20 % RSD	1 per 20 samples
Method Blank	All Target Analytes	< Reporting Limit	1 per 20 samples
Laboratory Control Sample (LCS)	Benzene Toluene Ethyl benzene	Water 63.3-131% 46 - 148% 32 - 160%	1 per 20 samples
Matrix Spike/ Matrix Spike Duplicate	Benzene Toluene Ethyl benzene	Water 63.3-131% 46 - 148% 32 - 160%	1 per 20 samples
Surrogates (Surr.)	4-Brmofluorobenzene	Water Soil 82-116% 72.8-119% (ADVISORY Criteria)	Every sample and standard analyzed

Table 5.13. Quality Control Measures and Frequency for UST Volatiles by Iowa Method OA-1.

Quality Control Measure	Analyte	Control Limits		Frequency
Inital Calibration Verification (ICV)	All Target Analytes	± 25% RSD		1 per calibration curve
Continuing Calibration Verifcation (CCV)	All Target Analytes	± 15% RSD		1 per 20 samples
Method Blank	All Target Analytes	< Reporting Limit		1 per 20 samples
Holding Blank	All Target Analytes	< Reporting Limit		1 per week
Laboratory Control Sample (LCS)		Water	Soil	1 per 20 samples
	Benzene	81 - 120%	75.6 - 138%	
	Toluene	77.5 - 125%	75.1 - 135%	
	Ethyl Benzene	84.8 - 120%	74.8 - 140%	
	Xylenes, Total	77.1 - 126%	77.4 - 136%	
	Methyl-tertbutyl- ether	66.8 - 133%	73.4 - 142%	
Matrix Spike/ Matrix Spike Duplicate		Water	Soil	1 per 20 samples
	Benzene	81 - 120%	75.6 - 138%	
	Toluene	77.5 - 125%	75.1 - 135%	
	Ethyl Benzene	84.8 - 120%	74.8 - 140%	
	Xylenes, Total	77.1 - 126%	77.4 - 136%	
	Methyl-tertbutyl- ether	66.8 - 133%	73.4 - 142%	
Surrogates (Surr.) (Advisory Criteria)	4-Bromofluorobenzene	78 - 123%	67 - 123%	Every Sample Analyzed

Table 5.14. Quality Control Measures and Frequency for UST Semi-Volatiles by Iowa Method OA-2.

Quality Control Measure	Analyte	Control Limits		Frequency
Continuing Calibration Verifcation (CCV)	All Target Analytes	± 15% RSD		1 per 20 samples
Method Blank	All Target Analytes	< Reporting Limit		1 per 20 samples
Laboratory Control Sample (LCS)	Deisel	Water 62 - 128.5%	Soil 63 - 125%	1 per 20 samples
Matrix Spike/ Matrix Spike Duplicate	Deisel	62 - 128.5%	63 - 125%	1 per 20 samples
Surrogates (Surr.) (ADVISORY CRITERIA)	n-Octacosane	24.8 - 161.7%	53.3 - 137%	Every Sample Analyzed

Table 5.15. Quality Control Measures and Frequency for Pesticides and PCBs by SW-846 Method 8080.

Quality Control Measure	Analyte	Control Limits	Frequency
Inital Calibration Verification (ICV)	All	± 20%	1 per calibration curve
Degradation Check	DDT Endrin	<20% Breakdown <20% Breakdown and total breakdown <30%	Daily
Method Blank	All	<RL	1 per extraction batch
Surrogate	Decachlorobiphenyl Tetrachlorometaxylene	60 - 150% (ADVISORY) 60 - 150% (ADVISORY)	Every sample
Continuing Calibration Verification (CCV)	All compounds	The % difference of the RF from the inital calibration should be less than 15%	Every 10 Samples
Laboratory Control Sample (LCS)[1]	Aldrin α-BHC β- BHC γ- BHC δ - BHC Chlordane 4,4'-DDD 4,4'-DDE 4,4'-DDT Dieldrin Endosulfan I Endosulfan II Endosulfan Sulfate Endrin Heptachlor Heptachlor Epoxide Toxaphene PCB 1016 PCB 1221 PCB 1232 PCB 1242 PCB 1248 PCB 1254 PCB 1260	42-122% 37-134% 17-147% 19-140% 32-127% 45-119% 31-141% 30-145% 25-160% 36-146% 45-153% detected-202% 26-144% 30-147% 34-111% 37-142% 41-126% 50-114% 15-178% 10-215% 39-150% 38-158% 29-131% 8-127%	1 per extraction batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All[1]	Recovery limits are the same as the LCS and the RPD of the MS/MSD should be less than 20 for waters and less than 35 for soils.	One MS/MSD per 20 samples per matrix.

[1]Depending on the analyses requested, LCS and MS/MSD may not contain all analytes listed. A representative single PCB is used.

5.16. Quality Control Measures and Frequency for Pesticides and PCBs by GC/ECD EPA Method 608.

Quality Control Measure	Analyte	Control Limits	Frequency
Inital Calibration Verification (ICV)	All	± 10%	1 per calibration curve
Degradation Check	DDT Endrin	<20% Breakdown <20% Breakdown and total breakdown <30%	Daily
Method Blank	All	<RL	1 per extraction batch
Surrogate	Decachlorobiphenyl Tetrachlorometaxylene	60 - 150% (ADVISORY) 60 - 150% (ADVISORY)	Every sample
Continuing Calibration Verification (CCV)	All compounds	The % difference of the RF from the inital calibration should be less than 15%	Every 24 hours
Laboratory Control Sample (LCS)[1]	Aldrin α–BHC β- BHC γ- BHC δ - BHC Chlordane 4,4'-DDD 4,4'-DDE 4,4'-DDT Dieldrin Endosulfan I Endosulfan II Endosulfan Sulfate Endrin Heptachlor Heptachlor Epoxide Toxaphene PCB 1016 PCB 1221 PCB 1232 PCB 1242 PCB 1248 PCB 1254 PCB 1260	42-122% 37-134% 17-147% 19-140% 32-127% 45-119% 31-141% 30-145% 25-160% 36-146% 45-153% detected-202% 26-144% 30-147% 34-111% 37-142% 41-126% 50-114% 15-178% 10-215% 39-150% 38-158% 29-131% 8-127%	1 per extraction batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All[1]	Recovery limits are the same as the LCS and the RPD of the MS/MSD should be less than 20 for waters and less than 35 for soils.	One MS/MSD per 20 samples per matrix.

[1]Depending on the analyses requested, LCS and MS/MSD may not contain all analytes listed. A representative single PCB is used.

Table 5.17. Quality Control Measures and Frequency for Farm Chemicals by Modified Method 608.

Quality Control Measure	Analyte	Control Limits	Frequency
Inital Calibration Verification (ICV)	All possible	± 20%	1 per calibration curve
Method Blank	All	<RL	1 per extraction batch
Surrogate	Decachlorobiphenyl Tetrachlorometaxylene	60 - 150% (ADVISORY) 60 - 150% (ADVISORY)	Every sample
Continuing Calibration Verification (CCV)	All	± 15%	Every 12 Hours
Laboratory Control Sample (LCS)	All or a subset of compounds	± 25%	1 per extraction batch
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	All or a subset of compounds	Recovery limits are the same as the LCS and the RPD of the MS/MSD should be less than 20 for waters and less than 35 for soils.	One MS/MSD per 20 samples per matrix.

Table 5.18. Quality Control Measures and Frequency for Polynuclear Aromatic Compounds by Method 8310.

Quality Control Measure	Analyte	Control Limits	Frequency
Inital Calibration Verification (ICV)	All Target Compounds	85 - 115% Recovery	1 per calibration curve
Method Blank	All Target Compounds	Should be less than the Reporting Limit	1 per extraction batch (max. of 20 samples)
Surrogate			
Continuing Calibration Verification (CCV)	All Target Compounds	85 - 115% Recovery	1 per 20 samples
Laboratory Control Sample (LCS)	All Target Compounds	75 - 125% Recovery	1 per 20 samples
Matrix Spike/Matrix Spike Duplicate (MS/MSD)*	Acenaohthene Acenaphthylene Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(ghi)perylene Benzo(k)Fluoranthene Chrysene Dibenzo(a,h)anthracene Fluoranthene Fluorene Indeno (1m,2,3-cd)pyrene Naphthalene Phenanthrene Pyrene	D - 124% Recovery D - 136% Recovery D - 126% Recovery 12 - 135% Recovery D - 128% Recovery 6 - 150% Recovery D - 116% Recvoery D - 159% Recovery D - 199% Recovery D - 110% Recovery 14 - 123% Recovery D - 142% Recovery D - 116% Recovery D - 122% Recovery D - 155% Recovery D - 140% Recovery	1 per 20 samples per matrix

* Please Note - MS/MSD control limits are Interim Limits, once adequate data is collected, the above limits will be statistically verified and may change.

6. SAMPLING PROCEDURES

Often the field sampling is the most critical aspect of an analysis. To assure the reliability of the data, quality control measures are included in all field sampling completed by NET, Inc. personnel. Result validity is aided by proper calibration, sampling, handling, identification of samples and chain-of-custody procedures.

SAMPLING

The sampling site is chosen by the client.

NET will not be responsible for sampling for most projects. NET recommends sample media, containers and preservatives as outlined in Tables 6.1 and 6.2 and will provide shipping containers (coolers) and sample containers for any project accepted by NET. A chain of custody record will be provided with each set of sample containers supplied. Chain of custody records are described in more detail in Section 7 of this document.

All field sampling equipment used by NET is thoroughly cleaned with lab detergent and water and a stiff brush. Field sampling equipment is decontaminated as much as possible between samples in the field. All sampling is performed to meet the analysis needs.

When sampling is performed by NET, background information is gathered to determine if any safety risks are involved in sampling. This background information is also used to make decisions on what type of sampler to use, type of sample container to use and number of samples to take.

SAMPLE TYPES

The two most common types of field samples are the grab sample and the composite sample. The definitions of grab and composite samples are as follows:

> Grab - A discrete aliquot that is representative of one specific sample site, at a specific point in time. The entire sample is collected at one point and all at one time.
>
> Composite - A sample composed of more than one specific aliquot collected at various sites and/or at different points in time.

Sampling points are documented as to their exact location for purposes of future sampling.

Blanks can also be collected during the sampling process. The two main types of blanks associated with sampling are the field blank and the trip blank. The definitions of the various types of field blanks are as follows:

> Field Blank - A field blank is an aliquot of analyte free water that is brought to the field site in a sealed sample container and transported back to the laboratory with the field samples. There are two types of field blanks: Equipment blanks and trip blanks.
>
> Equipment Blank - A sample of analyte free water that is poured appropriately over or through the sampling device, containerized, preserved (if the samples are preserved) and handled in the same manner as the samples. Used to identify sample ontamination (if any) acquired through collection, handling, preservation and transport.

Trip Blank - A sample of analyte-free water which is taken before the sampling event has begun. The trip blank travels with the sample containers as they are shipped to the field site and as the samples are sent back to the laboratory. The trip blank is not opened in the field. It is used to identify contamination or cross contamination due to location or shipping conditions.

All sample types should be maintained during shipment at 4° Celsius. Tables 6.1 and 6.2 list common sample containers and preservatives.

Table 6.1. Recommended Sample Containers and Volumes for Organics

Parameter	Container	Preservative	Minimum Volume	Maximum Holding Time
Volatile Orgainics	Water - 2 40 mL Glass Purge Vials Solids - 4 oz widemouth glass jar with teflon closure	1:1 HCl to a pH > 2, no headspace, cool 4°C Cool 4°C	80 mLs 30 g	14 days
2-Chloroethylvinyl ether (in Water)	2 - 40 mL Glass Purge Vials	No headspace, cool 4°C	80 mLs	7 days
Semi-Volatile Organics	Water - 1 L Amber Glass Jar Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C Cool 4°C	1 L 100 g	7 days
TCLP Extraction	Solids - 32 oz widemouth glass safety coated jar	Cool 4°C	300 g	
UST Volatiles	Water - 2 - 40 mL Glass Purge Vials Solids - 4 oz widemouth glass jar with teflon closure	1:1 HCl to a pH > 2, no headspace, cool 4°C Cool 4°C	80 mLs 30 g	14 days
UST Semi-Volatiles	Water - 1 L Amber Glass Jar Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C Cool 4°C	1 L 100 g	7 days
Pesticides/PCBs	Water - 1 L Amber Glass Jar Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C Cool 4°C	1 L 100 g	7 days
PCBs	Water - 1 L Amber Glass Jar Solids - 4 oz widemouth glass jar with teflon closure Oils - 15 mL glass vial	Cool 4°C Cool 4°C	1 L 100 g 5 mL	7 days
Alcohols	Water - 2 - 40 mL Glass Purge Vials Solids -4 oz widemouth glass jar with teflon closure	Cool 4°C Cool 4°C	80 mLs 30 g	14 days
Polynuclear Aromatic Compounds (PNA /PAH)	Water - 1 L Amber Glass Jar Solids - 4 oz widemouth glass jar with teflon closure	Cool 4°C Cool 4°C	1 L 100 g	7 days

Table 6.2. Recommended Sample Bottles and Volumes for Inorganics and Metals.

Parameter	Container	Preservative	Minimum Volume	Maximum Holding Time
Acidity	1L high density polyethylene bottle	Cool 4°C	100 mL	14 days
Alkalinity	1L high density polyethylene bottle	Cool 4°C	100 mL	14 days
Ammonia	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	400 mL	28 days
Biochemical Oxygen Demand (BOD)	1L high density polyethylene bottle	Cool 4°C	1L	48 hours
Carbonaceous Biochemical Oxygen Demand (cBOD)	1L high density polyethylene bottle	Cool 4°C	1L	48 hours
Bromide	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Chemical Oxygen Demand (COD)	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	100 mL	28 days
Chloride	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Cyanide	1L high density polyethylene bottle	Cool 4°C, NaOH pH>12	500 mL	14 days
Fluoride	1L high density polyethylene bottle	Cool 4°C	300 mL	28 days
Hardness	1L high density polyethylene bottle	Cool 4°C, HNO_3 pH<2	100 mL	180 days
pH	1L high density polyethylene bottle	Cool 4°C	100 mL	
Kjeldahl & Organic Nitrogen	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	500 mL	28 days
Hexavalent Chromium	1L high density polyethylene bottle	Cool 4°C	100 mL	24 hours
Mercury	1L high density polyethylene bottle	Cool 4°C, HNO_3 pH<2	100 mL	28 days
Metals	1L high density polyethylene bottle	Cool 4°C, HNO_3 pH<2	200 mL	180 days
Nitrate	1L high density polyethylene bottle	Cool 4°C	100 mL	48 hours
Nitrate-Nitrite	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	100 mL	28 days
Nitrite	1L high density polyethylene bottle	Cool 4°C	100 mL	48 hours
Oil & Grease	1L amber glass	H_2SO_4 pH<2 Cool 4°C	1 L	28 days
Total Organic Carbon (TOC)	125 mL amber bottle	Cool 4°C, H_2SO_4 pH<2	125 mL	28 days
Total Organic Halogens (TOX)	500 mL amber bottle	Cool 4°C, H_2SO_4 pH<2	500 mL	28 days
Phenols	1L amber glass	Cool 4°C, H_2SO_4 pH<2	500 mL	28 days
Orthophosphorus	1L high density polyethylene bottle	Cool 4°C	100 mL	48 hours

Table 6.2.(Cont.). Recommended Sample Bottles and Volumes for Inorganics and Metals.

Parameter	Container	Preservative	Minimum Volume	Maximum Holding Time
Total Phosphorus	1L high density polyethylene bottle	Cool 4°C, H_2SO_4 pH<2	100 mL	28 days
Total Solids	1L high density polyethylene bottle	Cool 4°C	100 mL	7 days
Total Dissolved Solids	1L high density polyethylene bottle	Cool 4°C	100 mL	7 days
Total Suspended Solids	1L high density polyethylene bottle	Cool 4°C	1 L	7 days
Settleable Solids	1L high density polyethylene bottle	Cool 4°C	1000 mL	48 hours
Total Volatile Solids	1L high density polyethylene bottle	Cool 4°C	100 mL	7 days
Silica	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Specific Conductance	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Sulfate	1L high density polyethylene bottle	Cool 4°C	100 mL	28 days
Sulfide	1L high density polyethylene bottle	Cool 4°C, NaOH pH>9	500 mL	7 days
Sulfite	1L high density polyethylene bottle	Cool 4°C, NaOH pH>9	100 mL	
Turbidity	1L high density polyethylene bottle	Cool 4°C	100 mL	48 hours

7. SAMPLE CUSTODY

Correct sample handling procedures are an integral part of the Quality Assurance program for NET. A chain of custody documents the sample identity, number of samples, requested analyses and the custody of samples.

CHAIN OF CUSTODY PROCEDURES

Chain of Custody forms are utilized to document, in a legally defensible manner, the transfer of custody for each sample. NET will follow the descriptions and requested analyses outlined on the Chain of Custody provided by the client. NET STRONGLY recommends that the chain of custody (COC) be completed and sent with the samples for analysis. Failure to submit a COC may result in delays for laboratory analysis and possible legal problems if the site evaluation comes into question at a later date. Figure 7.1 and 7.2 show examples of chain of custody forms.

When samples arrive at NET, the Sample Custodian documents the condition of custody seals on the Chain of Custody. The temperature of the cooler is documented. The sample custodian checks the sample label against the Chain of Custody, and notes any deviations. In the case where there are discrepancies between the samples received and the COC, or when samples are received damaged, incorrectly preserved or missing, NET will notify the client and require that any changes be submitted to NET in writing.

Samples are then logged into NET's Laboratory Information Management System (LIMS) and are assigned a unique sample identification number and the requested analyses are linked to that identification number. The LIMS system also has entered into it additional information such as sample time, date, matrix, date received and due dates. Each day a Standard Daily Log is generated from the LIMS system. Figure 7.3 shows an example of a standard daily log.

Samples are maintained at approximately 4 degrees Celsius in a designated sample storage area until the time of analysis and are returned to this area when not in the custody of an analyst.

LABORATORY DOCUMENT CONTROL

All documentation in logbooks and other pertinent documents are entered in ink. Corrections made to data is done in accordance with EPA Guidelines.

All raw data and pertinent records are maintained for an indefinite period in long-term record storage.

Figure 7.1. Example Chain of Custody Form.

NET®

NET, Inc. - Cedar Falls Division
704 Enterprise Drive
Cedar Falls, IA 50613

Phone 319 - 277 - 2401 or 1 - 800 - 750 - 2401
FAX 319 - 277 - 2425

Company: _____ P.O. Number: _____
Send Report To: _____ Invoice To: _____
Address: _____ NET Quote Number: _____
City/State/Zip Code: _____ Project Name: _____
Telephone Number: _____ Fax: _____ _____
Sampled By: (Print Name) _____ Project Number: _____
(Signature) _____ Project Manager: _____

Is this work being done for regulatory compliance?_____Yes _____No If yes, which program? (Please Circle One) RCRA NPDES UST SDWA Other (Specify)_____
Is this work being done for regulatory enforcement action?_____Yes _____No If yes, which program? (Please Circle One) RCRA NPDES UST SDWA Other (Specify)_____

Sample ID	Date Sampled	Time Sampled	# of Containers Shipped	Grab	Composite	Field Filtered	Preservative: Ice	HNO3 (Red & White Label)	HCl (Blue & White Label)	NaOH (Orange & White Label)	H2SO4 (Yellow & White Label)	None (Black & White Label)	Other (Specify):	Matrix: Groundwater	Wastewater	Drinking Water	Sludge	Soil	Other (Specify):	Analyze for:														Results need: 48 hours 'turn around time'*	3 day turn around time*	Standard turn around time	Fax Results	Send QC Data with report

NOTE: All turn around times are calculated from the time of receipt at NET. NOTE: There may be a charge for NET disposing of samples.
* Pre-arrangements MUST be made at least 48 hours in advance to receive results with these turn around time commitments. Additional charges may be assessed.

NOTES:

CHAIN OF CUSTODY RECORD

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY	DATE	TIME

SEALED YES NO	SHIPPED VIA:	SEALED YES NO	COMMENTS	SEALED YES NO	SHIPPED VIA:

RECEIVED FOR NET BY:	DATE	TIME	COC SEALS PRESENT AND INTAC YES NO NA	VOLATILES FREE OF HEADSPACE ? YES NO
			TEMPERATURE UPON RECEIPT	REMARKS:

PLEASE KEEP THE PINK COPY FOR YOUR RECORDS – THE ORIGINAL WILL BE RETURN WITH THE ANALYTICAL REPORT.

Figure 7.2. Example Chain of Custody Form.

NET NATIONAL ENVIRONMENTAL TESTING, INC.

NET Midwest, Inc.
Cedar Falls Division
704 Enterprise Drive
P.O. Box 625
Cedar Falls, IA 50613
Tel: (319) 277-2401
Fax: (319) 277-2425

IOWA UST CHAIN OF CUSTODY

Client Submitting Sample:	Sample Collector:
Name:	Name:
Address:	Address:
Phone: ( )	Phone: ( )

Client sample location identifier and tank contents*	UST Site Address	Date of sample collection	Sample Type		# of jars	Analysis Method	
			water	soil		OA1	OA2

*Tank contains (contained): (G)Gas (D)Diesel fuel (FO)Fuel oil (K)Kerosene (O)Oil (MS)Mineral spirits (S)Other(specify)_____

Comments:_____

Relinquished by	Date	Time	Received by	Date	Time
Shipping Notes/Damage/Lab Comments			Received for NET Midwest by:		

Custody Seals Intact? Y N N/A

Figure 7.3. Example Standard Daily Log.

NET, INC.
CEDAR FALLS DIVISION

STANDARD DAILY LOG
11/08/1994

START DATE: 11/08/1994 END DATE: 11/08/1994

ACCT NO.	COMPANY	PROJECT DESCRIPTION	JOB	JOB DESCRIPTION/ SAMPLE	SAMPLE DESCRIPTION	DUE	RUSH/ RECEIVED
[redacted]	[redacted]	[redacted]	94.10455		[redacted]	11/22/1994	N
				275350	#29307 [redacted]		11/08/1994
				275351	#29310 Blank [redacted]		11/08/1994
[redacted]	[redacted]	Y11394 Stormwaters	94.10450		Y11394 Stormwaters	11/29/1994	N
				275324	Grab Outfall #002		11/08/1994
				275325	Composite Outfall #002		11/08/1994
				275326	Grab Outfall #005		11/08/1994
				275327	Composite Outfall #005		11/08/1994
				275328	Grab Outfall #006		11/08/1994
				275329	Composite Outfall #006		11/08/1994
				275330	Grab Outfall #014		11/08/1994
				275331	Composite Outfall #014		11/08/1994
[redacted]	[redacted]	Ind. effluent	94.10445		Industrial Effluent	11/22/1994	N
				275315	Industrial Effluent - Grab		11/08/1994
				275316	Industrial Effluent - Composite		11/08/1994
[redacted]	[redacted] INC.	#722 Waterloo	94.10453		#722 Waterloo	11/12/1994	N
				275343	#722-1 North Basin @ 13' KS #722		11/08/1994
				275344	#722-2 N.W. Basin @ 13' KS #722		11/08/1994
				275345	#722-3 S.W. Basin @ 13' KS #722		11/08/1994
				275346	#722-4 South Basin @ 13' KS #722		11/08/1994
				275347	#722-5 East Basin @ 13' KS #722		11/08/1994
[redacted]	[redacted] ENVIRONMENTAL	94-240-0282 [redacted]./	94.10419		94-240-0282 [redacted]./	11/09/1994	Y
				275258	PT.1-A [redacted]		11/08/1994
[redacted]	[redacted] INC.	#315 [redacted]	94.10424		#315 [redacted]	11/22/1994	N
				275266	Effluent Manhole [redacted]		11/08/1994
[redacted]	NET - WATERTOWN	WT-2264 #115101-03	94.10431		WT-2264 #115101-03	11/15/1994	Y
				275288	#115101 94.06252 [redacted]		11/08/1994
				275289	#115102 94.06252 [redacted]		11/08/1994
				275290	#115103 94.06252 [redacted]		11/08/1994
[redacted]	NET - WATERTOWN	WT-2697 #114884-86	94.10433		WT-2697 #114884-86	11/18/1994	N
				275293	#114884 94.06219 [redacted]		11/08/1994
				275294	#114886 94.06219 [redacted]		11/08/1994
				275295	#114888 94.06219 [redacted]		11/08/1994
[redacted]	NET - WATERTOWN	WT-2698 #114878-9	94.10434		WT-2698 #114878-9	11/18/1994	N
				275296	#114878 94.06216 [redacted]		11/08/1994
				275297	#114879 94.06216 [redacted]		11/08/1994

8. CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and frequency for the instrumentation which will be used in the determination of the parameters of interest.

LABORATORY STANDARDS

All materials used for instrument calibration, internal standards and surrogate standards will be of the highest purity available from a commercial source. The calibration procedures outlined here are those routinely used in the laboratory. The calibration frequencies are listed in Tables 5.1 through 5.17.

STANDARDS TRACEABILITY

All materials whether high purity bulk material or prepared solutions, will have the following information, at a minimum, recorded into an analytical standards logbook: identity, supplier, lot number, date received, reported concentration and expiration date. This information will be recorded when the material is received or no later than the first time the material is used.

All analytical standards and spiking solutions will have a unique identification consisting of a name, number and the preparation or received date. This identification will be clearly recorded on the label of any bottle containing this material. By consistently using this identification on raw data, the material can be traced back to the original material. Documentation of all standard preparations will be recorded in logbooks. The volume and numerical reference of all analytical standards or spiking solutions used in the preparation of another standard will be recorded in the standard preparation logbook.

All calibration standards must be verified against an independently prepared standard from a second manufacturer or a different lot from the same manufacturer.

INSTRUMENT CALIBRATION

Gas Chromatograph/Mass Spectrometer

Calibration Standards

Stock solutions are high purity standards. The supplier, purity, date received and analyst who recorded the information in the logbook is documented in the standards logbook. All stock solutions are logged in the standards logbook and given a unique identification number. From the stock, working standards are prepared by diluting the stock. The process is as follows:

1. Prepare Stock solutions.

2. Preparing working standards by dilution of the stock standards

3. Verify the working standards by analysis of an initial calibration verification sample using an independent standard.

Calibration Procedure

1. At the beginning of each 12 hour shift that analyses are performed using Method 624 or 8240, the GC/MS system must be checked to verify that acceptable performance criteria are obtained for 4-Bromofluorobenzene (BFB). The performance test must be passed before analyzing any samples, blanks or standards.

2. At the beginning of each 12 hour shift that Method 625 or 8270 analyses are performed the GC/MS system must be checked to verify that acceptable performance criteria are obtained for Decafluorotriphenylphosphine (DFTPP). The performance test must be passed before analyzing any samples, blanks or standards.

3. Once the GC/MS system is tuned for volatiles or semi-volatiles, a five point initial calibration curve is prepared using standards prepared following EPA protocols. The calibration check compound (CCC) criteria must be met before sample analysis may begin.

4. Analyze a continuing calibration check standard is prepared following EPA protocols. If the CCC and the system performance check compounds (SPCC) compounds do not meet the criteria stated in the analytical method, the source of the problem must be located and the problem corrected before sample analysis can proceed. If SPCC and CCC criteria cannot be met, the instrument must have a new initial calibration performed following any necessary maintenance.

5. All values for initial and continuing calibration verifications are recorded.

Gas chromatography

Calibration Standards

Stock solutions are high purity standards. The supplier, purity, date received and analyst who recorded the information in the logbook is documented in the standards logbook. All stock solutions are logged in the standards logbook and given a unique identification number. From the stock, working standards are prepared by diluting the stock. The process is as follows:

1. Prepare Stock solutions.

2. Preparing working standards by dilution of the stock standards

3. Verify the working standards by analysis of an initial calibration verification sample using an independent standard.

Calibration Procedure - GC Volatiles

1. Calibrate the instrument using a minimum of three standards. Tabulate peak height or area response versus standard concentration. The response factors for the standards for each compound are calculated in addition to the average response factor for each compound and the percent relative standard deviation.

2. When the calibration curve has acceptable response and percent relative standard deviation, an initial calibration verification standard is analyzed and must be acceptable for analysis to continue.

3. A continuing calibration verification standard is analyzed every 24 hours and must meet the acceptance criteria in Section 5. If acceptance criteria cannot be met, the instrument must be re-calibrated.

Calibration Procedure - Pesticides and PCBs by Method 8080 and 608

1. Analyze initial evaluation standard mixtures at a minimum of three concentration levels. Determine the linearity of each compound and the breakdown of Endrin and 4,4'-DDT according to the procedures in the EPA method.

2. Analyze initial individual standard mixture(s) to determine response factors (RFs) for each compound by the external standard method.

3. Analyze Toxaphene and PCB standards.

4. Analyze samples in groups of five.

5. Record all values for the initial calibration verification and subsequent calibration verifications.

High Pressure Liquid Chromatography (High Performance Liquid Chromatography) (HPLC)

Calibration Standards

Stock solutions are high purity standards. The supplier, purity, date received and analyst who recorded the information in the logbook is documented in the standards logbook. All stock solutions are logged in the standards logbook and given a unique identification number. From the stock, working standards are prepared by diluting the stock. The process is as follows:

1. Prepare Stock solutions.

2. Preparing working standards by dilution of the stock standards

3. Verify the working standards by analysis of an initial calibration verification sample using an independent standard.

Calibration Procedure

1. Analyze initial evaluation standard mixtures at a minimum of five concentration levels. Determine the linearity of each compound according to the procedures in the EPA method.

2. Record all values for the initial calibration verification and subsequent calibration verifications.

Atomic Absorption Spectrophotometer

Calibration Standards

Stock solutions are high purity standards. The supplier, purity, date received and analyst who recorded the information in the logbook are documented in the standards logbook. All stock solutions are logged in the

standards logbook and given a unique identification number. Working standards are prepared by diluting the stock. The process is as follows:

1. Prepare calibration standards by dilution of the stock standard.

2. The calibration standards are prepared using the same type of acid or combination of acids as the sample will have after preparation.

Calibration Procedure

The instrument is calibrated beginning with a blank and three standards, analyzing from the lowest to the highest standard. The correlation coefficient (r) of the curve must be >0.995 to pass quality control criterion. If 0.995<r<1.00, the calibration curve is valid and can be used to analyze samples.

After the instrument is calibrated, the calibration curve is verified by the analysis of an initial calibration verification sample (ICV). The ICV is an independent known from a supplier different than the supplier of the stock standard and it has a concentration that was not used to generate the curve and within the linear range of the curve.

If the ICV sample analysis exceeds the control limits, the analysis is ended and the problem(s) is investigated and corrected.

To assure calibration accuracy throughout each analysis run, the Continuing Calibration Verification (CCV) sample must be analyzed at a frequency of one CCV per 10 samples analyzed.

The CCV is also analyzed after the last analytical sample. If the CCV is outside the control limits, the analysis must be terminated and the instrument recalibrated.

All continuing calibration verifications are recorded in LABSYS II and in log books.

Inductively Coupled Plasma Argon Emission Spectroscopy (ICP-AES)

Calibration Standards

Stock solutions are high purity standards. The supplier, purity, date received and analyst who recorded the information in the logbook are documented in the standards logbook. All stock solutions are logged in the standards logbook and given a unique identification number. Working standards are prepared by diluting the stock. The process is as follows:

1. Prepare calibration standards by dilution of the stock standard.

2. The calibration standards are prepared using the same type of acid or combination of acids as the sample will have after preparation.

Calibration Procedure

The instrument is calibrated beginning with a blank and one standard.

After the instrument is calibrated, the calibration curve is verified by the analysis of an initial calibration verification sample (ICV). The ICV is an independent known from a supplier different than the supplier of the stock standard and it has a concentration that was not used to generate the curve and within the linear range of the curve.

If the ICV sample analysis exceeds the control limits, the analysis is ended and the problem(s) is investigated and corrected.

The interelement correction factors are verified by analyzing a series of spectral interference check solutions.

To assure calibration accuracy throughout each analysis run, the Continuing Calibration Verification (CCV) sample must be analyzed at a frequency of one CCV per 10 samples analyzed.

The CCV is also analyzed after the last analytical sample. If the CCV is outside the control limits, the analysis must be terminated and the instrument recalibrated.

All continuing calibration verifications are recorded in LABSYS II and in log books.

UV/VIS Spectrophotometer

Stock solutions are high purity standards. The supplier, purity, date received and analyst who recorded the information in the logbook are documented in the standards logbook. All stock solutions are logged in the standards logbook and given a unique identification number. Working standards are prepared by diluting the stock. The process is as follows:

1. Prepare calibration standards by dilution of the stock standard.

2. The calibration standards are prepared using the same type of acid or combination of acids as the sample will have after preparation.

Calibration Procedure

A calibration curve is generated by the analyst. The calibration curve is generated with a minimum of three standards. The correlation coefficient (r) of the curve must be >0.995 to pass quality control criterion. If 0.995<r<1.00, the calibration curve is valid and can be used to analyze samples.

After the instrument is calibrated, the calibration curve is verified by the analyzing an initial calibration verification sample (ICV). The ICV is an independent known from a supplier different than the supplier of the stock standard and it has a concentration that was not used to generate the curve.

If the ICV sample analysis exceeds the control limits, the analysis is ended and the problem(s) is investigated and corrected.

Each day the reference calibration curve is verified. If the reference curve does not pass acceptance criteria of ± 10%, corrective action takes place to resolve the problem and the curve is re-analyzed. To assure calibration accuracy throughout each analysis run, the

Continuing Calibration Verification (CCV) sample must be analyzed at a frequency of one CCV per 20 samples analyzed The CCV is also analyzed after the last analytical sample. If the CCV is outside the control limits, the analysis must be terminated and the instrument recalibrated.

All continuing calibration verifications are recorded in LABSYS II and in log books.

Infra-red Spectrophotometer

Stock solutions are high purity standards. The supplier, purity, date received and analyst who recorded the information in the logbook are documented in the standards logbook. All stock solutions are logged in the standards logbook and given a unique identification number. Working standards are prepared by diluting the stock. The process is as follows:

1. Prepare calibration standards by dilution of the stock standard.

2. The calibration standards are prepared using the same type of acid or combination of acids as the sample will have after preparation.

Calibration Procedure

A calibration curve is generated by each analyst yearly. The calibration curve is generated with a minimum of three standards. The correlation coefficient (r) of the curve must be >0.995 to pass quality control criterion. If 0.995<r<1.00, the calibration curve is valid and can be used to analyze samples.

After the instrument is calibrated, the calibration curve is verified by the analyzing an initial calibration verification sample (ICV). The ICV is an independent known from a supplier different than the supplier of the stock standard and it has a concentration that was not used to generate the curve.

If the ICV sample analysis exceeds the control limits, the analysis is ended and the problem(s) is investigated and corrected.

Each day the reference calibration curve is verified . If the reference curve does not pass acceptance criteria of ± 10%, corrective action takes place to resolve the problem and the curve is re-analyzed. To assure calibration accuracy throughout each analysis run, the Continuing Calibration Verification (CCV) sample must be analyzed at a frequency of one CCV per 20 samples analyzed The CCV is also analyzed after the last analytical sample. If the CCV is outside the control limits, the analysis must be terminated and the instrument recalibrated.

All continuing calibration verifications are recorded in LABSYS II and in log books.

pH meter

Calibration Standards

Use primary standard buffers purchased from an appropriate source. Prepare or use as directed in the accompanying instructions. A minimum of two buffers which bracket expected sample pH are required. One must be in the range of pH 6 to 8.

Prepare an appropriate quality control sample from a second source.

Calibration Procedure

1. Perform an initial operating check of the electrode and meter according to the manufacturer's instructions.

2. Calibrate the meter according to the operating instructions.

3. Analyze a quality control standard to verify instrument calibration.

4. Record all values for initial and subsequent calibration verification.

Analytical Balances

Analytical balances are calibrated at least once daily with NBS traceable class S weights. When assembling or analyzing filters for total dust or particulates, the analytical balance's calibration is verified with the use of NBS traceable class S reference weights.

Titrations

All reagent for titrations have a maximum shelf life of six months.

9. ANALYTICAL PROCEDURES

The Cedar Falls Division of NET, Inc. uses a wide range of analytical methodology for the analysis of wastewater, groundwater, drinking water and hazardous waste.

METHODOLOGY

The methodology employed by NET Cedar Falls conforms to EPA approved procedures as published in the Federal Register. Methods cited are referenced in *Standard Methods for the Examination of Water and Wastewater*, *Methods of Chemical Analysis of Water and Wastes* (EPA Manual 600/4-79-020), *Test Methods for Evaluating Solid Waste* (USEPA Manual SW-846), *Methods for the Determination of Metals in Environmental Samples and Supplement 1* (EPA/600/4-91/010 and EPA/600/R-94/111), relevant ASTM, NIOSH, OSHA and other publications.

REPORTING LIMITS

NET has established reporting limits for all routine analyses. These reporting limits are based on the Limit of Quantitation (or LOQ) that was determined when method detection limit studies were performed. The LOQ is defined as the level above which quantitative results may be obtained with a specified degree of confidence. The LOQ is calculated as ten times the standard deviation of the population of data obtained in the method detection limit study. NET's goal in establishing reporting limits is to minimize the probability of reporting false positive or negative results by considering a more reliable detection level such as an LOQ.

10. DATA REDUCTION, VALIDATION AND REPORTING

DATA REDUCTION

All analytical data are reduced to the appropriate concentration units as specified by the method. The analyst will reduce the data taking into account any and all factors such as dilution, percent solids, sample weight or volume and reagent normality. Blank correction will be applied only when required by the method.

DATA VALIDATION

Data validation is the process by which data is accepted or rejected based on pre-determined criteria. NET does not provide data validation services.

DATA VERIFICATION

Data is evaluated based on the following broad range of criteria:

- Proper sample collection, storage and holding time
- Use of standard operating procedures or other approved analytical procedures.
- Use of properly operating and calibrated instruments
- Successful analysis of appropriate quality indicators

All data will be evaluated and validated prior to being released for reporting purposes to the NET Project Management team. The persons evaluating the data will have sufficient knowledge of the technical work to identify questionable values. All data is maintained in permanently bound data books or as instrument printouts for a period of at least 7 years.

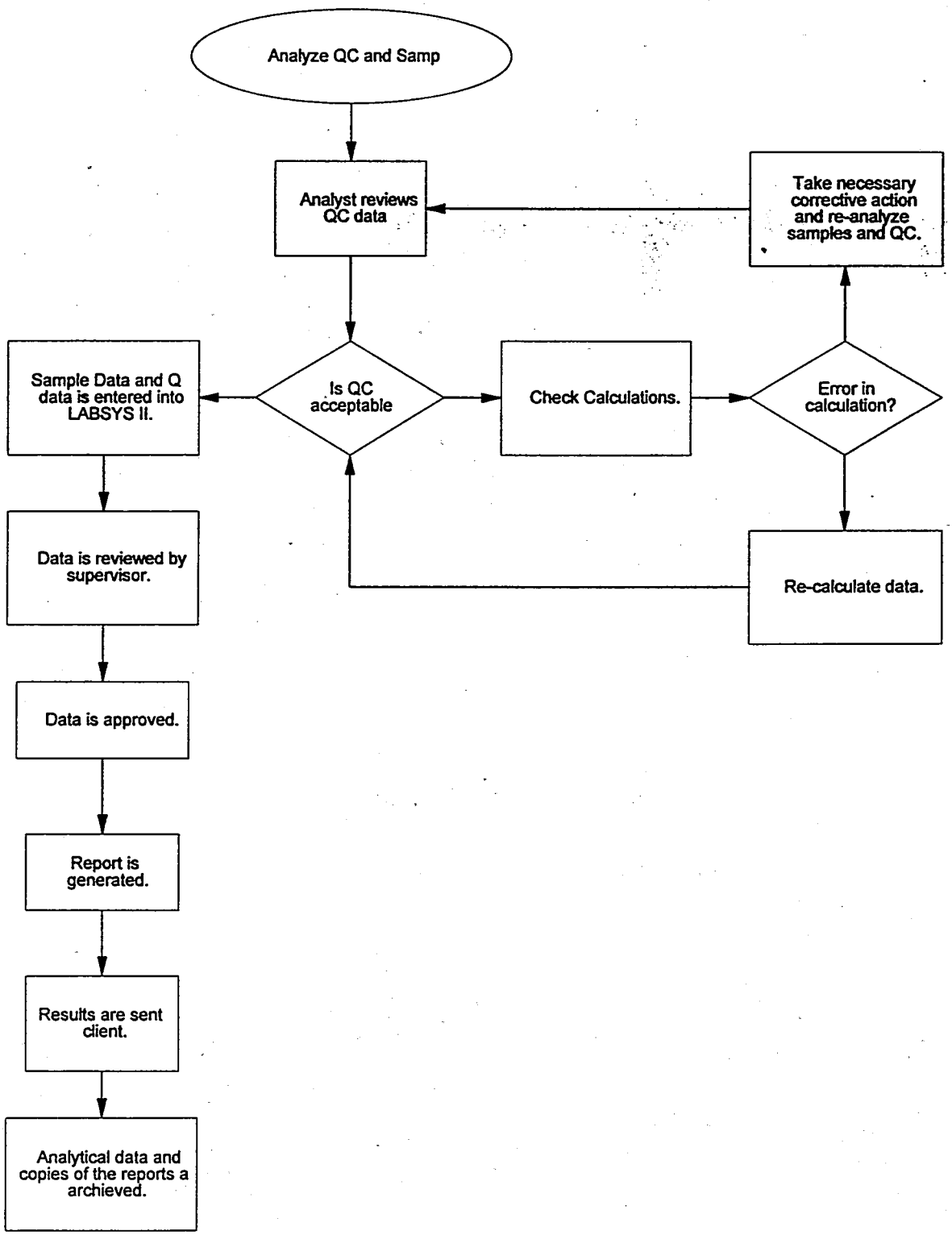
DATA REPORTING

Analytical results will be reported in a manner acceptable to the client. All reports will be assembled and approved by the project management team and delivered to the client within the time period agreed upon by the client and the laboratory. Data is generally reported at the limit of quantitation (LOQ) (Reporting Limit = LOQ). The LOQ is determined for most analytes by performing a method detection limit (MDL) study. The protocol used to determine the MDL is found in 40 CFR Part 136 Appendix B.

Additional data required by the customer, such as operating conditions, quality control data, method detection limits (MDLs), recommendations or problems will be reported by the project management team.

Figure 10.1 shows the analytical data review and reporting scheme utilized by NET.

Figure 10.1. Analytical Data Review and Reporting Scheme



11. INTERNAL QUALITY CONTROL AND FREQUENCY

INTERNAL QUALITY CONTROL

Internal quality control makes use of several types of QC samples to monitor the performance of the measurement process. Quality control checks are analyzed to ensure the generation of accurate and valid data on client samples. Please refer to section 5 for control limits for the following QC samples.

BLANK SAMPLES

Blank samples are analyzed to assess the extent (if any) of contamination due to the method, transit or storage. Trip blanks will be supplied with coolers if requested by the client. Equipment blanks will be provided to NET by the client. Both types of blanks will be analyzed as field samples at NET.

Method blank - prepared in the laboratory just like a sample. The method blank is analyzed with samples, processed at the same time as the blank, to assess the extent of contamination obtained during the preparation process before analysis.

Solvent/Reagent blank - prepared from any solvent or reagent lot used in the analysis; used to assess the background of solvents/reagents.

SURROGATE COMPOUND(S) (OR SURROGATE SPIKE (SS)) For Organic Analyses.

Surrogate - Compounds which are added to every blank, sample, matrix spike, matrix spike duplicate and standard in order to evaluate the analytical efficiency of the method in individual sample matrices. The surrogate compounds are chemically similar to the target compounds.

CALIBRATION VERIFICATION

Verification samples are analyzed during each run to assure calibration accuracy for each analyte.

Initial Calibration Verification (ICV) - a standard will be analyzed from a source different than those used for calibration to check the validity of the initial calibration curve. If the ICV does not pass QC criteria, first, the ICV is re-analyzed, then if the ICV still fails QC criteria, analysis is ended, the problem is investigated, and the instrument is re-calibrated.

Continuing Calibration Verification (CCV) - A standard, dictated by the SOP is analyzed during the analysis run to confirm calibration.

INTERNAL STANDARDS (IS) - GC/MS analyses

Compounds added to every standard, blank, matrix spike, matrix spike duplicate, and sample at a known concentration prior to the analysis. The internal standards are used as the basis for quantitation of the target compounds. Must meet internal standard area guidelines set by the EPA. If control limits cannot be meet, the sample(s) are re-analyzed. If samples cannot be re-analyzed due to limited sample volume or holding time issues, the results are flagged.

SPIKED SAMPLES

Matrix Spike/Matrix Duplicate (MS/MSD) Two aliquots of sample are spiked with the analyte(s) and the recovery is determined. The duplicate sample (MSD) analysis is carried out to verify precision.

Analytical Spike (AS) - (Furnace and Flame Metals) An aliquot of digested sample or sample into which a known amount of compound is added. The analytical spike is analyzed immediately and the recovery is calculated in order to assess the matrix effect on the analytical system.

Laboratory Control Sample (LCS) - A control sample of known composition. Aqueous and solid control samples are analyzed using the same sample preparation reagents, and analytical methods as employed for samples in order to verify that the preparation and analysis methods are in control.

DUPLICATE

A second aliquot of a sample which is carried through sample preparation and analysis procedures to verify the precision of the analytical method for that matrix.

REAGENT QUALITY CONTROL

Reagents used in the laboratory are of analytical reagent grade or higher purity. Reagent lots are checked for acceptable purity by the analysis of reagent blanks. Reagents are dated upon receipt and stored in a designated reagent storage area. Smaller quantities are stored in ventilated solvent cabinets in the laboratories and in accordance with the Material Safety Data Sheet (MSDS) storage requirements.

REAGENT/STANDARD QUALITY

A reagent/standard is labeled at the time of receipt with the date received, who received it, expiration date (or re-evaluation date), manufacturer's lot and date opened if not present on the bottle as received. Material Safety Data (MSDS) are on file for all hazardous chemicals and available to all analysts.

Records are maintained for all standards. All standards are logged into the appropriate standard log book. Standards log books contain records of manufacturer, expiration (or evaluation date) of the standard and concentration (or purity).

QC CHECK SAMPLES

Standard Reference Materials (SRMs) or any other appropriate known concentrates of the various analytes in the matrices analyzed are run on a routine basis as a Q.C. check. These samples are analyzed along with regular samples in the normal laboratory routine. The analyst compares the result with the known value and the quality control criteria outlined in Section 5.

INTERNAL QUALITY ASSURANCE

To monitor quality, the following actions are periodically taken by the Division/Operations Manager(s) and Quality Assurance Coordinator.

QC SINGLE OR DOUBLE BLIND SAMPLES

A single or double blind sample is prepared by the QA Coordinator on a periodic basis or when requested by Division/Project Manager(s) to assess analysis. Single blind samples are known to be QC samples and double blind samples are not recognizable as such. These samples are analyzed and the results are reported to the divisional QA Coordinator. The QA Coordinator then reviews the analytical data and determines what action (if any) is needed.

INTERNAL AUDIT

Periodically, internal audits are conducted by the divisional QA Coordinator to evaluate the following areas:

Sample Storage
Chain of Custody
Instrument Maintenance
Precision
Accuracy
Method and SOP Compliance

COMMUNICATING DATA QUALITY OBJECTIVES

Data quality objectives are determined by the client and/or the regulating agency which the client is working with, and communicated to NET by the client. All information contained in this QAPP has been communicated to the appropriate Laboratory Management Staff who are responsible for ensuring that supervisors and analysts are able to meet the stated QC requirements.

12. PERFORMANCE AND SYSTEM AUDITS AND FREQUENCY

Systems Audits

The system audit is a systematic check of a qualitative nature consisting of an on-site review of a laboratory's quality assurance systems and physical facilities for sampling, calibration and measurements. Systems audits are performed on a regular basis by the various state and federal agencies. NET, Inc. Cedar Falls Division will submit to external on-site audits at the request of a client at their convenience.

The audit may include several components listed below:

- Personnel, facilities and equipment
- Chain of custody procedures
- Instrument calibration and maintenance
- Standards preparation and verification
- Analytical procedures
- Quality control procedures
- Data handling procedures
- Documentation control procedures

Performance Audits

Performance Audits provide a systematic check of laboratory operations and measurement systems. NET, Inc. Cedar Falls Division routinely participates in laboratory performance evaluations for the following programs:

- USEPA Water Pollution (WP) Program, biannually
- USEPA Water Safety (WS) Program, biannually
- NET, Inc.'s own Interlaboratory Testing Program (ITP), biannually
- NIOSH Proficiency Analytical Testing (PAT) Program, quarterly
- Environmental Lead Proficiency Analytical Testing (ELPAT) Program, quarterly
- Wisconsin Department of Natural Resources Proficiency Samples, annually
- Bulk Asbestos Proficiency Analytical Testing Program, quarterly
- Environmental Resource Associates - Underground Storage Tank (UST) Proficiency Testing (for Iowa UST certification), quarterly

NET's Interlaboratory Testing Program is used to monitor performance as well. Twice a year, performance evaluation samples are submitted to each NET laboratory for analysis. These are submitted as blind samples to the laboratory and are analyzed using the method used to analyze client samples. Statistical summaries of each laboratory's performance is compiled and distributed to each lab.

13. PREVENTATIVE MAINTENANCE PROCEDURES AND SCHEDULES

NET follows a well-defined program to prevent the failure of laboratory equipment or instrumentation during use. This program of preventative maintenance helps to avoid delays due to instrument downtime. Adequate supplies of spare parts such as GC columns, syringes, septa, injection port liners and electronic parts are maintained in the laboratory.

Routine preventative maintenance procedures such as lubrication, source cleaning, detector cleaning and the frequency of such maintenance are performed according to the procedures outlined in the manufacturer's manual. Chromatographic carrier gas purification traps , injection port liners and septa are cleaned or replaced on a regular basis. Precision and accuracy data are examined for trends and excursions beyond established control limits to determine evidence of instrument malfunction. Maintenance must be performed by laboratory analysts when there is evidence of degradation of peak resolution, a shift in the calibration curves, loss of sensitivity, or failure to meet one of the quality control criteria.

Instrument logbooks containing usage, calibration, maintenance and repair records are kept in the laboratories at all times. The laboratories also maintain adequate supplies of spare parts such as GC columns, syringe, septa, injection port liners and electronic parts.

In the event of equipment malfunction that cannot be resolved within two working days, service shall be obtained form the instrument vendor or manufacturer, if such a service agreement exists or can be tendered. If on-site service in the laboratory in unavailable, arrangements shall be expedited to have the instrument shipped to the manufacturer for repair. Back-up instruments which have been approved for the analysis shall perform the analysis normally carried out by the malfunctioning instrument, if feasible. If back-up is not available and the analysis cannot be carried out within the needed time frame, the samples shall be subcontracted to another certified laboratory to carry out the analysis.

14. SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

PRECISION

Precision is a measure of the degree of agreement between repeated measurements of the same parameter under prescribed, similar conditions. Analytical precision will be monitored using results from duplicate analyses. Analytical precision goals, expressed as relative percent difference (RPD), are presented in Section 5. The RPD is calculated as follows:

$$RPD = \frac{2|D1 - D2|}{D1 + D2}$$

where,

RPD = Relative Percent Difference;

D1 = First Duplicate Value (percent recovery); and

D2 = Second Duplicate Value (percent recovery).

ACCURACY

Accuracy is a measure of the degree of agreement between an analyzed value and the true or accepted reference value where it is known. The accuracy of a measured value is expressed as a percent of the expected or known value. In the laboratory, accuracy will be evaluated by comparing the recoveries of parameters of interest against criteria outlined in Section 5, through the use of quality control reference samples or reference materials. The recovery of a compound will be defined as:

$$\%R = \frac{|SSR - SR|}{S} X100$$

where,

%R = Percent Recovery;

SSR = Spiked Sample Result;

SR = Sample Result; and

S = Spike Concentration.

COMPLETENESS

Completeness is a measure of the amount of valid data obtained from the samples received. It is defined in terms of percentage of the number of valid measurements expected. Ideally, every sample will generate all of the valid measurements expected, however, realistically some samples may be lost in laboratory accidents or some data may be deemed questionable based on internal QC criteria. Such instances will be documented and communicated to the client in a narrative section of the report.

Completeness also implies the ability of the final report to answer the client's questions. NET's will have personnel available to discuss analytical reports with clients. Every attempt will be made by NET to achieve 100% completeness on analytical parameters. All judgments of completeness will be determined by the client .

15. CORRECTIVE ACTION

An important part of any quality assurance program is a well-defined, effective policy for correcting quality problems. NET maintains a corrective action system which operates under the direction of the Division Manager and Quality Assurance Coordinator. While the entire quality assurance program is designed to avoid problems, it also serves to identify and correct those that occur. Usually these quality problems fall into two categories: immediate corrective action or long-term corrective action.

IMMEDIATE CORRECTIVE ACTION

Specific quality control procedures are designed to help analysts detect the need for corrective action. Often, an analyst's experience will be most valuable in identifying abnormal analyses or malfunctioning equipment; immediate corrective action then may be taken. Such actions should be noted in laboratory notebooks but no other formal documentation is required unless the corrective action taken fails to correct the problem.

LONG TERM CORRECTIVE ACTION

The need for formal corrective action may be identified by performance on routine QC samples, control chart trends, or as a result of a performance or systems audit. Any quality problem which cannot be solved by immediate corrective action falls into this category. The division QA Coordinator is responsible for managing the corrective action process and communicating the status of corrective action progress to the Division Manager. The QA Coordinator may, with the support of the Division Manager, delegate responsibilities for investigating problems and implementing solutions to appropriate operational groups or individuals. Involvement of the analyst and supervisor of the area concerned is crucial to the effectiveness of the corrective action process. It is the responsibility of analysts and supervisors to write corrective action reports, and it is the responsibility of the QA Coordinator to maintain the corrective action reports.

The essential steps in the closed loop corrective action system are:

1. Identification of the problem,
2. Assignment of responsibility for investigating the problem,
3. Determination of the cause of the problem through investigation,
4. Formulation of a corrective action plan,
5. Assignment of responsibility for implementation of the corrective action plan,
6. Monitoring the effectiveness of the corrective action plan,
7. Verifying the elimination of the problem,
8. Documenting the process involved.

STEPS REQUIRED TO COMPLETE A CORRECTIVE ACTION REPORT

1. Notification of acceptability of results.

2. Quality Assurance coordinator informs appropriate analyst, supervisor, and project managers of unacceptable parameters requiring a corrective action report.

3. Analyst determines through careful and thorough consideration, possible sources of the problem.

4. Analyst with the help of the Supervisor, if necessary, identifies the assignable cause of the problem and documents this on the corrective action report (CAR). Refer to the National Quality Assurance Plan (NQAP) Attachment 1 for examples of the CAR form.

5. Along with identification of the problem, the specific steps taken to correct the problem are documented on the CAR.

6. Analyst reviews the CAR with the Supervisor and/or Project Manager.

7. After the problem has been identified and corrected, a blind performance evaluation sample is submitted by the QA Coordinator.

8. Successful completion of the blind performance sample will demonstrate that the analysis is in control. Unsuccessful completion of the blind performance sample will indicate the appropriate corrective action has not taken place and the process must start over with the analyst identification of the problem.

9. After successful completion of the corrective action process, the CAR is reviewed and signed by the QA Cooedinator and the Division Manager.

10. The signed Corrective Action Report is then sent to the Executive Director of Data Quality for review.

16. QUALITY ASSURANCE REPORTS TO MANAGEMENT

EXECUTIVE DIRECTOR OF DATA QUALITY

The Executive Director of Data Quality manages NET's Interlaboratory Testing Program, Data Quality Audit Program and conducts system audits of the various NET laboratories. This information is distributed to each division so that appropriate corrective action can take place if necessary.

The Executive Director of Data Quality writes a biannual report to the Corporate officers and General Managers regarding the implementation of the National Quality Assurance Plan (NQAP).

QUALITY ASSURANCE COORDINATOR

The Quality Assurance Coordinator is responsible for reporting to management on the effectiveness of the Quality Assurance Plan. A monthly summary of quality related issues is prepared and submitted to the Executive Director of Data Quality, the Division Manager, and other appropriate personnel.

The monthly quality assurance report topics are outlined below:

1. Audits and Client Visits

   A. Who visited the lab and what did they have to say
   B. Lab's response to the audit
   C. Who will be visiting in the future
   D. Update on internal system audit recommendations

2. Performance Evaluation Samples

   A. Samples currently in-house and due date
   B. Completed results and notification of acceptability of results
   C. Corrective Action Reports

3. Certification, Accreditation and Contract Approval

   A. Certifications, accreditations and contract approvals in process
   B. Official certifications, accreditations or contract approvals received

4. Training

   A. QA/QC training
   B. Analyst training

5. SOPs

A. Implementation of common SOPs
B. SOPs being written
C. SOPs needed

6. QAPPs

A. QAPPs in progress or requested

7. Other

ATTACHMENT B

ATTACHMENT B

QUALITY ASSURANCE GOALS (PRECISION)

	Acceptable Relative Percent Difference (percent) Water	
Analysis of Duplicates for:	**Lab[a]**	**Field[b]**
Purgeables/Volatiles	20	100

a Unless otherwise noted, Quality Assurance Goals are from EPA's "Test Methods for Evaluating Solid Waste," SW-846, Third Edition, November 1986. For ease of presentation, where multiple target analytes are included in an analysis, the goals for specific analytes have been compiled and the given range rounded to the nearest factor of 10. Evaluation of QC results will be performed on an analyte-specific basis.

b Quality Assurance Goals based on prior project experience and laboratory performance because EPA or State recommended goals are not included in the approved method.

ATTACHMENT B (CONTINUED)

QUALITY ASSURANCE GOALS (ACCURACY)

Analysis of Spike Samples (MSD, External, Performance, etc.) for:	Acceptable Spike Recovery (percent) Water	
	Lab[a]	Field[b]
Purgeables/Volatiles	60 - 150	60 - 150

a Unless otherwise noted, Quality Assurance Goals are from EPA's "Test Methods for Evaluating Solid Waste," SW-846, Third Edition, November 1986. For ease of presentation, where multiple target analytes are included in an analysis, the goals for specific analytes have been compiled and the given range rounded to the nearest factor of 10. Evaluation of QC results will be performed on an analyte-specific basis.

b Quality Assurance Goals based on prior project experience and laboratory performance because EPA or State recommended goals are not included in the approved method.

ATTACHMENT B (CONTINUED)

QUALITY ASSURANCE GOALS (ACCURACY)

Analysis of Surrogate Spike[a] Samples for:	Acceptable Spike Recovery (percent) Water	
	Lab[a]	Field[b]
Purgeables/Volatiles	60 - 140	d

a Surrogate compounds will be added to all environmental and QC samples for the analyses shown.

b Unless otherwise noted, Quality Assurance Goals are from EPA's "Test Methods for Evaluating Solid Waste," SW-846, Third Edition, November 1986. For ease of presentation, where multiple target analytes are included in an analysis, the goals for specific analytes have been compiled and the given range rounded to the nearest factor of 10. Evaluation of QC results will be performed on an analyte-specific basis.

c Quality Assurance Goals based on prior project experience and laboratory performance because EPA or State recommended goals are not included in the approved method.

d No goal is established because the analysis of this type of QC sample is not applicable.

ATTACHMENT B (CONTINUED)

DETECTION LIMIT GOALS

	Acceptable Spike Recovery (percent) Water	
Class of Chemical	**Analytical Method**	**Target EQL[a]**
Purgeables/Volatiles	SW-8260	5 times DL[b]

[a] These targets represent the estimated quantitation limits (EQLs). EQL is defined in SW-846 (cited above) as the lower level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. All detection limits achieved in a given analysis will vary depending on instrument sensitivity and matrix effects. The target detection limits are found in the reference for each analytical method. The actual detection limits achieved by the laboratories will be reported by the laboratories for each analysis.

[b] DL represents detection level.

ATTACHMENT C

NATIONAL ENVIRONMENTAL TESTING, INC.

NET, Inc. - Cedar Falls Division
704 Enterprise Drive
Cedar Falls, IA 50613

Phone 319 - 277 - 2401 or 1-800 - 750 - 2401
FAX 319 - 277 - 2425

Company:
Send Report To:
Address:
City/State/Zip Code:
Telephone Number: Fax:
Sampled By: (Print Name)
(Signature)

PO #:
Invoice to:
NET Quote #:
Project Name:
Project Number:
Project Manager:

Sample ID	Date Sampled	Time Sampled	# of Containers Shipped	Grab	Composite	Field Filtered	Preservative: Ice	HNO3 (Red & White Label)	HCl (Blue & White Label)	NaOH (Orange & White Label)	H2SO4 (Yellow & White Label)	None (Black & White Label)	Other (Specify):	Matrix: Groundwater	Wastewater	Drinking Water	Sludge	Soil	Other (Specify):	Analyze for:										Results need: 48 HR TAT (SEE NOTE)	5 DAY TAT (SEE NOTE)	STANDARD TAT (10 DAYS)	Fax Results	Send QC Data with report

NOTE: All turn around times are calculated from the time of receipt at NET. NOTE: There may be a charge for NET disposing of sample

NOTE: PRE-ARRANGEMENTS MUST BE MADE AT LEAST 48 HOURS IN ADVANCE TO RECEIVE RESULTS WITH THESE TURN AROUND TIME COMMITMENTS. ADDITIONAL CHARGES MAY BE ASSESSED.

NOTES:

RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	DATE	TIME

RECEIVED FOR NET BY:	DATE	TIME	COC SEALS PRESENT AND INTACT? YES NO NA	SHIPPED VIA:
			TEMPERATURE UPON RECEIPT	ARE THESE SAMPLES FOR NPDES COMPLIANCE? YES NO

ATTACHMENT B

RECEIVED
MAY - 2 1996
MW/IOWA

NON-DOMESTIC WASTEWATER DISCHARGE PERMIT
CITY OF AMES, IOWA

Facility Name: Sauer-Sundstrand

Facility Location: 2800 E. 13th Street
Ames, IA 50010

Authorized Representative:

Name: George Charbonneau

Title: Plant Engineer

Address: 2800 E. 13th Street
Ames, IA 50010

Telephone No. 515-239-6617

Permit No: 6593-3

Issue Date: 05/20/96

Expiration Date: 05/19/01

For the City of Ames, Iowa

By _____
Water and Pollution Control Department

This permit is issued pursuant to the authority of Chapter 28 Ames Municipal Code. Permittee is hereby authorized to discharge wastewater from the Facility identified above provided said discharge meets all quality and quantity limitations and Permittee complies with all other conditions, including monitoring, reporting, and other terms as set forth in this Permit and the City of Ames Pretreatment Program. Any existing permit or discharge authorization previously used by the City of Ames for this Facility is hereby revoked by the issue of this Permit. This Permit may not be assigned or transferred by the Contributor unless authorized in writing by the City.

Failure to meet the standards and requirements of this permit and the pretreatment program shall be a municipal infraction punishable by a penalty of up to $1,000 for the first and each subsequent violation. Each occurrence of prohibited discharge is a violation.

Quality and Quantity Limitations

Permittee is prohibited from discharging any pollutants more frequently or in excess of the limitations specified below.

Wastewater Parameter	Units	Maximum[1]	Average[2] (where applicable)
Flow (main plant)	gpd	45,000	30,000
Flow (groundwater remediation project)	gpd	43,200	
$CBOD_5$	mg/l	1,500	1,000
TSS	mg/l	1,500	1,000
NH_3	mg/l	240	180
pH	std. units	6.0 to 10.0	
COD	mg/l	1,500	1,000
Oil & Grease	mg/l	300	200
Iron	mg/l	15	

1 - "Maximum" means the total discharge by mass, volume, or concentration which cannot be exceeded during any 24-hours period. Compliance shall be determined by composite sampling as specified except for those parameters (such as pH, temperature, volatile organics, etc.) where individual grab samples are specified.

2 - Average means the average value from four consecutive sampling days unless otherwise defined.

Monitoring and Reporting

Permittee or City will sample, analyze, and report the results as specified below. All samples and measurements shall be representative of the volume and nature of the permitted discharge. All samples shall be collected and analyzed in accordance with the procedures approved by the U.S. EPA.

Wastewater Parameter	Sample Frequency	Sample Type	Location
Flow	Monthly	24-hour total	1,4
$CBOD_5$	Semi-Annually	24-hour composite	2
$CBOD_5$	Annually	24-hour composite	3
TSS	Semi-Annually	24-hour composite	2
TSS	Annually	24-hour composite	3
NH_3	Semi-Annually	24-hour composite	2
pH	Semi-Annually	Grab	2
pH	Annually	Grab	3
COD	Semi-Annually	24-hour composite	2
COD	Annually	24-hour composite	3
Oil & Grease	Semi-Annually	24-hour composite	2
Oil & Grease	Annually	24-hour composite	3
Phenol	1/2 years	24-hour composite	2
Phenol	Annually	24-hour composite	3
Chromium (tot)	1/2 years	24-hour composite	2
Chromium (tot)	Annually	24-hour composite	3
Copper	1/2 years	24-hour composite	2
Copper	Annually	24-hour composite	3
Iron	1/2 years	24-hour composite	2
Iron	Annually	24-hour composite	3
Lead	1/2 years	24-hour composite	2
Lead	Annually	24-hour composite	3
Mercury	1/2 years	24-hour composite	2
Mercury	Annually	24-hour composite	3
Nickel	Annually	24-hour composite	3
Zinc	1/2 years	24-hour composite	2
Zinc	Annually	24-hour composite	3
Sulfates	1/2 years	24-hour composite	2
Total Petroleum Hydrocarbons	1/2 years	24-hour composite	2
Acetone	Monthly	Grab	4
1,1-dichloroethane	Monthly	Grab	4
1,1-dichloroethene	Monthly	Grab	4
cis,1,2-dichloroethene	Monthly	Grab	4
Tetrachlorethene	Monthly	Grab	4
1,1,1-trichloroethane	Monthly	Grab	4
Trichloroethene	Monthly	Grab	4
Total Xylenes	Monthly	Grab	4

* 1 - water meters
2 - manhole NW of building (sewer line to city sewer)
3 - coolant discharge
4 - groundwater remediation discharge

Beginning June 1, 1996, monitoring reports shall be submitted monthly for groundwater remediation project and semi-annually for all other to the City of Ames Pretreatment Coordinator, Water Plant, 300 E. 5th Street, Ames, Iowa (515-239-5150). All sampling results shall be submitted as soon as

received. All reports shall be submitted not later than 15 days following the end of the reporting period.

Compliance Schedule

Permittee shall provide the pretreatment facilities or make such process modifications to achieve compliance with the quantity and quality limitations, monitoring and reporting requirements, or such other requirements in the time period as specified below.

None required at this time.

SITE SAFETY PLAN ADDENDUM

FOR

REMEDIATION AND OPERATIONS AND MAINTENANCE ACTIVITIES
SAUER-SUNDSTRAND COMPANY FACILITY
AMES, IOWA

Prepared for

SAUER-SUNDSTRAND COMPANY
AMES, IOWA

AND

SUNDSTRAND CORPORATION
ROCKFORD, ILLINOIS

Project No. 8907.0330

April 1996
Revised August 1996

Prepared by

Montgomery Watson
11107 Aurora Avenue
Des Moines, Iowa 50322
515-253-0830

PREPARED BY: _____ **DATE:** _____
Health and Safety Coordinator

APPROVED BY: _____ **DATE:** _____
Project Manager

APPROVED BY: _____ **DATE:** _____
Program Director

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1.0 - INTRODUCTION

Montgomery Watson has developed this site-specific Site Safety Plan (SSP) addendum to address health and safety procedures for site investigative/remediation activities to be conducted at the Sauer-Sundstrand facility located at 2800 13th Street, Ames, Iowa. This site-specific SSP addendum establishes health and safety procedures for field activities that will minimize potential risks to Montgomery Watson personnel performing on-site work. This site-specific SSP addendum should be used in conjunction with Montgomery Watson's Standard SSP.

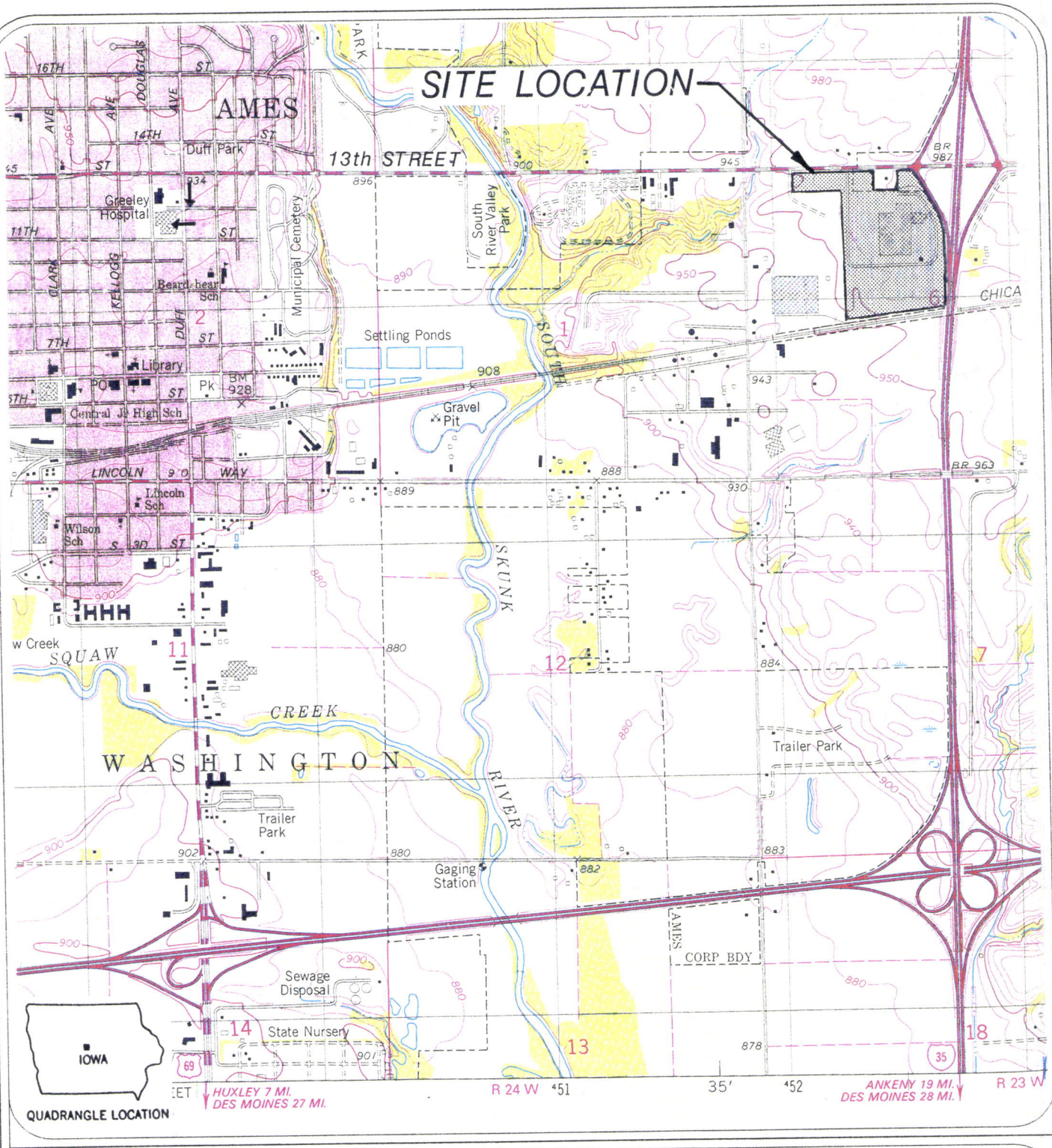
The Standard SSP and the site-specific SSP addendum apply to all Montgomery Watson employees who will potentially be exposed to safety and/or health hazards associated with the proposed field activities. Subcontractors are required to provide their own SSP which, at a minimum, must comply with the requirements of the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operation and Emergency Response Standards (29 CFR 1910.120) and other applicable OSHA regulations. If they choose, subcontractors can adopt applicable portions of Montgomery Watson's SSP addendum for this project. The adoption is an independent action on the part of the subcontractor working for Montgomery Watson. This site-specific SSP addendum has been developed based on limited knowledge regarding the specific chemical hazards and anticipated potential physical hazards which could be associated with the investigation activities proposed for this site. Site-specific work activities include the collection of groundwater and soil samples, groundwater elevation measurements, and installation of an interception trench.

The Standard SSP and the site-specific SSP addendum have been prepared in compliance with the requirements of the OSHA Hazardous Waste Operation and Emergency Response Standards (29 CFR 1910.120) and other applicable OSHA regulations. Actual working conditions may require modification of this site-specific SSP addendum. Except in emergency situations, the Industrial/Hazardous Waste Group Health and Safety Manager (HSM) or Health and Safety Coordinator (HSC) must approve any modifications before they can be implemented. Written documentation of the change must be attached as additional addenda to the Standard SSP. A "Field Change Request" form is included as Attachment A of the Standard SSP.

2.0 - SITE DESCRIPTION, HEALTH RISK, AND ACCIDENT PREVENTION

2.1 - Site Description

The Sauer-Sundstrand facility operates as a manufacturer of hydrostatic transmission power systems for use primarily in farm machinery and construction equipment. The facility, which began operation in 1972, is located in Ames, Iowa, within the Northeast 1/4 of the Northwest 1/4 of Section 6, Township 83 North, Range 23 West, Story County, Iowa (Figure 2-1). The site is bounded on the north by 13th Street and on the east by I-35. A small portion of the property located on the south side of 13th Street is owned by Doolittle Oil Company, Inc. The Chicago and Northwestern Railroad (CNW) forms the southern site boundary. A 3M corporation plant is located west of the site. The South Skunk River, located approximately one mile west of the site, flows generally toward the south.



MAP SOURCE: U.S.G.S. 7.5 MINUTE SERIES TOPOGRAPHIC MAP
AMES EAST QUADRANGLE

N

0 2000

SCALE IN FEET

MONTGOMERY WATSON

SAUER-SUNDSTRAND FACILITY
AMES, IOWA

SITE LOCATION MAP

FIGURE 2-1

BDR

2.2 - Existing Areas of Investigation and Associated Chemical Hazards

Soil and water sampling activities previously conducted at the site have identified the following volatile organic contaminants of concern in the proposed work zones: 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, methylene chloride, tetrachloroethene, 1,1,1-tetrachloroethane, 1,1,2-tetrachloroethane, trichloroethene and vinyl chloride.

2.3 - Proposed Investigation/Remediation Activities

The proposed investigative/remediation activities planned for the Sauer-Sundstrand site include:

- Groundwater elevation measurements.
- Interceptor trench and conveyance system installation.
- Collection of soil samples for on-site screening.
- Collection of groundwater and trench water samples.

Approximately 750-800 feet of trench with collection piping will be installed along the leading edge of the shallow groundwater volatile organic compound plume. The trench will be installed to a depth of approximately 25 feet. The trench will be installed using a special trenching machine that excavates the trench, inserts the drainage pipe, and backfills the trench in one continuous operation. Based on the installation method being used, it has been assumed that personnel on site will not be entering open excavations. If the need to enter an excavation should arise, the on-site safety officer (OSO) should contact the HSC and assure that appropriate shoring, benching, or sloping, and if applicable, confined space entry protocol, are in place.

2.4 - Safety and Health Risk Analysis

2.4.1 - Chemical Toxicity Hazard. The potential toxic exposure hazard to site personnel associated with chemical contaminants which may be present at the areas described in Section 2.2 can be expressed in Threshold Limit Values-Time Weighted Averages (TLVs-TWAs), Permissible Exposure Limits (PELs), Short Term Exposure Limits (STELs), Recommended Exposure Limits (RELs), and/or Immediately Dangerous to Life or Health (IDLH) values, as established by the American Conference of Governmental Industrial Hygienists (ACGIH), OSHA, and/or the National Institute for Occupational Safety and Health (NIOSH). Appropriate definitions for these health-based values are as follows:

TLV-TWA: The TWA airborne concentration of a substance for a normal 8-hour work day and 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effects.

PEL: The TWA airborne concentration of a substance for a normal 8-hour workday and a 40-hour work week, to which workers may be exposed, day after day. PELs are OSHA-promulgated exposure standards (29 CFR 1910.1000).

STEL: The TWA exposure which should not be exceeded at any time during a work day even if the 8-hour TWA is within the TLV-TWA. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes and should not occur more than four times per day.

REL: The TWA airborne concentration of a substance for up to a 10-hour exposure duration (unless otherwise noted) during a 40-hour work week. RELs are established by NIOSH to reduce or eliminate adverse occupational health effects.

IDLH: The maximum airborne concentration of a substance which one could escape within 30 minutes without escape-impairing symptoms or any irreversible effects.

Available information regarding site contamination, occupational exposure limits for potential contaminants, including TWA and IDLH values and ionization potentials, is presented in Table 2-1. Table 2-2 summarizes odor thresholds, routes of exposure and symptoms. Table 2-3 presents the abbreviations used for symptoms.

Due to the nature of this field work, the types and concentrations of these potential hazards remain unknown. Therefore, proper monitoring during sampling activities is necessary. Specific monitoring and hazard assessment procedures will be covered in Section 7 of this site-specific SSP addendum.

2.4.2 - Physical Hazards. Physical hazards anticipated during the field work include trenching equipment operation; potential underground and overhead utility lines; fire or explosion; noise; heat and/or cold stress; electrical hazards; vehicle traffic hazards; pinch hazards; and slip, trip and fall hazards. To prevent the hazard of trenching into underground power cables or other utilities, all utilities will be marked prior to activities. Montgomery Watson will contact and work with local utilities and on-site Sauer-Sundstrand personnel to assure, to the extent possible, that all underground utilities are identified and adequately marked. Standard trenching procedures, which prohibit drilling within 5 feet of marked underground utilities, or within 20 feet of overhead electrical hazards, will be followed for trenching operations.

2.4.3 - Levels of Personal Protection. Work will commence in Level D personal protective equipment (PPE), as described in Section 6. However, due to the potential for adverse employee exposure, the contingency to upgrade to Level C protection is included. The upgrade will occur in the event that dust and/or atmospheric concentrations monitored during specific site activities meet or exceed predetermined levels of dust and/or toxic air contaminants established for upgrading protective equipment. Further explanation and criteria for upgrading the level of protection are provided in Section 7.

If monitoring indicates that an upgrade to Level C protection is warranted, it will be the responsibility of the Montgomery Watson OSO to stop field activities until air-purifying respirators equipped with the appropriate cartridges are donned by Montgomery Watson personnel working in the exclusion zone.

TABLE 2-1

TOXICITY INFORMATION AND OCCUPATIONAL HEALTH GUIDELINES

Chemical Compound	Existing Contaminant Concentration in Groundwater (µg/L)	NIOSH-ACGIH TWA (for air) (ppm/[mg/m^3])	OSHA IDLH (for air) (ppm/[mg/m^3])	Ionization Potential
Volatile Compounds				
1,1-Dichloroethane	560	100/-	4,000/-	11.06
1,1-Dichloroethene (vinylidene chloride)	250	5/-	-/-	-
1,2-Dichloroethene	730	200/-	4,000/-	9.65
Methylene Chloride	-	50/-	5,000/-	11.32
1,1,2-Trichloroethane	30	10/-	500/-	11.00
Tetrachloroethene (perchloroethylene)	2,500	25/-	500/-	9.32
1,1,1-Trichloroethane (methyl chloroform)	970	C 350/-	1,000/-	11.00
Trichloroethene	170	25/-	1,000/-	9.45
Vinyl Chloride	-	1, C 5/-	-/-	9.99

- Indicates no information available.
C = Ceiling limit.
Ca = Potential carcinogen.
mg/m^3 = Micrograms per cubic meter.
NA = Not applicable.
NE = No evidence to indicate upper limit applicable.
ppm = Parts per million.

Abbreviations:

ACGIH = American Conference of Governmental Industrial Hygienists
IDLH = Immediately Dangerous to Life or Health
NIOSH = National Institute for Occupational Safety and Health
OSHA = Occupational Safety and Health Administration
TWA = Time Weighted Average

References:

1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Limits Agents.
NIOSH Pocket Guide to Chemical Hazards.
Photovac Incorporated Technical Bulletin No. 11.
Personnel Protection and Safety, EPA Course 165.2 (manual).
The Condensed Chemical Dictionary, 10th Ed., 1981.
Sax's Dangerous Properties of Industrial Materials, 8th Ed.

TABLE 2-2
ODOR AND EXPOSURE CHARACTERISTICS

Contaminant	Odor Threshold (ppm)	Description of Odor	Route of Exposure[a]	Symptomology[b]
Volatile Compounds				
1,1-Dichloroethane	49-1,359	Chloroform-like	Inh, Ing, Con	CNS depres; skin irrit; liver, kidney damage
1,1-Dichloroethene (vinylidene chloride)	190	Chloroform-like	-	-
1,2-Dichloroethene	0.08-17	Slightly acrid, chloroform-like	Inh, Ing, Con	Irrit eyes, resp sys; CNS depres
Methylene Chloride	160	Chloroform-like, sweet	Inh, Ing, Con	Ftg, weak, sleepiness, li-head; limbs numb, tingle; nau; irrit eyes, skin; [carc]
1,1,2-Trichloroethane	0.5-167	Sweet, etherish, chloroform-like	Inh, Abs, Ing, Con	Irrit nose, eyes; CNS depres; liver, kidney damage; [carc]
Tetrachloroethene (perchloroethylene)	47	Mild, chloroform-like	Inh, Ing, Con	Irrit eyes, nose, throat; nau; flush face, neck; verti, dizz, inco; head, som; skin eryt; liver damage; [carc]
1,1,1-Trichloroethane (methyl chloroform)	390	Chloroform-like, sweet, etherish	Inh, Ing, Con	Head, lass, CNS depres, poor equi; irrit eyes; derm; card arrhy
Trichloroethene	82	Chloroform-like, ether, solventy	Inh, Ing, Con	Head, verti; vis dist, tremors, som, nau, vomit; irrit eyes; derm; card arrhy, pares; [carc]
Vinyl Chloride	10-20	Pleasant at high concentrations, sweet	Inh	Weak; abdom pain, GI bleeding; hepatomegaly; pallor or cyan of extremities; [carc]

[a] Route of exposure key: Inh = Inhalation; Ing = Ingestion; Con = Skin and/or Eye Contact; Abs = Skin Absorption.
[b] Symptoms of exposure abbreviations key is presented in Table 2-3.
- Indicates no information available.
NA = Not applicable.
ppm = Parts per million.

Reference and Sources of Information:

1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Limits Agents.
The Condensed Chemical Dictionary 10th Ed., 1981.
NIOSH Pocket Guide to Chemical Hazards.
Personnel Protection and Safety, EPA Course 165.2 (manual).
Photovac Incorporated Technical Bulletin No. 11.
Sax's Dangerous Properties of Industrial Materials, 8th Ed.

TABLE 2-3

ABBREVIATIONS FOR SYMPTOMS OF EXPOSURE

Abbreviation	Symptom	Abbreviation	Symptom	Abbreviation	Symptom
abdom	abdominal	constip	constipation	fasc	fasiculation
album	albuminuria	constric	constriction	FEV	forced expiratory volume
anem	anemia	convuls	convulsions	fib	fibrosis
anes	anesthesia	cor	acute right heart strain or chronic right ventricular pulmonale, hypertrophy	fibrl	fibrillation
anor	anorexia			frost	frostbite
anos	anosmia			ftg	fatigue
ANS	automatic nervous system	corn	cornea	func	function
apat	apathy	CVS	cardiovascular system	fvr	fever
appre	apprehension	cyan	cyanosis	gasp	gasping
arrhy	arrhythmias	defat	defatting	GI	gastrointestinal
asphy	asphyxia	deg	degeneration	gidd	giddiness
asth	asthma	dent	dental	glau	glaucoma
atax	ataxia	depres	depressant/depression	glu	glucose
biliru	bilirubinuria	derm	dermatitis	halu	hallucinations
blur	blurred	diarr	diarrhea	head	headache
BP	blood pressure	dil	dilated	hema	hematuria
breath	breathing	dist	disturbance	hemat	hematoma
bron	bronchitis	dizz	dizziness	hemato	hematopoietic
broncopneu	bronchopneumonia	drow	drowsiness	hemog	hemoglobinuria
bronspas	bronchospasm	dys	dysuria	hemorr	hemorrhage
BUN	blood urea nitrogen	dysart	dysarthria	hep	hepatic
ca	cancer	dysp	dyspnea	hyper	hyperemia
cachexia	severe generalized weakness, emaciation	ecz	eczema	hypox	hypoxemia
		emphy	emphysema	ict	icterus
[carc]	carcinogenic/carcinogen	enl	enlargement	inco	incoordination
card	cardiac	eosin	eosinophilia	incr	increase(d)
cere	cerebral	epis	epistaxis	inflamm	inflammation
chol	cholinesterase	epit	epithelium	inj	injury
chor	chorea	equi	equilibrium	insom	insomnia
cirr	cirrhosis	ery chol	erhthrocyte cholinesterase	intox	intoxication
CNS	central nervous system	eryt	erythema	irreg	irregular
coll	collapse	euph	euphoria	irrit	irritation
conf	confusion	extrem	extremities	irrity	irritability
conj	conjunctivitis	fail	failure	jaun	jaundice

TABLE 2-3 (CONTINUED)

ABBREVIATIONS FOR SYMPTOMS OF EXPOSURE

Abbreviation	Symptom
kera	keratitis
kid	kidney
lab	labored
lac	lacrimation
lar	laryngeal
lass	lassitude
leucyt	leukocytosis
leuk	leukemia
leupen	leukopenia
li-head	lightheadedness
liv	liver
lo-ap	appetite loss
low-wgt	weight loss
lymp	lymphocytosis
mal	malaise
malnut	malnutrition
monocy	monocytosis
muc memb	mucous membrane
musc	muscle
myo	myotonia
narc	narcotic
narco	narcosis
nas	nose/nasal
nau	nausea
nec	necrosis
neph	nephritis
ner	nervousness
neur	neurologic
numb	numbness
opac	opacity
pal	pallor

Abbreviation	Symptom
palp	palpitations
para	paralysis
pares	paresthesia
paresis	incomplete loss of muscular power; weakness of a limb
parox	paroxysmal
perf	perforation
peri neur	peripheral neuropathy
perineurit	peripheral neuritis
periorb	periorbital
phar	pharyngeal
photo	photophobia
pig	pigmentation
plas	plasma
pleur	pleurisy
pneu	pneumonia
pneuitis	pneumonitis
PNS	peripheral nervous system
polyneur	polyneuropathy
pros	prostration
prot	proteinuria
psypec	psychialopecia
pulm	pulmonary
pulsus altenans	a pulse pattern in which beats occur at regular intervals, but with alternating weak and strong beats
pup	pupil
RBC	red blood cell
resp	respiratory
respar	respiratory arrest

Abbreviation	Symptom
retster	retrosternal
rhin	rhinorrhea
salv	salivation
scotoma	an area of absent or depressed vision in the visual field
sens	sensitization
sez	seizure
sleep	sleepiness
sneez	sneezing
som	somnolence
spas	spasm
strabismus	abnormality of the eyes in which the visual axes do not meet at the desired point
subs	substernal
sweat	sweating
swell	swelling
sys	system
tacar	tachycardia
tend	tenderness
trachbronc	tracheobronchitis
vasconst	vasoconstriction
venfib	ventricular fibrillation
verti	vertigo
vesic	vesiculation
vis dist	visual disturbance
vomit	vomiting
weak	weakness
wheez	wheezing

Reference: U.S. Department of Health and Human Services, June 1990. NIOSH Pocket Guide to Chemical Hazards, Department of Health and Human Services (National Institute for Occupational Safety and Health), Publication No. 90-117.

2.5 - Activity Hazard Analysis

2.5.1 - Interceptor Trench. Hazards associated with trenching activities include equipment dangers; soil collapse; pinch, slip, trip, and fall hazards; potential exposure to gas vapors; utility contact; heat/cold stress; and noise. At a minimum, hearing and eye protection, hard hats, 4 mil Nitrile gloves, and Tyvek® outer protective clothing will be worn during trenching operations.

Based on the type of trenching equipment to be used on site, there should not be a need for personnel to enter into an open excavation. If a need to enter does arise, the HSC should be notified and Title 29, CFR, 1926 (subpart P); Federal OSHA Construction Safety Standards - Excavations, Trenching, and Shoring safety requirements will be maintained. In addition, the site must be evaluated to determine if entry in to the trench would constitute a confined space entry. If the entry is determined to be confined space, procedures established in Montgomery Watson Industrial/Hazardous Waste Operations, Health and Safety Policies and Procedures Manual (Attachment A) must be implemented.

Monitoring for dust conditions and the potential gases listed in Table 2-1 (yellow card stock insert) will be conducted to minimize exposure by early detection. If necessary, based on visual and instrumentation monitoring, the site will be upgraded to Level C, or personnel will move away from the site until levels drop to acceptable working levels. Heat/cold stress will be monitored depending upon ambient conditions.

Additionally, the following heavy equipment operation procedures will be followed:

- Before operating equipment in the vicinity of electrical power lines, the equipment operator will walk completely around the equipment to be used to determine the distance from the equipment to the nearest power line (the distance should be greater than 20 feet).
- Before conducting intrusive activity, the location will be adequately cleaned and leveled to accommodate the equipment to be used.
- Suitable storage for all tools, materials and supplies will be provided.
- Work areas and equipment platforms will be kept free of materials, obstructions and substances that could cause a surface to become slick or otherwise hazardous.
- All unnecessary personnel will be cleared from the area.
- No piece of heavy equipment will be left running and unattended.
- All heavy equipment scheduled for use at the site will be inspected prior to use and be in safe operating condition.

- All field personnel will be required to wear, at a minimum, steel-toed boots, hard hats, hearing protection and safety glasses or goggles when working near heavy equipment.

2.5.2 - Soil Sampling/Handling. The same potential hazards exist for soil sampling/handling as described for trenching activities. Nitrile gloves (4-mil inner and 4-mil outer) and Tyvek® outer protective clothing will be worn during all soil sampling activities. Nitrile gloves (4-mil inner and 22-mil outer) and polycoated or SARANEX®-laminated Tyvek® protective clothing will be worn when contact with free product or liquids is anticipated.

2.5.3 - Groundwater Sampling. The same potential hazards exist for groundwater sampling activities as described for soil sampling activities, except equipment dangers and noise hazards. Polycoated or SARANEX®-laminated Tyvek® outer protective clothing and nitrile gloves (4-mil inner and 22-mil outer) will be worn during all groundwater sampling activities because of the increased potential for skin contact with contaminants.

3.0 - ASSIGNMENT OF RESPONSIBILITIES

Assignment of responsibilities for development, coordination and implementation of the Standard SSP and site-specific SSP addendum is essential for proper administration of the plan's requirements. Implementation of the Standard SSP and site-specific SSP addendum will be accomplished through an integrated effort of the following Montgomery Watson personnel:

Team Member	Work Assignment	Safety Training
Michael D. Geringer	Health and Safety Coordinator (HSC)	40-Hr Health and Safety 8-Hr First Aid, CPR 8-Hr Supervisory Training
Jeffrey L. Coon	Project Manager (PM)	40-Hr Health and Safety 8-Hr First Aid, CPR 8-Hr Supervisory Training
Keri A. Lewis	Project Engineer/ On-Site Safety Officer (OSO)	40-Hr Health and Safety 8-Hr First Aid, CPR 8-Hr Supervisory Training

3.1 - Project Manager (PM)

The PM is primarily responsible for safety performance of the project and is the central point of contact for Sauer-Sundstrand personnel. Should a health and safety issue develop in the performance of the field activities, the PM will contact the Sauer-Sundstrand personnel assigned to the project and the Montgomery Watson HSC.

3.2 - Health and Safety Coordinator (HSC)

The HSC is responsible for preparation of the Standard SSP and site-specific SSP addendum. The HSC will ensure that the Standard SSP and site-specific SSP addendum comply with OSHA standards and site-specific health and safety requirements based on known or anticipated health and safety concerns. If necessary, the OSO can modify the site-specific SSP addendum to accommodate on-site changes that may affect safety. The OSO will confer with the HSC on all modifications to the site-specific SSP addendum. The HSC will be available for consultation when required. The HSC may visit the site during field activities to perform a site safety audit but will not remain on site throughout the corrective measure implementation. A copy of the Site Safety Checklist is included as Attachment C of the Standard SSP.

3.3 - On-Site Safety Officer (OSO)

The OSO is responsible for the implementation of the site-specific SSP addendum. The OSO has the responsibility and authority to halt or modify any work condition or to remove personnel from the site if he considers conditions to be unsafe. The OSO will be the main contact in any on-site emergency situation and will direct all field activities. The OSO will ensure that all on-site Montgomery Watson personnel understand and comply with site safety requirements. If the OSO observes Montgomery Watson or contractor personnel deviating from standard health and safety practices, an "Incident Report" form (Attachment D of the Standard SSP) will be completed. A copy of the report will be submitted to the HSC and, if applicable, the contractor company. Except for minor changes or emergencies, the OSO can modify the site-specific SSP addendum requirements only after consultation with and approval by the HSC. The OSO or an assigned designee will be on site at all times during field activities to observe and audit the various field work zones throughout the corrective measure implementation.

3.4 - Field Staff

All Montgomery Watson field staff are responsible for understanding and complying with all requirements of the Standard SSP and site-specific SSP addendum. Every morning before the start of field activities, a tailgate safety meeting will be conducted to instruct Montgomery Watson field staff on Standard SSP and site-specific SSP addendum requirements. During this meeting, site safety concerns and questions can be directed to the OSO by field staff. Each worker must sign and date a "Personal Acknowledgment" form (Attachment B) stating that he/she understands the contents of the Standard SSP and site-specific SSP addendum.

3.5 - Notification Requirements

Unanticipated field conditions will occasionally require modifications to the site-specific SSP addendum. Notification and/or approval procedures will be dependent on actual field conditions. Conditions which require an upgrade of one level should be reported to the HSC and recorded on the "Tailgate Safety Meeting Form" (Attachment C). Minor changes not affecting the degree of protection can be implemented by the OSO. These changes will be documented and sufficiently justified in the field log book.

The OSO will stop all field activities and contact the HSC under the following conditions:

1. Any activity requiring an upgrade to Level B protection.

2. Any IDLH activity, as defined by NIOSH.

3. Any proposed entry by Montgomery Watson personnel into a confined space.

4. Any physical hazard where an exposure under reasonable circumstances could lead to possible death or permanent injury.

4.0 - MEDICAL SURVEILLANCE AND TRAINING

4.1 - Emergency Medical Assistance and First-Aid Equipment

Prior to work startup, the OSO will discuss the emergency medical assistance network which has been established for the Sauer-Sundstrand site with all personnel assigned to the site. Locations of phones, fire extinguishers, first-aid kits, emergency telephone numbers, etc., are identified in the "Emergency Assistance Information" form (Attachment D) (pink card stock insert). A map showing directions to the nearest hospital location will be provided to all field personnel. A map to the hospital is included as Figure 4-1 (blue card stock insert). Attachment D and the emergency route map will be clearly posted at each work site. A designated safety vehicle will be on site and available at all times for a medical or safety emergency. The OSO or his designee will be responsible for the availability and use of the safety vehicle.

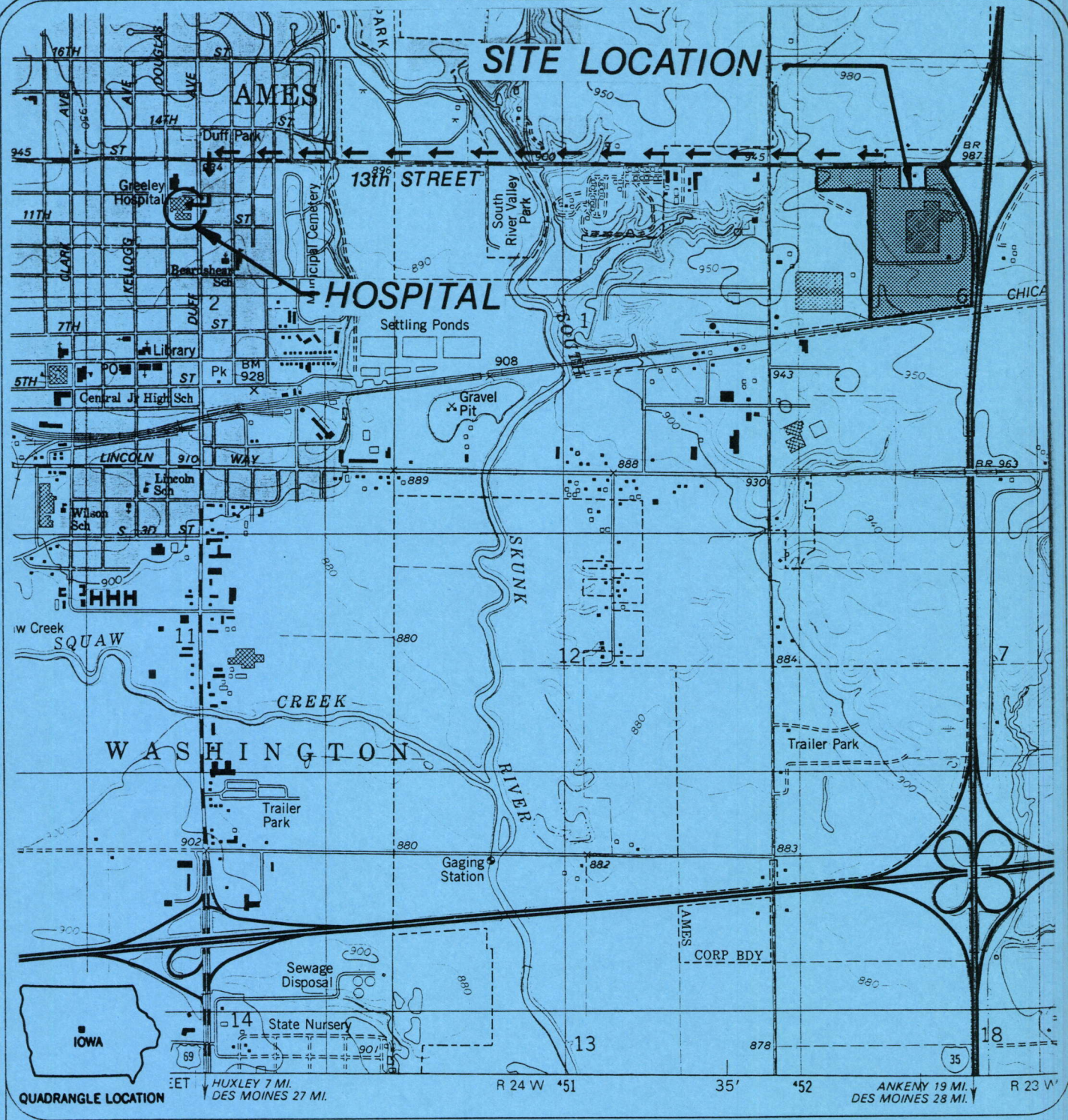
The OSO and key field staff will be certified to render first aid and cardiopulmonary resuscitation (CPR) prior to the initiation of field activities. A first-aid kit will be available at the site for use by trained personnel. An adequate supply of fresh water or a portable emergency eye wash will be available at each work site.

5.0 - SITE CONTROL

Site control requires the establishment of a regulated area, designated work zones, evacuation protocol and site security. Access to the Sauer-Sundstrand facility is restricted by a chain link fence. Montgomery Watson work zones will be secured with pylons or stakes and caution tape to prevent unauthorized access. Containers for disposable personal protective clothing will be positioned at the exit point of the exclusion zone.

6.0 - PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE will be required during the course of the work at the Sauer-Sundstrand site. PPE selection will be based primarily on hazard assessment data and work task requirements. Prior to entry, each working zone will be monitored for potentially hazardous contaminants using a photoionization detector (PID) equipped with a 11.7 eV lamp. The PID will be calibrated on site with the appropriate calibration span gas at the beginning of each work day according to manufacturer instructions. Following calibration, readings for equipment parameters will be recorded using upwind background measurements. During intrusive work, PID readings will be taken in the breathing zone of site workers (2 to 5 feet above the ground). At the end of each



MAP SOURCE: U.S.G.S. 7.5 MINUTE SERIES TOPOGRAPHIC MAP
AMES EAST QUADRANGLE

N

0 2000

SCALE IN FEET

MONTGOMERY WATSON

SAUER–SUNDSTRAND FACILITY
AMES, IOWA

EMERGENCY ROUTE TO HOSPITAL

FIGURE 4–1

BDP

work day, readings will be taken using upwind background measurements to determine calibration variation. All calibration information will be recorded on an "Equipment Calibration" form (Attachment E of the Standard SSP).

If organic vapors are detected in the breathing zone by the PID, a Dräger pump equipped with vinyl chloride Dräger tubes will also be used to monitor the site. Tubes will be pulled in the breathing zone of site workers periodically during completion of the intrusive work.

If open trenches are present during the collection pipe installation, an Exotox 50® Four Gas Detector will be used during excavation activities to evaluate lower explosive levels (LELs) and oxygen levels in and near the excavation.

Dust conditions will be visually monitored by Montgomery Watson personnel.

Based on the site history, the initial level of protection for all field activities will be Level D. Provisions are made in Section 6.2 for upgrading the level of protection to Level C or evacuating the site based upon dust conditions or high levels of organic vapors.

6.1 - Level D PPE

Montgomery Watson personnel working in the exclusion zone shall wear, as a minimum:

- Coveralls made of cotton or disposable, chemical-resistant Tyvek®. Polycoated or SARANEX®-laminated Tyvek® coveralls will be worn where the potential for contact with contaminated liquids exists (seams, arms and leg openings will be secured with duct tape). Protective aprons may be allowed for sampling purposes once sufficient sampling has occurred to evaluate the potential for contaminant exposure. The HSC should be consulted before implementing the use of aprons for sampling.

- Gloves (outer): chemical-resistant, 4-mil, nitrile. When contact with free product or liquid is anticipated, chemical-resistant, 22-mil, nitrile gloves will be worn.

- Gloves (inner): chemical-resistant, 4-mil, nitrile.

- Boots: leather or chemical-resistant; steel-toed (all field activities).

- Hard hat (all field activities).

- Hearing protection when near heavy equipment.

- Safety glasses or goggles (all field activities).

6.2 - Level C PPE

When air monitoring information, dust conditions or previously obtained site information dictates that a particular site be upgraded to a Level C protection area, Montgomery Watson personnel shall wear, as a minimum:

- Full-face or half-face air-purifying respirator equipped with Mine Safety and Health Administration/National Institute for Occupational Safety and Health (MSHA/NIOSH)-approved organic vapor (OV) cartridges if organic vapors are encountered. Highly toxic particulates (HEPA) cartridges (MSHA/NIOSH approved) will be used in conjunction with the respirators if sufficient dust levels are encountered. Safety glasses or goggles will be worn during all field activities when half-face respirators are used.

- Coveralls made of cotton or disposable, chemical-resistant Tyvek®. Polycoated or SARANEX®-laminated Tyvek® coveralls will be worn where the potential for contact with contaminated liquids exists (seams, arm and leg openings will be secured with duct tape). Protective aprons may be allowed for sampling purposes once sufficient sampling has occurred to evaluate the potential for contaminant exposure. The HSC should be consulted before implementing the use of aprons for sampling.

- Gloves (outer): chemical-resistant, 4-mil, nitrile. When contact with free product or liquid is anticipated, chemical-resistant, 22-mil, nitrile gloves will be worn.

- Gloves (inner): chemical-resistant, 4-mil, nitrile.

- Boots: steel-toed with chemical resistant covers (all field activities).

- Hard hat (all field activities).

- Hearing protection when near heavy equipment.

- Safety glasses or goggles if half-face respirator is used.

6.3 - Respirator Selection and Fit Test

The OSO is responsible for verifying that all on-site Montgomery Watson field personnel have been fit-tested for the applicable respirators prior to working in Level C protection at the Sauer-Sundstrand site. Montgomery Watson air-purifying respirator fit test protocol is presented in Attachment F of the Standard SSP. A record documenting the date, size, brand and model number of the air-purifying respirator for each site worker will be maintained by the OSO or HSC. Contact lenses can be worn when using a full-face respirator in the exclusion zone if they are gas permeable or soft lenses. Site workers who wear spectacles and are working in Level C PPE in the exclusion zone will be supplied with spectacles specially designed for respirators.

7.0 - HAZARD ASSESSMENT

Hazard assessment is essential in determining the hazard control measures that need to be implemented during site activities. Hazard assessment is an ongoing process and involves characterization of the chemical, physical, biological and other safety hazards at the site. Identified hazards include: vehicular traffic and busy highway.

7.1 - Site Survey

Prior to initiation of work activities, the OSO shall conduct a site survey to identify safety hazards and determine appropriate control measures. Hazards may include, but are not limited to, underground utilities or storage tanks, product transfer lines, ground traffic, overhead power lines and current weather conditions, such as excessive heat or cold conditions, lightning etc.

7.2 - Air Monitoring

The main objective of atmospheric monitoring is to assess the inhalation and explosion hazards presented to site personnel. During site activities, air monitoring will be conducted using a PID, and Dräger tubes.

7.2.1 - PID. Each work site shall be monitored for organic vapors using a PID equipped with a 11.7 eV lamp as described in Section 6.0. The PID will be checked daily and operated in the 0 to 20 parts per million (ppm) range. Organic vapor levels will be measured upwind of the work zone to determine a background reading on a daily basis. Readings in the breathing zone of site workers (2 to 5 feet above the ground) will be taken every 30 minute intervals, at a minimum. More frequent monitoring will be conducted if elevated readings are recorded. All PID readings will be recorded in a field log book by the OSO or designated Montgomery Watson personnel.

7.2.2 - Dräger Tubes. If organic vapor levels are detected with the PID equipment, vinyl chloride Dräger tubes will be pulled at regular intervals. All vinyl chloride Dräger tube readings will be recorded in the field log book by the OSO or his/her designee.

7.2.3 - Exotox 50®. The excavation area will be continually monitored for LELs and oxygen with an Exotox 50®, as described in Section 6.0. Vapor levels will be measured upwind of the excavation site to determine a background reading. Readings within the work zone, in the breathing zone of the site workers (2 to 5 feet above the ground), will be taken at approximately 15-minute intervals in the unsaturated zone and 30-minute intervals in the saturated zone. During confined space entry activities, Exotox 50® monitoring of the excavation site will be continuous as long as Montgomery Watson personnel are conducting activities within the confined space. All Exotox 50® readings will be recorded in a field log book by the OSO or designated Montgomery Watson personnel.

7.2.4 - Dust. Dust conditions will be visually monitored by Montgomery Watson personnel on a continual basis.

7.3 - Action Levels for Upgrading

7.3.1 - Action Levels for Upgrade to Level C. The decision to upgrade the level of protection will be based on elevated readings of organic vapors and dust conditions. Situations dictating selection of these upgrade levels and the corresponding actions to be taken are as follows:

- When the PID indicates sustained (15 minutes) breathing zone organic vapor concentrations in excess of 5 meter units, the OSO will require the use of air-purifying respirators equipped with OV cartridges until readings in the work zone drop and maintain a level below 5 meter units.

- If vinyl chloride Dräger tube readings exceed 1 ppm, but are less than 5 ppm, respirators equipped with OV cartridges will be donned.

- Should dusty conditions that are irritating to the eyes, nose or throat prevail during field activities, respirators equipped with HEPA cartridges will be donned.

7.3.2 - Action Levels for Ceasing Operations. Situations dictating the ceasing of operations include:

- When the PID indicates sustained (15 minutes) breathing zone organic vapor concentrations exceeding 25 meter units, the designated work zone (exclusion zone) shall be evacuated until the vapor levels have subsided.

- If the TWA of a contaminant exceeds the maximum use concentration (MUC) of the air-purifying respirator cartridge, operations will cease and the work zone will be evacuated. The MUC for OV cartridges is 1,000 ppm.

- If the Exotox 50® indicates percent LELs of flammables in excess of 25 percent, operations will cease and the work zone will be evacuated.

- If the oxygen concentration, as measured by the Exotox 50®, falls below 19.5 percent, or exceeds 23.5 percent, operations will cease and the work zone will be evacuated until the oxygen concentration returns to the 19.5 to 23.5 percent range.

- If vinyl chloride Dräger tube readings exceed 5 ppm, work will cease, workers will leave the exclusion zone, and the HSC will be notified.

- If no air-purifying respirator cartridge is available or protection greater than an air-purifying respirator is recommended by the respirator manufacturer or recognized publications or authorities, operations will cease and the work zone will be evacuated.

- If contaminant levels as measured by the PID reach their corresponding IDLH values, operations will cease and the work zone will be evacuated.

The HSC will be notified of any upgrade in PPE in accordance with Section 3.

ATTACHMENT A

ATTACHMENT A

Environmental/Occupational Health & Safety Manual

SUBJECT: PERMIT REQUIRED CONFINED SPACES

I. PURPOSE

To set forth minimum requirements and procedures for the safety and health of Montgomery Watson employees who work in and about confined spaces.

II. REFERENCES

A. Federal Occupational Safety and Health Agency (OSHA) Standard: Title 29, Code of Federal Regulations, Part 1910.146 "Permit Required Confined Spaces" 1993.

B. Corresponding requirements from various State-administered OSHA programs.

C. American National Standards Institute, ANSIZ117.1-1977.

D. National Institute for Occupational Safety and Health (NIOSH) Criteria Document, "Working in Confined Spaces," December 1979.

E. NIOSH Alert, "Request for Assistance in Preventing Occupational Fatalities in Confined Spaces," January 1986.

III. ATTACHMENTS

A. Entry Permit, "Inspection and Testing for Confined Space Entry"

B. Area Danger Sign

C. Simplified Permit (Ventilation Control)

D. Sewer Entry Procedure

E. Tank Entry Procedure

IV. DISCUSSION

Confined spaces are normally considered to be enclosures having limited means for personnel entry and exit, by reason of location, size or number of openings; and, unfavorable natural ventilation which could contain or produce dangerous air contaminants, flammable or explosive atmospheres, and/or oxygen deficiency.

Confined spaces include, but are not limited to, storage tanks, process or reaction vessels, boilers, pits, silos, vats, degreasers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, trenches, excavations, pumping/lift stations and pipelines.

The multiple hazards associated with entrance and work in confined spaces are capable of causing bodily injury, illness, or death to Montgomery Watson employees. Confined spaces can become unsafe as a result of: (1) possible atmospheric contamination by toxic or flammable vapors; (2) oxygen deficiency (i.e. less than 19.5%); (3) the possibility of liquids, gases, vapors or solids being admitted during occupancy; or (4) physical isolation and engulfment of employees in need of rescue.

This procedure prescribes minimum requirements for safe entry, continued work in, and exit from confined spaces. Additionally, it describes the steps necessary to protect Montgomery Watson personnel from exposure to dangerous air contaminants, explosive atmospheres, and/or oxygen deficiency.

V. DEFINITIONS

A. **Atmosphere** - Gases, vapors, mists, fumes and dusts present within the confined space.

B. **Attendant** - A standby employee who is stationed nearby to the confined space operation. The attendant is familiar with confined space procedures, in recognizing signs of fatigue or overexposures, is in frequent communication with entrants, insures the security of the work site, is authorized to terminate any operations, and is prepared to summon rescue & emergency services.

C. **Authorized Entrants** - An employee who has received special training in confined space procedures, specialized equipment, hazard recognition, and is authorized by the company to enter a permit space.

D. **Confined Space** - A space that

1. Is large enough and so configured that an employee can bodily enter and perform assigned work; AND

2. Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits); AND

3. Is not designed for continuous employee occupancy.

E. **Hazardous Atmosphere** - An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability of self-rescue, injury, or acute illness. This would include:

1. The presence of a flammable gas, vapor, or mist in excess of 10% of the lower explosive level (LEL).

2. Airborne combustible dust at a concentration that exceeds its LEL. (Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less.)

3. Any oxygen concentration below 19.5% or above 23.5%.

4. Any atmospheric condition recognized as immediately dangerous to life and health (IDLH).

5. An atmospheric concentration of any substance above its permissible exposure limit (PEL).

F. **Entry** - Passing through an opening into a permit-required confined space. Entry is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

G. **Entry Supervisor** - The employee assigned the overall responsibility for the safe confined space operation. The entry supervisor must be familiar with the operation and its hazards, must insure that all appropriate tests have been conducted before endorsing the entry form, verify availability of rescue services, control access to the space during operations, and insure continued operational compliance during any transfer of responsibilities/personnel.

H. **Hot Work** - Any work involving burning, welding, or similar fire producing operations, as well as work that produces a source of ignition such as drilling, abrasive blasting and space heating.

I. **IDLH** - Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

J. **Inerting** - Displacement of the atmosphere by a nonreactive gas (such as nitrogen or carbon dioxide) so that the resultant atmosphere is noncombustible. (Note: This procedure produces an IDLH oxygen-deficient atmosphere.)

K. **LEL** - Minimum concentration of a combustible gas, vapor, or mist in air that will ignite if an ignition source is present.

L. **Material Safety Data Sheet (MSDS)** - A document prepared by the manufacturer or importer of a chemical material which lists its fire, physical and health hazards, as well as, recommended workplace controls and personal protective equipment.

M. **Non-Permit Confined Space** - A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

N. **Oxygen Deficiency** - An atmosphere containing less than 19.5 percent oxygen by volume. Normal air contains approximately 21% oxygen. For the purpose of this procedure, any atmosphere containing less than 19.5% oxygen by volume shall be considered oxygen deficient and IDLH.

O. **PEL** - The maximum time weighted average concentration of a substance to which an employee can be exposed 8 hours a day, 5 days a week for a working lifetime, without harmful effects. PELs are established by OSHA.

P. **Permit-Required Confined Space** - A confined space that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere;

2. Contains a material that has the potential for engulfing an entrant;

3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

4. Contains any other recognized serious safety or health hazard.

Q. **Purging** - Method by which gases, vapors, or other airborne contaminants are displaced from a confined space.

VI. PROCEDURE

A. The entry supervisor shall evaluate the workplace for "confined spaces."

1. The permit-required confined spaces (PRCSs) shall be identified.

2. All PRCSs shall be identified with a sign reading: DANGER -- Permit-Required Confined Space, Do Not Enter (Attachment B), or any other method, such as training, or a site identification map.

B. If entry is required into a PRCS, the entry supervisor must insure that the following requirements are met:

1. Written procedure for safe entry must be established. (Refer to Attachment D "Sewer Entry Procedure" and Attachment E "Tank Entry Procedure" for two typical entries at Montgomery Watson.)

2. All equipment referenced in the appropriate written procedures must be provided.

3. Perform the air testing and monitoring.

4. Provide at least one attendant (or as many as needed to adequately cover multiple entry operations).

5. Designate in writing the names of the authorized entrants, attendants, and entry supervisors.

6. Establish a plan for providing rescue and emergency services.

7. Establish an expiration time/date for the PRCS operation.

8. Complete and issue the Entry Permit, and maintain a copy for future reference.

9. Conduct an annual review of the PRCS program, using past completed Entry Permits. Maintain a written record of this.

C. A simplified entry may be employed provided that the entry supervisor determines that the following two conditions are met:

1. Identified hazards are exclusively atmospheric (for example, no direct contact hazards with corrosive liquids, no radiation, mechanical or electrical hazards); AND

2. The atmospheric hazards (actual or potential) can be eliminated by continuous forced air ventilation, as measured from outside the PRCS.

D. The simplified entries into a PRCS noted in "C" above involve the following steps (which require verification from the entry supervisor):

1. Completion of employee training.

2. Removal of entry cover safely, e.g., watch for pressure and explosive potential.

3. Guard opening created by removal of the cover promptly.

4. Test space for oxygen content, LEL, and toxic air contaminants to PEL levels.

5. Provide continuous forced air ventilation insuring a non-hazardous atmosphere.

6. Retest periodically for oxygen content, LEL, and toxic air contaminants.

7. When a hazard is detected:

   a. Leave the confined space.

   b. Reevaluate the site.

c. Correct any deficiencies.

8. Maintain written documentation of the entry (See Attachment C, "Simplified Permit") and include:

   a. Date

   b. Location

   c. Signature

E. If any entry will be made into a PRCS by a contractor employee, a visitor, official, or any regulatory personnel, the entry supervisor must notify that person of the procedures, hazards, and general precautions of the entry.

F. Employee Training

1. Employees assigned to work in or about PRCSs shall have documented training proficiency that includes:

   a. Chemical and physical hazards

   b. Safe work practices and techniques

   c. Testing requirements/Instrumentation

   d. Safety Equipment, including:

      (1) Respiratory protection

      (2) Protective clothing

      (3) Lifelines, harnesses, extraction devices, etc.

   e. Emergency first aid and rescue procedures

   f. Applicable Federal, state and local regulations

   g. This Permit Required Confined Space Procedure

2. A written record will be maintained of the employee's training, including the name of the trainer.

G. Personal Protective Devices

1. Respirators may be required by the entry supervisor to provide protection against varying concentration levels of toxic air contaminants.

   a. All users must be trained as regards the use/limitations of the specific respirator, and be medically qualified as noted in Bulletin VIII-2 ("Respiratory Protection Equipment"), H&S Manual.

   b. All respirators have use limitations; use of the wrong respirator can result in serious injury or death.

2. Hand & Body Protection may be required by the entry supervisor if the PRCS contains any potential chemical, mechanical, or abrasive hazards.

   a. Protective gloves and coveralls must provide chemical resistance from hazardous materials. Refer to Bulletin VIII-5 ("Hand & Body Protection"), H&S Manual.

   b. Secondary exposures to chemicals can occur by use of improperly rated materials, i.e., chemical permeation through glove material.

3. Fall Protection is required during ALL PRCS operations as part of the Non-Entry Rescue Requirements. (Refer to next section, H.4.)

   a. Full-body harness must meet the Class III requirements of OSHA 1926.104 and ANSI A10.14.

   b. Nylon lifeline at least 1/2" in diameter and a minimum breaking strength of 2,650 pounds.

   c. Careful inspection of equipment before and after use is required.

4. Eye & Face Protection may be required by the entry supervisor to protect against chemical, splashing, or mechanical hazards.

   a. Protective glasses, goggles, or face shields must be used within their design limitations. See Bulletin VIII-1 ("Eye & Face Protection"), H&S Manual.

   b. The potential hazard will determine the type of protection to be worn.

H. PRCS Rescue

1. A rescue team must be designated and available for all PRCS entries. The rescue team can be either in-house employees or from an outside service.

2. If in-house employees,

a. Employees must be trained and provided all protective and rescue equipment.

b. Employees must be trained to perform all duties, and receive same training as authorized entrants.

c. Must complete a yearly practice exercise in a simulated/actual PRCS using mannequins or actual persons.

d. Each team member shall have received basic first aid and CPR training in the past. One of the members must be currently certified and available.

3. If outside service,

   a. Entry supervisor must inform rescue service of hazards they may encounter if called.

   b. Entry service must provide rescue service with access to all permit spaces for planning and practice.

4. Non-Entry Rescue Requirements

   Systems or methods to provide non-entry rescue must be in place during all PRCS entries, unless the entry supervisor determines that such systems would increase risks to entrants.

   a. Each entrant must wear a chest or full body harness, with a lifeline attached to a "D" ring located at the center of the entrant's back or above the entrant's head. (Wristlets may be used if the entry supervisor determines that this is the most effective alternative.)

   b. The other end of the lifeline shall be attached to a mechanical device (such as a winch) or fixed point outside the PRCS to begin immediate rescue.

      Mechanical devices are required for entry into vertical permit spaces more than 5 feet deep.

5. MSDSs or similar material must be kept at the worksite and made available to the medical facility treating any exposed entrant.

VII. SUMMARY

Entry into Permit-Required Confined Spaces entails extensive training, specific monitoring, following detailed procedures, and keeping accurate records. This is reflective of the potentially serious exposure hazards, and even fatalities, that can occur during an improper entry.

Therefore, the company requires full compliance with these provisions during all entries into PRCSs. If you have any further questions, or need technical support and training, please contact the Corporate Health & Safety Office at (818)568-6678 in Pasadena.

ENTRY PERMIT

INSPECTIONS AND TESTS FOR ENTRY
INTO PERMIT REQUIRED CONFINED SPACES

Date: _____
Job Number: _____

Client Name/Address: _____
Space to be Entered: _____
Identified Hazards: _____
Authorized Entrants (By Name): _____
Attendants (By Name): _____
Rescue & Emergency Services Provided By: _____
Telephone: _____

PERMIT EXPIRATION

This permit EXPIRES: Time/Date: _____

MONITORING DATA

(Monitor in this order: Oxygen, LEL, Toxicity)

TIME	% OXYGEN (19.5% to 23.5%)	% LEL (<10%)	TOXICITY e.g., hydrogen sulfide 10 ppm; carbon monoxide 35 ppm. (Others in PEL Tables.)

Instrumentation (Serial No./Calibration Date): _____

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE
_____ Chemical Goggles
_____ Face Shield
_____ Safety Glasses

EXTREMITIES
_____ Hard Hat
_____ Gloves (TYPE: _____)
_____ Rubber Boots
_____ Safety Shoes

BODY

_____ Cotton Coveralls
_____ Tyvek® Suite
_____ Coated Tyvek® Suit
_____ Other (_____)

RESPIRATORY

_____ SCBA
_____ Airline (Supplied Air)
_____ Air Supplied w/Egress
_____ Air Purifying, Model: _____
Cartridge Type: _____
_____ Disposable (Brand/Type: _____)

OTHER

_____ Hearing Protection
_____ Full Body Harness w/"D" ring and Lifeline

EMERGENCY EQUIPMENT

_____ Fire Extinguisher. Type: _____ Location: _____
_____ Emergency Eyewash/Shower Facility. Location: _____
_____ Emergency Telephone. Location: _____
_____ Fire/Emergency Alarm. Location: _____

CHECKLIST

	YES	N/A
All lines leading to and from permit required confined space have been blinded or disconnected.	_____	_____
Electrical service disconnected or locked out.	_____	_____
Grounding and bonding wire in place.	_____	_____
Breathing supply and alarms checked and are in proper condition.	_____	_____
The complete respiratory supply system has been checked and is in proper condition.	_____	_____
All safety harnesses and life lines checked and in proper condition. (Mechanical hoisting device required for vertical entries greater than 5 feet deep.)	_____	_____
Required protective clothing (gloves, boots, etc.) being used.	_____	_____
Employees have been trained in the use, care, and limitations of their respiratory protective equipment.	_____	_____
Outside attendant trained in emergency procedures.	_____	_____

All emergency systems such as air packs, fire extinguishers, backup breathing supply, alarms, etc., ready for use. _____ _____

Danger sign posted. _____ _____

Ventilation equipment in use. _____ _____

All electrical equipment listed Class 1, Division 1, Group D and non-sparking tools. _____ _____

SPECIAL INSTRUCTIONS

_____

_____

_____

Completed By: _____ Signature: _____
(Print Name) Date: _____

Entry Supervisor Approval: _____ _____
(If different than above.) (Print Name) (Date)

_____
(Signature)

DANGER

Permit Required Confined Space

Do No Enter!

SIMPLIFIED PERMIT
FOR
PERMIT REQUIRED CONFINED SPACES

Date: _____
Job Number: _____

Client Name/Site Address: _____
Space to be Entered: _____
Identified Hazards: _____

MONITORING DATA
(Monitor in this order: Oxygen, LEL, Toxicity)

TIME	% OXYGEN (19.5% to 23.5%)	% LEL (<10%)	TOXICITY e.g., hydrogen sulfide 10 ppm; carbon monoxide 35 ppm. (Others in PEL Tables.)

PERSONAL PROTECTIVE EQUIPMENT

List: _____

CHECKLIST

	YES	N/A
Safe to remove cover.	_____	_____
Opening guarded.	_____	_____
Space tested for oxygen, LEL, and toxic contaminants.	_____	_____
Provide continuous forced air ventilation.	_____	_____
Retest after ventilation, but prior to entry. (Periodically, as appropriate.)	_____	_____

HAZARD DETECTION

If a hazard is detected: Leave the confined space. Reevaluate the site. Correct any deficiencies.

APPROVAL

Completed By: _____ Signature: _____
(Print Name) Date: _____

Entry Supervisor Approval: _____ _____
(If different than above.) (Print Name) (Date)

_____
(Signature)

SEWER ENTRY PROCEDURE

I. GENERAL DISCUSSION

Sewer entry differs in two vital respects from other permit entries; first, there rarely exists any way to completely isolate the space (a section of a continuous system) to be entered; second, because isolation is not complete, the atmosphere may suddenly and unpredictably become lethally hazardous (toxic, flammable or explosive) from causes beyond the control of the entrant or employer.

A. *Adherence to procedure.*

Montgomery Watson designates as entrants only employees who are thoroughly trained in these sewer entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing sewer entries.

B. *Atmospheric monitoring.*

Entrants should be trained in the use of, and be equipped with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout, whenever one of the following conditions is encountered: oxygen concentration less than 19.5 percent; flammable gas or vapor at 10 percent or more of the lower explosive limit (LEL); or hydrogen sulfide or carbon monoxide at or above their PEL (10 ppm or 35 ppm, respectively); or, if a broad range sensor device is used, at 100 ppm as characterized by its response to its hydrocarbon calibration source. While the oxygen sensor/broad range sensor instrument can be used for sewer entry, substance specific devices should be used whenever actual contaminants have been identified. The instrument should be carried and used by the entrant in sewer line work to monitor the atmosphere in the entrant's environment, and in advance of the entrants' direction of movement, to warn the entrant of any deterioration in atmospheric conditions. Where several entrants are working together in the same immediate location, one instrument, used by the lead entrant, is acceptable.

C. *Entry Coordination.*

Sewer crews should develop and maintain liaison, to the extent possible, with the local weather bureau and fire and emergency services in their area so that sewer work may be delayed or interrupted and entrants withdrawn whenever flammable or other hazardous materials are released into sewers during emergencies by industrial or transportation accidents.

D. *Special Equipment.*

Entry into large bore sewers may require the use of special equipment. Such equipment might include such items as atmosphere monitoring devices with automatic audible alarms, escape self-contained breathing apparatus (ESCBA) with 5 to 10 minutes air supply (or other NIOSH approved self-rescuer), and waterproof flashlights, and may also include boats and rafts, radios and rope stand-offs for pulling around bends and corners as needed.

II. POTENTIAL HAZARDS

The employees could be exposed to the following:

A. *Engulfment.*

B. *Presence of toxic gases.*

Equal to or more than 10 ppm hydrogen sulfide. If the presence of other toxic contaminants is suspected, specific monitoring to its PEL will be conducted.

C. *Presence of explosive/flammable gases.*

Equal to or greater than 10% of the lower explosive limit (LEL).

D. *Oxygen Deficiency.*

A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume.

III. SIMPLIFIED ENTRY REQUIREMENTS

A permit required confined space may be entered without the need for completing an entry permit (Attachment A) or assigning an attendant, if: 1) the space is determined *not* to be a permit required confined space, or 2) the space can be maintained in a safe condition for entry by mechanical ventilation alone. All spaces shall be considered permit-required confined spaces until a pre-entry evaluation demonstrates otherwise.

A Simplified Permit (Attachment C) must be completed by the entry supervisor before entry into these spaces. This simplified permit verifies completion of minimum safety guidelines. If problems are encountered, however, the entrants must be removed, and the permit space re-evaluated.

A. *Pumps and Lines.*

All pumps and lines which may reasonably cause contaminants to flow into the space shall be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of dangerous air contamination or engulfment. Not all laterals to sewers or storm drains require blocking. However, where experience or knowledge of industrial use indicates there is a reasonable potential for contamination

of air or engulfment into an occupied sewer, then all affected laterals shall be blocked. If blocking and/or isolation requires entry into the space, the provisions for entry into a permit-required confined space must be implemented.

B. *Surveillance.*

The surrounding area shall be surveyed to avoid hazards such as drifting vapors from the tanks, piping, or sewers.

C. *Testing.*

The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. An alarm only type gas monitor may be used. Testing shall be performed by the entry supervisor who has successfully completed training for the monitor he/she will use. The minimum parameters to be monitored are oxygen deficiency, LEL, and hydrogen sulfide concentration. The test results shall be recorded on the Simplified Permit and kept at the work site for the duration of the job. The supervisor will certify in writing, based upon the results of the pre-entry testing, that all hazards have been eliminated. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connecting spaces.

D. *Entry Procedures.*

If there are no non-atmospheric hazards present and if the pre-entry tests show there is no dangerous air contamination and/or oxygen deficiency within the space and there is no reason to believe that any is likely to develop, entry into and work within may proceed. **Continuous** testing of the atmosphere in the immediate vicinity of the workers within the space shall be accomplished. Forced air ventilation into the confined space shall be provided at all times during the entry operation. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until the entry supervisor, who has completed the gas detector training, has used a direct reading gas detector to evaluate the situation and has determined that it is safe to enter.

E. *Rescue.*

Arrangements for rescue services are not required for entry into simplified permit spaces.

IV. ENTRY PERMIT REQUIREMENTS

A. *Permits.*

Confined Space Entry Permit. All spaces shall be considered permit-required confined spaces until the pre-entry evaluation demonstrates otherwise. Any

employee required or permitted to pre-check or enter a permit-required confined space shall have successfully completed, at a minimum, the training as required by the following sections of these procedures.

A written copy of this procedure, including specific rescue information as required by these procedures shall be at the work site for the duration of the job. The Confined Space Entry Permit (Attachment A) must be completed before approval can be given to enter a permit-required confined space. This permit verifies completion of items listed below. This permit shall be kept at the job site for the duration of the job.

If circumstances cause an interruption in the work or a change in the alarm conditions for which entry was approved, the employees must be removed immediately from the space, and a new Confined Space Entry Permit must be completed.

B. *Surveillance.*

The surrounding area shall be surveyed to avoid hazards such as drifting vapors from tanks, piping, or sewers.

C. *Testing.*

The confined space atmosphere shall be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. A direct reading gas monitor shall be used. Testing shall be performed by the entry supervisor who has successfully completed the training for the monitoring equipment he/she will use.

The minimum parameters to be monitored are oxygen deficiency, LEL, and hydrogen sulfide concentration. The test results shall be recorded on the Entry Permit, and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results.

The most hazardous conditions shall govern when work is being performed in two adjoining, connected spaces.

D. *Space Ventilation.*

Mechanical ventilation systems, where applicable, shall be set at 100% outside air. Where possible, open additional manholes to increase air circulation. Use portable blowers to augment natural circulation if needed. After a suitable ventilating period, repeat the testing.

Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

E. *Entry Procedures.*

The following procedure shall be observed under any of the following conditions:

- -- Testing demonstrated the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels;
- -- The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop;
- -- It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or
- -- An emergency exists and it is not feasible to wait for pre-entry procedures to take effect.

1. All personnel must be trained.

2. A self contained breathing apparatus shall be worn by any person entering the space.

3. At least one worker shall stand by the outside of the space ready to give assistance in case of emergency.

4. The standby worker shall have a self contained breathing apparatus available for immediate use.

5. There shall be a least one additional worker within sight or call of the standby worker. Continuous powered communications shall be maintained between the worker within the confined space and standby personnel.

6. If at any time there is any questionable action or non-movement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately. Exception: If the worker is disabled due to falling or impact, he/she shall not be removed from the confined space unless there is immediate danger to his/her life.

   Local fire department rescue personnel shall be notified immediately.

7. The standby worker may only enter the confined space in case of an emergency (wearing the self contained breathing apparatus), if previously trained and qualified, and only after being relieved by another worker.

   Safety belt or harness with attached lifeline shall be used by all workers entering the space with the free end of the line secured outside the entry opening.

The standby worker shall attempt to first remove a disabled worker via his lifeline before entering the space.

8. When practical, these spaces shall be entered through side openings--those within 3 1/2 feet (1.07 m) of the bottom. When entry must be through a top opening, the safety belt shall be of the harness type that suspends a person upright and a hoisting device or similar apparatus shall be available for lifting workers out of the space.

9. In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued, if approved by the entry supervisor.

10. When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division 1 rated per National Electrical Code and no ignition sources shall be introduced into the area.

11. Continuous gas monitoring shall be performed during all confined space operations. If alarm conditions change adversely, entry personnel shall exit the confined space and a new confined space permit issued.

F. *Rescue.*

1. Call the fire department services for rescue.

2. Where immediate hazards to injured personnel are present, workers at the site shall implement emergency procedures to fit the situation.

TANK ENTRY PROCEDURE

I. GENERAL DISCUSSION

Workplaces where tank cars, trucks, and trailers, chemical storage tanks, dry bulk tanks and trailers, railroad tank cars and similar tanks are installed, inspected or serviced pose potential confined spaces hazards to employees.

A. Adherence to procedure

Montgomery Watson designates as entrants only employees who are thoroughly trained in these tank entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing tank entries.

B. Atmospheric monitoring

Entrants should be trained in the use of, and be equipped with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout, whenever one of the following conditions is encountered: oxygen concentration less than 19.5 percent; flammable gas or vapor at 10 percent or more of the lower explosive limit (LEL); toxic air contaminant at or above its PEL; or, if a broad range sensor is used, at 100 ppm as characterized by its response to its hydrocarbon calibration source.

While the oxygen sensor/broad range sensor can be used for tank entry, substance specific devices should be used whenever actual contaminants have been identified. Monitoring should be repeated periodically as directed by the entry supervisor.

C. Sources of Hazards

<u>New Tanks/Installations</u>

In addition to the mechanical hazards arising from the risks that an entrant would be injured due to contact with components of the tank or the tools being used, there is also the risk that a worker could be injured by breathing fumes from welding materials or mists or vapors from materials used to coat or clean the tank interior. In addition, many of these vapors and mists are flammable, so the failure to properly ventilate a tank could lead to a fire or explosion.

<u>Servicing/Inspection, Existing Tanks</u>

Tanks which have been in service may contain residues of dangerous materials, whether left over from previous cargoes or generated by chemical or bacterial action on residues of non-hazardous cargoes.

D. Control of Hazards

1. Welding: Local exhaust ventilation shall be used to remove welding fumes once the tank or carrier is completed to the point that workers may enter and exit only through a manhole. (Follow the requirements of 29 CFR 1910, Subpart Q, OSHA's welding standard, at all times.) Welding gas tanks may never be brought into a tank or carrier that is a permit entry confined space.

   Surface materials shall be removed 4 inches or more from any surface area where welding or any torch work will be done and care taken that the atmosphere within the tank remains well below the LEL.

2. Application of interior coatings/linings: Atmospheric hazards shall be controlled by forced air ventilation sufficient to keep the atmospheric concentration of flammable materials below 10% of the lower explosive limit (LEL). The appropriate respirators are provided and shall be used in addition to providing forced ventilation if the forced ventilation does not maintain acceptable respiratory conditions.

II. SIMPLIFIED ENTRY REQUIREMENTS

A permit required confined space may be entered without the need for completing an Entry Permit (Attachment A), or to have an attendant assigned, if: 1) the space is determined not to be a permit required confined space, or 2) the space can be maintained in a safe condition for entry by mechanical ventilation alone. All spaces shall be considered permit required confined spaces until a pre-entry evaluation demonstrates otherwise.

A. A Simplified Permit (Attachment C) must be completed by the entry supervisor before entry into these spaces. This Simplified Permit verifies completion of minimum safety guidelines. If problems are encountered, however, the entrants must be removed, and the space evaluated.

   1. All pumps and lines which may reasonably cause contaminants to flow into the space shall be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of dangerous air contaminants or engulfment. If blocking and/or isolation requires entry into the space, the provisions listed in the Entry Permit (Attachment A) must be followed.

   2. The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen concentration problems exist. Testing shall be performed by the entry supervisor who has successfully competed training for the monitor used. The minimum checks will be for oxygen deficiency/enrichment, LEL, and toxic gases. The test results shall be recorded on the Simplified Permit and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results.

3. If there are no non-atmospheric hazards present and if the pre-entry tests show there is no dangerous air contamination and/or oxygen concentration problems within the space and there is no reason to believe that any is likely to develop, entry into and work within may proceed. Periodic testing, as determined by the entry supervisor, will be completed.

   Forced air ventilation into the confined space shall be provided at all times during the entry operation. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until the entry supervisor determines it is safe to do so.

4. Arrangements for rescue services are not required for entry into simplified permit spaces.

III. ENTRY PERMIT REQUIREMENTS

A. Permits.

The entry supervisor must insure that an Entry Permit (Attachment A) is completed if the space has been classified as a permit required confined space, and cannot be entered using a Simplified Permit (Attachment C). If circumstances cause an interruption in the work or a change in the alarm conditions for which entry was approved, the employees must be removed immediately from the space, and a new Entry Permit completed.

B. Testing.

The confined space atmosphere shall be tested whether dangerous air contamination and/or oxygen concentration problems exist. A direct reading gas monitor shall be used. The test results shall be recorded on the Entry Permit, and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results.

C. Space Ventilation.

Mechanical ventilation systems, where applicable, shall be set at 100% outside air. After a suitable ventilating period, repeat air testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

D. Entry Procedures.

The following procedures shall be observed under any of the following conditions:

-- Testing demonstrated the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels;

-- The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop;

-- It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or

-- An emergency exists and it is not feasible to wait for pre-entry procedures to take effect.

1. All personnel must be trained.

2. A self contained breathing apparatus shall be worn by any person entering the space.

3. At least one worker shall stand by on the outside of the space ready to give assistance in case of emergency.

4. The standby worker shall have a self contained breathing apparatus available for immediate use.

5. There shall be at least one additional worker within sight or call of the standby worker. Continuous communications shall be maintained between the worker in the confined space and standby personnel.

6. If at any time there is any questionable action or non-movement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately. Exception: If the worker is disabled due to falling or impact, he/she shall not be removed from the confined space unless there is immediate danger to his/her life. Local fire department rescue personnel shall be notified immediately.

7. The standby worker may only enter the confined space in case of an emergency (wearing the self contained breathing apparatus), if previously trained and qualified, and only after being relieved by another worker. Safety belt or harness with attached lifeline shall be used by all workers entering the space with the free end of the line secured outside the entry opening. The standby worker shall attempt to first remove a disabled worker via his lifeline before entering the space.

8. When practical, these spaces shall be entered through side openings--those within 3 1/2 feet of the bottom. When entry must be through a top opening, the safety belt shall be of the harness type that suspends a person upright and a hoisting device or similar apparatus shall be available for lifting workers out of the place.

9. In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued, if approved by the entry supervisor. An alternate procedure must be instituted.

10. When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division 1 rated per national Electrical Code and no ignition sources shall be introduced into the area.

11. Continuous gas monitoring shall be performed during all confined space operations. If alarm conditions change adversely, entry personnel shall exit the confined space and a new Entry Permit issued.

E. Rescue

1. Call the fire department services for rescue.

2. Where immediate hazards to injured personnel are present, workers at the site shall implement emergency procedures to fit the situation.

ATTACHMENT B

ATTACHMENT B

PERSONAL ACKNOWLEDGEMENT

As a component of the Site Safety Plan (SSP) designed to provide personnel safety during site activities at the Sauer-Sundstrand facility in Ames, Iowa, you are required to read and understand the standard SSP and site-specific SSP addendum. When you have fulfilled this requirement, please sign and date this "Personal Acknowledgement." Also, provide the requested information pertaining to use of Level C respiratory protection.

Model/Type of Level C Respirator: _____

Date Fit Tested: _____

_____
Signature

_____
Name (Printed)

_____
Date

ATTACHMENT C

ATTACHMENT C

TAILGATE SAFETY MEETING FORM

Date: _____ **Time:** _____ **Job Number:** 8907.0330

Client: Sauer-Sundstrand Company/Sundstrand Corporation **Address:** Ames, IA/Rockford, IL

Site Location: 2800 13th Street, Ames, Iowa

Scope of Work: Water table measurements, soil and groundwater sample collection, and trenching activities.

SAFETY TOPICS PRESENTED

Chemical Hazards:

1. Chemicals of Concern:

   1,1-Dichloroethane, 1,1-dichloroethene, 1,2-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, methylene chloride, tetrachloroethene, 1,1,1-tetrachloroethane, 1,1,2-tetrachloroethane, trichloroethene, and vinyl chloride.

2. Warning properties (Table 2-2 of SSP)

3. PPE Needed:

   - *Trenching Activities:* Steel-toed boots, hard hats, hearing, and eye protection.
   - *Soil Sampling/Handling:* Steel-toed boots, hard hats, eye protection, Tyvek® outer clothing, and 4-mil inner and outer nitrile gloves. Groundwater PPE where the potential for skin contact with contaminants is present.
   - *Groundwater Sampling/Measurements:* Steel-toed boots, hard hats, eye protection, and 4-mil nitrile inner and 22-mil nitrile outer gloves. Polycoated or SARANEX®-laminated Tyvek® protective clothing. Protective apron may be worn subject to HSC's approval.

Physical Hazards:

1. Equipment dangers.
2. Utility lines.
3. Heat/cold stress.
4. Vehicle traffic hazards.
5. Trip, slip, and fall hazards.

6. Work limitations (temperature, weather conditions, light): Work will take place during daylight unless artificial light is provided; work may be postponed due to adverse weather conditions such as lightning, extreme hot or cold temperatures; a sufficient number of breaks will be allowed.

Monitoring:

1. Equipment needed/used: PID and Dräger vinyl chloride monitoring; Exotox 50®; dust conditions will be visually monitored.

2. Chemicals being monitored for: Organic vapors, oxygen, flammables (LELs) and dust.

3. Levels for upgrading:

   - If PID indicates sustained (15 minute) reading of 5 meter units, upgrade to Level C.
   - If Dräger tube readings exceed 1 ppm, but are less than 5 ppm, respirators equipped with OV cartridges will be donned.
   - If Dräger tube readings exceed 5 ppm for vinyl chloride, operations will cease, the work zone will be evacuated, and the HSC will be notified.
   - Should irritating, dusty conditions exist, HEPA cartridges will be used in conjunction with respirators.
   - If the Exotox 50® indicates percent LELs of flammables in excess of 25 percent, operations will cease and the work zone will be evacuated.
   - If the oxygen concentration, as measured by the Exotox 50®, falls below 19.5 percent, or exceeds 23.5 percent; operations will cease and the work zone will be evacuated until the oxygen concentration returns to the 19.5 to 23.5 percent range.
   - If PID indicates sustained reading of 25 meter units; TWA exceeds MUC for respirator cartridges; no respirator is recommended; or IDLH values are reached, evacuate the exclusion zone and notify the HSC.

4. Frequency of readings and logging in field book: PID readings will be taken in the breathing zone of site workers (2 to 5 feet above the ground) during intrusive activities. If organic vapors are detected by the PID, Dräger tubes will be pulled at regular intervals. Exotox 50® readings will be taken during open trenching operations, and if confined space entry is required. All readings will be logged in the field note book.

Special Equipment: Diesel fuel will be brought on-site for fueling of trenching equipment.

Decontamination of Clothing/Equipment:

1. Cleaning solvents used: Alconox®, distilled water.

2. Disposal of clothing/equipment: In sealed plastic bags and on-site dumpster.

Site Control:

1. Location of working zones
2. PPE needed in various zones:
   Level D or C in exclusion zone
   Level D or work clothes in support zone

Other:

- No smoking, eating or drinking in work areas.
- Containers for disposable PPE available at exit point of exclusion zone.

Emergency Procedures:

1. Location of emergency equipment:
   First aid kit, eye wash kit and fire extinguisher located in each field vehicle; extra safety supplies located in field vehicle.
2. Designated safety vehicle
3. Posted emergency information, route to hospital map, chemical symptoms table.

ATTENDEES

Name Printed	Signature

Meeting Conducted By: _____ _____
Name Printed Signature

ATTACHMENT D

ATTACHMENT D

EMERGENCY ASSISTANCE INFORMATION

Sauer-Sundstrand Facility
2800 13th Street
Ames, Iowa

Nearest Hospital

Address

Mary Greeley Medical Center
117 11th Street, Ames, Iowa
Phone: (515) 239-2011

Directions to Hospital*

- Exit site and turn west (left) on East 13th Street; proceed on East 13th Street to Duff Avenue.
- Turn south (left) on Duff Avenue; proceed two blocks to East 11th Street.
- Hospital is on your right.

* See Emergency Route Map supplied with SSP Addendum (Figure 4-1).

Nearest Telephone — Montgomery Watson Field Vehicle

Ambulance, Fire, Police, & Sheriff — Telephone 911

State Highway Patrol — 1 (800) 525-5555

First-Aid Kit, Fire Extinguishers, & Emergency Eye Lavages — Montgomery Watson Field Vehicle

Poison Control — 1 (800) 362-2327

Project Contacts

Montgomery Watson

- Michael D. Geringer
  Health and Safety Coordinator
  (515) 253-0830 (8:00 - 5:00)
  (515) 224-6380 (after hours)
- Jeff L. Coon
  Project Manager
  (515) 253-0830 (8:00 - 5:00)

Client Contact

- Mr. Gary McConnell (515) 239-6631

Regulatory Notification

- IDNR Emergency Response (515) 281-8694
- EPA Spill Response (913) 236-3778

Utilities

- Telephone:
  U.S. West
  1 (800) 954-1211
- Gas Company:
  Iowa Electric
  1 (800) 822-4348
- Electric:
  Ames Utility
  232-5549
- Water and Sewer:
  Ames Utility
  232-5148
- Iowa One Call:
  1 (800) 292-8989

APPENDIX H

OPERATION AND MAINTENANCE MANUAL OUTLINE

I. INTRODUCTION

General Description of Site
General Operation and Maintenance

II. INTERCEPTION TRENCH/SUMP

Trench Drainage Pipe
Sump

III. CONVEYANCE PIPING

Piping
Valves
Sanitary Sewer Connection

IV. EQUIPMENT

Submersible Pump
Level Transmitter
Flow Meter
Heat Tracing
Temperature Sensor
Level Sensor

V. ELECTRICAL

System Power
Pull Boxes
Control System

APPENDICES

Equipment Manuals
Cut Sheets