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**CERTIFIED FOR CONSTRUCTION TECHNICAL SPECIFICATIONS LEACHATE  
CONVEYANCE SYSTEM - ON-SITE DISPOSAL FACILITY, REVISION 0,  
OCTOBER 1996 - (ACTUAL SUBJECT OF LETTER IS TRANSMITTAL OF  
FINAL DESIGNS OF THE OSDF AND LEACHATE CONVEYANCE SYSTEM)**

10/11/96

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DOE-FN        EPAS  
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REPORT

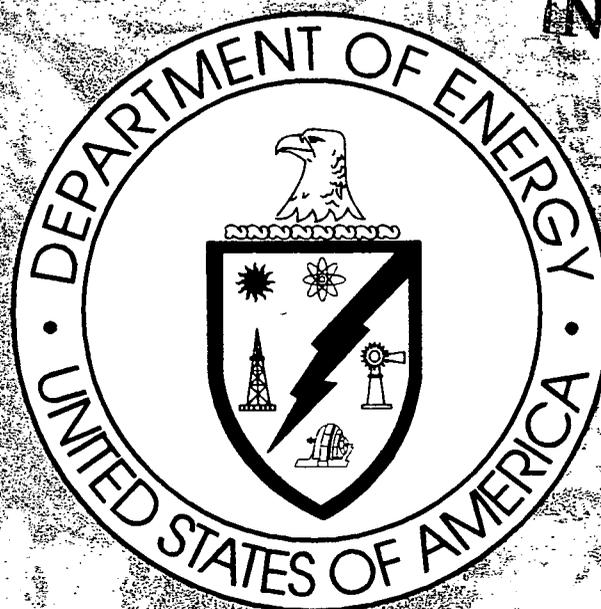
**CERTIFIED FOR CONSTRUCTION  
TECHNICAL SPECIFICATIONS  
LEACHATE CONVEYANCE SYSTEM**

**ON-SITE DISPOSAL FACILITY**

Subcontract No. FSC 589

**REVISION 0  
OCTOBER 1996**

**FOR  
INFORMATION  
ONLY**



**United States Department of Energy  
Fernald Environmental Management Project  
Fernald, Ohio  
(FERMCO Project No. 20100)**

prepared by

**GEO-SYNTEC CONSULTANTS**

1100 Lake Hearn Drive, NE, Suite 200  
Atlanta, Georgia 30342

under

**Fernald Environmental Restoration Management Corporation  
Subcontract 95PS005028**

**Systems Plan  
for the On-Site Disposal Facility  
Leachate Conveyance System**

**FOR  
INFORMATION  
ONLY**

**Operable Unit 2  
Project Order 164  
October 1996  
Revision 0  
Construction Package**

**Environmental Remedial Action Project  
Fernald Environmental Management Project  
Fernald, Ohio  
FDF Subcontract No. 2-21487  
FDF Project No. 20211**



**25 Merchant Street  
Cincinnati, Ohio 45246**

# Systems Plan for the On-Site Disposal Facility Leachate Conveyance System

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**LIST OF ACRONYMS AND ABBREVIATIONS**

AWWT	Advanced Wastewater Treatment
BSL	Biodenitrification Surge Lagoon
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COMH	Clean-Out Manhole
CS	Carbon Steel
FERMCO	Fernald Environmental Restoration Management Corporation
gpm	gallons per minute
HDPE	High-Density Polyethylene
H-O-A	Hands-Off-Auto (selector switch)
NEMA	National Electrical Manufacturers Association
O&M	Operation and Maintenance
OSDF	On-Site Disposal Facility
OU	Operable Unit
PLC	Programmable Logic Controller

## 1.0 INTRODUCTION

The low-level radioactive and Resource Conservation and Recovery Act wastes originating within the Fernald Environmental Management Project property are to be placed in the On-Site Disposal Facility (OSDF). The Leachate Conveyance System supports the OSDF by transferring leachate and stormwater runoff from the OSDF's permanent lift station to the Bionitrification Surge Lagoon (BSL). Existing piping from the BSL to the Advanced Wastewater Treatment (AWWT) Facility conveys the leachate and stormwater to the AWWT for treatment. An alternate emergency bypass line to Catch Basin 130 is provided in the event that flow cannot be routed to the BSL.

## 2.0 SYSTEM DESCRIPTION AND INTENDED PERFORMANCE

The Leachate Conveyance System (see construction drawings and specifications in Appendix A for detailed information) consists of the following:

- 1) **Permanent Lift Station Pumps:** Two 200-gallon-per-minute (gpm) submersible centrifugal pumps are located in the permanent lift station. The pumps are designated as PMP-001 and PMP-002. A 4-inch hose quick-coupling with cap is provided in the lift station at the pumps discharge header for emergency use.
- 2) **Leachate Conveyance Pipeline and Clean-Out Manholes (COMHs):** The leachate and stormwater collected in the lift station is pumped to the BSL through a 4-inch High-Density Polyethylene (HDPE) pipe. This 4-inch HDPE pipe is contained in an 8-inch HDPE pipe buried at a minimum 36-inch depth. At several locations, the 8-inch pipe is contained in a casing pipe as well.

Thirteen manholes are provided in the pipeline at an approximate spacing of 500 feet. The 4-inch carrier pipe in each COMH is constructed of carbon steel. The COMH is constructed of HDPE and acts as a secondary containment. Leak detection is provided by visual observation. Each COMH, with the exception of COMH-1 and COMH-11 which are meter manholes, is provided with a 4-inch gate valve and a 4-inch threaded nipple to permit draining and cleaning of the piping.

COMH-4 also contains a tee connection to the emergency by-pass line to Catch Basin 130; one 4-inch gate valve is provided in the line to the catch basin and one 4-inch gate valve is provided in the line to the BSL downstream of the tee. From this tee, the line to the catch basin continues as a 4-inch HDPE pipe in an 8-inch buried HDPE pipe.

Upstream of COMH-7, a 4-inch tee and blind flange are provided for possible future use as a connection to the AWWT.

Between COMH-7 and COMH-12, the Leachate Conveyance pipeline may be co-located with a 6-inch treated water line and a 6-inch fuel gas line. The treated water and fuel gas lines, if installed, will run from the vicinity of the AWWT to the Operable Unit 1 (OU-1) area.

Near the top of the berm at the BSL, the pipeline comes out of the ground and continues above ground into the BSL. The above-grade pipeline into the BSL is made of 4-inch carbon steel (CS) carrier pipe with an 8-inch CS containment pipe. Above-grade piping is heat-traced and insulated. Discharge into the BSL will occur over a fabri-form splash apron.

- 3) Meter Manholes: COMH-1 and COMH-11 function as meter manholes. Two meters are provided to detect leaks in the piping system through a difference in the meter flow rates and to measure total flow into the BSL. Each meter manhole houses a flow rate transmitter and manual shut-off valves (a gate valve upstream of each meter and downstream of the first meter, and a ball valve downstream of the second meter). One 1/2-inch gate valve is provided in each meter manhole for use as a drain and to collect samples for periodic monitoring of leachate/stormwater quality. The meter manholes do not contain provisions for clean-out of the piping.

## **3.0 OPERATION**

### **3.1 Description of Equipment**

Electrical power at 480 volts, three phase, is supplied to each sump pump via buried cable in conduit. The power source is a 100 amp disconnect switch located near the permanent lift station (by others).

Electrical controls at the pump station include a pump Hand-Off-Auto (H-O-A) selector switch. During maintenance, the pump(s) may be run manually by placing the selector switch in "HAND" position. This will bypass the level controls and the pump will continue to run until switched off, regardless of level. Motor overloads in the starter, and motor internal protection consisting of a moisture sensor and a winding temperature sensor will still protect the motor.

The pumps are electric motor-driven, submersible centrifugal pumps with cast iron impellers, cast iron housing, stainless steel shafts, and double mechanical seals. The pumps are designed for guide rail (pipe or cable) installation. Gate and ball valves are manually operated type, and check valves are swing type.

A 480 volt, three pole, main fused disconnect switch is located near the permanent lift station. This switch may be used to disconnect all electrical power to the pump starters and local 120 volt distribution transformer/panel.

All electrical equipment enclosures are rated National Electrical Manufacturers Association (NEMA) 4 and are located on an equipment rack at the permanent lift station. A 10 KVA, 480-120/240V, single-

phase transformer/distribution panel is provided with ten 20 amp branch circuits. These provide 120 volt power for level controls, lighting, and local duplex receptacle.

The sump pump duplex motor starter is located on the equipment rack. It is furnished with dual 120V control transformers, H-O-A selector switches, "run" indicating lights, and total run time meters.

Submersible pump power and control cables are furnished with pump and cable entry seal design to ensure a watertight and submersible seal.

### **3.2 Pre-Start-Up Check**

Before the system is started, the following checks shall be performed by Fernald Environmental Restoration Management Corporation (FERMCO):

- 1) Check the construction acceptance documents to ensure that every component is constructed according to the plans and specifications, and acknowledge acceptance.
- 2) Check the accuracy of the documents for all applicable and relevant functional technical tests (shop or field) for the electrical, mechanical, and instrumentation equipment, and acknowledge acceptance.
- 3) Make sure that all relevant site-specific procedural requirements, permits, and coordinations are complete.

Pre-start-up tests shall be performed in the following order: (1) electrical, (2) mechanical, and (3) instrumentation. The following tests (involving opening of electrical panels, as well as operation and voltage testing of electrical panels) shall be performed by FERMCO:

#### **3.2.1 Electrical**

- 1) Visually inspect the electrical installation and equipment, noting completion of construction. Ensure that there is no loose or exposed accessible wiring, that equipment ground is installed, and that conduit fitting covers are in place.
- 2) The overhead feeder line should be energized. Check voltage at the disconnect switch. Voltage should measure a minimum of 460 volts between phases.
- 3) Visually inspect the interior of the starter for completion of installation, including control transformer, control relay, lights, and H-O-A switch. Verify installation of motor overload heaters sized in accordance with the pump manufacturer's instructions.

- 4) Verify installation of 100-amp fuses in main disconnect switch. Throw the switch to the "ON" position to supply power to the starter and distribution transformer/panel.
- 5) Switch on the distribution panel main circuit breaker, secondary main breaker, and branch circuit breakers for the light and receptacles. Verify 120 volts available at receptacles, with correct polarity and grounding. Verify operation of Ground Fault Circuit Interrupter circuit breakers.
- 6) Cover the photocell on the light fixture to check operation of the lamp.

### 3.2.2 Mechanical

- 1) Visually inspect the mechanical installation and equipment, noting completion of construction.
- 2) Position the manual valves as shown below:

Table 3-1 - Manual Valve Operating Positions

Valve No.	Location	Initial Position
V098	Permanent Lift Station	N/A (check valve)
V099	Permanent Lift Station	N/A (check valve)
V100	Permanent Lift Station	Open
V101	Permanent Lift Station	Open
V102 through V105, V108 through V113, V119	COMH-1A through COMH-10, COMH-12	Closed
V106	COMH-4	Open
V107	COMH-4	Closed
V116	COMH-11 (Meter Manhole)	Open
V117	COMH-11 (Meter Manhole)	Open
V118	COMH-11 (Meter Manhole)	Closed
V120	COMH-5	Open
V121	COMH-1 (Meter Manhole)	Open
V122	COMH-1 (Meter Manhole)	Open
V123	COMH-1 (Meter Manhole)	Closed

### 3.2.3 Instrumentation

#### Flow Meter Transmitter Calibration

After verifying that the electrical and mechanical portions of the pre-start-up checks have been completed, proceed with the following (see Instrument manufacturer instructions for mag-flow meter):

- 1) Check the flow meter (FIT012A) for a calibration sticker. The information that is to appear on the sticker is the date of calibration, the next scheduled date of calibration, and the signature of the person performing the calibration. If the calibration sticker information is not complete, continue with the next step; otherwise, the calibration is complete.
- 2) Calibrate the flow meter FIT012A according to the manufacturer's instructions.
- 3) Calibrate the transmitter so that 1 pulse to 300 pulse corresponds to 1 to 300 gpm.
- 4) Check the frequency pulse receiver for calibration documents per the manufacturer's standard procedure, such as 1 pulse to 300 pulse corresponds to 4 to 20 mA.
- 5) Check the pulse to pulse transmitter and receiver for pulse input and output specification per the manufacturer's standard procedure.
- 6) Check the lightning arrester installation per the manufacturer's standard procedure.
- 7) Fill in the information on the calibration sticker and affix it to the flow meter.
- 8) Repeat Steps 1 through 7 for the second flow meter (FIT012B).

#### Programmable Logic Controller (PLC)

- 1) Verify that 1-day test in the PLC specification section has been satisfactorily completed.
- 2) Verify that the status lights indicate in accordance with the manufacturer's instructions.

#### Flow Chart Recorder Calibration

- 1) Calibrate the flow chart recorder FIR012B according to the manufacturer's instructions.

### **3.3 Normal Start-Up**

The following are the steps needed for a normal start-up of the Leachate Conveyance System. The steps should be followed in the order listed.

#### **3.3.1 Electrical**

FERMCO lockout/tagout procedures shall be followed during the testing phases of construction to safeguard personnel from electrical hazards. Construction acceptance testing shall be witnessed and documented by the FERMCO Quality Assurance/Quality Control Department.

**NOTE:** To prevent operation of the pump during the following tests 1 through 4, temporarily disconnect power leads to the pump motor at the contactor terminals or remove overload heaters (see Drawing 92X-5900-E-00324).

- 1) Throw the fused disconnect switch to the "ON" position, applying power to the starter and associated control circuits. Verify that the correct voltage is present.
- 2) Turn the H-O-A switch for PMP-002 to "OFF." Turn the H-O-A switch for PMP-001 to the "HAND" position. Verify that the main contactor energizes and that the "PUMP RUNNING" indicating light is on. Repeat Step 2 for PMP-002.
- 3) The pumps are equipped with internal thermal and moisture detectors. Disconnect the control wires at the terminal block for PMP-001, one wire at a time to verify continuity through these circuits. Repeat Step 3 for PMP-002.
- 4) Disconnect the power via the fused disconnect switch and reinstall the motor wiring or heater elements for normal operation of the pumps.
- 5) With water in the sump, operate PMP-001 in the "HAND" position and verify pump operation, checking for correct rotation and any abnormal operation or vibration. Repeat Step 5 for PMP-002.

#### **3.3.2 Mechanical**

- 1) Fill the permanent lift station wet well with clean water to approximately midway between the low-level stop and high-level start positions. Verify that both PMP-001 and PMP-002 H-O-A selector switches are in the "OFF" position.

- 2) Turn the PMP-001 H-O-A selector switch to "HAND" and observe the following:
  - (1) Check the pump for normal operation without unusual sounds.
  - (2) Check for leakage at the discharge elbow connection.
- 3) Turn the PMP-001 H-O-A selector switch to "OFF" if any unusual conditions are observed. If the pump is running normally, stop it when the water level reaches the low-level stop. Correct any problems encountered before proceeding further with the start-up.
- 4) Reset the PMP-001 H-O-A selector switch to "AUTO" and refill the sump with water. Check to see that the pump starts properly at the high-level start position and stops at the low-level stop position.
- 5) Repeat Step 4 until flow is observed at the meter. Adjust Valve V-117 until approximately 200 gpm is flowing.
- 6) Repeat Steps 1 through 5 for PMP-002.
- 7) Place the PMP-001 and PMP-002 H-O-A selector switches in "AUTO."
- 8) Refill the sump with water. Note which pump starts at the high-level start position. Verify that the pump stops properly at the low-level stop position.
- 9) Refill the sump with water. Verify that the alternate pump starts. If PMP-001 started in Step 8, verify that PMP-002 starts; if PMP-002 started in Step 8, verify that PMP-001 starts.
- 10) Working with the equipment subcontractor, perform acceptance operating tests to demonstrate the ability of PMP-001 and PMP-002 to meet the full range of operating flow rates and operating points as shown on pump curves.

### **3.3.3 Instrumentation**

When one pump is operating in a steady-state condition, verify that the local and remote flow indicators FIT012A and FI012A all read the same value, plus or minus 1 percent. Verify that the local and remote flow indicators FIT012B, FI012B, and FIR012B all read the same value, plus or minus 1 percent. Also verify that the 012A and 012B series indicators all read the same value, plus or minus 2 percent. If not, do the following:

- 1) Check the phone line according to the phone company standard procedure.

- 2) Check steps 1, 2, 3, and 4 of Flow Meter Transmitter Calibration according to Subsection 3.2.3 of this document.
- 3) Check step 1 of Flow Chart Recorder Calibration according to Subsection 3.2.3 of this document.
- 4) Send the frequency pulse receiver to the manufacturer for recalibration.

Verify that the PLC status lights indicate in accordance with the manufacturer's instructions.

### **3.4 Normal Shutdown**

At the successful completion of the above tests and checks, turn all the switches and controls to the "OFF" position.

### **3.5 System Operation**

During leachate collection, the pumps will be operated with the local pump H-O-A selector switches set in the "AUTO" position. Pump start will be automatically initiated by water level in accordance with the wet well level controls provided by others. The level control signal completes the circuit to the starter contactor, starting the pump. The circuit is maintained until a low level signal is received from the level controls, which drops out the relay and the starter contactor. Operation of the pump is indicated by a red "run" indicating light. Total run time is registered on a meter for each pump.

Automatic pump start is also controlled by the sequence alternator relay. The alternate pump will be started in each pumping cycle (i.e., first PMP-001, then PMP-002, then PMP-001 again). If one pump is running and its disconnect switch is opened, an overload relay trips, or the starter is de-energized for any reason, the other pump will be automatically started.

- 1) The pumps will normally be set in automatic operation by the local pump H-O-A selector switches, which will allow the pumps to cycle on and off under control of the wet well water level controls. Table 3-1 lists the positions in which the manual valves should be.

### 3.6 Potential Operating Problems

1) Description and Remedy:

**Caution:** Comply with current lockout/tagout procedures before attempting a remedy.

<u>Problem</u>	<u>Result</u>	<u>Remedy</u>
Pump fails to start	Wet well fills to high level alarm point	1) Refer to vendor Operations and Maintenance (O&M) Manual. 2) Check if 480 volt power is energized. 3) Check selector switch position. 4) Check for tripped overload relay. 5) Check continuity of motor internal protection circuits (repair motor). 6) Check/repair level controls.
Pump fails to stop	Pump runs dry	1) Refer to vendor O&M Manual. 2) Check selector switch position. 3) Check/repair level controls. 4) Check contactor for welded contacts.
Pump discharge header check valve leaks	Wet well refills quickly after pump stops, resulting in frequent cycling of pump.	Remove and repair or replace valve.
Drain valve leaks	Water in manhole	Remove and repair or replace valve.
Pipeline plugs	1) No flow to BSL  2) Pump deadheads	1) Determine where plug is located by opening the drain valves located in the cleanout manholes in successive order. Drain leachate to a tank truck and transport to AWWT for treatment. 2) Clean out pipeline from appropriate clean-out manhole.
Flow meter malfunctions	No flow indication when there is known to be a flow, or loop cannot pass recalibration.	1) Refer to vendor O&M Manual. 2) Repair or replace meter.

<u>Problem</u>	<u>Result</u>	<u>Remedy</u>
BSL fills over top	Leachate is released.	Turn pumps off or send flow to SWRB/catch basin 130 by use of valves in COMH-4. Pump flow must be throttled to maintain satisfactory pump operation.
Signal wire broken or termination is bad	Flow rate meter and totalizer provide erroneous or sporadic readings.	Disconnect wires and check for conductivity. Replace signal wire if no conductance; otherwise, remake terminations.
Leak in leachate conveyance pipeline	Difference in flow rates of two flow meters, alarm condition then pump shutdown if leak rate increases.	Determine affected section by examining each manhole for leachate/stormwater. Repair the damaged/failed piping or components. Re-start the pump and verify consistent flow rates of input and output flow meters.

### **3.7 Maintenance**

- 1) Valves: Follow procedures given in current applicable maintenance work instructions.
- 2) Pumps: Refer to pump vendor O&M manuals and current applicable maintenance work instructions.
- 3) Meters: Refer to meter vendor O&M manuals.

### **3.8 Spare Parts**

- 1) One set of recommended pump and meter spare parts per vendor O&M manuals
- 2) One each 4-inch check valve, 4-inch gate valve, 4-inch ball valve, and 1/2-inch gate valve

## **4.0 O&M ACTIVITIES, RECORDS, AND REPORTS**

Table 4-1 provides a list of operation and maintenance activities, calibration activities, and records and reports associated with the Leachate Conveyance System, peripheral monitoring, safety, and regulatory compliance. The frequency of each activity is also included in the table. Further details on maintenance and calibration frequencies associated with system equipment are provided in Tables 4-2 and 4-3, respectively. Refer to Appendix B for vendor-recommended maintenance and calibration procedures.

Fernald Environmental Restoration Management Corporation will maintain copies of all pertinent records and reports.

Table 4-1 - Summary of O&M Records and Reports

<b>Report</b>	<b>Frequency</b>
<b>Maintenance and Calibration</b>	
Pump Inspection Report	Annually
Piping Inspection Report	Annually
Valve System Inspection Report	Annually
Equipment Calibration	See Table 4-3
<b>Other Monitoring</b>	
Check Sumps for Sediment*	Quarterly
Testing Total Uranium**	Quarterly
Testing for Total Suspended Solids**	Quarterly
<b>Regulatory Compliance</b>	
Compliance Monitoring Record	See Performance and Compliance Monitoring Plan

\* Sediment to be removed and transferred to OU-2 sediment stockpile at OU-5 stockpile area next to the Stormwater Retention Basin.

\*\* Perform testing in accordance with Sitewide CERCLA Quality Assurance Project Plan.

Table 4-2 - Equipment Maintenance Schedule

Item	Maintenance Schedule
Pumps	Inspect annually per MWI PCP100*
Flow Meters	Semi-annually
Control Panel	Annually
Main Disconnect Switch and Starter	Inspect monthly for moisture
Indicating Lights	"Push-to-test" monthly
Motor Starters	Annually
Motor Controls	Annually
Main Disconnect Switch	Monthly
PLC	Semi-annually or in accordance with manufacturer's instructions
Chart Recorder	Change chart paper once every 7 days

\*A sample copy of MWI PCP-100 is included in Appendix C.

Table 4-3 - Equipment Calibration Schedule

Item	Frequency
Flow Meters	Semi-annually, or in accordance with manufacturer's instructions

**APPENDIX A**

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**CONSTRUCTION DRAWINGS AND SPECIFICATIONS**

*Construction Drawings and Specifications are to be supplied later  
with the Revision 0 issue of this document.*

**APPENDIX B**

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**VENDOR MANUALS**

*Vendor O&M manuals (including spare parts lists, equipment model, and serial numbers) and manufacturer addresses and phone numbers to be supplied later (following procurement).*

APPENDIX C

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SAMPLE COPY OF MWI PCP-100

*Sample copy of MWI PCP-100 to be supplied by FERMCO.*

**CERTIFIED FOR CONSTRUCTION  
TECHNICAL SPECIFICATIONS**

**LEACHATE CONVEYANCE SYSTEM  
Subcontract No. FSC 589**

**Revision 0  
October 1996**

**United States Department of Energy**

**Fernald Environmental Management Project  
Fernald, Ohio  
(FERMCO Project No. 20100)**

*Prepared by*

**GeoSyntec Consultants  
1100 Lake Hearn Drive, NE, Suite 200  
Atlanta, Georgia 30342**

*Under*

**Fernald Environmental Restoration Management Corporation  
Subcontract 95PS005028**

**LEACHATE CONVEYANCE SYSTEM  
SPECIFICATIONS PACKAGE  
ON-SITE DISPOSAL FACILITY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

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- Section 02300 - Boring and Jacking
- Section 02605 - High Density Polyethylene (HDPE) Manholes, Pipes,  
and Fittings
- Section 02831 - Chain-Link Fences and Gates
- Section 02930 - Vegetation

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- Section 03100 - Concrete

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- Section 16170 - Grounding and Bonding
- Section 16370 - Overhead Power Distribution
- Section 16462 - Dry Type Transformer/Panelboards

**SECTION 02100****SURVEYING****PART 1 GENERAL****1.01 SCOPE**

- A. This section describes the requirements for surveying, including:
1. Establishing temporary control benchmarks.
  2. Establishing a horizontal and vertical project control system based on the existing monuments.
  3. Surveys for quantity determinations.
  4. Setting limits and boundaries of construction activities.
  5. Conducting topographic surveys as required to periodically determine amount of work performed for periodic progress payments and final payment prior to Subcontract completion.
  6. Preparing and furnishing as-built drawings.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02110 - Clearing, Grubbing, and Stripping
- B. Section 02200 - Earthwork
- C. Section 02215 - Trenching and Backfilling
- D. Section 02270 - Erosion and Sediment Control
- E. Section 02300 - Boring and Jacking
- F. Section 02605 - High Density Polyethylene (HDPE) Manholes, Pipes, and Fittings
- G. Section 02831 - Chain-Link Fence and Gates
- H. Construction Quality Assurance (CQA) Plan.

### 1.03 REFERENCES

- A. National Geodetic Survey Standards.

### 1.04 QUALIFICATIONS

- A. A Land Surveyor licensed in the State of Ohio shall provide oversight. Staking shall be in accordance with accepted surveying practices, provisions herein, and subject to Construction Manager review.
- B. Surveying work shall be under the direct supervision of a person who has a least 5 years of experience in construction surveying. Any work performed in referencing or re-establishment of land or United States survey monuments shall be stamped and certified by an Ohio-licensed land surveyor.

### 1.05 SUBMITTALS

- A. Submit the following to the Construction Manager for review within 15 calendar days from Notice to Proceed:
  - 1. Ohio surveyor's license;
  - 2. periodic deliverable data (deliver to Construction Manager, as completed, during project):
    - a. reduced and checked field notes,
    - b. all drawings and sketches, and
    - c. electronic files in DXF format or Construction Manager approved electronic files.
  - 3. manner of notation; approved notation shall be consistently applied to all project survey work; the stake marking format and the fieldbook notation shall be compatible.
- B. One complete set of as-built (i.e., "record") survey drawings certified and stamped by a Surveyor licensed in the State of Ohio shall be submitted to the Construction Manager within 15 days of completion of the project. The Subcontractor shall also provide the Construction Manager with an electronic file in DXF format or a Construction Manager approved electronic file upon final submittal of the record drawings. Three (3) copies of the certified survey record drawings will be required.

**1.06 PROJECT RECORD DOCUMENTS**

- A. Maintain on site, a complete, accurate survey log documenting survey work as it progresses.
- B. Maintain on-site, a plan clearly showing all site reference points, survey control points, and benchmarks.
- C. Maintain on-sites an accurate and current set of marked-up drawings showing "as-built" conditions.
- D. Upon completion of each work item as specified in Part 3, prepare and/or update "as-built" drawing.

**PART 2 PRODUCTS****2.01 MATERIALS AND SURVEY INSTRUMENTS**

- A. Provide materials as required to properly perform the surveys, including, but not limited to, instruments, tapes, rods, measures, mounts, and tripods, stakes and hubs, nails, ribbons, other reference markers, and all else as required.
- B. Survey instruments shall be calibrated and maintained in accurate calibration throughout the execution of the subcontract. The survey instruments used for this work shall be precise and accurate to meet the needs of the project. All survey instruments should be capable of reading to a precision of 0.001 ft and with a setting accuracy of  $\pm 0.8$  seconds.

**PART 3 EXECUTION****3.01 GENERAL**

- A. Maintain accurate and complete notes of surveys:
  - 1. Handwritten survey notes and information shall be written with lead pencil(s) and entered in "write-in-rain" notebooks. A copy of the numbered, dated, and signed field book pages shall be given to the Subcontractor daily for use in checking the work.

2. Electronically collected field survey information shall be collected and backup equipment shall be available in the event of equipment malfunction.
  - a. Electronic format for printed output of data collector field survey notes shall be compatible with the approved fieldbook notation format.
  - b. Electronic format for printed output of data collector field work shall be compatible with the Subcontractor's and Construction Manager's computer equipment and software for verifying and checking the work. A copy of the data disk shall be submitted to the Construction Manager weekly.
  
- B. During construction of the Leachate Conveyance System, survey notes shall be retained by the Subcontractor and Surveyor. During construction of the Leachate Conveyance System, the Subcontractor and/or Surveyor shall submit surveys to the Construction Manager for review. Prior to the placement of successive soil layers the Subcontractor shall submit a written statement certifying compliance of the preceding layer thickness and grades to the Construction Manager. Surveys will be required from the Subcontractor prior to approval for the placement for overlying materials by the Construction Manager.
  
- C. The precision of horizontal and vertical controls shall meet or exceed Third-Order Class I and Third-Order accuracies respectively, as defined by National Geodetic Survey Standards.
  
- D. Conformance check surveys for elevation and for horizontal coordinates shall be recorded to the nearest 0.01 ft and for angles shall be to the nearest 20 seconds.
  
- E. Measurement and payment surveys for elevation and for horizontal distances shall be recorded to the nearest 0.1 ft  $\pm$  0.05 ft.
  
- F. Final "as-built" drawings shall be certified for procedure and accuracy of work and sealed by the Land Surveyor.
  
- G. Perform construction layout surveys in advance of scheduled construction activities. At completion of a survey, provide a copy of the field notes, drawings, or sketches to the Construction Manager for review. The Subcontractor shall allow the CQC Consultant and/or Construction Manager one calendar day for review. The Subcontractor is responsible for rework and/or construction delays caused by survey or staking errors.
  
- H. Set slope stakes in accordance with accepted surveying practices.

- I. Set grade stakes required for construction activities as the work progresses. Set fine grade stakes on all surfaces for which the plans show a definite grade line.
- J. Upon completion of the work, the Subcontractor shall provide the Construction Manager with all original surveying field notes, layouts, computations, and electronic files in standard bound survey notebooks, binders containing electronic file information and two copies each of electronic files compatible with the Construction Manager's computer equipment and software.
- K. Protect survey control points. Replace disturbed survey control points at no additional cost.

### 3.02 SPECIFIC FIELD REQUIREMENTS

- A. Establish temporary control points, as necessary, to support construction work activities.
- B. Survey Monuments, Accuracy, and Documentation:
  - 1. Record the following information in survey notebooks for each control point established:
    - a. designation of control point;
    - b. state planar North American Datum (NAD), 1983 Ohio South;
    - c. elevation;
    - d. date of establishment;
    - e. description and sketch of the control point location; and
    - f. control points shall be referenced to a minimum of three features that can be seen from the control point.
  - 2. Document survey work in field notebooks using the format and procedures described below:
    - a. title and consecutive number on the front cover;
    - b. consecutively numbered pages;
    - c. table of contents, indicated by survey task, on the first numbered page;
    - d. legend indicating symbols used in survey notes;
    - e. names of survey team members for each task;
    - f. notes on weather, equipment, etc.;
    - g. date and time on each page to indicate when work was performed;
    - h. notes in a uniform character such that they can be interpreted and used by anyone with survey knowledge; and
    - i. description and/or sketches of the existing survey control used.

C. Preliminary Surveys:

1. Clearing Limit Staking: Stake clearing limits according to the minimum limits identified on the Construction Drawings. Clearing limits stakes shall be flagged and the lathe marked "clearing limits".
2. Alignment and Existing Ground Staking: Following clearing operations and before stripping operations begin, preliminary locations of alignments and/or baseline of project features shall be established. Perform topographic surveys to describe original ground features before stripping or excavation begins. The distance between grid points shall not exceed 50 feet, and all breaks shall be noted.
3. Earthwork Staking: Staking for cut and fill limits shall establish the exterior limits of excavations and embankments. The maximum staking interval shall be 50 feet. Stakes shall be prominently noted with description of point, vertical distance to design elevation, and offset distance as applicable. A brightly flagged 4-foot lathe shall be provided with each stake. Flagging color will be designated by the Subcontractor.

D. Final Surveys:

1. Final topography shall be staked at nominal 50-foot intervals. Additionally, the following points shall be staked and noted as applicable.
  - a. Grade breaks.
  - b. Points of horizontal curvature and tangency.
  - c. Points of stationing equation.
2. Structures: Stake structure centerlines or building lines so that the orientation, position, limits, and foundation elevation(s) are positively identified. Mark stakes to reflect the design elevation and offset distance as applicable.
3. Ditches and Channels: Stake ditches and channels such that the layout remains undisturbed during construction.

**3.03 SURVEYS FOR MEASUREMENT AND PAYMENT**

- A. Perform surveys to determine quantities of work and percent of completed work.
- B. Calculate and certify quantities and submit survey results, calculations, and certification to the Construction Manager for review, evaluation, and payment.

**3.04 SURVEYS FOR CONFORMANCE CHECKS AND "AS-BUILT" DOCUMENTS**

- A. Survey the following surfaces to verify the lines and grades achieved during soil placement and compaction:

1. for berms, ditches, roads, and other earthwork:
  - a. original grade surface;
  - b. compacted surface of cut slopes; and
  - c. finished grade surface;
  
- B. Perform conformance check "as-built" surveying immediately upon completion of a given installation to facilitate progress and avoid delaying commencement of the next installation. Provide the following minimum spacings and locations for survey points:
  1. surfaces with gradients less than 10 percent, survey on a square grid spaced not wider than 50 ft;
  2. on slopes greater than 10 percent, a square grid spaced not wider than 50 ft shall be used, but in any case, a line at the crest, midpoint, and toe of the slope shall be taken;
  3. a line of survey points spaced not more than 50 ft apart shall be taken along any slope break (this will include the inside edge and outside edge of any bench on a slope);
  4. a line of survey points spaced not more than 50 ft apart shall be taken at the top of any pipes or other appurtenances;
  5. pipe terminations as shown on the Construction Drawings;
  6. at the invert of temporary gravity line cleanouts; and
  7. at the base of the LCS and LDS manholes, and the permanent lift station locations shown on the Construction Drawings.

[END OF SECTION]

**SECTION 02110****CLEARING, GRUBBING, AND STRIPPING****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes clearing, grubbing, and stripping from impacted and non-impacted areas, removing roadways, clay pipe subdrain system, abandoned utilities, borehole grout, and transporting and stockpiling these materials to, and managing them in, the Subcontractor's work area.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02100 - Surveying
- B. Section 02200 - Earthwork
- C. Section 02270 - Erosion and Sediment Control
- D. Surface-Water Management and Erosion Control (SWMEC) Plan

**1.03 DEFINITIONS**

- A. Clearing consists of the removal of trees, bushes, vegetation, and other surface debris that are 18 inches above the ground surface.
- B. Grubbing consists of the removal of stumps and roots to a depth of 3 feet below the existing ground surface or subgrade elevation, whichever is lower. Grubbing also includes removal of roadways, clay pipe subdrain system, abandoned utilities, and borehole grout associated with abandoned monitoring wells, boreholes, lysimeters, and piezometers. Removal of roadways shall include removal of road courses to subgrade elevation.
- C. Stripping consists of the removal of the topsoil layer (6 inches minimum) including roots and organic matter, grass, and other material unsuitable for use as subgrade or compacted fill.

- D. Impacted material is material requiring disposal in the On-Site Disposal Facility (OSDF). Impacted material is identified on the Construction Drawings, or in the field by the Construction Manager.

#### 1.04 SUBMITTALS

- A. Submit Subcontractor's Work Area Plan to the Construction Manager for review within 15 calendar days from Notice to Proceed. Location of the Subcontractor's work area shall be as shown on the Construction Drawings. Subcontractor's Work Area Plan shall include the following as a minimum:
  1. location of construction laydown area;
  2. locations of stockpiles for material generated from clearing, grubbing, and stripping operations;
  3. locations of impacted clearing, grubbing, and stripping material stockpile areas;
  4. layout of roads within the Subcontractor's work area;
  5. location of equipment-service area;
  6. construction site access layout; and
  7. construction utilities layout including construction power and construction water.

### PART 2 PRODUCTS

#### 2.01 MATERIALS

Section not used.

#### 2.02 EQUIPMENT

- A. Furnish, operate, and maintain equipment to perform the clearing, grubbing, and stripping activities associated with the work of this Section and with managing the Subcontractor's work area.

### PART 3 EXECUTION

#### 3.01 EROSION AND SEDIMENT CONTROL

- A. Prior to implementing any of the work described in this Section, install surface-water management and erosion and sediment controls in the area to be disturbed as required by Section 02270 and the SWMEC Plan. Maintain erosion and sediment controls through completion of this Subcontract.

**3.02 CLEARING AND GRUBBING**

- A. Perform clearing and grubbing in the areas identified on the Construction Drawings.
- B. Perform clearing and grubbing as separate activities.
- C. In impacted areas identified on the Construction drawings or by the Construction Manager, perform clearing of material which is in excess of 18 inches above existing ground, and chip this cleared material as non-impacted in accordance with this Section.
- D. In those areas where only clearing is required, perform clearing in a manner that minimizes disturbance to the existing ground surface.
- E. Chip cleared materials of a woody nature to a size that is suitable for use as mulch. Keep cleared material to be chipped as free of soil and other inorganic matter as possible. Cleared material smaller than 3 inches in size need not be chipped. Handle chipped material as non-impacted, unless otherwise directed by the Construction Manager.
- F. Stockpile cleared material in Subcontractor's work area as shown on the approved Subcontractor's Work Area Plan.
- G. Stockpile grubbed material in Subcontractor's work area as shown on the approved Subcontractor's Work Area Plan. Handle materials grubbed from areas designated for impacted soil removal as impacted and stockpile separately from materials grubbed outside the impacted soil removal areas. Provide sheeting (minimum 0.006-inch thick polyethylene) or equal to separate impacted grubbed material from the existing ground surface and to cover the impacted grubbed material to prevent rainfall infiltration. Use sandbags or other means to prevent wind uplift of the plastic sheeting.
- H. After completion of grubbing, fill depressions with compacted fill in accordance with the requirements of Section 02200.

**3.03 STRIPPING**

- A. Perform stripping within the limits indicated on the Construction Drawings. Transport stripped material to the Subcontractor's work area and stockpile in accordance with the approved Subcontractor's Work Area Plan. Handle stripped material from impacted areas as impacted material, unless otherwise directed by the Construction Manager. Stockpile non-impacted stripping material separately from impacted material. For non-

impacted material, stockpile separately topsoil from roots, grass, and other organics. These latter materials may be stockpiled with non-impacted grubbing material.

- B. If soil or weather conditions are unsuitable for stripping, due to precipitation or high wind as determined by the Construction Manager, cease stripping activities until permission to resume stripping activities is obtained from the Construction Manager.
- C. Construct stockpiles for non-impacted and impacted stripped materials no steeper than 3H:1V (horizontal:vertical), grade to drain, seal by tracking perpendicular to the slope contours with a dozer, and dress daily during periods when stripping material is placed on, or borrowed from, the stockpile. Temporarily cover impacted material stockpiles using plastic sheeting (minimum 0.006-inch thick polyethylene) or other material approved by the Construction Manager. Use sandbags or other means acceptable to the Construction Manager to prevent wind uplift of the plastic sheeting. Install temporary erosion and sediment control measures at the stockpile areas in accordance with Section 02270 and the SWMEC Plan.

#### 3.04 DISPOSAL OF MATERIALS

- A. The Construction Manager will define final disposal or end-use options for clearing, grubbing, and stripping materials that are non-impacted.
- B. Materials from clearing, grubbing, and stripping defined in the Construction Drawings or by the Construction Manager as impacted will be evaluated by the Construction Manager to establish that they meet waste acceptance criteria (WAC) for the OSDF. The Construction Manager will direct the Subcontractor to separately stockpile any material not meeting the WAC for the OSDF. The Construction Manager will assume responsibility for management and disposal of this material. Stockpile impacted material meeting the WAC from clearing, grubbing and stripping activities in the as directed by the Construction Manager.

#### 3.05 SURVEYING CONTROL

- A. Survey the limits of cleared, grubbed, and stripped surfaces in accordance with Section 02100.

[END OF SECTION]

**SECTION 02200****EARTHWORK****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes site preparation, excavation, surface-water control, excavation dewatering, stockpiling, compacted fill, subgrade preparation, and earthwork materials.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02100 - Surveying
- B. Section 02110 - Clearing, Grubbing, and Stripping
- C. Section 02215 - Trenching and Backfilling
- D. Section 02270 - Erosion and Sediment Control
- E. Section 02300 - Boring and Jacking
- F. Section 02605 - High Density Polyethylene (HDPE) Manholes, Pipes, and Fittings
- G. Section 02930 - Vegetation
- H. Construction Quality Assurance (CQA) Plan
- I. Surface-Water Management and Erosion Control (SWMEC) Plan

**1.03 REFERENCES**

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
1. ASTM D 698. Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using a 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop.
  2. ASTM D 2487. Standard Test Method for Classification of Soils for Engineering Purposes.

- B. Reference Reports addressing OSDF and borrow area site subsurface conditions:
1. "Geotechnical Investigation Report, On-Site Disposal Facility" [Parsons, 1995]. This report contains geotechnical data for the subsurface soils in the OSDF area.
  2. "Disposal Facility Pre-Design Geotechnical Investigation, Soil Investigation Data Report, CERCLA/RCRA Unit 2" [Science Applications International, 1995]. This report presents geotechnical data for the subsurface soils in the OSDF area.
  3. "Geotechnical Data and Evaluation Report for East and South Field Borrow Areas" [Parsons, 1996a]. This report contains geotechnical data for the subsurface soils in the East Field borrow area.
  4. "Off-Site Borrow Materials Evaluation" [Parsons, 1996b]. This report presents geotechnical data for potential off-site borrow sources for OSDF construction materials, including fine and coarse concrete aggregates, pea gravel, and riprap.

#### 1.04 SUBMITTALS

- A. Within 15 calendar days from Notice to Proceed, submit to the Construction Manager for review an Earthwork Work Plan. The Earthwork Work Plan shall include, at a minimum:
1. list of equipment proposed for the earthwork;
  2. excavation methods;
  3. dewatering methods and techniques;
  4. coordination of survey requirements for the earthwork;
  5. locations and establishment and maintenance procedures for soil stockpile areas;
  6. coordination of earthwork activities with surface-water management and erosion and sediment control measures;
  7. schedule for earthwork activities;
  8. borrow requirements;
  9. coordination of fugitive emissions dust control; and
  10. plans and measures for earthwork below 32 degrees Fahrenheit (F).

#### 1.05 EXISTING CONDITIONS

- A. Existing site surface and subsurface conditions, based on available site data, are indicated on the Construction Drawings and in the Reference Reports identified in the "References" Article of this Part.
- B. In advance of earthwork in an area, verify the accuracy of existing conditions shown on the Construction Drawings. Immediately notify the Construction Manager in writing of deviations from the existing conditions indicated on the Construction Drawings.

- C. The approximate locations of all known underground and above ground utility lines and structures are shown on the Construction Drawings and Reference Drawings. Immediately stop work and notify the Construction Manager if other utility lines or structures, not shown on the Construction Drawings and Reference Drawings, are encountered during the verification of existing conditions and execution of work.
- D. Ground-water levels in the brown and gray till layers at the site vary during the year and may be higher than those shown on the Reference Drawings. Levels may approach ground surface during extended periods of heavy precipitation.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Obtain fill for compacted fill from the Leachate Conveyance System excavations included in this Subcontract or from areas identified by the Construction Manager.
- B. Fill material shall be soil that is relatively free of debris, foreign objects, large rock fragments, organics, and other deleterious materials. Do not allow rock fragments larger than 3 inches. Fill material shall be GC, SC, SM, ML, or CL as classified according to the Unified Soil Classification System (per ASTM D 2487).

### 2.02 EQUIPMENT

- A. Use compaction equipment to achieve the required minimum soil dry density within the range of acceptable moisture contents.
- B. Use hand compaction equipment such as walk-behind padfoot compactors, hand tamper, or vibratory plate compactors for compaction in areas inaccessible to large compaction equipment.
- C. Use water tank trucks, pressure distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths to provide the required in-place moisture content.
- D. Use miscellaneous equipment such as scarifiers, disks, spring tooth or spike tooth harrows, earth hauling equipment, and other equipment, as necessary for earthwork construction.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Perform construction activities in such a manner that equipment operating in radiologically controlled areas (RCA) do not operate in non-RCAs. Equipment operating in RCAs shall be decontaminated before use in non-RCAs.
- B. Dust control measures for all earthwork activities shall be in accordance with Part 6, Statement of Work, of the Subcontract Documents.

### **3.02 SITE PREPARATION**

- A. Install erosion and sediment controls in the relevant areas of construction as shown on the Construction Drawings and as required by Section 02270. Maintain the erosion and sediment controls for the duration of construction and until the contained areas are revegetated in accordance with Section 02930. Accumulated sediment behind silt fences shall be disposed on-site in a manner approved by the Construction Manager.
- B. Perform clearing, grubbing, and stripping to the limits shown on the Construction Drawings and in accordance with Section 02110 prior to any earthwork activity.
- C. Construct haul roads and access corridors in accordance with the Construction Drawings and Section 02230.
- D. Locate manholes, catch basins, monitoring wells, piezometers, lysimeters, utilities, and other structures in the work area. Protect and maintain or abandon these structures and utilities during the excavation and grading activities as indicated on the Construction Drawings and Reference Drawings.

### **3.03 SURFACE-WATER CONTROL**

- A. Prior to installation of surface water and erosion controls, ensure Construction Manager has reviewed the Surface-Water Management and Erosion Control Plan prepared by the Subcontractor as required in Section 02270.
- B. Install surface-water and erosion controls in and around work areas to control runoff and erosion and to prevent surface-water runoff into Leachate Conveyance Systems excavations in accordance with Section 02270. Perimeter controls may include shallow ditches, small berms, or localized regrading.

**3.04 EXCAVATION**

- A. Excavate designated areas to subgrade elevations or excavation limits shown on the Construction Drawings. Stockpile excavated material in the Subcontract Work Area for use in subsequent construction as specified by this Section. Prepare the subgrade in accordance with this Section.
- B. Excavate material within the excavation limits, including any rock encountered, regardless of type, character, composition, and condition.
- C. Excavated material defined in the Construction Drawings or by the Construction Manager as impacted will be evaluated by the Construction Manager to establish that it meets waste acceptance criteria (WAC) for the OSDF. The Construction Manager will direct the Subcontractor to separately stockpile any material not meeting the OSDF WAC. The Construction Manager will assume responsibility for management and disposal of this material. Stockpile of impacted excavated material meeting the OSDF WAC in accordance with the Earthwork Work Plan prepared by the Subcontractor.
- D. Minimize sluffing and caving of the excavation. Over-excavate and fill areas of the excavation that cave or sluff with fill material compacted in accordance with this Section.
- E. Do not remove soil from the site or dispose of soil included in this Subcontract except as approved in writing by the Construction Manager.
- F. Perform activities in such a manner that hauling equipment transporting non-impacted material does not operate on impacted material haul roads.

**3.05 EXCAVATION DEWATERING**

- A. Anticipate seepage of ground water into excavations. The volume of ground water is likely to increase after precipitation events. Manage ground water and surface-water runoff in the excavation, in accordance with this Section.
- B. Collect ground-water seepage and surface-water runoff in the excavation in a toe drain, or other suitable sump, and pump to the Fernald Environmental Management Project former production area storm drain control system at location(s) directed by the Construction Manager.
- C. Prevent surface water run-on from adjacent areas from entering the excavation.

### 3.06 STOCKPILING

- A. Stockpile excavated "non-impacted" soil free of incompatible soil, clearing and grubbing debris, or other objectionable material in Subcontractor's work area. Locate stockpiles in accordance with the approved Subcontractor Work Area Plan specified in Section 02110.
- B. Stockpile excavated soil identified as "impacted" by the Construction Manager, or shown as "impacted" on the Construction Drawings, in separate stockpile areas in accordance with the approved Subcontractor Work Area Plan as specified in this Section.
- C. Construct stockpiles no steeper than 3H:1V (horizontal:vertical), grade to drain, seal by tracking perpendicular to the slope contours with a dozer, and dress daily during periods when fill is taken from the stockpile. Temporarily cover stockpiles using minimum 12-mil thick polyethylene plastic sheeting or other approved material. Use sandbags or other means to prevent wind uplift of the plastic sheeting. Install erosion and sediment control measures around stockpile areas in accordance with Section 02270 and the Subcontractor's Surface-Water Management and Erosion Control Plan.
- D. Stabilize stockpiles that will remain out of active use for a period greater than 6 months by vegetation in accordance with the requirements stated in Section 02930. Alternatively, cover stockpiles with minimum 12-mil thick polyethylene plastic sheeting. Use sandbags or other means to prevent wind uplift of the plastic sheeting.

### 3.07 SUBGRADE SURFACE PREPARATION

- A. Subgrade material shall consist of soil relatively free of debris, foreign objects, organics, and other deleterious material.
- B. Perform subgrade proofrolling by driving a loaded dump truck (minimum weight of 10 tons per axle and minimum loaded weight of 20 tons) or other pneumatic-tired vehicle, back and forth across the area to be prepared to confirm the firmness of the subgrade surface. Overlap the passes such that one set of tires on each pass runs between the two sets of tire tracks from the previous pass. Except for roads and access corridors, soils shall not exhibit pumping or develop ruts more than 1 inch in depth. Along roads and access corridors, soils shall not exhibit pumping or develop ruts more than 1/2 inch in depth. Unsuitable soils are soils exhibiting pumping or rutting exceeding the above specified limits.

- C. In areas where unsuitable soils are encountered, remove and replace a minimum depth of 1 foot below the proposed subgrade elevation. Remove unsuitable subgrade to a deeper depth if necessary to obtain a firm surface for subsequent fill placement. Fill the area with compacted fill in accordance with the requirements of this Part. Compact the fill material to at least 95 percent standard Proctor maximum dry density (ASTM D 698). Compact the uppermost lift of compacted fill beneath road and access corridor alignments to at least 100 percent of the standard Proctor maximum dry density.
- D. In areas where compacted fill is to be placed, prepare the subgrade by scarifying to a depth of 2 inches using the equipment identified in Part 2.
- E. In excavations or other areas where water accumulates, implement measures to remove the water in accordance with this Section. Prepare the subgrade surface to be free of standing water and firm to meet the proofrolling requirements of this Article. Maintain dewatered areas in this condition until overlying construction is complete.
- F. Manage surface-water runoff as described in Section 02270 and the Surface-Water Management and Erosion Control Plan.

### 3.08 COMPACTED FILL

- A. Use fill material that meets the requirements of Part 2 of this Section. Place the compacted fill to the limits and grades shown on the Construction Drawings.
- B. Prior to fill material placement, make the surface on which the fill material is to be placed free of debris, branches, vegetation, mud, ice, or other deleterious material.
- C. Place fill material in loose lifts with a thickness of 8 inches  $\pm$  1 inch. In areas where compaction is to be performed using hand-operated equipment, place the fill material in loose lifts with a thickness of 4 inches  $\pm$  1 inch.
- D. Remove rock particles with a maximum dimension larger than 3 inches.
- E. Prior to placing a succeeding lift of material over a previously compacted lift, thoroughly scarify the previous lift to a depth of 2 inches by discing, raking, or tracking with a dozer. Moisture condition the preceding lift in accordance with this Article if the moisture content of the surface of the preceding lift is not within the range of acceptable moisture contents.

- F. The trafficking of scarified surfaces by trucks or other equipment, except compaction equipment, is not permitted.
- G. The maximum acceptable soil clod size after processing is 3 inches. Reduce clod size by discing, raking, or tracking with a dozer, using a soil stabilizer or other means. Soil clumps, consisting of an agglomeration of smaller clods, will not be considered a clod for purposes of this Article.
- H. Except as specified in the Article "Subgrade Preparation" in this Section, compact fill material in each lift to at least 95 percent of its standard Proctor maximum dry density (ASTM D 698). Compact fill at a moisture content within  $\pm 3$  percent of the standard Proctor optimum moisture content (ASTM D 698).
- I. Moisture condition the soil if the moisture content of the soil to be used as compacted fill is not within  $\pm 3$  percent of the optimum moisture content as determined by ASTM D 698. Use a water truck and spray nozzle for wetting. During wetting or drying, regularly disc, rake, or otherwise mix the material to thoroughly blend the moisture throughout the lift. Use discing, raking, or other appropriate methods to dry the material as required.
- J. Do not place frozen fill nor place fill material on frozen subgrade or previously place compacted fill.
- K. Do not compact fill material at temperatures below 32° Fahrenheit (F), unless otherwise authorized in writing by the Construction Manager.
- L. Do not place compacted fill during periods of precipitation. Placement may occur during periods of misting or drizzle, but only if authorized by the Construction Manager.

### 3.09 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will perform soil conformance testing on compacted fill to establish compliance with this Section. Conformance testing to be performed and testing frequencies are given in the CQA Plan. Provide equipment and labor to assist the CQC Consultant in obtaining samples from excavations and stockpiles borrow areas. Identify source(s) of compacted fill material at least 10 calendar days prior to use.
- B. CQC Consultant will perform soil performance testing on compacted fill lifts to evaluate compliance with this Section. Performance testing to be performed and testing frequencies are given in the CQA Plan.

- C. If CQC Consultant's performance tests indicate that any portion of the compacted fill does not meet the requirements of this Section, the CQC Consultant will delineate the extent of the nonconforming area. Rework the nonconforming area until it meets the requirements of this Section.

### 3.10 SURVEY CONTROL

- A. Survey the limits and elevations of excavations, top of subgrade, and top of the compacted fill in accordance with Section 02100.

### 3.11 TOLERANCES

- A. Perform the earthwork construction to within  $\pm 0.3$  ft of the elevations indicated on the Construction Drawings unless otherwise indicated.

[END OF SECTION]

**SECTION 02215****TRENCHING AND BACKFILLING****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes trenching, bedding, and backfilling materials and placement.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02100 - Surveying
- B. Section 02110 - Clearing, Grubbing, and Stripping
- C. Section 02200 - Earthwork
- D. Section 02270 - Erosion and Sediment Control
- E. Section 02300 - Boring and Jacking
- F. Section 02605 - High Density Polyethylene (HDPE) Manholes, Pipes, and Fittings
- G. Section 02930 - Vegetation
- H. Construction Quality Assurance (CQA) Plan

**1.03 REFERENCES**

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
1. ASTM C 136. Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  2. ASTM D 698. Standard Test Method for Moisture-Density Relations of Soils and Soil-Aggregate Mixture using a 5.5 Pound Rammer and a 12-inch Drop.
  3. ASTM D 2487. Standard Test Method for Classification of Soils for Engineering Purposes.

4. ASTM E 946. Standard Test Method for Water Absorption of Bentonite by the Porous Plate Method.
- B. Latest version of Ohio Department of Transportation Construction and Material Specifications (Ohio DOT Specifications).
- C. Latest version of Occupational Safety and Health Administration (OSHA) Construction Standards.
- D. Reference Reports addressing OSDF site subsurface conditions:
  1. "Geotechnical Investigation Report, On-Site Disposal Facility" [Parsons, 1995]. This report contains geotechnical data for the subsurface soils in the OSDF area.
  2. "Disposal Facility Pre-Design Geotechnical Investigation, Soil Investigation Data Report, CERCLA/RCRA Unit 2" [Science Applications International, 1995]. This report presents geotechnical data for the subsurface soils in the OSDF area.
  3. "Geotechnical Data and Evaluation Report for East and South Field Borrow Areas" [Parsons, 1996a]. This report contains geotechnical data for the subsurface soils in the East Field borrow area.
  4. "Off-Site Borrow Materials Evaluation" [Parsons, 1996b]. This report presents geotechnical data for potential off-site borrow sources for OSDF construction materials, including fine and coarse concrete aggregates, pea gravel, and riprap.

#### 1.04 SUBMITTALS

- A. Submit the following to the Construction Manager for review within 45 calendar days from Notice to Proceed:
  1. a list of equipment for trenching and backfilling;
  2. for each source of manhole and embedment fill material, submit:
    - a. the source of the embedment fill;
    - b. the results of tests conducted on each of three embedment fill samples (taken from three different locations within the material stockpile such that the material is fully represented) in accordance with ASTM C 136 and ASTM D 2487.
    - c. a 50-pound representative sample of the embedment fill;
    - d. written certification that the embedment fill meets the material requirements of this section; and
  3. a specification sheet for the proposed bentonite powder or granules and a 5-pound representative sample of the material.

**1.05 EXISTING CONDITIONS**

- A. Existing site surface and subsurface conditions, based on available site data, are indicated on the Construction Drawings and in the Reference Reports identified in the "References" Article of this Part.
- B. In advance of trenching in an area, verify the accuracy of existing conditions shown on the Construction Drawings. Immediately notify the Construction Manager in writing of deviations from the existing conditions indicated on the Construction Drawings.
- C. The approximate locations of all known underground and above ground utilities and structures are shown on the Construction Drawings and/or Reference Drawings. Immediately stop work and notify the Construction Manager if other utility lines or structures, not shown on the Construction Drawings and/or Reference Drawings, are encountered during the verification of existing conditions and execution of work.
- D. Ground-water levels in the brown and gray till layers at the site vary during the year and may be higher than those shown on the Reference Drawings. Levels may approach ground surface during extended periods of heavy precipitation.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. Furnish embedment fill material consisting of homogeneous crushed or angular soil, relatively free of metal, roots, trees, stumps, concrete, construction debris, organic matter, or other deleterious material.
- B. Furnish manhole embedment fill material classifying as GW, GP, SW, or SP in accordance with the Unified Soil Classification System (per ASTM D 2487), not gap graded, and having a gradation (per ASTM C 136) meeting the requirements for AASHTO No. 89 coarse aggregate presented in Section 703 of the Ohio DOT Specifications.
- C. Furnish pipe embedment fill material for HDPE pipes meeting the requirements of Section 703.06 of the Ohio DOT Specifications.

- D. Furnish granular filter material at the locations shown on the Construction Drawings meeting the requirements of Section 703.06 of the Ohio DOT Specifications.
- E. Furnish trench backfill material for HDPE pipes and manholes that meets the material requirements for compacted fill as specified in Section 02200.
- F. Furnish bentonite powder or granules consisting of Wyoming-grade bentonite containing at least 85 percent sodium montmorillonite, and a water adsorption of at least 500 percent when tested in accordance with ASTM E 946.
- G. Furnish a minimum 4-inch wide plastic underground warning tape with suitable warning legend and with integral magnetic locator wire to mark all HDPE and PVC pipes, electrical conduits, control cables, and any other underground utilities as shown on the Construction Drawings.
- H. Furnish pipe line marker signs at the intervals shown on the Construction Drawings.

## **2.02 EQUIPMENT**

- A. Furnish, operate, and maintain all equipment necessary to perform the work of this Section.

## **PART 3 EXECUTION**

### **3.01 GENERAL**

- A. Review Existing Site Utility Drawings and identify and stake existing utilities to locate existing utilities in vicinity of trench lines.
- B. In areas of trenching and backfilling, maintain and protect existing above and below ground utilities.
- C. Do not damage or disturb survey benchmarks, finished construction, and existing structures.
- D. Do not damage or disturb above and below grade utilities that are to remain.
- E. Dust control measures for all trenching and backfilling shall be in accordance with Part 6, Statement of Work, of the Subcontract Documents.

**3.02 TRENCHING**

- A. Trench subsoils for placement of pipes and HDPE manholes to the depths and minimum dimensions shown on the Construction Drawings. Manage excavated material in accordance with Section 02200.
- B. Use sheeting and bracing where necessary to maintain the safety and stability of all slopes and trenches and to protect adjacent structures. Satisfy all applicable local, state, and federal requirements for slope and trench sheeting and bracing, including requirements of the Occupational Safety and Health Administration (OSHA) Construction Standards. Provide sheeting and bracing materials on site prior to the start of trenching. Adjust spacing and arrangement of sheeting and bracing as required by conditions encountered. Remove sheeting and bracing as backfill progresses. Fill any voids left from sheeting or bracing withdrawal with compacted fill or other approved material.
- C. Protect and maintain the trench bottom. Remove rock fragments or raveled materials that collect on the trench bottom. Backfill any overexcavation with pipe embedment fill. Excavate any soft subgrade encountered at the trench bottom and backfill to subgrade elevation with embedment fill or compacted fill.
- D. In fill areas, perform trenching only after compacted fill has reached an elevation of at least 2 feet above the elevation of the top of the pipe.
- E. Limit the maximum length of open trench to 200 feet in advance and 200 feet behind pipe installation.
- F. Dewater trenches and HDPE manhole excavations. Perform dewatering in accordance with Section 02200.
- G. Stockpile excess material from trenching in accordance with Section 02200.

**3.03 BACKFILLING**

- A. General
  1. Do not backfill with frozen or saturated material.
  2. Do not backfill over frozen, wet, or soft subgrade.

3. Do not disturb or damage pipes or HDPE manholes in trenches and excavations during backfilling.
4. Do not use heavy compaction equipment which exerts greater than 5 pounds per square inch ground pressure over piping that is covered by less than 12 inches of backfill material.

**B. Manhole Excavations**

1. For HDPE manholes, place and compact manhole embedment fill as follows.
  - a. Place manhole embedment fill material in lifts to the elevation of the bottom of the HDPE manhole. Place material in 7-inch  $\pm$ 1-inch thick loose lifts.
  - b. Compact the manhole embedment fill with a minimum of 4 passes of a vibratory plate compactor prior to placing manhole.
  - c. Place HDPE manholes and manhole flotation anchor on the compacted manhole embedment fill.
  - d. Place manhole embedment fill in the annulus between the HDPE manhole and the excavation, the minimum annulus width shall be 3.5 feet horizontally and 6 inches beneath the manholes, in 7-inch  $\pm$ 1-inch thick loose lifts.
  - e. Compact with a minimum of 4 passes with a vibratory plate compactor to 3.5 feet below the manhole cover slab.
  - f. Place granular filter material above the manhole embedment fill to a thickness of 6 inches.
  - g. Compact granular filter material with a minimum of 4 passes of a vibratory plate compactor.
  - h. Place compacted fill above the granular filter material to the bottom of the manhole cover slab in accordance with Section 02200.

**C. Pipe Trenches**

1. Place pipe embedment fill in 7-inch  $\pm$ 1-inch thick loose lifts to the elevation of the bottom of the pipe, except for electrical conduits (Section 16110).
2. Compact pipe embedment fill with a minimum of 4 passes of a vibratory plate compactor prior to placing pipe.
3. Place pipe on top of the compacted pipe embedment fill.
4. Place additional pipe embedment fill on the sides of the pipe and gently hand tamp the fill around the sides of the pipe as needed to insure that intimate contact between the pipe and the pipe embedment fill is maintained below the spring line of the pipe. Continue placing pipe embedment fill until it is even with the top of the pipe. Compact the pipe embedment fill with a minimum of 4 passes of a vibratory plate compactor. Do not compact on top of the pipe unless a minimum of 12 inches of trench backfill separates the compactor from the top of the pipe.

5. For HDPE pipe trenches between HDPE manholes, construct a soil-bentonite plug in the trench to the limits shown in the Construction Drawings. Prepare soil-bentonite mixture consisting of pipe embedment fill at its natural moisture content mixed with minimum 10 percent (by dry weight basis) bentonite powder or granules by thoroughly mixing with a portable cement mixer or other suitable method. Place and compact the soil-bentonite mixture in the same manner as the pipe embedment fill.
  6. After placement and compaction of pipe embedment fill and soil-bentonite plugs, place the first lift of trench backfill material in a 12-inch loose lift. Place subsequent lifts of trench backfill material in 8-inch  $\pm$ 1-inch loose lifts.
  7. Compact each lift to 95 percent of the maximum standard Proctor dry unit weight and at a moisture content with  $\pm$ 3 percent of the standard proctor optimum moisture content as determined by ASTM D 698.
- D. Place underground warning tape in trench backfill 12 inches below finished grade and directly above all HDPE and PVC pipes, electrical conduits, control cables, and underground utilities.

#### 3.04 CONSTRUCTION QUALITY REQUIREMENTS

- A. The CQC Consultant will perform conformance testing on the pipe embedment fill, manhole embedment fill, and trench backfill materials to establish compliance with this Section and Section 02200, as applicable. The conformance testing to be performed and the testing frequencies are given in the CQA Plan.
- B. The CQC Consultant will perform performance testing on compacted fill trench backfill materials to establish compliance with this Section and Section 02200, as applicable. The performance testing to be performed and the testing frequencies are given in the CQA Plan.

[END OF SECTION]

**SECTION 02270****EROSION AND SEDIMENT CONTROL****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes silt fence, straw bales, check dams and ditches, and temporary vegetation.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02110 - Clearing, Grubbing, and Stripping
- B. Section 02200 - Earthwork
- C. Section 02930 - Vegetation
- D. Surface-Water Management and Erosion Control (SWMEC) Plan

**1.03 REFERENCES**

- A. Rainwater and Land Development, 2nd. ed., 1996, Ohio Department of Natural Resources [Rainwater and Land Development, 1996].

**1.04 SUBMITTALS**

- A. For each manufactured product proposed for use, submit the following to the Construction Manager for review within 15 calendar days from Notice to Proceed:
  - 1. Manufacturer's product data and recommended methods of installation; and
  - 2. written certification from the supplier or Manufacturer that the product meets the material requirements of this Section.
- B. Prepare and submit to the Construction Manager within 15 calendar days from Notice to Proceed a SWMEC Plan that meets the requirements of the SWMEC Plan identified in this Section. Organize the SWMEC Plan to include, at a minimum:
  - 1. descriptions of the surface-water management and erosion and sediment control measures to be implemented throughout the duration of the Subcontract;

2. procedures for installing and maintaining surface-water management and erosion and sediment control measures;
3. drawings illustrating, in plan view, the location and sequencing of the surface-water management and erosion and sediment control measures;
4. details of the surface-water management and erosion and sediment control measures; and
5. calculations supporting the use of surface-water management and erosion and sediment control measures.

## **PART 2 PRODUCTS**

### **2.01 SILT FENCE**

- A. Furnish silt fence with either woven or nonwoven fabric. Silt fence shall:
1. be woven fabric consisting of slit films of polypropylene treated with ultraviolet light stabilizers or;
  2. be nonwoven fabric consisting of long chain polymeric filaments or polyester yarns;
  3. be inert to chemicals commonly found in soils and to hydrocarbons;
  4. be resistant to mildew, rot, insects, and rodent attack; and
  5. have fabric and fence post properties and minimum dimensions in accordance with Rainwater and Land Development [1996].

### **2.02 STRAW BALE BARRIERS**

- A. Furnish straw bales for sediment control made of tightly baled straw bound with at least two individual strands of poly-type twine. Bale dimensions shall be at least 1.5 feet by 2.5 feet long. Anchors for straw bales shall be wooden stakes that are a nominal 1.5 inches by 1.5 inches by 3 feet in length.

### **2.03 TEMPORARY VEGETATION**

- A. Temporary vegetation shall be furnished as specified in Section 02930.

### **2.04 OTHER MATERIALS**

- A. Material for other erosion and sediment controls shall be as required in Rainwater and Land Development [1996].

**PART 3 EXECUTION****3.01 INSTALLATION****A. Silt Fence**

1. Install silt fence in accordance with, and at the locations required by, the SWMEC Plan.
2. Install silt fence in accordance with the requirements of Rainwater and Land Development [1996].

**B. Straw Bale Barriers:****1. Sheet Flow Applications:**

- a. Place bales in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another.
- b. Install bales so that bindings are oriented around the sides rather than along the tops and bottoms of the bales to prevent deterioration of the bindings.
- c. Place bales directly on top of the ground surface in vegetated areas.
- d. Entrench and backfill bales on bare ground where there is no vegetation. Excavate the trench the width of a bale and the length of the proposed barrier to a minimum depth of 6 inches. Backfill the excavated soil against the barrier after the bales are staked and chinked.
- e. Securely anchor each bale with a minimum of two stakes driven through the bale. Drive the first stake in each bale toward the previously laid bale to force the bales together. Drive stakes deep enough into the ground to securely anchor the bales.
- f. Chink the gaps between bales by wedging with straw to prevent water from escaping between the bales. Install perpendicular bale checks at a maximum 100-feet on-center along sloping areas where surface flow follows the bale line.

**2. Check Dams:**

- a. Install checks with bale barriers, gravel, and filter fabric as shown on the Construction Drawings.
- b. Place bale barriers in a single row, lengthwise, perpendicular to the channel, with ends of adjacent bales tightly abutting one another.
- c. Follow all steps for installing a bale barrier for sheet flow.
- d. Extend the length of the check dam so that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale to ensure that sediment-laden runoff will flow either through or over the barrier but not around it.

**C. Temporary Vegetation: Establish temporary vegetation as specified in Section 02930.**

- D. Other Erosion and Sediment Controls: Install other erosion and sediment controls as required by Rainwater and Land Development [1996].

### **3.02 ADDITIONAL PROVISIONS DURING CONSTRUCTION**

- A. Prevent the run-off of polluting substances such as silt, clay, fuels, oils, and contaminated soils into water supplies and surface waters. Take special precautions in the use of construction equipment to prevent operations which promote erosion.
- B. Remove accumulated silt and debris from behind the face of the silt fence when the silt deposits reach approximately one half the height of the fence. Replace silt fence fabric damaged during maintenance operations.

### **3.03 MAINTENANCE**

- A. Clean, maintain, repair, and replace erosion and sediment control measures as needed throughout the duration of this Subcontract in accordance with the SWMEC Plan.

[END OF SECTION]

SECTION 02300  
BORING AND JACKING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Installation of steel casing pipe to carry dual containment leachate piping system underneath roads and K-65 concrete utility trench.

**1.2 RELATED SECTIONS**

- A. Section 02100 - Surveying.  
B. Section 02200 - Earthwork.  
C. Section 02215 - Trenching & Backfilling  
D. Section 02270 - Erosion and Sediment Control.  
E. Section 02930 - Vegetation.

**1.3 REFERENCES**

- A. American Society for Testing and Materials (ASTM), Annual Book of Standards:  
1. ASTM A139-90 Standard Specifications for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).  
B. Horizontal Earth Boring and Pipe Jacking Manual No. 2, National Utility Contractors Association, 1986 Edition.

**1.4 SEQUENCING/SCHEDULING**

- A. The Contractor shall coordinate and schedule boring and jacking operations concurrently with installation of dual containment piping system.

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**1.5 SUBMITTALS**

- A. Product Data: Provide for steel casing and for sealing ends of casing.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- A. Boring and Jacking:
  - 1. Steel casing pipe shall have diameter sufficient to accommodate pipes as specified on the construction drawings. Steel casing pipe shall be spiral or straight, seam-welded steel pipe conforming to ASTM A139, Grade B, with a minimum Schedule 40 wall thickness.
- B. End-Seals:
  - 1. Seals shall be modular, mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the casing pipe and the dual containment piping system. The elastomeric element shall be sized and selected per manufacturer's recommendations.
  - 2. Casing ends shall be sealed with link-seal or approved equal.

**PART 3 EXECUTION**

**3.1 FIELD CONDITIONS**

- A. Before excavation begins, provide erosion and sediment control to minimize erosion and the transport of sediment beyond the limits of the Contractor's work area. Methods of control shall conform to Section 02270.

**3.2 ERECTION/INSTALLATION/APPLICATION**

- A. The procedures and precautions set forth by Horizontal Earth Boring and Pipe Jacking Manual No. 2 shall be followed. Locations of known utility interferences shall be field identified and marked prior to commencement of boring. Boring alignment will need to accommodate any known interferences that are not to be relocated.
- B. Excavate boring and receiving pits to the width, length, and depth necessary for boring and jacking operations following Section 02215. Centering of crossing shall be established and staked.
- C. Pits shall be located a minimum of 3 feet beyond toe-of-slopes, and a minimum of 3 feet beyond far bank of ditches or swales. Jacking pit shall be shored and braced.
- D. Materials excavated from pits shall be stockpiled in areas designated by the Construction Manager. Excavated materials or equipment shall not be placed on pavement, shoulders of roadway, or within 3 feet of pit.
- E. Boring and jacking operations shall begin immediately after excavation of the pits has been completed. Stormwater is to be diverted from entering pit. Sump drainage to be provided to keep pits dry.
- F. Bored installations shall be a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed. A backing plate capable of withstanding boring machine thrust shall be installed against the back wall of the pits.
- G. Casing pipe shall be jacked into boring as soon as possible after boring is made. Lengths of casing pipe as long as practical shall be used. Joints between sections of casing pipe shall be welded as recommended for joining the particular type of pipe.

- H. Care shall be taken to ensure that casing pipe installed by boring and jacking is at the proper alignment and grade as shown on drawings. A check shall be made after each length of casing is installed. Use lubricants (i.e., bentonite) as necessary.
- I. After casing pipe is installed, the carrier and containment pipes shall be installed in such a manner as to protect coating, lining, and joint integrity. The containment pipe shall be placed in proper horizontal and vertical alignment using wooden blocking/wedges or prefabricated pipe collars spaced radially around pipe and secured firmly in place. Blocking or collars shall be installed around the pipes such that joints do not touch. Spacing of blocking or collars shall be no greater than 10 feet on center longitudinally in casing pipe. Annular space between containment pipe and casing pipe shall be sealed at each end.
- J. Promptly backfill excavated pits as specified in Section 02215. Backfilling of pits shall be brought to the lines and grade existing before excavation.
- K. Excess debris, waste generated, surplus soil, and contaminated material encountered shall be stockpiled at locations indicated on the construction drawings.

### 3.3 PROTECTION

- A. Protect excavation by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in of loose soil into excavation.

### 3.4 CLEANING

- A. Leave the site in a condition suitable for final grading, surfacing, or stabilization. Reseed all disturbed vegetative areas as described in Section 02930.

**END OF SECTION**

**SECTION 02605****HIGH DENSITY POLYETHYLENE (HDPE) MANHOLES,  
PIPES, AND FITTINGS****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes high density polyethylene (HDPE) manholes, pipes, fittings, supports, gussets, and appurtenances.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02100 - Surveying
- B. Section 02200 - Earthwork
- C. Section 02215 - Trenching and Backfilling
- D. Section 03100 - Concrete
- E. Section 15000 - Mechanical
- F. Construction Quality Assurance (CQA) Plan

**1.03 REFERENCES**

- A. Latest version of the American Society for Testing and Materials (ASTM) standards:
  - 1. ASTM D 638. Test Method for Tensile Properties of Plastics.
  - 2. ASTM D 790. Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - 3. ASTM D 1238. Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
  - 4. ASTM D 1248. Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
  - 5. ASTM D 1505. Test Method for Density of Plastics by the Density-Gradient Technique.
  - 6. ASTM D 1603. Standard Test Method for Carbon Black in Olefin Plastics.

7. ASTM D 1693. Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
  8. ASTM D 2122. Method for Determining Dimensions of Thermoplastic Pipes and Fittings.
  9. ASTM D 2657. Standard Practice for Heat Joining Polyolefin Pipe and Fittings.
  10. ASTM D 2837. Standard Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
  11. ASTM D 3350. Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
  12. ASTM F 714. Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
  13. ASTM F 1055. Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
- B. Latest version of the American National Standards Institute (ANSI) standards:
1. ANSI B16.1. Standard Specifications for Cast-Iron Pipe Flanges and Flange Fittings.
- C. Latest version of the American Society of Mechanical Engineers (ASME) standard:
1. ASME B31.9 §937.1 through 937.3 Building Services Piping.

#### 1.04 SUBMITTALS

- A. Submit the following to the Construction Manager for review within 30 calendar days from Notice to Proceed:
1. detailed shop drawings of all HDPE manholes, pipes, support centralizers, fittings, supports, gussets, and appurtenances;
  2. a list of materials to be furnished;
  3. the names of the suppliers and the proposed dates of delivery of the materials to the site;
  4. detailed procedures to be used for hydrostatic testing of the manholes, pipes, and fittings;
  5. a list of completed facilities for which the Manufacturer has manufactured 7-ft diameter or larger HDPE manholes. Provide the following information for each facility:
    - a. name, location, purpose of facility, and date of installation;
    - b. names of owner, project manager, design engineer, and installer; and
    - c. diameter and height of the manholes provided;

6. documentation demonstrating that the Manufacturer has adequate quality control procedures to ensure that fabrication of the HDPE manholes complies with the requirements of this Section;
  7. origin (resin supplier's name, resin production plant) and identification (brand name, number) of the polyethylene resin used;
  8. minimum Manufacturer certifiable values and the corresponding test procedures for HDPE material properties listed in Tables 02605-1 and 02605-2; submit values that are specific to the resin used in manufacture.
- B. Submit to the Construction Manager for review at least 30 calendar days prior to shipment, the following documentation on the resin used to manufacture the HDPE manholes, pipes, fittings, supports, and gussets.
1. Copies of quality control certificates issued by the resin supplier including the production dates and origin of the resin used to manufacture the HDPE products for this Subcontract.
  2. Results of tests conducted by the Manufacturer to verify the quality of the resin used to manufacture the HDPE products assigned to the project.
  3. Certification that no reclaimed polymer is added to the resin during the manufacturing of the HDPE products to be used for this project.
- C. Submit at least 30 calendar days prior to installation of any material covered by this Section, Manufacturer's written certification of compliance with these Specifications for that material. Include in this certification of compliance a final inspection and a written record of this inspection. The inspection shall include the following:
1. HDPE manholes, including attached pipes, fittings, supports, gussets, and appurtenances;
    - a. dimensional check;
    - b. material quality check;
    - c. weld quality; and
    - d. leak check;
  2. HDPE pipes, fittings, and appurtenances:
    - a. dimensional check; and
    - b. material quality check.
- D. Submit at least 14 calendar days prior to installation documentation of training and certification of personnel qualified for performing HDPE manhole installation and HDPE pipe joining operations.

## **PART 2 PRODUCTS**

### **2.01 GENERAL**

- A. Design and proportion all parts to have adequate strength and stiffness and to be adapted for the purposes shown on the Construction Drawings.
- B. Furnish each HDPE manhole completely assembled with all pipes, valves, fittings, supports, gussets, and appurtenances such that field work involves only installation and connection of external products.
- C. Furnish each HDPE manhole with watertight construction of welds and pipe penetrations.

### **2.02 HDPE COMPOUND**

- A. Furnish HDPE manholes and flat stock manufactured from new, high performance, high molecular weight, HDPE resin conforming to ASTM D 1248 (Type III, Class C Category 5, Grade P34), ASTM D 3350 (minimum cell classification as shown in Table 02605-1), and having a Plastic Pipe Institute (PPI) Rating of PE 3408. Furnish material having minimum certifiable property values listed in Table 02605-1.
- B. Furnish HDPE pipe and fittings manufactured from new, high performance, high molecular weight, HDPE resin conforming to ASTM D 1248 (Type III, Class C Category 5, Grade P34), ASTM D 3350 (minimum cell classification as shown in Table 02605-2), and having a Plastic Pipe Institute (PPI) Rating of PE 3408. Furnish material having minimum certifiable property values listed in Table 02605-2.

### **2.03 HDPE MANHOLE**

- A. Furnish manholes of the types, and to the dimensions, shown on the Construction Drawings.
- B. Furnish manholes having exterior and interior surfaces that are smooth with no sharp projections, homogeneous throughout with respect to resin compound, and free of foreign inclusions and surface defects. Furnish HDPE manholes that are as uniform as commercially achievable in color, opacity, density, and other physical properties.
- C. Shop fabricate manhole from HDPE pipe meeting the requirements of this Section. Shop fabricate 7-foot diameter manholes using HDPE Class 100 material conforming to ASTM F 894. Shop fabricate 54-inch diameter manholes using an HDPE Standard

Dimension Ratio (SDR) of 32.5 conforming to ASTM F 714. The primary containment of the permanent lift station shall be shop fabricated using Class 160 material and the secondary containment shall be shop fabricated using Class 250 material conforming to ASTM F 894.

- D. Shop fabricate manhole pipe stub-outs with the same pipe SDR as the HDPE pipe specified in the Article "HDPE Pipes, Fittings, and Appurtenances" of this Section. Fabricate with a minimum stub-out length of 12 inches, or more if necessary for thermal butt fusion of external pipes.
- E. Shop fabricate cover, base, gussets, and supports from minimum 1-inch thick HDPE flat stock.
- F. Shop weld components of the HDPE manhole. Weld pipes and fittings to each other by thermal butt fusion. Weld other components, including gussets and supports, to the manhole by extrusion welding. Hot air welding is not acceptable. Do not join the pipe supports with the pipes unless specifically called for on the Construction Drawings.
- G. Extrusion weld manhole cover and base at both inside and outside intersections with the riser section.
- H. Extrusion weld stiffener rings to the permanent lift station primary containment. Perforate stiffener rings to provide 1 square inch of open area at bottom to allow flow of liquid to the annular space liquid level transmitter.
- I. Provide manholes and the permanent lift station with adequate lugs for lifting and placement.
- J. Permit the CQC Consultant and/or Construction Manager to visit the manufacturing plant for project specific visits. If possible, such visits will be prior to, or during, the manufacturing of the manholes for this project.

#### **2.04 HDPE PIPES, FITTINGS, AND APPURTENANCES**

- A. Unless otherwise shown on the Construction Drawings, furnish HDPE pipe and fittings that have a SDR of 11 and conform to ASTM F 714.
- B. Furnish HDPE pipes in standard laying lengths not exceeding 50 feet.

- C. Furnish HDPE pipes and fittings that are homogeneous throughout and free of visible cracks, holes (other than intentional manufactured perforations), foreign inclusions, or other deleterious effects, and are uniform in color, density, melt index, and other physical properties.
- D. Furnish HDPE end caps at the end of pipes as shown on the Construction Drawings.
- E. Furnish electrofusion couplings meeting the requirements of ASTM F 1055 and as recommended by the electrofusion coupling manufacturer.
- F. Furnish HDPE pipe supports which cradle the pipe for a length of at least 1 pipe diameter and encircle the pipe 180 degrees of the pipe diameter. Furnish pipe supports conforming to the Construction Drawings.
- G. Perforate pipe by factory drilling at locations shown on the Construction Drawings.

#### 2.05 HDPE DUAL CONTAINMENT PIPING SYSTEM

- A. Furnish dual containment piping system consisting of field or factory fabricated carrier and containment pipes and pre-fabricated fittings.
- B. Furnish components of the dual containment piping system, including carrier piping, containment piping, fittings, and appurtenances meeting the requirements for HDPE pipes, fittings, and appurtenances given in this Section.
- C. Furnish pipe and fittings with the carrier pipe/fitting ends extending 6 inches beyond the containment pipe/fitting ends. Provide pipe in nominal lengths of 20 to 50 feet, and allow for field adjustment of pipe length.
- D. Furnish pre-fabricated dual containment fittings with the carrier fitting factory installed within the containment fitting, with all necessary support centralizers installed.
- E. Fabricate all carrier to carrier containment to containment joints using thermal fusion procedures recommended by the Manufacturer and as required by this Section. Fabricate carrier to carrier joints and containment to containment joints independently of each other. Inspect carrier to carrier joints before final closure of the containment.
- F. Furnish support centralizers to provide a continuous annular space between the carrier and the containment pipes in conformance with the recommendations of the Manufacturer or with a maximum allowable spacing of 4 feet, whichever is less.

Centralizers shall not inhibit flow of carrier pipe leakage in the containment pipe. Material for centralizers shall be as recommended by HDPE pipe manufacturer.

## 2.06 IDENTIFICATION

- A. Identify each HDPE manhole using a manhole number, as indicated on the Construction Drawings. Mark the number on the interior and exterior of the manhole.
- B. Mark the HDPE manhole with the Manufacturer's name, production code, date, and place of manufacture on the interior of the manhole.
- C. Continuously indent print on the HDPE pipe, or space at intervals not exceeding 5 feet the following:
  - 1. name and/or trademark of the HDPE pipe manufacturer;
  - 2. nominal HDPE pipe size;
  - 3. standard dimension ratio (e.g., SDR-11);
  - 4. the letters PE followed by the polyethylene grade per ASTM D 1248, followed by the Hydrostatic Design Stress in 100's of psi (e.g., PE 3408);
  - 5. manufacturing Standard Reference (e.g., ASTM F 714); and
  - 6. a production code from which the date and place of manufacture can be determined.

## 2.07 MANHOLE FRAME AND COVER

- A. Furnish manhole frame and access cover meeting the requirements of Section 15000.

## 2.08 MANUFACTURER TECHNICAL SUPPORT

- A. Furnish on-site services of Manufacturer's technical representative as required for the installation of HDPE manholes.

## 2.09 EMBEDMENT FILL AND BACKFILL MATERIALS

- A. Furnish pipe and manhole embedment fill materials in accordance with Section 02215.
- B. Furnish trench backfill and compacted fill materials in accordance with Sections 02215 and 02200, respectively.

## **PART 3 EXECUTION**

### **3.01**

- A. Perform HDPE manhole installation and pipe joining operations with trained and certified personnel.

### **3.02 HDPE MANHOLE HANDLING**

- A. Drain all entrapped water and prevent the entrance of water during shipment, storage, and handling.
- B. Exercise care when transporting, handling, and placing the manhole, such that the HDPE manhole is not damaged. Handle manhole only by the lifting lugs specifically designed and installed by the Manufacturer for lifting. Protect finished surfaces.
- C. Store HDPE manhole as recommended by Manufacturer.

### **3.03 HDPE MANHOLE INSTALLATION**

- A. Carefully examine HDPE manholes, fittings, supports, gussets, and appurtenances for cracks, damage or defects before installation. Remove defective materials from the site.
- B. Install HDPE manholes, fittings, supports, gussets, and appurtenances in accordance with the Manufacturer's recommendations.
- C. Inspect the HDPE manhole interior and HDPE pipe, fittings, supports, gussets, and appurtenances and remove any foreign material present before installation into the final position.
- D. Perform excavation and backfilling for each manhole in accordance with Section 02215.
- E. Perform a hydrostatic test of each installed manhole in accordance with this Section.

### **3.04 HDPE PIPE, FITTINGS AND APPURTENANCES**

- A. Deliver HDPE pipe, fittings, and appurtenances to the site at least 10 calendar days prior to the planned installation date.

- B. Provide proper handling and storage of the HDPE pipe, fittings, and appurtenances at the site. Protect materials from excessive heat or cold, dirt, moisture, cutting, or other damaging or deleterious conditions. Provide any additional storage procedures required by the Manufacturer.
- C. Exercise care when transporting, handling, and placing HDPE pipe and fittings. Use rope, fabric, or nylon slings and straps when handling HDPE pipe. Do not position slings, straps, etc., at butt-fusion joints or at fittings.
- D. The maximum allowable depth of cuts, gouges or scratches on the exterior surface of HDPE pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. Replace any HDPE pipe and fittings that become gouged, twisted, or crimped. Remove from the work area damaged pipes and fittings.
- E. Whenever pipe laying is not actively in progress, close the open ends of all installed pipes using watertight plugs.
- F. Perform trenching and backfilling of all installed pipe, fittings, and appurtenances in accordance with Section 02215.
- G. Perform testing of all installed pipe, fittings, and appurtenances in accordance with this Section.

### 3.05 HDPE PIPE AND FITTINGS INSTALLATION

#### A. General:

1. Carefully examine HDPE pipe and fittings for cracks, damage or defects before installation. Do not use cracked, damaged, or defective material.
2. Inspect the interior of all pipe and fittings and remove any foreign material from the pipe interior before the pipe is moved into final position.
3. Perform field-cutting of pipes, where required, with a machine specifically designed for cutting pipe. Make cuts carefully without damage to pipe, so as to leave a smooth end at right angles to the axis of pipe. Taper cut ends and smooth sharp edges. Flame cutting is not allowed.
4. Do not lay pipe until the Construction Manager has verified the bedding conditions.
5. Install HDPE pipe and fittings in accordance with the Manufacturer's recommendations and the requirements of this Section.
6. Install pipe and fittings to the lines and grades shown on the Construction Drawings.

7. Place and compact pipe embedment fill and trench backfill material as shown on the Construction Drawings in accordance with Section 02215.
8. Provide all necessary adapters and/or fittings required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

B. Install pipe marker in accordance with Section 02215.

### **3.06 HDPE PIPE JOINTS, FITTINGS, AND APPURTENANCES CONNECTIONS**

A. Qualify all personnel performing joining operations as specified in this Section.

B. Weather Conditions for Joining:

1. Do not join HDPE pipes and fittings at ambient temperatures below 40°F or above 104°F, unless authorized in writing by the Construction Manager. For cold (<40°F) or hot (>104°F) weather joining, use the additional procedures authorized in writing by the Construction Manager.
2. Measure ambient temperatures at fusion machine.
3. Do not join HDPE pipe and fittings during any precipitation, in the presence of heavy fog or dew, or in areas of ponded water.

C. Prior to joining, clean the joint area to be free of moisture, dust, dirt, debris of any kind, and foreign material.

D. Joining equipment shall be approved for the applicable field joining processes which are thermal butt fusion and electrofusion. Fusion-welding apparatus shall be automated devices equipped with gauges giving the applicable temperatures and pressures.

E. Make trial butt-fusion joints on spool pieces of HDPE pipe to verify that joining conditions are adequate. Conduct trial joints on the same material to be installed and under similar field conditions as production joints. Conduct trial joining at the beginning of each day for each fusion apparatus used that day. Also, each joiner shall make at least one trial joint each day. Conduct trial joining under the same conditions as the actual joining. Prepare trial joints that are at least 2 feet long (after seaming) with the joint at the midpoint.

F. Weld HDPE carrier and containment pipe with thermal butt-fusion joints or electrofusion adapters. Fabricate joints in compliance with ASTM D 2657, ASTM F 1055, the Manufacturer's recommendations, and the requirements of this Section.

- G. Install flanged connections of HDPE pipe and fittings as shown on the Construction Drawings and as follows:
1. Thermal butt-fuse HDPE flange connection (flange adapter) to HDPE pipe.
  2. Use Type 316 stainless steel lap joint flange. Outside diameter and drillings shall comply with American National Standards Institute (ANSI) B16.1.
  3. Use Type 316 stainless steel flange bolts, nuts and washers that meets the requirements of ANSI B16.1. Lubricate bolt threads prior to attaching nuts. Tighten bolts to a torque of  $100 \pm 5$  foot-pounds.
- H. Bolt HDPE flange adapter and stainless steel lap joint flanges at the ambient temperature of the surrounding soil to prevent relaxation of the flange bolts and loosening of the joint due to thermal contraction of the polyethylene. Draw bolts up evenly and in line. Retighten bolts 1 and 4 hours after initial tightening.

### 3.07 FIELD TESTING AND INSPECTION

- A. Notify the CQC Consultant a minimum of 24 hours in advance of any manhole or pipe testing or pipe inspection.
- B. HDPE Manhole Hydrostatic Testing:
1. Provide testing apparatus, including pumps, hoses, gauges, taps, plugs, drains, temporary connections, and fittings to perform testing in accordance with this Section.
  2. Hydrostatically test each HDPE manhole and primary containment after final pipe connections have been completed and after backfilling. Hydrostatically test each HDPE manhole, each primary containment vessel of each LDS manhole, and the primary containment of the permanent lift station using the following method.
    - a. Perform each test in the presence of the CQC Consultant and in accordance with the detailed procedure approved under this Section.
    - b. Temporarily seal any holes or gaps.
    - c. Fill the HDPE manhole to 6 inches below its top with clean water.
    - d. Monitor the level of water for a 4-hour period.
    - e. Identify any leaks, remove the water, and make repairs to the HDPE manhole or primary containment. A leak is defined as any water level drop over the test period except for an anticipated drop due to material relaxation and expansion. The anticipated drop must be demonstrated in the approved test procedure submitted by the Subcontractor in accordance with this Section.
    - f. Retest the HDPE manhole or primary containment until a passing test is achieved.

- g. After completion of the test, remove temporary seals, pump the HDPE manhole or primary containment dry, and dispose of test water.

C. HDPE Pipe and Fittings Hydrostatic Testing:

1. Provide testing apparatus, including pumps, hoses, gauges, taps, plugs, drains, temporary connections, and fittings to perform testing in accordance with this Section.
2. HDPE pipe hydrostatic testing:
  - a. Pressure test all installed HDPE solid wall, carrier, and containment pipe prior to placing fill over the pipes.
  - b. Perform tests in the presence of the CQC Consultant and in accordance with the detailed test procedure submitted by the Subcontractor in accordance with this Section.
  - c. Test HDPE solid wall and carrier pipe at 120 psi internal pressure for gravity pipe systems and at 130 psi internal pressure for force main system. Test pipes in accordance with ASME B31.9 §937.1 through §937.3.
  - d. Test HDPE containment pipe at 15 psi internal pressure. Test containment pipe in accordance with ASME B31.9 §937.1 through §937.3.
  - e. Test pipes at the required internal pressure for a minimum of one hour after the pressure in the pipe has stabilized. The test duration does not include the initial expansion phase after the pipe is first pressurized. The duration of the expansion phase shall be as recommended by the Manufacturer.
  - f. Identify any leaks, remove the water, and make repairs to the pipe.
  - g. Retest the pipe until acceptance criteria are achieved in accordance with the approved procedures for testing prior to placing backfill over the pipe.
  - h. Test gauges shall be calibrated within one year of date of test. Calibration shall be traceable to national or industry standards where possible.
  - i. Acceptance criteria for hydrostatic testing is zero leakage for the stabilized pressure for the minimum duration of the test.

- D. Subcontractor may substitute air testing in lieu of hydrostatic testing if authorized in writing by the Construction Manager. Submit detailed work plan for review and approval by the Construction Manager.

E. HDPE Pipe Inspection

1. Inspect fusion joints for evidence of excess or insufficient bead size, contamination, offset, or any other evidence of inadequate joining. The surface of the HDPE pipe shall be clean at the time of inspection. Wipe or wash the HDPE pipe surface if surface contamination inhibits inspection.
2. Repair any pipe sections where greater than 4 percent pipe diameter deflection from vertical is observed.

**F. Defects and Repairs:****1. Repair Procedures:**

- a. Repair any portion of the HDPE pipe exhibiting a flaw, or poor quality fusion joint by removing bad joint or pipe section and replacing with a new pipe section.
- b. When making repairs, satisfy the following:
  - (1) clean and dry all pipe surfaces immediately prior to repair;
  - (2) only use approved fusion equipment; and
  - (3) extend repairs at least 12 inches in all direction beyond the extent of the defect.

**2. Repair Verification:**

- a. Inspect each repair using the methods described in the this Article. Repair areas that fail the inspection.

**3.08 SURVEY CONTROL**

- A. Survey location and elevation of the manholes, pipes, and appurtenances in accordance with Section 02100.
- B. Survey the top of HDPE containment pipe on no greater than 50-foot centers and at manhole inlets and outlets in accordance with Section 02100.

**3.10 TOLERANCES**

- A. Install HDPE manholes and the permanent lift station to within  $\pm 0.1$  feet of the elevations indicated on the Construction Drawings.
- B. Install HDPE manholes within 0.5 degrees of plumb.
- C. Install all HDPE pipes to within  $\pm 0.1$  feet of bottom of pipe elevations of the containment pipes as indicated on the Construction Drawings.
- D. Provide positive slope of gravity lines at all locations to within  $\pm 10$  percent of the values indicated on the Construction Drawings.

**TABLE 02605-1**

**REQUIRED HDPE MANHOLES AND FLAT STOCK PROPERTIES  
 ASTM D 3350 CELL CLASSIFICATION PROPERTIES AND RANGES**

Properties	Cell Range	Qualifiers	Units	Specified Values	Test Method
Specific Gravity	3	minimum	N/A	0.94	ASTM D 1505
Melt Flow Index	3 to 5	maximum	g/10 min	<0.4	ASTM D 1238 (Condition E)
Flexural Modulus	5	minimum	lb/in <sup>2</sup>	110,000	ASTM D 790
Tensile Strength	4 or 5	minimum	lb/in <sup>2</sup>	3,000	ASTM D 638
Environmental Stress Crack	3	minimum	hrs	F <sub>20</sub> > 192	ASTM D 1693
Hydrostatic Design Basis at 73°F	4	minimum	lb/in <sup>2</sup>	1,600	ASTM D 2837
UV Stabilizer	C	minimum	% Carbon Black	2	ASTM D 1603

TABLE 02605-2

REQUIRED HDPE PIPE AND FITTINGS PROPERTIES  
 ASTM D 3350 CELL CLASSIFICATION PROPERTIES AND RANGES

Properties	Cell Range	Qualifiers	Units	Specified Values	Test Method
Specific Gravity	3	minimum	N/A	0.94	ASTM D 1505
Melt Flow Index	4 or 5	maximum	g/10 min	<0.15	ASTM D 1238 (Condition E)
Flexural Modulus	5	minimum	lb/in <sup>2</sup>	110,000	ASTM D 790
Tensile Strength	4 or 5	minimum	lb/in <sup>2</sup>	3,000	ASTM D 638
Environmental Stress Crack	3	minimum	hrs	F <sub>20</sub> > 192	ASTM D 1693
Hydrostatic Design Basis at 73°F	4	minimum	lb/in <sup>2</sup>	1,600	ASTM D 2837
UV Stabilizer	C	minimum	% Carbon Black	2	ASTM D 1603

[END OF SECTION]

**SECTION 02831****CHAIN-LINK FENCES AND GATES****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes chain-link fences and gates.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 03100 - Concrete
- B. Section 16170 - Grounding and Bonding

**1.03 REFERENCES**

- A. Latest version of the American Society for Testing and Materials (ASTM) Standards:
1. ASTM A 121. Standard for Zinc-Coated (Galvanized) Steel Barbed Wire.
  2. ASTM A 123. Standard for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
  3. ASTM A 153. Zinc-Coated (Hot Dip) in Iron and Steel Hardware.
  4. ASTM A 392. Standard for Zinc-Coated Steel Chain-Link Fence Fabric.

**1.04 SUBMITTALS**

- A. Submit the following to the Construction Manager for review within 30 calendar days from Notice to Proceed:
1. manufacturer's product data and shop drawings showing details for fence, gates, hardware, footings, grounding, and installation.

**PART 2 PRODUCTS****2.01 GENERAL**

- A. Furnish 6-foot high chain-link fencing as shown on the Construction Drawings. At gates, corners, and end posts, use vertical stretcher bars and horizontal and diagonal bracing rods which extend to the first adjacent line post. Use a fence with a top rail,

1 foot of three-strand barbed wire above the top rail, and a bottom tension wire as shown on the Construction Drawings.

- B. Furnish gate posts and gates spaced as indicated on the Construction Drawings.

## 2.02 FABRIC

- A. Furnish 6-foot high chain-link fabric woven from 9-gauge steel wire galvanized in accordance with ASTM A 392 Class II in a 2-inch mesh. Use a wire with a minimum breaking strength of 1,200 pounds.

## 2.03 POSTS AND FITTINGS

- A. Furnish hot-dip galvanized posts and rails conforming to ASTM A 123 with ASA Schedule 40 steel pipe sizes as follows:
  - 1. line posts are 2.375-inch outside diameter (O.D.);
  - 2. end, corner, and pull posts are 2.875-inch O.D.; and
  - 3. top brace rails are 1.66-inch O.D.
- B. Furnish cylindrical concrete footings with a minimum diameter of 9 inches, extending a minimum of 6 inches below the bottom of the posts. Use cast-in-place concrete as specified in Section 03100.
- C. Furnish brace bands, tension bands, tie-rods, and turn-buckles manufactured from malleable iron or pressed steel and coated in accordance with ASTM A 153.
- D. Furnish galvanized stretcher bars in one piece lengths equal to the full height of the chain-link fabric with a minimum cross section of 0.1875 inches by 0.75 inches and coated in accordance with ASTM A 153. Provide stretcher bars for gate posts, end posts, and corner posts.
- E. Furnish 9-gauge steel tie wire and 7-gauge steel tension wire galvanized in accordance with ASTM A 123.

## 2.04 SUPPORTING ARMS AND BARBED WIRE

- A. Furnish supporting arms:
  - 1. coated in accordance with ASTM A 153;
  - 2. oriented at 45 degrees to vertical; and
  - 3. manufactured from malleable iron or pressed steel.

- B. Furnish supporting arms with caps which securely fit to the tops of posts to exclude moisture and have openings to receive top rail.
- C. Furnish three rows of barbed wire manufactured from two-strand, 12.5-gauge wire with 14-gauge, 4-point barbs spaced at 5 inches on center and galvanized in accordance with ASTM A 121, Class 3.

## 2.05 GATES

- A. Furnish gates manufactured with:
  - 1. 1.90-inch O.D. frames;
  - 2. welded fittings;
  - 3. braces and 0.375-inch truss rod fabrication; and
  - 4. fabric and barbed wire in accordance with this Section.
- B. Furnish gates which are the same height as the adjacent fence.
- C. Furnish 2.875-inch O.D. gate posts for gates with up to 6-foot leaf widths. Use 4.0-inch O.D. gate posts for gates with 6-foot to 13-foot leaf widths. Provide gate posts with securely fitting caps to exclude moisture. Supply each gate with:
  - 1. a locking bar and locking device;
  - 2. non lift-off type malleable iron hinges; and
  - 3. plunger-bar type latch.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF FENCES AND GATES

- A. Perform all final grading prior to installation of permanent fencing. Install fencing as shown on the Construction Drawings and follow the general lines and grades of the finished ground.
- B. Installation:
  - 1. Set posts plumb in concrete as shown on the Construction Drawings. Concrete shall meet the requirements of Section 03100. Posts shall be in a straight alignment, with temporary bracing until concrete has set. Trowel finish and slope exposed tops of concrete footings to promote drainage away from the posts.
  - 2. Install pull posts every 300 feet if no corner posts are encountered in that distance.

3. Install corner posts at changes in direction of 30 degrees or more, and pull posts at changes in direction of 15 degrees or more. Install pull posts at abrupt changes in grade.
  4. Install supporting arms on each post.
- C. Set post bracing as specified below after concrete in post bases has set.
1. Install pull posts at gate posts, end posts, and at each side of corner posts; install so posts are plumb when diagonal rod is under tension.
- D. Install top brace rails as specified below.
1. Continuously run through barbed wire supporting arms.
  2. Install expansion couplings at each joint.
- E. Install chain-link fabric as specified below:
1. Stretch taut with equal tension on each side of line posts.
  2. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
  3. Use U-shaped tie wire, conforming to diameter of pipe to which fabric is being attached, clasp pipe and fabric firmly with ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.
  4. Fasten fabric to line posts with tie wire spaced at a maximum of 12 inches on center.
  5. Fasten fabric to top rail with tie wire spaced at a maximum of 24 inches on center.
  6. Join roll of fabric together by weaving a single strand into the end of the roll to form a continuous piece.
  7. Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. (Peen ends of bolts or score threads to prevent removal of nuts.)
  8. Attach tension wire along the bottom of the fabric with ring-type fasteners spaced at a maximum of 24 inches on center.
  9. Attach tension wire to line posts with brace bands and pull wire taut.
- F. Install stretcher bars as described below.
1. Thread through or clamp to fabric at a maximum of 4 inches on center.
  2. Secure to posts with metal bands spaced 15 inches on center maximum.
  3. Install at each gate, pull and end posts, and both sides of corner post.
- G. Install barbed wire as described below.
1. Attach 3 rows to each barbed wire supporting arm. Pull wire taut and fasten securely to each arm.
  2. Install 3 rows above fabric and on extended gate and members of swing gate.

- H. Install manual-swing gates as described below.
  - 1. Install plumb, level, and free swinging through full opening without interference.
  - 2. Install all hardware.
  - 3. Install keepers, ground set items and flush place in concrete to engage gate stop.
- I. Install fence grounding as indicated on the Construction Drawings.
- J. Repair any damaged coating in the shop or field by recoating with compatible and similar coating. Apply coating per manufacturer's recommendation.

### 3.02 TOLERANCE

- A. Erect the chain-link fences and gates with a maximum variation from plumb of 0.25 inches.
- B. Erect the chain-link fence with a maximum offset of 1 inch from true position.

[END OF SECTION]

**SECTION 02930****VEGETATION****PART 1 GENERAL****1.01 SCOPE**

- A. This section includes seeding, mulching, fertilizing, liming, and maintaining vegetated areas until vegetation is established and accepted.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02100 - Surveying
- B. Section 02200 - Earthwork
- C. Section 02270 - Erosion and Sediment Control
- D. Construction Quality Assurance (CQA) Plan
- E. Surface-Water Management and Erosion Control (SWMEC) Plan

**1.03 REFERENCES**

- A. Latest version of American Association of State Highway and Transportation Officials (AASHTO) standards:
  - 1. AASHTO M140. Standard Specification for Emulsified Asphalt.
  - 2. AASHTO M208. Standard Specification for Cationic Emulsified Asphalt.
- B. Latest version of the State of Ohio Department of Transportation Construction Manual and Specifications (Ohio DOT Specifications).

**1.04 SUBMITTALS**

- A. Submit the following to the Construction Manager within 30 calendar days of Notice to Proceed for review:
  - 1. Proposed seed mixes, mulches, asphalt emulsion tackifier, and fertilizers.
  - 2. Manufacturer's product data and recommended methods of application for seed, mulches, lime, asphalt emulsion tackifier, and fertilizer.

- B. Submit a manufacturer's certificate of compliance for each seed mix. These certificates shall include the seed mixture, guaranteed percentages of purity, weed content, germination of the seed, name of the seller, the test date for the seed, and the net weight and date of shipment. Do not sow seed until the Construction Manager has reviewed the certificates.
- C. After review of the product data for fertilizer, lime, and mulches by the Construction Manager, submit the following:
  - 1. a manufacturer's certificate stating the available nutrients contained in the proposed fertilizer;
  - 2. a manufacturer's certificate that the lime meets the requirements of this Section;
  - 3. a manufacturer's certificate that the wood cellulose mulch meets the requirements of this Section; and
  - 4. a manufacturer's certificate that the asphalt emulsion tackifier meets the requirements of this Section.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Furnish seed labeled in accordance with US Department of Agriculture (USDA) Rules and Regulations under the Federal Seed Act and applicable State seed laws. Furnish seed in sealed bags or containers bearing the date of expiration. Do not use seed after its date of expiration. Furnish seed from same or previous year's crop. Each variety of seed shall have a purity of not less than 90 percent, a percentage of germination not less than 80 percent, shall have a weedseed content of not more than 0.75 percent and contain no noxious weeds. The above percentages are by weight. Furnish seed mixtures having seed proportioned by weight in accordance with Tables 02930-1 and 02930-2.
- B. Furnish mulch meeting the requirements stated below.
  - 1. Furnish mulch consisting of straw or wood cellulose fiber unless otherwise directed by the Construction Manager. Furnish mulch that is free of clay, stones, foreign substances, plant parts of Canada Thistle and Johnson grass, and reasonably free of other weed seeds.
  - 2. Furnish straw that does not contain sticks larger than 1/4-inch diameter or other materials that may prevent matting down during application. No straw shall be used within 48 hours after cutting. Use straw that is free from mold and other objectionable material and in an air-dry condition suitable for placing with mulch blower equipment. Ninety-five percent of the straw shall be 6 inches or more in length.

3. Mulch applied by spraying shall be a specially processed wood cellulose processed into a uniform fibrous physical state. Use wood cellulose fiber containing a green dye that will provide easy visual inspection for uniformity of the slurry spread. The wood cellulose fiber including dye, shall contain no growth or germination-inhibiting properties. The wood cellulose fiber shall be manufactured in such a manner that, after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogeneous material. When sprayed on the ground, the material shall allow absorption and percolation of moisture. The wood cellulose fiber shall meet the following requirements:

<u>Quantity</u>	<u>Specification Limit</u>
Particle Length	0.375 inch (maximum)
Particle Thickness	0.047 inch (maximum)
pH	4.0 to 8.5
Ash Content	1.6 percent (maximum)
Water Holding Capacity	90 percent (minimum)

Deliver the material in uniform packages bearing the name of the manufacturer, the net weight, and a statement of content.

- C. Maintain straw mulching materials in place with an asphalt emulsion tackifier. Use asphalt emulsion for vegetative mulch conforming to AASHTO M140 or AASHTO M208. Asphalt emulsion tackifier shall be nontoxic to plants and shall be prepared so that it will not change during transportation or storage.
- D. Use fertilizer that is dry or liquid commercial grade fertilizer uniform in composition that meets the requirements of all State and Federal regulations and standards of the Association of Agricultural Chemists. Deliver fertilizer to the site in original, properly labeled, unopened, clean, containers each showing the manufacturer's guaranteed analysis conforming to applicable fertilizer regulations and standards. Use fertilizer that is 10-10-10, 12-12-12, or as modified by the Construction Manager based on testing of the topsoil by the CQC Consultant. Apply fertilizer to all areas receiving seed.
- E. Use lime that is agricultural ground limestone with a minimum total neutralizing power of 90 percent. The lime shall have a material gradation of at least 40 percent passing the U.S. Standard Number 100 sieve, and at least 95 percent passing the U.S. Standard Number 8 sieve.

## **PART 3 EXECUTION**

### **3.01 APPLICATION**

- A. Apply fertilizer, lime, seed, mulch, and asphalt emulsion tackifier to disturbed areas and areas graded under this Subcontract at and adjacent to the Leachate Conveyance System requiring vegetative cover unless otherwise indicated.
- B. Application rates:
  - 1. Application rates for fertilizer, lime and seed as specified in this Section may be adjusted after the results of the site soil test results have been received by the CQC Consultant.
  - 2. Base subcontract price on application rates for fertilizer, lime, seed, mulch, and asphalt emulsion tackifier specified in this Section. Subcontract price will be adjusted for any variations either decreasing or increasing the application rates for fertilizer or lime specified in this Section.
- C. For areas to be seeded:
  - 1. Apply fertilizer at a uniform rate of 12 pounds per 1000 square feet or as otherwise directed by the Construction Manager.
  - 2. Apply the specified seed mix at the rates indicated on Tables 2930-01 and 2930-02.
  - 3. Spread straw mulch or apply sprayed wood cellulose fiber as follows:
    - a. Spread straw mulch either by hand or by the blowing method at the rate of 2 air-dried tons per acre within 24 hours of seeding. Apply asphalt emulsion tackifier at a rate of 120 gallons per acre.
    - b. Apply sprayed wood cellulose fiber, at a net dry weight of 750 pounds per acre. Mix the wood cellulose fiber with water at a ratio of 50 pounds of wood cellulose fiber per 100 gallons of water.
  - 4. Apply agricultural lime at a rate of two tons per acre or as otherwise directed by the Construction Manager.
- D. The application of fertilizer and lime may be performed hydraulically with pasture species or temporary vegetation in one operation with hydroseeding. All structures and paved areas shall be cleared of deposits of the hydroseed mixture.

### **3.02 PLACEMENT**

- A. Do not commence vegetation until the CQC Consultant reviews the results of the soil analyses.

- B. Perform permanent seeding, fertilizing, liming, and mulching (if applicable) only during those periods indicated in Table 02930-1. Hydroseed only on a calm day with winds below twenty miles per hour. Do not seed on frozen ground or when the temperature is 32°F or lower.
- C. Notify the Construction Manager 24 hours prior to seeding or fertilizing.
- D. In cut areas to be vegetated, loosen the finished subgrade to a depth of 4 to 6 inches by discing or harrowing immediately prior to application of lime and fertilizer and seeding.
- E. In fill areas to be vegetated, scarify areas to be hydroseeded and disc or harrow all other areas to a depth of 4 to 6 inches immediately prior to application of lime and fertilizer and seeding.
- F. Apply fertilizer and lime at the specified rate or hydraulically with seed. If not applied hydraulically, thoroughly harrow, disc, or rake the fertilizer and lime into the prepared surface to a minimum depth of 2 inches.
- G. Prior to seeding, track the prepared surface with a bulldozer up and down the slope, and repair all gullies, washes, or disturbed areas that develop.
- H. Apply seed at the rates indicated in Tables 02930-01 and 02930-02. Apply seed by drilling, broadcasting, or hydroseeding as described below.
  - 1. Seeding by drilling shall be done to a depth of 0.25 inches followed by cultipacking.
  - 2. For hydroseeding:
    - a. The spraying equipment and mixture shall be designed such that when the mixture is sprayed over an area, the fertilizer, seed, and mulch shall be equal in quantity to the specified rates.
    - b. Prior to the start of work, furnish the Construction Manager with a certified statement as to the number of pounds of materials to be used per 100 gallons of water. The certified statement shall also specify the number of square feet of seeding that can be covered with the quantity of solution in the hydroseeder.
    - c. Seed and/or fertilizer and lime shall be mixed together with water in the relative proportions specified so that these combined solids do not exceed 300 pounds per 100 gallons. Mixing shall be done within one hour of application.
    - d. The water-seed-fertilizer-lime mixture shall be applied at a minimum rate of 1,000 gallons/acre.

- e. After hydroseeding on flat areas, the seedbed shall be immediately rolled with a roller weighing 40 to 65 pounds per foot of width unless an intervening precipitation causes such rolling to be detrimental to the seeded area.
  - f. Upon completion of seeding operations, furnish the Construction Manger with a certified statement on the actual quantity of solution applied.
- I. Apply mulch materials on seeded areas within 24 hours after seeding. Mulch shall achieve a uniform distribution and depth so that no more than 10 percent of the soil surface is exposed. Spray asphalt emulsion tackifier on the mulch to hold it in place.

### **3.03 MAINTENANCE**

- A. Maintain the vegetated areas in satisfactory condition until acceptance of the vegetation. Maintenance of the vegetated areas includes repairing eroded areas, revegetating, watering, and mowing (if applicable). A satisfactory condition of vegetated area is defined as a 10,000 square feet section of turf that has no bare spots larger than three square feet and not more than fifteen percent of total area with bare spots larger than 6 square inches.

### **3.04 ACCEPTANCE**

- A. The vegetated areas shall be accepted at the end of the warranty period if a satisfactory condition as defined in this Section exists.
- B. The acceptance inspection will be performed by the Construction Manager who will determine whether repair of seeded areas or revegetation is required.

### **3.05 WARRANTY PERIOD**

- A. Vegetated areas shall be subject to a guarantee period of not less than 2 full growing seasons from initial establishment of permanent vegetation over 100 percent of the areas seeded.
- B. At the end of the warranty period, the Construction Manager will perform an inspection upon written request by the Subcontractor. As part of the inspection, the Construction Manager may collect soil samples from areas not demonstrating satisfactory vegetation conditions and forward them to the local Natural Resources Conservation Service (NRCS) for recommendations. Vegetated areas not demonstrating satisfactory condition of vegetation as outlined above, shall be repaired,

reseeded, and maintained to meet all requirements as specified herein at the Subcontractor's expense.

- C. After all necessary corrective work has been completed, the Construction Manager will certify in writing the final acceptance of the vegetated areas.

**TABLE 02930-01**

**SEED MIXES FOR PERMANENT VEGETATION  
PASTURE SPECIES**

Slope - Moisture Class	Planting Period	
	15 Mar - 31 May or 1 Aug - 30 Sep	
	Species	lb/ac
Drainage Channels	Reed Canarygrass	8
	Kentucky Bluegrass	10
	Alsike Clover	5
All Other Areas	Creeping Red Fescue	20
	Annual Ryegrass	10
	Kentucky Bluegrass	15
	Alsike Clover	5
	Flatpea	5

TABLE 02930-02

SEED MIXES FOR TEMPORARY VEGETATION

Planting Period			
Warm Season (Jun - Aug)		Cool Season (Aug - Nov)	
Species	lb/ac	Species	lb/ac
Annual Ryegrass	40	Annual Ryegrass	40
Oats	64	Rye	80
Sudangrass	80	Perennial Ryegrass	20

[END OF SECTION]

**SECTION 03100****CONCRETE****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes concrete reinforcement, concrete forms, and cast-in-place concrete.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02100 - Surveying
- B. Section 02215 - Trenching and Backfilling
- C. Construction Quality Assurance (CQA) Plan

**1.03 REFERENCES**

- A. Latest Version of American Concrete Institute (ACI) Standards:
  - 1. ACI 301. Specifications for Structural Concrete.
  - 2. ACI 304. Guide for Measuring, Mixing, Transporting, and Placing Concrete.
  - 3. ACI 305. Hot-Weather Concreting.
  - 4. ACI 306. Cold-Weather Concreting.
  - 5. ACI 315. Details and Detailing of Concrete Reinforcement.
  - 6. ACI 318. Building Code Requirements for Structural Concrete.
  - 7. ACI 347. Guide to Formwork for Concrete.
- B. Latest version of American Society for Testing Materials (ASTM) Standards:
  - 1. ASTM A 185. Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
  - 2. ASTM A 615. Standard Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
  - 3. ASTM C 33. Standard Specification for Concrete Aggregates.
  - 4. ASTM C 39. Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - 5. ASTM C 94. Standard Specification for Ready-Mixed Concrete.

6. ASTM C 143. Standard Test Method for Slump of Hydraulic Cement Concrete.
7. ASTM C 150. Standard Specification for Portland Cement.
8. ASTM C 231. Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
9. ASTM C 260. Standard Specification for Air-Entraining Admixtures for Concrete.
10. ASTM C 309. Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
11. ASTM C 494. Standard Specification for Chemical Admixtures for Concrete.
12. ASTM D 994. Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
13. ASTM C 1107. Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

#### 1.04 SUBMITTALS

- A. Submit the following to the Construction Manager within 45 calendar days from Notice to Proceed for review:
  1. Complete bar schedule, bar details, and erection drawings conforming to ACI 315.
    - a. Mark each bar with identification corresponding to type, grade, and size.
    - b. Detail drawings indicating spacings, location, and quantities of reinforcing steel.
  2. Design Mix
    - a. Proposed concrete design mix for concrete specified herein.
    - b. Name and address of transit mix concrete supplier. Provide batch ticket and history per ASTM C 94.
    - c. Test results for the mix design showing compressive strength at 2, 7, and 28 calendar days per ASTM C 39.
  3. Certification from the supplier that concrete materials and concrete mix meet the material requirements of this Section.
  4. Shop drawings for cast-in-place concrete structures.
  5. Sample of preformed expansion joint filler for concrete.

**PART 2 PRODUCTS****2.01 MATERIALS****A. Forms**

1. Design concrete formwork for vertical loads and lateral pressures in accordance with the standards prescribed in ACI 347.
2. Furnish plywood forms that are grade marked B-B Plyform.
3. Furnish minimum 16 gauge steel forms.
4. Furnish factory fabricated snap-off metal form ties of adequate design to minimize form deflection and preclude concrete spalling upon removal.
5. Furnish a bond breaker or form release agent made from non-staining colorless mineral oil or similar liquid product that imparts a waterproof film to prevent adhesion of concrete to formwork and will not impair natural bonding characteristics of subsequent coatings.

**B. Concrete Reinforcement**

1. Furnish concrete reinforcement as shown on the Construction Drawings or as otherwise specified.
2. Furnish reinforcing steel bars meeting the requirements of ASTM A 615, Grade 60, modified in accordance with ACI 318.
3. Furnish welded steel wire fabric meeting the requirements of ASTM A 185.
4. Furnish bolsters, chairs, and accessories meeting the requirements of ACI 315.

**C. Cast-In-Place Concrete**

1. Furnish Type II Portland Cement conforming to ASTM C 150.
2. Furnish concrete aggregate complying with the provisions of ASTM C 33.
3. Furnish water for concrete mix that meets the requirements of ASTM C 94.
4. Furnish concrete mix with:
  - a. a compressive strength of 4,000 psi at 28 days when tested in accordance with ASTM C 39;
  - b. a water/cement ratio (maximum) of 0.45;
  - c. a maximum aggregate size of 1 inch;
  - d. a slump of 4 inches ( $\pm 1$  inch) when tested in accordance with ASTM C 143;
  - e. a minimum cement content of six 90-pound bags of cement per cubic yard of concrete; and
  - f. a total air content of 5 percent ( $\pm 1.5$  percent) when tested in accordance with ASTM C 231.
5. Furnish admixtures for the concrete conforming to ASTM C 260 for air entraining agent and to ASTM C 494, Type A, for water reducing admixtures for concrete.

6. Furnish polyethylene sheet for vapor barriers with a 6-mil minimum thickness between all concrete and ground interfaces and overlap vapor barriers a minimum of 6 inches, and seal joints with tape designed for use with the above specified material.
7. Furnish a pre-molded bituminous expansion joint filler. Construct the joint filler to the full depth of the slab and to a thickness of 1/2 inch at all joints between slab and vertical walls, columns, etc., unless otherwise indicated on the Construction Drawings. Set expansion joint material conforming to ASTM D 994 with a 1/2-inch deep removable strip at top.
8. Furnish a curing compound conforming to the requirements of ASTM C 309 and that does not impair natural bonding characteristics of subsequent coatings.

#### D. Grout

1. Non-Shrinking Grout
  - a. Mix and place as recommended by the manufacturer.
  - b. Furnish flowable nonmetallic grout, manufactured by one of the following:
    - (1) Five Star Grout, U.S. Grout Corporation;
    - (2) Masterflow 713 Grout, Master Builder's Company; or
    - (3) Sauereisen F-100, Sauereisen Cements Company.

#### E. Bonding Agent

1. Furnish moisture insensitive, epoxy-resin bonding agent as manufactured by one of the following:
  - a. Expoxite; W.R. Grace;
  - b. Euco Epoxy; Euclid Chemical Company; or
  - c. Weld-crete, Larson Products.
2. Use where indicated or specified.
3. Use in conformance with manufacturer's instructions.

#### F. Reinforcement Bar Tags

1. Reinforcement bar tags made of durable material and marked with permanent markings, not less than one tag per bundle. Use tags that show grade, size, number of pieces, and mark or length of bars.

### PART 3 EXECUTION

#### 3.01 PREPARATION

- A. Erect formwork and bracing to achieve design requirements in accordance with requirements of ACI 301 and ACI 347.
  1. Provide bracing to ensure stability of formwork.

2. Align joints and make watertight. Keep number of form joints to a minimum.
3. Provide chamfer strips on external corners of permanently exposed edges.
4. Shore or strengthen formwork subject to overstressing by construction loads.

**B. Form Release Agent:**

1. Apply form release agent on formwork in accordance with manufacturer's instructions.
2. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
3. Keep surfaces coated prior to placement of concrete.

**C. Form Cleaning:**

1. Clean and remove foreign matter within forms as erection proceeds.
2. Clean formed cavities of debris prior to placing concrete.
3. Flush with water or vacuum to remove remaining foreign matter.
4. Ensure that water and debris drain to exterior.
5. During cold weather, remove ice and snow from within forms. Do not use de-icing salts or water to clean out forms.

**D. Form Removal:**

1. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
2. Loosen forms carefully.
3. Do not wedge with pry bars, hammers, or tools against finished concrete surfaces.

### **3.02 PLACING AND FASTENING**

- A. Arrange and place reinforcing steel as shown on the Construction Drawings.
- B. Secure reinforcement against displacement during placing of concrete. Do not deviate from required position.

### **3.03 ERECTION/INSTALLATION/APPLICATION**

- A. Maintain concrete cover around reinforcing according to the requirements of ACI 301, ACI 318, and as shown on the Construction Drawings.
- B. Provide formed openings where required for work to be embedded in concrete members.

- C. Coordinate forming and setting openings, slots, recesses, sleeves, bolts, anchors, and other inserts with other concrete activities.
- D. Install concrete accessories straight, level, and plumb, or as called out on the Construction Drawings.
- E. Place concrete continuously between forms or other limits indicated on the Construction Drawings. Place concrete in accordance with ACI 301 and ACI 318, and ensure that reinforcement and forms are not disturbed during concrete placement.

### **3.04 PROTECTION**

- A. Provide concrete curing and protection in accordance with ACI 301. Apply curing compound, where used, in accordance with the approved manufacturer's recommendations.
- B. Provide finishes as defined in ACI 301.
- C. Provide broom finish on all exposed slabs.

### **3.05 CONCRETE PLACEMENT**

- A. Notify the Construction Manager and the CQC Consultant at least 24 hours in advance of concrete placement.
- B. Do not place concrete until foundations, forms, vapor barrier, reinforcing steel, pipes, conduits, sleeves, hangers, anchors, inserts and other work required to be built into concrete has been inspected and approved by the CQC Consultant.
- C. Place concrete in accordance with the Construction Drawings, the requirements of the local building code, and in compliance with practices and recommendations of ACI-304. Place the concrete in a continuous operation to prevent the formation of seams. Vibrate the concrete in place without dislocation or damage to the reinforcement and built-in items.
- D. Mix and place concrete only when the temperature is within the limits of ACI 305/306, unless otherwise approved by the Construction Manager.
- E. Prepare construction joints by roughening, brushing clean, and maintaining moisture for 24 hours (or apply bonding agent on clean prepared concrete joint in accordance

with Manufacturer's instructions) prior to placement of concrete against construction joint. Joint the concrete fully around pipes.

- F. Spread/broadcast red concrete dye on top of all electrical duct banks.

### 3.06 CONSTRUCTION QUALITY REQUIREMENTS

- A. Samples of concrete will be taken by the CQC Consultant during the concrete placement. Testing will be carried out in accordance with the CQA Plan.

### 3.07 SURVEY

- A. Survey the location and elevations of the concrete structures in accordance with Section 02100.

### 3.08 TOLERANCE

- A. Install cast-in-place concrete structures to within  $\pm 0.1$  feet of the elevations indicated on the Construction Drawings.

[END OF SECTION]

SECTION 13400  
INSTRUMENTS AND EQUIPMENT

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. This section specifies the design and performance requirements of the instrumentation and controls that will support the Leachate Conveyance System.
1. Pressure gauges.
  2. Magnetic flowmeters.
  3. Frequency pulse receiver.
  4. Pulse to pulse transmitter.
  5. Pulse to pulse receiver.
  6. Lightning arrester.
  7. Isolator.
  8. Receiver instruments.
- B. Refer to the Instrument Data Sheets, Attachment A. The format for these data sheets is based on that developed by the International Society for Measurements and Control (ISA).
- C. Refer to the Installation Details, Attachment B.
- D. Refer to the Instrument Index, Attachment C.

**1.2 RELATED SECTIONS**

- A. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCES, CODES, AND STANDARDS**

- A. American Society of Mechanical Engineers (ASME):
1. ASME B31.3-90 Chemical Plant and Petroleum Refining Piping.
- B. National Fire Protection Association (NFPA):
1. NFPA 70-96 National Electrical Code.

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#### 1.4 SYSTEM DESCRIPTION

- A. General Design Requirements: For description of instrumentation equipment and detailed design requirements, reference Attachment A.
1. Electronic analog transmitters and receivers shall have their input and output signals isolated from ground.
  2. Contact closure outputs shall be "dry" contacts isolated from ground.
  3. Instruments and control devices which require external power shall accept 120 volts, 60 Hz as the power source.
  4. Indication devices shall be located for ease of operator readability.
  5. Instruments operating at 50 volts or greater shall be insulated in front and back to avoid accidental contact by personnel.
  6. Install instrument equipment in accordance with NFPA 70.
- B. General Performance Requirements
1. For detailed performance requirements for all instrumentation for this design package, reference Attachment A.
  2. All instruments shall be accurate to the tolerance levels specified in Attachment A and shall maintain these tolerance levels under project conditions as described in Article 1.8.
  3. Instrumentation shall perform to the stated requirements whether stationary or mobile, and require minimal calibration if remounted or moved.

#### 1.5 SUBMITTALS

- A. Product Data: . Include catalog "cut sheets," data sheets, and flow characteristic curves.
- B. Shop Drawings: Include assembly drawings and wiring diagrams.

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- C. Installation instructions, including recommended calibration procedures and installation details.
  - 1. Include frequency of calibration required at the time after system installation and regular intervals of time thereafter.
  - 2. Certification of test equipment (calibration records) used to complete the work as described herein.
- D. Provide inspection and test procedures to the Construction Manager for review prior to testing.
- E. Test reports: Test reports shall list equipment used, person or persons performing the tests, date tested, device or circuit tested, and results of test.
- F. Calibration reports.
- G. Operation and maintenance manuals.
- H. Suggested spare parts inventory for each type of equipment.

#### 1.6 QUALITY ASSURANCE

- A. Instrumentation equipment shall be industrial type, of the function and type specified in Part 2.
- B. Compatibility and Calibration: Instrumentation equipment provided shall be compatible with intended service.
  - 1. Instrument equipment shall be calibrated to manufacturer's standards.
  - 2. Test equipment shall be calibrated and shall be traceable by tag number, make, and model number to the instrument certified by the National Institute of Standards and Technology (NIST).
- C. Manufacturers' Qualifications: Manufacturers shall have 5 years of verifiable experience in the production of instrumentation equipment of the same type and similar performance as that specified herein.

1.7

**DELIVERY, STORAGE, HANDLING, AND SHIPPING**

A. Packing and Shipping

1. Product shipping container(s) shall contain packing materials to prevent the entrance of water to instrument surfaces, interior, and exterior.
2. Product shipping container(s) shall be clearly marked "FRAGILE - DO NOT DROP," and shall be furnished with an itemized invoice stating the contents and quantity of products contained therein.
3. Ports for process, electrical, and/or pneumatic connections shall be plugged to prevent the interior accumulation of dirt and moisture.
4. Ensure that closures used for covering, wrapping, or plugging openings shall not be made of polyvinyl chloride (PVC) or other plastics that contain chlorides.
5. Control components assembled prior to shipment shall be packaged to minimize entry of dirt and moisture.

B. Acceptance at the FEMP

1. Products arriving at the FEMP shall be examined for general damage during shipping. Those products found to be damaged shall not be accepted at the FEMP.

C. Storage and Protection

1. Instrumentation equipment shall be stored according to manufacturer's requirements for storage, if information regarding storage is provided by the manufacturer. In cases where specific storage requirements are not provided, equipment shall be stored in a clean, dry area protected from the weather until required for installation.

1.8

**PROJECT CONDITIONS**

A. Services

1. Operating Hours: 24 hours/day, 7 days/week, 52 weeks/year.

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2. Industrial design with a minimum plant life of 5 years.

B. Ambient Conditions

1. Plant Location: Fernald, Ohio.
2. Plant Elevation: Approximately 600 feet above sea level.
3. Ambient Temperature Range: -20 to 110 degrees F.
4. Barometric Pressure, inches Hg absolute (mean at 70 degrees F): 29.92.
5. Relative Humidity: Varies from 20 percent to 95 percent.

C. Electrical Supply: 120 volts, single phase, 60 Hz.

1.9 **WARRANTY**

A. Special Warranty

1. No special warranty requirements apply.

1.10 **MAINTENANCE**

A. Maintenance Service

1. Maintenance service numbers and information shall be provided along with product documentation sent in shipping. Maintenance policies and procedures shall be fully described in the maintenance documentation.

B. Extra Materials

1. Any extra/replacement parts or materials required to maintain acceptable product performance levels shall be referenced in the product documentation provided with shipping.

**PART 2 PRODUCTS**

**2.1 PRODUCTS/EQUIPMENT**

- A. Pressure Gauges (See Attachment A, Sheet 1)
1. Pressure element shall be bourdon tube or diaphragm.
  2. Gauge shall have a 4-1/2-inch dial, 1/2-inch threaded connection, and a shut-off valve.
  3. All gauges shall be vibration and shock resistant.
  4. Gauges shall be equipped with diaphragm seals.
  5. Scale shall be selected so that normal operating range is between 33 percent and 67 percent of span.
  6. Manufacturers: Helicoid, Dwyer, or McDaniel.
- B. Magnetic Flowmeters (see Attachment A, Sheet 2)
1. Magnetic flowmeter shall comply with the following performance requirements:
    - a. Rangeability shall be 10 to 1, minimum.
    - b. Response time shall be adjustable to 10 seconds.
  2. Signal converters/transmitters shall be two wire devices, and produce and output a pulse-duration output signal. Minimum output signal shall be equal to 0 percent of span and maximum output signal shall be equal to 100 percent span. Output shall be linear with respect to flow. Loop impedance shall be 750 ohms, minimum. Accuracy shall be plus and/or minus 0.50 percent of calibrated span. The transmitter detector housing shall be NEMA 4 type.
  3. Manufacturer: Honeywell, Fischer & Porter, or Rosemount Inc.
- C. Frequency Pulse Receiver
1. Frequency pulse receiver shall be single channel and shall receive pulse-duration signal via a single metal pair data quality telephone line. Analog output signal shall be 4-20 mA DC. The receiver housing shall be NEMA 12 type.
  2. For installation detail see vendor submittal drawings.

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3. Manufacturer: AGM, Divelbiss Corporation, or J Instrument.

D. Pulse To Pulse Transmitter

1. Pulse to pulse transmitter shall be single channel and shall receive a dry contact from PLC and convert to the pulse to pulse which can be transmitted via a one metal pair data quality telephone line. The transmitter housing shall be NEMA 12 type.
2. For installation detail see vendor submittal drawings.
3. Manufacturer: AGM, Divelbiss Corporation, or J Instrument.

E. Pulse To Pulse Receiver

1. Pulse to pulse receiver shall be single channel and shall receive pulse to pulse signal via a single metal pair data quality telephone line. Receiver output shall be dry contact Form C, rated at 5 amperes @ 120 VAC. The receiver housing shall be NEMA 4 type.
2. For installation detail see vendor submittal drawings.
3. Manufacturer: AGM, Divelbiss Corporation, or J Instrument.

F. Lightning Arrester

1. Lightning Arrester shall be UL listed and connected to the metal pair data quality telephone line. The unit shall automatically disconnect the telephone line under surge and peak current conditions, and automatically reconnect after the surge condition is no longer present.
2. For installation details see vendor submittal drawings.
3. Manufacturer: MCG Electronic, Panamax, or J Instrument.

G. Isolator

1. Isolator shall be UL listed and shall receive analog 4-20 mA DC input with an output of two 4-20 mA DC outputs. Both outputs shall be isolated.

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2. For installation detail see vendor submittal drawings.
3. Manufacturer: AGM, Divelbiss Corporation, or J Instrument.

H. Receiver Instruments

1. See Attachment A, Sheet 3.

**2.2 MATERIALS**

- A. See Attachment A for data sheets.

**2.3 LABELING**

- A. Instrument Tagging (see Attachment C): Instruments shall be tagged accordingly with a three-layer, laminated plastic plate 1 inch by 2-1/2 inches having a minimum of 1/16-inch thickness.

1. Lettering shall be minimum 1/4 inch high and boldly stamped.
2. Tags shall be secured to the instruments by a beaded SST chain or SST wire, 16 AWG minimum, so that they will remain attached to the instrument and not inhibit its operation.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Install and/or wire equipment following the instructions of the equipment manufacturers.
1. After energizing and prior to start-up, check control circuits and programs for proper sequence of operation and interlocking functions.
  2. Any wiring changes required as a result of such checks shall be properly identified by changing terminal strip and/or wiring markers.

### 3.2 SPECIAL INSTRUCTIONS

#### A. General

1. Instrument locations shall be as indicated on drawings approved for construction. Any proposed deviation from the indicated locations shall be submitted to the Construction Manager for approval prior to implementation.
2. The hand valves shall be positioned so that handwheels or handles shall be facing the operator and easily accessible without any obstruction or interference.
3. Support: Provide supports and brackets as necessary to make the installation rigid.

### 3.3 FIELD QUALITY ASSURANCE

#### A. Test equipment used shall be calibrated and traceable by tag number, make, and model number to the instrument certified by NIST.

1. Test gauges shall have been calibrated within 90 days prior to testing.
2. Test gauges shall have a range of 0 to 150 psig, with marked resolution of 0.5 psig.

#### B. Piping and tubing shall be pneumatically pressure tested with clean, dry, compressed air and in accordance with ASME B31.3, Paragraph 345.5.

### 3.4 ADJUSTING

#### A. Calibration: Calibrate instruments and components in accordance with manufacturer's calibration data over the full operational range; verify instruments to be within published specification and accuracy; affix a calibration sticker.

1. Instruments shall be calibrated individually and, where applicable, as a system.
2. Components that have adjustable features shall be carefully set for specific conditions and applications of this project.

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3. Calibration sticker shall contain the following information:
  - a. Equipment identification tag number.
  - b. Range of calibration.
  - c. Date and name of persons doing calibration.
  - d. Date of next scheduled calibration.

B. Calibration Ranges:

1. Pressure Gauges: Check at 10 percent, 50 percent, and 90 percent of their ranges for linearity within manufacturer's stated specifications.

C. Acceptable Calibration Standards:

1. Pressure
  - a. 25 to 300 psi: Deadweight tester, 0.25 percent accuracy (maximum).
2. Others
  - a. Equipment as specified by manufacturer's instruction.

D. Test Gauges:

1. Test gauges shall have a calibration interval of 30 days.
2. Test gauges shall have a range of 0 to 150 psig with marked resolution of 0.5 psig.

### 3.5 CLEANING

- A. Instruments shall be cleaned in accordance with the manufacturer's recommended cleaning procedures.
- B. After cleaning, work shall be free from foreign material in accordance with the following:
  1. No residual material present that could cause the instrument to become inoperative.
  2. No residual moisture present.
  3. No corrosion products, such as rust, present.

## 3.6

## ATTACHMENTS

- A. The following Instrument Data Sheets are attached:
1. Pressure Gauges Sheet No.1
  2. Magnetic Flowmeters Sheet No.2
  3. Receiver Instruments Sheet No.3
- B. The following Instrument Installation Details are attached:
1. Pressure Gauge with Isolation Valve Sheet No.1
  2. Magnetic Flowmeters With Transmitter Sheet No.2
- C. Instrument Index Sheet No.1

END OF SECTION

**ATTACHMENT A**

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**INSTRUMENT DATA SHEETS**

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**ATTACHMENT B**

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**INSTRUMENT INSTALLATION DETAILS**

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**ATTACHMENT C**

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**INSTRUMENT INDEX**

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SECTION 13401  
PROGRAMMABLE LOGIC CONTROLLER

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Definition of design and performance requirements for the procurement, delivery, and installation assistance for the Programmable Logic Controller (PLC) that will support the leachate conveyance system.

**1.2 REFERENCES, CODES, AND STANDARDS**

- A. National Fire Protection Association (NFPA):
  - 1. NFPA 70-96 National Electrical Code.

**1.3 SYSTEM DESCRIPTION**

- A. The Contractor shall program, test, calibrate, and place into operation a PLC.
- B. Construction
  - 1. The PLC Central Processing unit (CPU) shall be solid-state design. The CPU operating logic shall be contained on plug-in modules for quick replacement. Chassis wired logic is not acceptable. The controller shall be capable of operating in a hostile industrial environment (i.e., heat, electrical transients, RFI, vibrations, etc.), without fans, air conditioning, or electrical filtering (up to 110 degrees F and 95 percent humidity).
- C. The PLC shall have input facilities for the discrete input and 4-20 mA DC analog unit signals specified and shown on drawings. The PLC shall produce isolated output contacts and 4-20 mA DC signals for control functions. Each CPU shall provide internal fault analysis with a failsafe mode, a dry contact output for remote location alarming, and a local indicator on the PLC frame in the event of a fault in the PLC.

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#### 1.4 SUBMITTALS

##### A. Vendor Drawings

1. The vendor drawings shall include a full description of the PLC system, including documentation of operation theory, programming methods (i.e., ladder logic diagram; all contacts, coils, timers, latches, and each section of the ladder shall be clearly annotated and defined. The annotation of each of the input contacts representing a field device will clearly define the status of the device.), data codes and security features, and maintenance and troubleshooting information. Schematics of all cards or units within the system, along with point-to-point wiring diagrams, shall be furnished after award of contract.
2. The documentation shall provide a sequential flow chart of the logic implemented. The format of the flow chart and the annotation shall be proposed for acceptance by the Construction Manager before implementation.
3. Two sets of the program and documentation shall be forwarded for review and comments at least 30 days before factory test.

#### 1.5 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience in manufacturing similar products.
- B. **Installer Qualifications:** Company specializing in performing the work of this section with minimum 3 years related experience in process control system installation.

## 1.6

## DELIVERY, STORAGE, AND HANDLING

- A. Packaging and shipping of the systems shall be in accordance with the following requirements:
1. Immediately before packaging, all items shall be visually inspected by the Contractor for cleanliness and completeness.
  2. Installed equipment shall be placed in sealable plastic bags or wrapped in plastic film, which shall be sealed with sealing tape. Bagged desiccant shall be added before sealing.
  3. Items shall be wrapped (see 2 above) and placed in suitable shipping containers with sufficient cushioning material to prevent damage during shipment and storage.
- B. Storage and Protection: Components shall be kept in a clean dry place protected from the weather or according to manufacturer's recommendations, whichever is more stringent.

## 1.7

## PROJECT CONDITIONS

- A. Services:
1. Operating Hours: 24 hours/day, 7 days/week, 52 weeks per year.
  2. Industrial design with plant life of 20 years.
- B. Ambient Conditions (building, except control room):
1. Plant Location: Fernald, Ohio.
  2. Plant Elevation: 600 feet above sea level.
  3. Ambient Temperature Range: 70 to 105 degrees F.
  4. Barometric Pressure, inches Hg absolute (mean at 70 degrees F): 29.92.
  5. Relative Humidity: Varies from 35 percent to 60 percent.
- C. Electrical Supply:
1. 120 volts, single phase, 60 Hz.

**1.8 SEQUENCING AND SCHEDULING**

- A. The sequencing of work and scheduling of tasks shall follow the project schedule and milestones approved by the Construction Manager. Acquisition/delivery of system equipment shall adhere to and support the approved project schedule.

**1.9 WARRANTY**

- A. Special Warranty
  1. Correct defective work within a 1-year period after substantial completion.
  2. Provide 2-year manufacturer's warranty for system components.

**1.10 OPERATION AND MAINTENANCE**

- A. The Contractor shall furnish to the Construction Manager, two complete sets of operation and maintenance manuals. These shall include a complete description of the recommended operating procedures, maintenance procedures, and a spare/replacement parts list for equipment items with catalog data, diagrams, and drawings or cuts describing the equipment. Each set shall include full size assembly and wiring diagrams. Drawings showing "as-built" conditions shall be furnished to the Construction Manager.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. The PLC and its accessories shall be Allen Bradley, or equal.
- B. The CPU shall be SLC5/03 Base System, or equal.

## 2.2

## EQUIPMENT

## A. Control Processor

1. The CPU shall contain all the relays, timers, counters, number storage registers, shift registers, sequences, arithmetic capability, and comparators necessary to perform the specified control functions. It shall be capable of interfacing sufficient discrete input, analog inputs, discrete outputs, and analog outputs to meet the specified requirements plus 25 percent excess capacity. The power supply shall contain capacitors to provide for orderly shutdown in the event the incoming power does not meet specifications. If this occurs, the processor will cease operation, forcing all outputs off. The processor shall have a memory protect capable of preventing unauthorized program changes.

## B. Memory

1. The programmable controller memory shall have CMOS semi-conductor memory with battery backup or EPROM electrically alterable read only memory. The CMOS memory shall be a minimum of 2K with battery backup to retain the program during power interruptions of up to 1 year. An indicator shall show the status of the batteries and a reference shall be available through the discrete outputs to alarm the operator that the batteries should be changed.
2. The unit shall be supplied with sufficient memory to implement the specified control functions plus a reserve capacity of 25 percent of the total provided. This reserve capacity shall be totally free from any system use. The memory shall be programmed in a multi-node configuration with multiple series or parallel contacts, counters, timers, and arithmetic functions.

C. Controller

1. The controller shall be programmed in annotated "ladder diagram" language. It shall be easily reprogrammed with a portable programmer. The PLC system shall be programmed by the vendor to accomplish the control and monitoring specified and shown on the drawings. Two documented copies of the operating program shall be furnished which allow direct, step-by-step, reloading of the system program. Copies of this program shall be furnished in the format used in the contract diagrams for conventional relay control systems. These diagrams shall reflect equipment name designations used in the PLC as well as the contract diagram equipment name designations (i.e., timer "Q" in the contract drawing may become timer OL in PLC program). Two sets of application software on 3-1/2 inch floppy disk shall be provided.
2. Process Control Logic Description
  - a. The FE/FIT012A and FE/FIT012B are analog input to the PLC.
  - b. FY012A and FY012B are software functions monitoring the differential flow rate of flow elements FE/FIT012A and FE/FIT012B.
  - c. FSH012A is a software function alarming when the flow rate differential between FI012A and FI012B is greater than 5 percent.
  - d. FSHH012B is a software function stopping PMP-001 and PMP-002, via XS-010, when the flow rate differential between FI012A and FI012B is greater than 10 percent.
  - e. FSH012A is a software function which sends two digital outputs, one to the PLC for the pilot light (FAH-012A) and the second to alarm at the pump station.
  - f. FSHH012B is a software function sending two digital outputs, one to stop the pump and the second signal to the PLC for alarm.
  - g. FI012A and FI012B are analog outputs to the PLC to indicate the flow.

- h. One analog output to FIR012B is for the flow recorder.

D. Power Supply

- 1. The power supply shall operate at the following:
  - a. 120V AC rms  $\pm 15$  percent continuously.
  - b. 120V AC rms  $\pm 30$  percent maximum 30 seconds.
  - c. 120V AC rms  $\pm 100$  percent maximum 17 milliseconds.
  - d. Line spikes at 1000V AC (5000 micro-seconds duration; 0.5 percent maximum duty).

E. Input/Output Modules

- 1. All input/output housings and modules shall be rugged construction with modules in place. Sufficient input and output modules shall be provided to implement the specified control functions.
  - a. Discrete Input Modules - are defined as contact closure inputs from devices external to the programmable controller module. Input modules shall be shielded from short time constant noise and 60 Hz pickup. Individual inputs shall be optically isolated from low energy, common mode transients to 1500 volts peak from users wiring or other input/output modules. The modules shall have LED lights to indicate a discrete input.
  - b. Discrete Output Modules - are defined as contact closure output for on/off operation of devices external to the programmable controller module. The output modules shall be optically isolated from inductively generated, normal mode and low energy common mode transients to 1500 volts peak. All modules shall have LED lights to indicate output has been cycled on by the controller.
  - c. Analog Input Modules - are defined as analog inputs or 1 to 5V DC, 0 to 10V DC, or 4 to 20 mA DC signals, where an analog to digital conversion is performed and the digital result is entered into the processor. Inputs are read every scan.

d. Analog Output Modules - are defined as analog output or 1 to 5V DC, 0 to 10V DC, or 4 to 20 mA DC signals, where a digital-to-analog conversion is performed and the analog result is produced as an output. Outputs are produced on every scan.

F. Input/Output Section

1. Defined as heavy duty housing containing input and output control device that are directly connected to the controller.

G. Programming Unit

1. The programmer shall be capable of being directly plugged into the system without the requirement of additional hardware. All programming, monitoring, searching, and editing shall be accomplished with the programmer. These functions shall be capable of being done "on-line" while the process is scanning or "off-line." The programmer shall display multiple series and parallel contact, coils, timers, counters, and calculate functions. The programmer shall also be able to monitor the status of all inputs, outputs, timers, counters, and coils. It shall have the capability to disable/force all inputs, outputs, and coils to simulate system operation. It shall also indicate "power flow" through all elements and include a search function to locate any element and its program location. The processor status information, such as error indication and amount of memory remaining, shall be shown on the CRT screen. Two sets of system operating software on a 3-1/2 inch floppy disk along with documentation shall be provided.

## H. Electrical Control Panels and Cabinets

## 1. General

- a. Any control panel and/or cabinets the contractor provides for equipment including the system controller(s) shall be NEMA enclosure, Type 4. NEMA Type 12 is acceptable for equipment located in the control room or in clean areas. Cabinets constructed of metal shall have their exterior finished with primer and finish enamel, and the interior of the cabinet shall be finished in white enamel, except when the enclosure is stainless steel. The cabinet shall be permanently mounted and the pushbuttons shall be readily accessible from a walkway. Equipment in the control room will be mounted on a raised floor.

## 2. Wiring

- a. All wiring internal to the panel shall be in accordance with NFPA 70 and rated for electrical service as follows:
  - 1) Instrument and alarm systems shall be operated from 120 volt, 60 Hz circuits.
- b. The panel shall be provided with terminal blocks to receive all wires leaving the enclosure with no more than two wires per terminal.
- c. All internal wires shall run continuously (without splices) between instruments and/or terminal points.
- d. Wiring must be installed so that disconnection or removal of each individual component or device can be made without distortion or removal of wiring bundles, surface raceways, etc.
- e. Any instrument whose power sources exceed 30 volts DC or 30 volts AC shall be connected to panel electrical ground through a separate grounding conductor.

3. Components and equipment
  - a. Pushbuttons shall be heavy duty, oil tight, and mounted directly on the panel with rear access for wiring.
  - b. Voltage transformers shall be air-cooled dry type rated for the service.
  - c. Electrical protection for each major circuit shall be provided by appropriately sized fuses and/or circuit breakers.
  - d. Permanently mounted nameplates shall be provided on the interior of the panel for identifying major components, and on the exterior of the panel for identifying the function of the associated pushbuttons. Nameplates shall be of a size that makes them readily observable, white, and engraved with black lettering.

## 2.3 ACCESSORIES

### A. Tools and Special Equipment

1. The Contractor shall furnish any tools and/or special equipment unique to the system required for maintenance and operation of the system such as, but not limited to:
  - a. Card extenders
  - b. Extraction tools
  - c. Special cables
  - d. Jumper connections
  - e. Software

## 2.4

## FABRICATION

## A. Panel Fabrication Requirements

1. A data access panel shall be furnished to display the process condition.
  - a. The digital panel meters (FI-012A and B) shall have a display of at least 3-1/2 digits and shall be 14 mm high LED display. Accuracy shall be plus or minus 0.1 percent of full scale and plus or minus one digit. The indicator input shall be 4-20 mA DC and power supply shall be 120 VAC.
  - b. The pilot light (FAH-012A) shall be LED display, and power supply shall be 120 VAC.
  - c. The flow alarm (FAHH-012B) shall be panel-mounted, audible (buzzer) type, and power supply shall be 120 VAC.
  - d. The instrument receiver (FIR-012B) shall be chart recorder type. The input shall be 4-20 mA DC and power supply shall be 120 VAC (Refer to Section 13400, Article 2.1, Paragraph H).
2. Cabinets and enclosures shall be designed to prevent hot spots. Surfaces shall be dry and clean of rust, dirt, weld spatter, oil, grease, crayon, and other loose materials prior to painting. If painted, rust inhibiting prime coat shall be applied in a dust-free sheltered area as soon as possible after surface preparation to a minimum dry film thickness of 1-1/2 mils. Temperature of adjacent air and surface to be coated shall be within the limits recommended by the coating manufacturer. Materials shall be prepared, mixed, applied, and cured in accordance with coating manufacturer's instructions.

**PART 3 EXECUTION**

**3.1 ONE DAY ACCEPTANCE TEST**

- A. A 1-day acceptance test is required. The system must run continuously for one consecutive 24-hour period. During this period, all system functions shall be exercised and any system interruption and accompanying component, subsystem, or program failure shall be logged for cause of failure, as well as time of occurrence and duration of each failure. A failure shall cause termination of the 1-day acceptance test. When the cause of a failure has been corrected, a new 1-day acceptance test shall be started.
  
- B. Each time the contractor's technician is required to respond to a system malfunction, the technician must complete a report which shall include details concerning the nature of the complaint or malfunction, and the resulting repair action required and taken.

**3.2 FACTORY TESTING**

A. Test

- 1. All electrical equipment containing a solid-state logic system shall be tested for a minimum of 40 hours at an ambient temperature of 120 degrees F prior to shipment from the factory. For testing, the equipment shall be interconnected with devices which will cause it to repeatedly perform all operations it is expected to perform in service with loads of the various components equivalent to those which will be experienced in actual service. the Construction Manager may witness testing of the units. Solid-state logic systems shall be tested as complete assemblies. Testing of individual components or modules will not be acceptable.

**3.3 PROTECTION**

- A. During the course of installation, it is the Contractor's responsibility to take appropriate measures to maintain the general work area in a clean and safe condition.

**END OF SECTION**

**SECTION 15000****MECHANICAL****PART 1: GENERAL****1.01 SCOPE**

- A. This section includes material and equipment for:
1. Permanent lift station electrically actuated isolation valve, lift station control panel, associated instrumentation, sealed 12 VDC battery, battery charger, alarm light, alarm sirens and all other work indicated on Construction Drawings or as specified herein.
  2. Leachate collection and leak detection manhole manual valves, control panel and associated instrumentation, sealed 12 VDC battery, alarm lights, and all other work indicated on Construction Drawings or as specified herein.
  3. Access covers for the leak detection and leachate collection manholes, permanent lift station, and LCS, LDS, and reduded LCS cleanouts.
  4. Leachate transmission system vent pipe and vent pipe support.
  5. Leachate transmission system auxiliary connection.
  6. Temporary gravity line flow control valve.
- B. Additional work included in this section is the testing/startup and necessary support for testing/startup activities of the following:
1. Leak detection and leachate collection manhole manual sampling valves, manual monitoring valves and manual isolation valves.
  2. Permanent lift station electrically actuated isolation valve, lift station alarms and level control panel, associated instrumentation, sealed 12 VDC battery, battery charger, alarm light, and alarm sirens.
  3. Leak detection manhole and leachate collection manhole control panels, associated instrumentation, and alarm lights.
  4. Temporary gravity line flow control valve.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02605 - High Density Polyethylene (HDPE) Manholes, Pipe, and Fittings
- B. Section 16050 - Basic Electrical Materials and Methods
- C. Construction Quality Assurance (CQA) Plan

### 1.03 REFERENCES

- A. Materials and methods shall conform to applicable requirements of documents listed below. In case of conflict between this Section and the listed documents, the requirements of this Section shall prevail.
- B. Latest version of American National Standards Institute (ANSI) standards:
  - 1. ANSI A13.1 Standard Specification for Piping and Piping Systems.
  - 2. ANSI A74 Standard Specification for Cast Iron Soil Pipe and Fittings.
- C. Latest version of American Petroleum Institute (API) standards:
  - 1. API 1104 Standard Specification for Welding of Pipeline and Related Facilities.
- D. Latest version of American Society of Mechanical Engineers (ASME) standards:
  - 1. ASME B2.1. Standard Specification for Pipe Threads.
  - 2. ASME B16.1. Standard Specification for Cast Iron Pipe Flanges and Flanged Fittings.
  - 3. ASME B31.9. Standard Specification for Building Services Piping.
- E. Latest version of American Society for Testing Materials (ASTM) standards:
  - 1. ASTM F 477. Standard Test Method for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - 2. ASTM A 312.
- F. National Electrical Manufacturers' Association (NEMA):
  - 1. NEMA ICS 6-93 Industrial control and Systems-Enclosures
- G. American Institute of Steel Construction (AISC):
  - 1. Manual of Steel Construction, Ninth Edition

### 1.04 SUBMITTALS

- A. Submit shop drawings with the type of construction materials, manufacturer and catalog or model number, electrical characteristics, etc. for products in this Section to the Construction Manager for review at least 30 calendar days from Notice to Proceed.
- B. Submit to the Construction Manager for review and approval at least 30 calendar days from Notice to Proceed shop drawings that include dimensions, ratings, mounting

requirements, clearances, components interface, wiring diagrams and other information required for evaluation and complete installation.

- C. Submit "Record" copies of all shop drawings to the Construction Manager before final inspection and acceptance.
- D. After completion of the work, furnish and deliver 4 copies of complete operating instructions, installation and maintenance instructions, and spare parts bulletins.

## **PART 2 PRODUCTS**

### **2.01 LEACHATE COLLECTION AND LEAK DETECTION MANHOLE EQUIPMENT**

- A. Furnish control panels to house leak detection and level alarm equipment.
- B. Furnish control panel enclosure exposure rated National Electrical Manufacturer's Association (NEMA) ICS 6, Type 3R, constructed of 14 gauge G-90 galvanized steel, with all surfaces phosphatized, finished inside and outside with ANSI 61 gray polyester powder finish, with an outer door and inner panel face door and the following features:
  - 1. Provide the panel with a full width drip shield formed into the top cap to prevent standing water from dripping into the interior when door is opened.
  - 2. Furnish The panel drip shield and formed edges of the enclosure to provide a seating surface for the full door gasket.
  - 3. Equip the outer door and inner panel face door with two galvanized hinges with stainless steel hinge pins.
  - 4. Equip the panel outer door with two padlock-capable draw-pull latches.
  - 5. Provide the panel with removable steel component mounting panel plate finished in white enamel and drilled and tapped for component mounting.
- C. Furnish power to the control system from a 12 VDC source supplied by a pole mounted 53 watt solar collector with a NEMA ICS 6, Type 3R sealed control module and 115 Amp/hour sealed lead acid battery in a NEMA ICS 6, Type 3R enclosure. Mount solar collector on pole facing due south at the angle recommended by the manufacturer.
- D. Include the following as standard features for the control panel.
  - 1. Terminal strip to allow for easy connection of external components.
  - 2. Two (2) Programmable Level Controller/Level Indicators mounted in a cutout on the inner panel face door, with the following:

- a. Digital level indication readout accurate to  $\pm 0.1$ -inch of water.
  - b. Minimum of 2 alarm relay contacts rated at 5 amps at 120 VAC.
  - c. Minimum of 2 alarm signal inputs rated at 4-20mA/250 Ohms, 0-10 Volts.
  - d. Full span accuracy of 0.20 percent.
  - e. Input signal smoothing for 120 second.
3. On-Off spring return to OFF, single pole, single throw switch, NEMA Type 3R, rated 0.5 Amp, 24 VDC, mounted on inner panel door face for alarm light testing.
  4. Three (3), single pole, Class 8700, industrial control relays, NEMA Type 600, with normally open contacts, rated at 24 VDC, 5 Amp, with 12 VDC coil.
  5. One (1), single pole, Class 9050 timing relay, NEMA Type PM, rated at 24 VDC, with timing range of at least 2 hours.
- E. Furnish submersible level transmitter with the following:
1. Solid state semiconductor sensor.
  2. Housing of 316 stainless steel .
  3. Range of 0-14 feet of water, 0-6 psi with 4-20 mA output.
  4. Full span accuracy of  $\pm 0.50$  percent.
  5. Fifty (50) feet of lead wire.
- F. Furnish alarm light with an intensity of 50 candelas, pipe mount, amber color, strobe type, with a flash rate of 60 flashes per minute, rated at 12 VDC, weatherproof marine type.

## 2.02 LEACHATE COLLECTION AND LEAK DETECTION MANHOLE CONTROL PANEL FUNCTIONAL OPERATION

- A. For each OSDF cell, with the cell number herein indicated by the "\*" symbol, when the leachate collection system manhole level transmitter LT-\*02 transmits a Hi-Hi level signal to the Programmable Level Controller/Level Indicator LIC-\*02, the LIC Hi-Hi-level contact closes, energizing relay \*Y2 (Hi-Hi Level), which energizes relay \*TY4 (Alarm Light Timer), which then energizes relay \*Y3 (Alarm Light) and the alarm light LA-\*01 begins flashing and continues operation for at least 2 hours after the level transmitter ceases sending a Hi-Hi level signal unless alarm light timer is manually reset.
- B. For each OSDF cell, with the cell number herein indicated by the "\*" symbol, when the leak detection system manhole level transmitter LT-\*01 transmits a Hi-Hi level signal to the Programmable Level Controller/Level Indicator LIC-\*01, the LIC Hi-Hi-level contact closes, energizing relay \*Y1 (Hi-Hi Level), which energizes relay \*TY4 (Alarm Light Timer) which then energizes relay \*Y3 (Alarm Light) and the alarm light

LA-\*01 begins flashing and continues operation for at least 2 hours after the level transmitter ceases sending a Hi-Hi level signal unless alarm light timer is manually reset.

## 2.03 LEACHATE COLLECTION AND LEAK DETECTION MANHOLE VALVES

- A. Furnish leachate collection manhole monitoring valves consisting of 1/2 inch polyvinyl chloride (PVC) ball valves with NPT threaded connectors, Teflon backed ethylene propylene diene (EPDM) seats and EPDM seals, rated at 30°F to 120°F, 150 psig, and mounted on an HDPE service saddle fitting with a noncorroding threaded insert on the leachate collection and redundant leachate collection system containment pipes for monitoring leakage from the carrier pipe.
- B. Furnish leachate collection manhole sampling valves consisting of 1/2 inch PVC ball valves with NPT threaded connectors, Teflon backed EPDM seats and EPDM seals, rated at 30°F. to 120°F, 150 psig, and mounted on an HDPE service saddle fitting with a noncorroding threaded insert on the leachate collection and redundant leachate collection system carrier pipes for sampling leachate.
- C. Furnish leachate collection manhole check valve from APCO Valve and Primer Corp., Series 906GEIF (or equal), consisting of 6-inch flanged Type 316 stainless steel double door check valve with EPDM seat, low torque Type 316 stainless steel torsion spring, Type 316 stainless steel doors, hinge pin, and stop pin. Doors shall require less than 9 inches of water head to begin to open, rated at 30°F to 120°F, 125 psig, and mounted in the leachate collection system carrier pipe with any required spacers for proper valve operation. Mount the check valve downstream of the butterfly valve.
- D. Furnish leachate collection manhole manual butterfly valves consisting of 6-inch flanged PVC wafer style, lever action, Type 75, butterfly valve with PVC disc, EPDM seats, EPDM seals rated at 30°F to 120°F, 100 psig, and mounted in the leachate collection and redundant leachate collection system carrier pipes with any required spacers for proper valve operation.
- E. Furnish leak detection manhole monitoring valve consisting of 1/2 inch PVC ball valve with NPT threaded connectors, Teflon backed EPDM seats and EPDM seals, rated at 30°F. to 120°F, 150 psig, and mounted on an HDPE service saddle fitting with a noncorroding threaded insert on the leak detection containment pipe for monitoring leakage from the carrier pipe.
- F. Furnish leak detection manhole check valve from Red Valve Co., Series 37 (or equal) consisting of a 3-inch flanged EPDM in-line check valve rated at 30°F to 120°F,

100 psig, and mounted in a flanged SDR 13.5 spool piece before installation in the leak detection system manhole outlet piping.

#### 2.04 TEMPORARY GRAVITY LINE FLOW CONTROL VALVE

- A. Furnish temporary gravity line manual butterfly valve from CSR Polypipe, Assembly 8771 (or equal) consisting of 6-inch/10-inch HDPE dual contained fusion type butterfly valve with Type 316 stainless steel disk and stem, and EPDM seats. Include 7-foot stem extension with 3/4-inch type 316 stainless steel shaft, 1 1/2-inch HDPE guide sleeve with stabilizer fins. Manufacture HDPE components from resin satisfying the requirement for Article 2.02 "HDPE Compound" of Section 02605. Valve shall be installed by fusion personnel in accordance with Article 3.05 "HDPE Pipe Joints, Fittings, and Appurtenances Connections" of Section 02605.

#### 2.05 PERMANENT LIFT STATION EQUIPMENT

- A. Furnish the control panel to house level detection, level alarm and isolation equipment.
- B. Furnish control panel enclosure exposure rated NEMA ICS 6, Type 3R, constructed of 14 gauge, G-90 galvanized steel, with all surfaces phosphatized, finished inside and outside with ANSI 61 gray polyester powder finish, with an outer door and inner panel face door and the following features.
  - 1. Provide the panel with a full width drip shield formed into the top cap to prevent standing water from dripping into the interior when door is opened.
  - 2. Furnish the panel drip shield and formed edges of the enclosure to provide a seating surface for the full door gasket.
  - 3. Equip the outer door and inner panel face door with two galvanized hinges with stainless steel hinge pins.
  - 4. Equip the panel outer door with two padlock-capable draw-pull latches.
  - 5. Provide the panel with removable steel component mounting panel plate finished in white enamel and drilled and tapped for component mounting.
- C. Furnish power to the control system from a 120 volt, 60 hertz, 1 phase power feed.
- D. Include the following as standard features for the control panel.
  - 1. Heater with adjustable thermostat to promote even distribution of heat and elimination of hot spots and condensation. Heater element shall be mounted in a space between the subpanel and the back of the enclosure and provide a minimum of 50 watts of heating capacity at 120 VAC.
  - 2. Terminal Strip: to provide easy connection of external components.

3. One (1) Programmable Level Controller/Level Indicator mounted in a cutout on the inner panel face door, with the following:
    - a. Digital level indication readout accurate to  $\pm 0.1$ -inch of water.
    - b. Minimum of 4 alarm relay contacts rated at 5 amps at 120 VAC.
    - c. Minimum of 4 alarm signal inputs rated at 4-20mA/250 Ohms, 0-10 Volts.
    - d. Full Span accuracy of  $\pm 0.20$  percent.
    - e. Input signal smoothing for 120 second .
  4. One (1) Honeywell UDC 3000 Versa-Pro Universal Digital Programmable Level Controller/Level Indicator mounted in a cutout on the inner panel face door, with the following:
    - a. Digital level indication readout accurate to  $\pm 0.1$ -inch of water.
    - b. Minimum of 2 alarm relay contacts rated at 5 amps at 120 VAC.
    - c. Minimum of 2 alarm signal inputs rated at 4-20mA/250 Ohms, 0-10 Volts.
    - d. Full Span accuracy of  $\pm 0.20$  percent.
  5. On-off spring return to OFF, single pole, single throw switch, NEMA Type 3R, rated at 5 Amps, 24 VDC mounted on inner panel door face for alarm testing.
  6. One (1) 5 pole, Class 8501 industrial control relay, NEMA Type A 600, rated 600 volt, 10 Amp, with 120 VAC coil with 2 normally open contacts and 3 normally closed contacts
  7. One (1) 115-VAC to 12-VDC, 100 mA rectifier for level control panel normal 12-VDC supply power.
  8. One (1) single pole Class 9050 timing relay, NEMA type PM, rated at 12 VDC with timing ranges of at least 2 hours.
  9. The following Class 8700 industrial control relays, NEMA Type 600, rated at 24 VDC, 5 Amp, with 12 VDC coil as follows:
    - a. Two (2) 2-pole with 1 normally open contact and 1 normally closed contact.
    - b. One (1) 2-pole with 2 normally open contacts.
    - c. One (1) 4-pole with 1 normally open contact and 3 normally closed contacts.
- E. Furnish submersible level transmitter with the following:
1. Solid state semiconductor sensor.
  2. Housing of 316 stainless steel .
  3. Range of 0-14 feet of water, 0-6 psi with 4-20 mA output
  4. Full span accuracy of  $\pm 0.50$  percent.
  5. Fifty (50) feet of lead wire.
- F. Furnish alarm light pipe mount, amber color, strobe type, with a flash rate of 60 flashes per minute, an intensity of 50 candelas, rated at 12 VDC, weatherproof marine type.

- G. Furnish industrial siren, motor driven, UL Listed, heavy duty, weatherproof rated at 120 VAC, 110 dB at 100 yards.
- H. Furnish industrial siren, UL Listed, heavy duty, weatherproof rated at 12-VDC, 40 dB at 25 feet.
- I. Furnish sealed lead acid battery, maintenance free-valve regulated rated at 12-VDC, 50 Watt, 40 Amp/hr with a NEMA ICS 6 Type 3R enclosure.
- J. Furnish 12-VDC solid state battery charger, rated at 120 VAC input, 12-VDC output, 30/2 Amp fully automatic with analog ammeter.

## **2.06 PERMANENT LIFT STATION CONTROL PANEL FUNCTIONAL OPERATION**

- A. The permanent lift station level control panel normal power supply is from a 120-VAC breaker to a 115-VAC to 12-VDC rectifier (PS-110). The rectifier (PS-110) supplies 12-VDC power to the LICs and control relays. Relay 10Y5 is normally energized and the relay coil (120 VAC) is fed from the same breaker as the rectifier. With 10Y5 energized its normally open contacts 1-2 and 3-4 are closed supplying 12-VDC power to the level control system.
- B. If the 120-VAC breaker trips or if 120-VAC power is lost, relay 10Y5 deenergizes, the normally open contacts 1-2 and 3-4 open, and the normally closed contacts 5-6 and 7-8 close supplying 12-VDC backup power from a 12-VDC sealed battery (PS-111) mounted in the control panel. Also relay 10Y5 contact 9-10 closes which energizes timing relay 10TY4 which energizes the 12-VDC alarm light (LA-110) and 12-VDC (LA-111B) alarm siren.
- C. When 120-VAC power is restored, relay 10Y5 energizes, the normally open contacts 1-2 and 3-4 close, and the normally closed contacts 5-6 and 7-8 open, isolating the 12-VDC backup power (PS-111) and restoring the normal 12-VDC power from the rectifier (PS-110) for the control panel.
- D. If the 12-VDC control power fuse (10-1) blows, relay 10Y6 deenergizes, the normally closed contacts 1-2 and 3-4 close supplying 12-VDC backup power from a 12-VDC sealed battery (PS-111) mounted in the control panel. Relay 10Y6 contact 7-8 opens to isolate the relay from the 12-VDC backup power. Also relay 10Y6 contact 5-6 closes which energizes timing relay 10TY4 which energizes the 12-VDC alarm light (LA-110) and 12-VDC (LA-111B) alarm siren.

- E. When normal 12-VDC power (PS-110) is restored, relay 10Y6 energizes, the normally closed contacts 1-2 and 3-4 open isolating the 12-VDC backup power and restoring the normal 12-VDC power from the rectifier, (PS-110) for the control panel.
- F. When the permanent lift station level transmitter transmits a Hi-Hi level signal to the Programmable Level Indicator/Controller, LIC-110, the Hi-Hi level contact closes, energizing relay 10Y1 which closes the permanent lift station inlet motor operated valve (V-001) and energizes relay 10TY4 (alarm time relay) which energizes relay 10Y2 (alarm light and alarm siren relay) and the 12-VDC alarm light (LA-110) begins flashing and the 120-VAC alarm siren (LA-111A) sounds and both continue operation for at least 2 hours after the level transmitter ceases sending a Hi-Hi level signal unless the alarm timer is manually reset.
- G. When the permanent lift station annular space level transmitter transmits a Hi-Hi level signal to the Programmable Level Indicator/Controller, LIC-111, the Hi-Hi level contact closes, energizing relay 10Y3 which closes the permanent lift station inlet motor operated valve (V-001) and energizes relay 10TY4 (alarm time relay) which energizes relay 10Y2 (alarm light and alarm siren relay) and the 12-VDC alarm light (LA-110) begins flashing and the 120-VAC alarm siren (LA-111A) sounds and both continue operation for at least 2 hours after the level transmitter ceases sending a Hi-Hi level signal unless the alarm timer is manually reset.
- H. The High 2 level, High 1 Level, and Low level contacts in the Programmable Level Indicator/Controller (LIC-110) will be available for permanent lift station pumps control. The wiring and programming of those setpoints are given in Section 15160 and as indicated on the Construction Drawings.

## 2.07 PERMANENT LIFT STATION MANHOLE LEACHATE TRANSMISSION SYSTEM HEADER ISOLATION VALVE

- A. Furnish the permanent lift station manhole leachate transmission system header isolation valve consisting of a 6-inch flanged safe block PVC ball valve with EPDM valve seals, Teflon backed EPDM seats, rated at 30°F to 120°F, 150 psig with a BV Series electric actuator rated at 120 VAC. The electric valve actuator shall fail closed upon loss of electric power by means of a return spring or a backup battery pack. Furnish electric valve actuator with reversing type, capacitor run motor design, thermally protected with a permanently lubricated gear train in a NEMS ICS6, Type 4 enclosure. Provide actuator with manual override, visual position indicator, and bolt circle to match header isolation valve.

## 2.08 FRAME AND COVERS

- A. Frame and access covers shall be single leaf of the size indicated on the Construction Drawings. Metal curb, complete with counter flashing and 1-inch rigid insulation shall be 14 gauge, Type 316 stainless steel. The 12-inch curb shall be formed with a 3-1/2-inch flange which includes holes at 6 inches on center for attachment to the concrete slab with expansion anchors. Metal cover, complete with 1-inch insulation covered by metal liner, and inside handle, shall be 14 gauge, Type 316 stainless steel.
- B. Frame and access cover shall be assembled with spring hinges entirely contained within cover to prevent outside tampering. All hardware shall be cadmium plated. Cover shall be equipped with automatic hold open arm, complete with grip handle, which provides easy one-hand release. Spring latch, providing inside and outside operation, shall include provision of locking from the outside. Cover shall provide for venting of the manhole and prevent infiltration of surface-water runoff from entering the manhole.
- C. Frame and access cover for temporary gravity line cleanout shall be as indicated on the Construction Drawings.

## 2.09 LTS VENT PIPE AND VENT PIPE SUPPORT

- A. LTS Vent Pipe
  - 1. Design, fabrication, and erection of structural steel shall be in accordance with American Institute of Steel Construction (AISC) Manual of Steel Construction, Ninth Edition.
  - 2. Pipe shall be seamless, Type 316 stainless steel, ASTM A-312, and ASTM 1-53, beveled ends.
  - 3. Fittings shall be seamless Type 316 stainless steel butt weld ASTM A-403.
  - 4. All welding electrodes shall be AWS D1.1 Class E316. Visually inspect all welds.
  - 5. Vent pipe shall have Type 304 stainless steel insect screen with a 18 x 18 mesh constructed of 0.009-inch diameter wire.
  - 6. Vent pipe shall be equipped with a 4 inch quick connect hose coupling with chain connected locking dust plug manufactured of Type 316 stainless steel.
- B. LTS Vent Pipe Support
  - 1. Support shall be able to resist loads of 1,000 pounds vertical and horizontal, have 3 legs, be fabricated from Type 316 stainless steel, and be connected to the manhole cover slab.

**2.10 AUXILIARY CONNECTION**

- A. Auxiliary connection shall be constructed of Type 316 stainless steel.
- B. Quick connect shall be a 3-inch disconnect with Buna-N seals, rated at 30°F to 120°F, 100 psig, NPT threads.

**2.11 FLANGE GASKETS**

- A. Furnish low torque type flange gaskets in accordance with ASTM F 477.

**PART 3 EXECUTION****3.01 INSTALLATION**

- A. Install all materials included in this Section in compliance with the manufacturer's written installation instructions.
- B. Fabricate the control systems as shown on the approved shop drawings. Install controls and perform all necessary field electrical work to connect the local and remote control devices.
- C. Control panel signal and control circuit wiring shall conform to the following:
  - 1. Run all wires in plastic wireways except field wiring, wiring run between mating blocks in adjacent sections, wiring from components on a swing-out panel to components on a part of the fixed structure, and wiring run to panel-mounted components.
  - 2. Wiring run from components on a swing-out panel to other components on a fixed panel shall be made up in tied bundles. Tie these bundles with nylon wire ties, and secure to panels at both sides of the "hinge loop" so that conductors are not strained at the terminals.
  - 3. Tie wiring run to control devices on the front panels together at short intervals (6 inches maximum) with nylon wire ties and secured to the inside face of the panel using adhesive mounts.
  - 4. Run wiring to rear terminals on panel-mount instruments in plastic wireways secured to horizontal brackets run above or below the instruments in approximately the same plane as the rear of the instruments.
  - 5. Conformance to the above wiring installation requirements shall be reflected by details shown on the shop drawings.

6. Tag instrument signal circuit conductors with unique multiple digit numbers consistent with Section 16050 of these specifications.
  7. Tag black and white wires from the circuit breaker panel board including the 1- or 2-digit number of the branch circuit breaker.
- D. Installation, calibration, testing and start-up instructions are as follows:
1. Provide the installation personnel with a final reviewed copy of the shop drawings and data. Install all external wiring in conformance with Section 16050 of these specifications. All systems shall be installed, connected, calibrated, and tested as described below.
    - a. Install the instrument process sensing lines in a similar manner to the installation of conduit specified under Section 16050. Run individual tubes parallel and near the surfaces from which they are supported. Use supports at intervals of not more than 3 feet of rigid tubing.
    - b. Form bends with the proper tool and to uniform radii. Bends shall be made without deforming or thinning the walls of the tubing. Use plastic clips to hold individual plastic tubes parallel. Square-cut ends of tubing and clean before insertion in the fittings. Provide bulkhead fittings at all panels requiring pipe and/or tubing entries.
    - c. The Subcontractor shall have a technical field representative instruct the installation personnel on any and all installation requirements. Thereafter, the technical field representative shall be readily available by telephone to answer questions and supply clarification when needed by the installation personnel.
    - d. After all installation and connection work has been completed, the technical field representative shall check it for correctness, verifying polarity of electric power and signal connections, making sure all process connections are free of leaks, and all other similar details. The technical field representative shall certify in writing to the Subcontractor that for each loop or system checked out, all discrepancies have been corrected by the installation personnel.
- E. Attach access covers to concrete slab with expansion anchors. Provide a watertight connection between the access cover and the concrete slab.

[END OF SECTION]

SECTION 15160  
LIFT STATION PUMPS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Materials, equipment, components, and services necessary for furnishing and installing two automatically controlled lift station pumps and furnishing one spare pump.

**1.2 RELATED SECTIONS**

- A. Section 15000 - Mechanical.
- B. Section 16050 - Basic Electrical Materials and Methods.

**1.3 REFERENCES**

- A. National Fire Protection Association (NFPA):
- NFPA 70 National Electrical Code, 1996 Edition.
- B. American National Standards Institute (ANSI):
- ANSI B16.1-89 Cast Iron Pipe Flanges and Flanged Fittings.
  - ANSI 360-86 UL Standard for Safety Liquid-Tight Flexible Steel Conduit, Third Edition., 1994
- C. National Electric Manufacturers Association (NEMA):
- NEMA ICS 2-93 Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.
  - NEMA ICS 6-93 Industrial Control and Systems Enclosures.
  - NEMA MG 1-93 Motors and Generators. Rev. No. 2, 1995

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- D. Hydraulics Institute Standards - 1995.
- E. Underwriters Laboratories, Inc. (UL):
  - 1. UL 67-93 UL Standard for Safety Eleventh Ed., 1995 Panelboards.
  - 2. Electrical Construction Materials Directory, 1995.

1.4 SUBMITTALS

- A. Support Literature:
  - 1. The Subcontractor shall submit dimensional drawings with size, weight, ratings, materials of construction, pump curves, and test procedures from the pump manufacturer for the pump and related equipment specified herein.
  - 2. Installation Instructions.
  - 3. Operation and Maintenance Instructions:
    - a. The pump manufacturer shall supply a complete set of comprehensive written instructions to enable an operator to properly operate and maintain the equipment supplied. Content of the instructions shall assume the operator is familiar with pumps, motors, piping, and valves, but that the operator has not previously operated nor maintained the exact equipment supplied.
    - b. The instructions shall be prepared as a system manual applicable solely to the pump equipment and related devices supplied by the manufacturer, as specified herein.
    - c. The instructions shall include, but not be limited to, the following:
      - (1) Descriptions of, and operating instructions for, each major component of the complete pump package as supplied.
      - (2) Instructions on operation of the pump and pump controls in all intended modes of operation.
      - (3) Instruction for adjustments which must be performed at initial start-up of pump equipment, adjustments required after the replacement of liquid level control

system components, and adjustments as required in the course of preventative maintenance as specified by the manufacturer.

- (4) Service instructions for major components not manufactured by the pump package manufacturer, but supplied by the manufacturer in accordance with the specifications. In such case, the literature supplied by the actual manufacturer shall be incorporated as appendices.
- (5) Electrical schematic diagram of the pump and control package.
- (6) Layout drawings of the pump package as supplied showing the location of all submersible pumps, baseplates, and guide assemblies. Drawings shall provide necessary information to ensure proper installation and alignment of the guide rails and baseplate to the pump.

B. Certificates of Conformance: Manufacturer shall certify and provide data which indicate that supplied products meet or exceed the requirements of this specification.

C. Suggested spare parts inventory.

#### 1.5 QUALITY ASSURANCE PROGRAM

A. Manufacturer: Company specializing in the manufacture of the equipment and other items specified in this section having a minimum 3 years documented experience.

B. All work shall comply with NFPA 70. Use of conduit for equipment ground is prohibited.

C. Products shall be listed in the UL Electrical Construction Materials Directory for the purpose specified and indicated.

D. Operational Test:

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1. The pumps, motors, and controls shall each be given an independent operational test in accordance with the standards of the Hydraulics Institute. Recordings of the test shall constitute the correct performance of the equipment at the design head, capacity, and rated speed and horsepower as specified herein.

## 1.6 Warranty

- A. Special Warranty
  1. No special warranty requirements apply.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

- A. KSB, Inc., Model KRT K40-250, Flygt Model CP-3152-267, or equal.

### 2.2 PUMPS

- A. See Attachment A - Pump Data Sheet.
- B. Hydraulic Components and Solids Handling:
  1. Pump openings and passages shall be of adequate size to pass 1/2-inch-diameter spheres.
  2. Impeller shall be of cast iron and precision balanced. Balancing shall not deform or weaken the impeller. Impeller fasteners shall be non-corroding.
- C. Hoisting Bail: A hoisting bail shall provide for proper balance of pump and guide shoe from the discharge connection while using a single lift cable.
- D. Components: Other major pump components such as stator housing, seal housing, and bearing brackets shall be of structural grade steel or cast iron. Exposed fasteners and lock washers shall be of stainless steel.
- E. Shaft Seal:

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1. The pump shaft shall be sealed against leakage by a double mechanical seal.
2. The rotating seal faces shall be lubricated from an oil-filled reservoir between pump and motor, the oil serving as both lubricating and cooling media. The reservoir shall have separate oil fill and drain plugs to ensure accuracy when measuring lubricant level, and for ease of maintenance.
3. Seal shall require no special maintenance or routine adjustment. However, it shall be easily inspected or replaced. No seal damage shall result from operating the pump for short periods without liquid.

### 2.3 PUMP MOTORS

- A. Electrical Power: The electrical power available will be 480 volts, three phase, 60 Hertz, four wire.
- B. Motor Description:
  1. The motor and pump must be connected to form an integral unit. Motor shall be a squirrel-cage, induction type in an air-filled, watertight enclosure. The motor shall be design Class B, with NEMA MG 1 Class F insulation materials to withstand a continuous operating temperature of 155 degrees C (311 degrees F).
  2. Motor shall be capable of sustaining a minimum of 10 starts per hour. Factory test and provide documentation with equipment.
  3. Motor housing shall be of cast iron. The stator shall consist of copper windings with copper connectors applied to high-grade electrical steel laminations.
  4. Motor rpm: 3,600 maximum.
- C. Watertight Integrity:
  1. All static seals at watertight mating surfaces shall be of nitrile "O" ring type. Use of auxiliary sealing compounds shall not be required. The power and control cables shall enter the motor through a terminal housing.

2. The pump and electrical cables shall be capable of continuous submergence without loss of waterproof integrity.
3. The watertight integrity of the motor housing and shaft seal shall be tested during manufacture by pressurizing the motor cavity and submerging in water with motor operating.

D. Motor Protection: The motor shall be protected from thermal and moisture damage. Thermal protection shall consist of three separate thermostatic switches (minimum) embedded into the stator windings. Each switch shall open independently and terminate motor operation if temperature of the protected winding reaches the high temperature setpoint. Any moisture in the motor housing shall be detected by a mechanically activated, moisture-sensing micro-switch. The switch shall be sensitive enough to detect airborne moisture and terminate operation of motor before liquid enters the cavity. Use of probes or floats that rely on the presence of liquid to initiate signal shall not be considered acceptable. The thermal and moisture-sensing devices shall be connected to the pump control panel by the Subcontractor.

## 2.4 DISCHARGE

### A. Description:

1. Each pump shall be furnished with a submersible discharge connection system to permit removal and installation of the pump without the necessity of an operator entering the wet well. The design shall ensure an automatic and firm connection of the pump to the discharge piping when lowered into place.

### B. Baseplate:

1. A cast iron base with integral guide system pilots shall be provided along with all hardware and anchor bolts required for permanent installation to the wet well floor. The base shall be designed with an integral 90-degree elbow, or adapt to a commercially available elbow for connection to the

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vertical discharge piping utilizing standard ANSI B16.1 125-lb flanges.

C. Discharge Connection:

1. Each pump shall be provided with a replaceable cast iron guide shoe attached to the pump discharge flange. A replaceable seal shall be provided as an integral part of the guide shoe to form a seal with the baseplate connection and eliminate the possibility of leakage and erosive wear during operation. The seal shall contact mating faces in a static position and shall have adequate flexibility to flex under pumping pressure to increase seal efficiency. Metal-to-metal contact at the discharge connection shall not be acceptable.
2. Schedule 40 stainless steel guide rail pipe or stainless steel cable shall be provided for each pump.
3. Upper guide system pilots and a lifting cable shall be furnished for each pump. Bottom pilots shall be an integral part of the baseplate for ease of installation and proper alignment.

D. Guide Rail System and Method of Operation:

1. The guide shoe shall direct the pump down the guide system and onto the discharge connection in a simple linear movement. The design shall ensure that the buildup of sludge and grease on guide rails will not present problems during the lifting operation. The guide shoe shall be designed with integral hooks at the top to transmit the full weight of the pump to the baseplate flange. No portion of the pump shall be supported directly on the bottom of the wet well, guide system, or lifting cable.
2. The lifting cable shall consist of a stainless steel braided wire cable attached to the pump lifting bail. An eyelet shall be provided at the upper end of this cable for attaching to the wet well access frame.
3. Bolts, machine screws, nuts, washers, and lockwashers for complete assembly of the guide

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rails and discharge elbow shall be stainless steel.

4. Allow 15 feet for pump setting depth. Adjust final length of guide and lifting systems in the field.

## 2.5 ELECTRICAL CONTROL COMPONENTS

### A. Controls:

#### 1. Panel Enclosure

- a. The electrical control equipment shall be mounted within a Type 4X, NEMA ICS 6, stainless steel, dead front type control enclosure. It shall include a removable steel back panel on which control components shall be mounted. Operator controls shall be mounted on the front of the panel. The control panel shall be equipped with vapor emission type corrosion inhibitors.
- b. Control panel shall conform to UL 67 and NEMA ICS 6.

## 2.6 MOTOR BRANCH COMPONENTS

- A. All operating controls and instruments shall be securely mounted and shall be clearly labeled to indicate function.
- B. Main Connections: A main terminal block and ground bar shall be furnished for field connection of the electrical supply.
- C. Combination Motor Starters: An open-frame, across-the-line, NEMA ICS 2 rated magnetic motor starter (size 1 or larger) shall be furnished for each pump motor. All motor starters shall be equipped to provide undervoltage release and overload protection on all three phases.
- D. Overload Relays: Overload relays shall be of block type, utilizing melting alloy type spindles, and shall have visual trip indication with trip-free operation. Overload relays shall be of manual reset only. Heater

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elements shall provide Class 10 trip times per NEMA ICS 2 and shall be selected in accordance with the actual motor nameplate data. An overload reset pushbutton shall be mounted through the door of the control panel in such a manner as to permit resetting the overload relays without opening the control panel door.

- E. Pump Motor Protection: The pump control panel shall be equipped to terminate pump operation due to high motor winding temperature or moisture in the motor housing, and shall utilize the contacts in the pump motor. If either event should occur, the motor starter shall drop out and a mechanical indicator, visible on the inner door, shall indicate that the pump motor has been shut down. The pump motor shall remain locked out until the condition has been corrected and then shall be manually reset.

## 2.7 OTHER CONTROL COMPONENTS

- A. Pump Mode Selection: Pump mode selector switches shall be connected to permit manual start and manual stop for each pump individually, and to select automatic operation of each pump under control of the liquid level control system.
- B. Pump Run Indicators: Control panel shall be equipped with one oil-tight, red pilot light for each pump motor. Light shall be wired in parallel with the related pump motor starter to indicate that the motor is on or should be running. Run lights shall be equipped with lamps providing a minimum of 15,000 hours.
- C. Elapsed Time Indicators: Six-digit elapsed time indicators (non-reset type) shall be connected to each motor starter to indicate the total running time of each pump in "hours" and "tenths of hours."
- D. Panel Heater: The control panel shall be equipped with a panel heater and thermostat to minimize the effects of humidity and condensation.

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E. Control Power Transformer: The lift station shall be equipped with a control power transformer to supply 120 volt, AC, single phase. A mechanical means of disconnecting power to the transformer shall be provided. The operator handle for the mechanism shall be located on the exterior of the control panel, with interlocks which permit the door to be opened only when the mechanism is in the "OFF" position.

F. Wiring:

1. The control panel, as furnished by the manufacturer, shall be completely wired. The Subcontractor shall field connect the power feeder lines to the main terminal block, final connections to the remote alarm devices, and the connections between the pump and the pump motor control. All wiring, workmanship, and schematic wiring diagrams shall comply with NFPA 70.
2. All user serviceable wiring shall be type MTW or THW, 600 volts, minimum No. 12 AWG, and shall be color coded as follows:
  - a. Line and Load Circuits, AC or DC power, see Section 16050, Article 3.2, Paragraph B.
  - b. AC Control Circuit Less Than Line Voltage . . . . . Red
  - c. DC Control Circuit . . . . . Blue
  - d. Interlock Control Circuit, from External Source . . . . . Yellow
  - e. Equipment Grounding Conductor . . . . . Green
  - f. Current Carrying Ground . . . . . White
  - g. Hot With Circuit Breaker Open . . . . . Orange

G. Wire Identification and Sizing:

1. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be type MTW or THW, 600 volts.
2. The ampacity of motor branch conductors and other power conductors shall not exceed the temperature rating of the connecting terminals. Wires shall be clearly numbered at each end in accordance with the electrical diagrams.

- H. Wire Bundles: Wires connected to components mounted on the enclosure door shall be bundled and tied.
- I. Conduit:
1. Conduit requirements
    - a. Liquid-tight flexible metal conduit shall be constructed of smooth, flexible galvanized steel core with smooth, abrasion-resistant, liquid-tight polyvinyl chloride cover in accordance with ANSI 360.
  2. Grounding
    - a. The pump control manufacturer shall provide a common ground bar mounted on the enclosure back plate. The mounting surface of the ground bar shall have any paint removed before making final connections.
  3. Equipment Marking
    - a. Permanent, screw fastened, corrosion-resistant nameplate(s) shall be attached to the equipment.
    - b. Control components shall be permanently marked using the same identification shown on the manufacturer's electrical diagram. Identification label shall be mounted adjacent to the device.
    - c. Switches, indicators, and instruments shall be plainly marked to indicate function, position, etc. Marking shall be mounted adjacent to and above the device.

## 2.8 LIQUID LEVEL CONTROL

- A. Functional Description: The level control system shall start and stop the pump motors in response to changes in wet well level, as indicated.
- B. Level Signals: The level control system signals will be provided remotely, as indicated.
- C. Automatic Pump Alternation: The level control system shall utilize the alternator relay to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a

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pumping cycle. Both pumps must be capable of running at the same time.

**2.9 LABELING**

- A. Equipment identification: Pumps shall be provided with a permanently attached stainless steel nameplate indicating equipment name, number, model number, and rated capacity. Lettering shall be manufacturer's standard size and shall be stamped.

**PART 3 EXECUTION**

**3.1 ERECTION/INSTALLATION/APPLICATION**

- A. The installation of the equipment shall be in accordance with the manufacturer's installation manual.
- B. A copy of the manufacturer's installation and service manual for each piece of the equipment shall be available at the site.

**3.2 QUALITY CONTROL**

- A. Tests: Acceptance operating tests shall be performed by the Subcontractor after installation. The Subcontractor shall adjust or replace the equipment to meet the specification requirements and retest the equipment.
- B. Inspection: The Subcontractor shall notify the Construction Manager of testing and inspection activities prior to the start of all tests and/or inspections.

**3.3 MANUFACTURER ASSISTANCE**

- A. The manufacturer shall provide installation supervision and start-up assistance. Service assistance shall be in accordance with the manufacturer's warranty.

## 3.4 DEMONSTRATION

- A. Demonstrate ability to meet full range of operating flow rates and operating points as shown on pump curves.

END OF SECTION

**ATTACHMENT A**

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**PUMP DATA SHEET**

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**PUMP DATA SHEET**

PROJECT TITLE: Leachate Conveyance System						PROJECT ORDER: 164			
PUMP NAME: Permanent Lift Station Pumps						QUANTITY: 2 (duplex) + 1 spare			
TYPE PUMP: Submersible centrifugal						DRAWING NUMBER 92X-5900-N-00322			
TYPE DRIVER: Submersible electric motor		SUPPLY W/PUMP		X YES		NO			
MANUFACTURER AND MODEL NO.: KSB, Inc., Model KRT K40-250, Flygt Model CP-3152-267, or equal				EQUIP NO.: PMP-001,002 & spare					
<b>OPERATING CONDITIONS</b>									
FLUID PUMPED: Leachate/Construction Water						AT A PUMPING TEMPERATURE OF:		60 °F	
SPECIFIC GRAVITY: 1.0 AT 60°F		AT P.T.		VISCOSITY:		AT P.T.			
SOLIDS IN FLUID: 1-5 WT%		DENSITY:		SIZE: ≤1/2" dia.		ABRASIVE: NO			
NATURE OF SOLIDS:				FLUID VAPOR PRESSURE:		FT. of FLUID @ P.T.			
<b>PUMP SPECIFICATIONS</b>									
TYPE PUMP: Centrifugal, direct-connected						NO. STAGES: 1		RPM: 3600 max.	
TYPE IMPELLER: Open						SIZE: IN.		MAX SIZE: IN.	
EFFICIENCY AT DESIGN CAPACITY: (min)%				BHP @ DESIGN CAPACITY:		MAXIMUM BHP:		30	
TYPE BEARINGS: Oil-lubricated, anti-friction									
TYPE COUPLING:						LUBRICATION:			
TYPE OF SEAL: Mechanical									
<b>CONNECTIONS - SIZE &amp; RATING</b>									
SUCTION: IN.		LB.		Flange		DISCHARGE: IN.		Flange	
VENT: IN.		LB.				DRAIN: IN.			
<b>CONSTRUCTION MATERIALS</b>									
RESTRICTIONS:									
CASING: Cast iron				IMPELLER: Cast iron					
SHAFT: Stainless steel				SHAFT SLEEVE: Stainless steel					
CASE RING:				IMP. RING:					
DISCHARGE ELBOW: Cast iron				RELIEF VALVE:					
<b>ELECTRIC MOTOR</b>									
VOLTS	PHASE	HERTZ	H.P.	NON-OVERLOAD	CLASS	GROUP	RPM	TYPE	
460	3	60		YES					
REMARKS:									

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SECTION 16050  
BASIC ELECTRICAL MATERIALS AND METHODS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Conduit.
- B. Wire and cable.
- C. Instrument cable.
- D. Nameplates.
- E. Wire markers and cable tags.
- F. Wireway and auxiliary gutters.
- G. Splicing and termination components.
- H. Boxes and Cover Plates.
- I. Supporting devices.
- J. Inspection and testing for project electrical work.

**1.2 RELATED SECTIONS**

- A. Section 02215 -
- B. Section 15160 - Lift Station Pumps.
- C. Section 16170 - Grounding and Bonding.
- D. Section 16462 - Dry-Type Transformer/Panelboards.

**1.3 REFERENCES**

- A. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.

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- B. American National Standards Institute (ANSI):
1. ANSI C80.1-90 Rigid Steel Conduit-Zinc Coated.
- C. Underwriters Laboratories Inc. (UL):
1. UL 360-86 UL Standard for Safety Liquid-Tight Flexible Steel Conduit.
  2. UL 486A-91 UL Standard for Safety Wire Connectors and Soldering Lugs for Use with Copper Conductors.
  3. UL 510-94 UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
  4. UL 870-95 UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings.
  5. Electrical Construction Materials Directory - 1995.
- D. National Electrical Manufacturers Association (NEMA):
1. NEMA ICS 6-93 Industrial Control and Systems - Enclosures.
  2. NEMA TC 3-90 PVC Fittings for Use with Rigid PVC Conduit and Tubing.
  3. NEMA OS 1-89 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
  4. NEMA TC 6-90 PVC and ABS Plastic Utilities Duct for Underground Installation.
  5. NEMA WD 1-83 General Requirements for Wiring Devices.
  6. NEMA WD 6-88 Wiring Devices - Dimensional Requirements.
  7. NEMA 250-91 Enclosures for Electrical Equipment (1,000 Volts Maximum).

- E. InterNational Electrical Testing Association (NETA):
1. NETA ATS-95 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

### 1.5 SUBMITTALS

- A. Catalog Cut Sheets.
- B. Certifications.
- C. Test Reports.

### 1.6 QUALITY ASSURANCE PROGRAM

- A. All work shall comply with NFPA 70. Use of conduit for equipment ground is prohibited.
- B. Products shall be listed in the UL Electrical Construction Materials Directory-95, for the purpose specified and indicated.
- C. Select only one manufacturer for any specific class of material or equipment.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Receptacles
  1. Convenience Receptacle: 125 V, 15/20 A, NEMA WD 1, heavy-duty, general use with metal cover plate; conforming to NEMA WD 6, Configuration 5-20. 125 V, 30 A, NEMA WD 1, heavy-duty, general use with metal cover plate; conforming to NEMA WD 6, Configuration 5-30. Furnish with weatherproof covers for outdoors, wet, or industrial locations.

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2. Convenience receptacles in potentially wet environments, in addition to those required by NFPA 70, shall be GFCI type for personnel protection with covers to protect the receptacle from water during usage.

B. Conduit

1. Rigid steel, heavy wall, galvanized conduit conforming to ANSI C80.1. Rigid steel intermediate metal conduit (IMC) shall be acceptable for interior spaces. Conduit shall be 1/2 inch diameter minimum.
2. Liquid-tight flexible metal conduit conforming to UL 360. Conduit shall be 1/2 inch diameter minimum, 5 feet in length (maximum) unless indicated on drawings.
3. Nonmetallic conduit, schedule 40, 90 Degrees C., conforming to NEMA TC 6, PVC. Fittings shall conform to NEMA TC 3. Conduit shall be 1 inch diameter minimum.
4. Threaded conduit connections shall be NPT.

C. Wire and Cable

1. Single conductor, 600 volt insulated copper conductor. Conductors for power and lighting branch circuits shall not be smaller than No. 12 AWG. Conductors No. 12 AWG and larger shall be stranded. Conductors for control shall not be smaller than No. 14 AWG stranded. Conductors for Class 1 remote-control and signal circuits shall be enclosed in cable and shall comply with NFPA 70. Power and lighting conductor insulation shall be Type THW, XHHW, or THWN. Conductors required to be rated 90 degrees C in accordance with NFPA 70 shall be insulation Type XHHW-2 or THW-2.

## D. Instrument Cable

1. Instrumentation cable shall be No. 16 AWG stranded tinned copper conductors. Conductors shall be polyethylene insulated and rated 600 volts, 60 degrees C. Conductors shall be twisted with aluminum-polymer shield; No. 18 AWG stranded, tinned copper drain wire. Cable shall have overall-chrome gray FR-PVC jacket.

## E. Nameplates

1. Nameplates shall be engraved, three-layer laminated plastic, 5/16-inch bold style, black letters on white background.

## F. Wire Markers and Cable Tags

1. Wire markers shall be single-conductor slip on, heat-shrinkable sleeve with typed or printed black letters on a white background. Wire markers shall be W. H. Brady Co. computer-printable "Bradysleeve" or approved equal.
2. Cable tags shall be rectangular, flat, non-heat shrinkable tags with 1/8-inch-high letters. Cable markers shall be Raychem-type TMS or approved equal.

## G. Wireway and Auxiliary Gutters

1. Wireway and Auxiliary Gutters: General purpose, NEMA ICS 6, Type 3R enclosure with knockouts on bottom.
2. Size: As required.
3. Cover: Screw cover with full gasketing.
4. Fittings: UL 870, lay-in type with removable top, bottom, and side; captive screws.
5. Material: Carbon steel.
6. Finish: Rust-inhibiting primer coating with gray enamel finish.

## H. Splicing and Termination Components

1. Wire connectors, UL 486A, as applicable.
2. Insulation tape, UL 510.
3. Provide solderless terminal lugs, rated 75 degrees C minimum, on stranded conductors.

I. Boxes and Cover Plates

1. Junction and Pull Boxes
  - a. Junction and pull boxes shall be sized as indicated in accordance with NFPA 70, Article 370.
  - b. Junction and pull boxes located indoors shall be code-gage, galvanized sheet steel and shall be of welded construction with conduit knockouts or raceway openings and hinged or screwed covers as indicated. Type 3R, according to NEMA 250.
  - c. Junction and pull boxes located outdoors shall have screwed, gasketed covers, and watertight hubs. Type 3R, according to NEMA 250.
2. Device and Outlet Boxes
  - a. Device and outlet boxes shall be pressed steel, zinc, or cadmium coated in accordance with NEMA OS 1 unless otherwise indicated.
  - b. Outlet boxes shall not be smaller than 4 inches octagonal by 1-1/2 inches deep and shall be provided with the proper size knockouts for the conduits intended. Unused knockouts shall remain closed or shall be sealed with knockout closures.
  - c. Device or outlet boxes shall be of unit construction of a size required for the number of switches or outlets called for on the project design drawings. No sectional device boxes shall be permitted.
  - d. Surface-mounted outlet boxes for receptacles, switches, or similar devices shall be cast type.

J. Supporting Devices

1. Support channel shall be galvanized or painted steel.
2. Support hardware and accessories shall be corrosion resistant.
3. Supports shall be of all-welded construction.

**PART 3 EXECUTION****3.1 SITE CONDITIONS**

- A. Ensure site is ready to proceed with work before start of construction.

**3.2 ERECTION/INSTALLATION/APPLICATION****A. Conduit**

1. Route conduit parallel or at right angles to building lines. Provide conduit supports at approximately 8-foot intervals. Route conduit so as not to create a hazard for tripping or to compromise head clearance. Minimum height above floor shall be 7 feet, 6 inches.
2. Cut conduit square using saw or pipecutter. All cut ends of conduit shall be reamed smooth.
3. Install no more than the equivalent of three 90 degree bends between junction boxes. Use hydraulic one-shot conduit bender or factory elbows for conduit diameter larger than 1-1/2 inch.
4. Use Form 8 conduit bodies to make sharp changes in direction. Avoid moisture traps, provide junction box with weep hole.
5. Provide cast metal boxes such as FS or FD in damp or wet locations.
6. Provide 1/8-inch nylon pull cord in empty conduits. Cap empty conduits to prevent entry of moisture and foreign objects.
7. Final conduit connections to motors, motor-operated valves, or other vibrating equipment shall be made with approximately 3-foot liquid-tight flexible metal conduit.
8. Conduit and supports are to be field routed. They are not indicated explicitly on drawings.
9. Install nonmetallic conduit underground or below slabs on grade only. Perform trenching and backfilling in accordance with Section 02215. Backfill shall be free of rocks greater than 1 inch maximum dimension.

10. Install fittings at manhole penetrations to provide a liquid tight seal.
11. Arrange and slope conduits entering manholes to drain away from manholes.
12. Install 4 inch wide plastic tape, colored yellow with suitable warning legend describing buried electrical lines for all underground conduits.

B. Wire and Cable

1. Swab conduit before installing cable. Remove burrs, dirt, or other debris. For existing conduit, pull a mandrel through before pulling cable to verify roundness and bending radii.
2. When pulling cable into conduit, use wire pulling compound.
3. Visually inspect cable insulation for damage before installing.
4. Splices shall be made only in outlet or junction boxes.
5. Provide equipment grounding conductor along with phase conductors in all conduits.
6. Multiconductor cables shall contain an integral ground conductor.
7. Grounding conductors shall be connected to equipment with compression lugs. Grounding connections shall be made to clean, dry surfaces. Scale, rust, grease, and dirt shall be removed from surfaces to which grounding connections are to be made.
8. Conductors shall be color coded. Conductors No. 6 AWG and larger shall be identified using colored tape at terminals and splice points. Conductors No. 8 AWG and smaller shall be identified using colored insulation or jacket. Color coding shall be as follows:

480Y/277V Phase A	Yellow
Phase B	Orange
Phase C	Brown
Neutral (grounded)	Gray
Ground	Green

208Y/120V Phase A	Black
Phase B	Red
Phase C	Blue
Neutral (grounded)	White
Ground	Green
Plant Fire	Red and Yellow
Alarm System	Brown and Yellow

C. Nameplates

1. Clean surfaces prior to installing nameplates.
2. Install nameplates parallel to equipment lines. Secure nameplates to equipment fronts using self-tapping screws.

D. Wire and Cable Markers

1. Provide wire markers on each conductor in pull boxes and junction boxes and at each load connection. Provide cable tags in pull boxes for multiconductor cables.
2. Wire and cable tags shall identify panel and circuit number or control wire number, as required.

E. Receptacles

1. Install convenience receptacles 36 inches above finished floor. Receptacle mounting supports shall not be fastened to or penetrate wall panels.
2. Label receptacles with panelboard and circuit number from which they are served.

F. Clearances

1. Clearances from points of access to electrical equipment and other devices shall conform to the requirements of NFPA 70.
2. All equipment control devices and other electrical equipment requiring operation or maintenance shall have a minimum working clearance of 3 feet from the surface of operation or access, unless greater clearance is required by NFPA 70.

## G. Boxes and Cover Plates

1. Coordination of Box Locations
  - a. Provide electrical boxes as indicated and as required for splices, taps, wire pulling, and equipment connections.
  - b. Electrical box locations indicated are approximate unless dimensioned.
  - c. Locate and install boxes to allow access.
  - d. Do not install boxes back to back in walls. Provide 6-inches (minimum) separation in non-acoustic rated walls and 24 inches (minimum) separation in acoustic rated walls.
  - e. Coordinate mounting heights of boxes and locations of outlets mounted above counters, benches, and backsplashes to ensure locations are useful.
  - f. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
2. Outlet Box Installation
  - a. Firmly secure in place outlet or utility boxes concealed in the construction. Set outlet or utility boxes true, square, and flush with the finish surfaces for the application of the appropriate cover plate.
  - b. Provide knockout closures for unused knockout openings.
  - c. Support boxes independently of conduit except for cast boxes when connected to two rigid metal conduits, both supported within 12 inches of the box to be supported.
  - d. Use multiple gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
3. Pull and Junction Box Installation
  - a. Support pull and junction boxes independently of conduit.

## H. Supporting Devices

1. Installation of structural steel framing, concrete pads, etc., shall be complete before installing supporting devices.

2. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structures in accordance with manufacturer's recommendations as indicated.
3. Use expansion anchors for support on concrete surfaces.
4. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
5. Do not drill structural steel members for installing support devices.
6. Fabricate supports from structural steel or steel channel. Rigidly bolt to structural steel to present a neat appearance. Use hexagon head bolts with spring lock washers under nuts.
7. Install freestanding electrical equipment on concrete pads.
8. Install surface mounted cabinets and enclosures with four anchors (minimum). Provide steel channel supports to stand cabinets and enclosures 1 inch from the wall.

### 3.3 QUALITY CONTROL

#### A. Electrical Inspection and Testing - General

1. All electrical inspection and testing for work in this section and in other electrical sections shall conform to the following requirements and to NETA ATS. Tests required by NETA ATS for electrical work on this project shall be performed unless specific instruction is provided otherwise. Any additional requirements or exceptions shall be as noted in the other electrical sections for the specific electrical work of that section only.
2. Testing shall be witnessed by the Construction Manager, CQC Consultant-Quality Control personnel (who must approve results) and manufacturer's service representative(s), if required. Notice of testing must be furnished 7 days in advance.
3. Submit test results and calibration data on approved forms.
4. Perform operational tests to demonstrate control and interlocking wiring.

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5. Visual inspections shall be performed for phasing and connections. Phasing shall be A, B, C clockwise at all three phase disconnects.
6. Repair or replacement of all components where test results are unacceptable, including those damaged during testing process, is required.
7. Medium voltage circuits (bare and insulated) shall be tested according to NETA ATS.

B. Electrical Inspection and Testing - This Section

1. Perform continuity and operation tests on receptacle, power, and control circuits. Low voltage thermographic survey of cable connections required by NETA ATS are not required.
2. Insulation resistance tests shall not be performed on circuits 120 V and lower, and on solid state equipment unless authorized by its manufacturer and in strict accordance with the manufacturer's recommendations. Solid state equipment includes static ground fault devices, such as ground fault circuit interrupters.
3. Perform motor tests according to NETA ATS.
4. Motor and phase rotation shall be checked with a phase rotation tester manufactured by G. Biddle Company (Catalog No. 56060) or equal on equipment which could be damaged by reverse rotation.
  - a. Motor and phase rotation shall be verified before energizing motors.
  - b. All motors shall be "bumped" to check for proper direction of rotation prior to performing operational tests on the equipment in the presence of the Construction Manager.

**END OF SECTION**

## SECTION 16121

## MEDIUM VOLTAGE CABLE

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Medium voltage cable.
- B. Cable terminations.

## 1.2 REFERENCES

- A. ANSI/IEEE C2 - National Electrical Safety Code.
- B. ANSI/NFPA 70 - National Electrical Code.
- C. IEEE 48 - Test Procedures and Requirements for High- Voltage Alternating-Current Cable Terminations.
- D. NEMA WC 8 - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

## 1.3 SUBMITTALS

- A. Product Data: Provide for cable, terminations, and accessories.
- B. Test Reports: Indicate results of cable test in tabular form and in plots of current versus voltage for incremental voltage steps, and current versus time at 30 second intervals at maximum voltage.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.
- D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

## 1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record actual sizes and locations of cables.

## 1.5 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include instructions for testing and cleaning cable and accessories.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years experience.
- B. Installer: Company specializing in installing Products specified in this Section with minimum three years experience.

- C. Conform to requirements of ANSI/NFPA 70 and ANSI/IEEE C2.
- D. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept cable and accessories on site in manufacturer's packaging. Inspect for damage.
- B. Store and protect in accordance with manufacturer's instructions.
- C. Protect from weather. Provide adequate ventilation to prevent condensation.

1.8 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of cable bank prior to rough-in.
- C. Cable routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

**PART 2 PRODUCTS**

2.1 MANUFACTURERS

- A. Okonite.
- B. Houston wire and cable.
- C. Rome.

2.2 MEDIUM VOLTAGE CABLE

- B. Cable shall be 350 KCMIL single conductor, ethylene-propylene insulated, shielded, type MV 90 cable. Insulated for 15 kV ungrounded neutral service, 133 percent insulation level, rated 90C normal operating, 130C emergency, 250C short circuit. Provide cable with stranded copper conductors and PVC overall jacket. Cable suitable for installation in underground duct. Construction and performance of cable shall be in accordance with latest editions of ICEA Publication No. S-68-516/NEMA Publication No. WC8, AEIC CS6 and UL 1072.

2.3 15 kV CABLE TERMINATIONS

Terminations of 15 kV cables 133% insulation shall be made with 15 kV premolded termination kits and 2 hole NEMA lugs. RAYCHEM "HVT-152G" series kits and 3M Company "Quick Term" II series kits are acceptable or approved equal.

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## 2.4 15 kV SPLICES

Splices shall be made with Dielectric Splice Kits with preparation kit for 350 kcmil 15 KV volt single conductor shielded and jacketed cable.

Termination kits supplied shall be capable of properly terminating a 15 kV class single-conductor polymeric-insulated cable. Kits shall meet Class 1 requirements and be design-proof tested to IEEE 48 latest revision and be capable of passing a test sequence per IEEE 404 latest revision. Kits as specified shall accommodate any common form of cable shielding/construction without the need for special adapters or accessories, and shall accommodate a wide range of cable size and also, be capable of being properly installed on out-of-round or out-of-tolerance cable as per relevant ICEA standards. Kits shall accommodate commercially available connectors.

Terminations for single-conductor cables shall consist of heat-shrinkable stress control and outer non-tracking insulation tubings along with a high relative permittivity stress relief mastic for insulation shield cutback treatment with a heat activated sealant for environmental sealing. Three-conductor kits shall contain necessary materials to seal the cable jacket, phase conductors, and any ground wires, as well as rejacket phase and ground conductors.

The manufacturer shall, upon request, be able to demonstrate fifteen years of actual field experience and suitable accelerated and real-time testing of weathering resistance. Test reports shall also be available, upon request, which verify device stability with time, temperature, and stress variations.

Field training shall be available, upon request, for certification of installers at no cost.

Terminations kits shall be manufactured by Raychem Corporation or approved equal.

### A. STRAIGHT SPLICES

Straight splices shall utilize compression connectors, such as Thomas and Betts #10-54015 or approved equal, and preparation kits for single conductor, extruded dielectric, shielded, and jacketed 15 kV sized for 350 kcmil cable such as Raychem Corp., #HVS-1522-S, or approved equal.

### B. TAP SPLICES

Tap circuits shall be made with "Y" splices. The "Y" splices shall utilize connectors such as Mac Cat #MHD 350 F/350 MCM (Mac Product Inc., 60 Pennsylvania Ave., South Kearny, NJ 07032) or approved equal. These splices shall be insulated with preparation kits for Wye splices, 1/C 15 kV extruded dielectric shielded and jacketed power cable, such as Raychem Corp., #HUSY-1523-SC or approved equal.

## 2.5 FIREPROOFING TAPE

### A. Manufacturers:

1. 3M #7700 secured with 3M #27 or approved equal.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify that conduit is ready to receive cable.

**3.2 PREPARATION**

- A. Use swab to clean conduits and ducts before pulling cables.

**3.3 INSTALLATION**

- A. Install cable and accessories in accordance with manufacturer's instructions.
- B. Avoid abrasion and other damage to cables during installation.
- C. Use suitable lubricants and pulling equipment.
- D. Do not exceed cable pulling tensions and bending radius.
- E. Ground cable shield at each termination and splice.
- F. Craft personnel making splices and terminations shall be skilled in the procedures and techniques required for the particular type of work assigned. Personnel shall be certified by cable splicing vendor.
- G. Each individual splice or termination shall be completed from start to finish by the same individual(s). All splices and terminations shall be tagged with an aluminum band (around the cable at the splice or termination) identifying the date of completion, the initials of the craftsman, and the Subcontractor employing the craftsman.

**3.4 FIELD QUALITY ASSURANCE**

- A. Inspect exposed cable sections for physical damage.
- B. Inspect cable for proper connections as shown on Drawings.
- C. Inspect shield grounding, cable supports, and terminations for proper installation.
- D. Perform DC high potential test of each conductor in accordance with NEMA WC 8 and or NETA ATS. Ground other conductors in the circuit during the test. Perform test on existing cable after installation. Perform test on new 15 kV cable before making tap onto existing cable.
- E. Apply test voltage in at least eight equal increments to maximum test voltage.

	Maximum Voltage	10 Increments of:
New Cables 15 kV	65 kV	6.5 kV
Existing Cables 13.2 kV	12 kV	1.2 kV

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- F. Record leakage current at each increment, allowing for charging current decay.
- G. Hold maximum test voltage for ten minutes.
- H. Test Reports: Record results of cable test in tabular form, in plots of current versus voltage for incremental voltage steps, and current versus time at 30-second intervals at maximum voltage. Submit for approval.
- I. Inspection and testing shall be by Subcontractor and may be observed by FERMCO.

END OF SECTION

SECTION 16170  
GROUNDING AND BONDING

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Grounding electrodes and conductors.
- B. Equipment and fence grounding conductors.
- C. Bonding.

**1.2 RELATED SECTIONS**

- A. Section 15160 - Lift Station Pumps.
- B. Section 16050 - Basic Electrical Materials and Methods.
- C. Section 16462 - Dry-Type Transformer/Panelboards.

**1.3 REFERENCES**

- A. InterNational Electrical Testing Association (NETA):
  - 1. NETA ATS-95 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code, 1996 Edition.
- C. Underwriters Laboratories, Inc. (UL):
  - 1. UL 467-93 UL Standard for Safety Grounding and Bonding Equipment.
  - 2. Electrical Construction Materials Directory-95.

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**1.4 SYSTEM DESCRIPTION**

- A. Rod electrode and test well rod electrode.
- B. Grounding System Resistance: 5 ohms maximum.

**1.5 SUBMITTALS**

- A. Catalog cut sheets.
- B. Certificates of Conformance.
- C. Test reports.
- D. Provide certification of ground testing instrumentation.

**1.6 QUALITY ASSURANCE PROGRAM**

- A. Manufacturer: Company specializing in manufacturing products specified in this section, with a minimum of 3 years experience.
- B. Conform to requirements of NFPA 70.
- C. Furnish products listed in the UL Electrical Construction Materials Directory as suitable for the purpose specified and indicated.
- D. Provide certification of ground testing instrumentation according to NETA ATS.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers
  - 1. Mechanical Connectors
    - a. Burndy.
    - b. Ideal.
    - c. IlSCO.

2. Exothermic Connections
  - a. Cadweld.
  - b. Thermoweld.

## 2.2 MATERIALS

- A. Rod Electrode
  1. Copper-clad steel, 3/4-inch diameter, 10-foot length.
- B. Mechanical Connectors
  1. Bronze.
- C. Wire
  1. Stranded copper.
    - a. Grounding Conductor: Size to meet NFPA 70 requirements.
- D. Grounding and bonding materials shall conform to UL 467.

## PART 3 EXECUTION

### 3.1 SITE CONDITIONS

- A. Verify that final backfill and compaction have been completed before driving rod electrodes.
- B. Verify that underground utilities will not interfere with the proposed rod locations prior to driving rod electrodes.

### 3.2 ERECTION/INSTALLATION/APPLICATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install rod electrodes where shown on the construction drawings. Install additional rod electrodes as required to achieve specified resistance to ground.

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- C. Equipment Grounding Conductor: Provide separate, insulated conductor with each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Connect ground conductors to reinforcing bars in foundation before pouring concrete. Tie to structural steel members by exothermic connection when they are installed.
- E. Ground metal equipment enclosures by attachment to ground rod system or to the building steel.
- F. Ground pole-mounted equipment, static line conductors, and fencing as indicated on the drawings.

### 3.3 QUALITY CONTROL

- A. Test according to general requirements of Section 16050.
- B. Inspect grounding and bonding system conductors and connections for tightness and proper installation as defined by contract documents and manufacturer's instructions. Accurately record as-built locations of grounding electrodes where different from drawings, and submit to the Construction Manager. Test instrumentation shall conform to NETA ATS. Provide certification for instrumentation.
- C. Perform resistance to ground test on each ground rod installed and power pole butt plate. Resistance shall be 5 ohms or less. When resistance is greater than 5 ohms, a second ground rod size shall be installed a minimum of 6 feet from the original and connected with a #6 copper wire minimum. Test new ground rod and record results.

- D. Measure the system's resistance to the ground; perform testing in accordance with instrument manufacturer's recommendations using the fall-of-potential method. Provide written test reports indicating overall resistance to ground and resistance of each electrode to ground.

END OF SECTION

## SECTION 16370

## OVERHEAD POWER DISTRIBUTION

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Poles and crossarms.
- B. Pole hardware.
- C. Overhead line conductors.
- D. Pole mounted distribution transformers.

## 1.2 REFERENCES

- A. ANSI/IEEE C2 - National Electrical Safety Code
- B. ANSI C29.2 - Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type.
- C. ANSI C29.3 - Wet-Process Porcelain Insulators - Spool Type.
- D. ANSI C29.4 - Wet-Process Porcelain Insulators - Strain Type.
- E. ANSI C29.5 - Wet-Process Porcelain Insulators - Low and Medium Voltage Type.
- F. ANSI C29.7 - Wet-Process Porcelain Insulators - High- Voltage Line-Post Type.
- G. ANSI C37.42 - Specifications for Distribution Cutouts and Fuse Links.
- H. ANSI C135.1 - Galvanized Steel Bolts and Nuts for Overhead Line Construction.
- I. ANSI C135.2 - Threaded Galvanized Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction.
- J. ANSI C135.4 Galvanized Ferrous Eyebolts and Nuts for Overhead Line Construction.
- K. ANSI C135.5 - Galvanized Ferrous Eynuts and Eyelets for Overhead Line Construction.
- L. ANSI C135.17 - Galvanized Ferrous Bolt-Type Insulator Pins with Lead Threads for overhead Line Construction.
- M. ANSI C135.22 - Galvanized Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction.
- N. ANSI C135.30 - Galvanized Ferrous Ground Rods for Overhead or Underground Line Construction.
- O. ANSI C135.31 - Galvanized Ferrous Single and Double Upset Spool Insulator Bolts for Overhead Line Construction.

- P. ANSI 05.1 - Specifications and Dimensions for Wood Poles.
- Q. ASTM A475 - Zinc-Coated Steel Wire Strand.
- R. ASTM A675 - Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
- S. ANSI/ASTM B1 - Hard-Drawn Copper Wire.
- T. ANSI/ASTM B2 - Medium-Hard-Drawn Copper Wire.
- U. ASTM B3 - Soft or Annealed Copper Wire.
- V. ASTM B8 - Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
- W. ANSI/ASTM B228 - Concentric-Lay-Stranded Copper-Clad Steel Conductors
- X. ANSI/ASTM B232 - Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR).
- Y. AWPA C4 - Standard for the Preservative Treatment of Poles by the Pressure Process.
- Z. AWPA C25 - Standard for the Preservative Treatment of Crossarms by the Pressure Process.
- AA. FS TT-W-571 - Wood Preservation: Treating Practices.
- AB. NEMA LA1 - Surge Arrestors.
- AC. ANSI/UL 96 - Lightning Protection Components
- AD. ANSI C57.12.20 - Overhead type transformers 500 KVA and smaller.

### 1.3 SYSTEM DESCRIPTION

- A. Overhead distribution line consisting of one circuit operating at 13.2 kV and one circuit operating at 480V as shown on drawings.

### 1.4 DESIGN REQUIREMENTS

- A. Comply with ANSI/IEEE C2, heavy loading conditions, Grade B construction.

### 1.5 SUBMITTALS

- A. Submit product data indicating materials and construction of hardware and line conductors.

### 1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record exact locations of poles, guys, anchors, and required horizontal and vertical clearances.

**1.7 QUALITY ASSURANCE**

- A. Installer: Company specializing in applying work of this Section with minimum three years experience.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Accept poles and hardware on site and inspect for damage.
- B. Protect poles from damage and decay by stacking to provide free circulation of air. Maintain one foot (300 mm) minimum spacing between bottom pole and ground or ground vegetation. Do not store poles above decayed or decaying wood.
- C. Stack poles stored for more than two weeks on decay-resistant skids arranged to support poles without noticeable pole distortion.
- D. Handle treated poles with tools which will not produce an indentation greater than one inch (25 mm) deep. Do not drag treated poles along ground. Do not apply tools to that section of treated poles between one foot (300 mm) above and 2 feet (600 mm) below ground line.

**PART 2 PRODUCTS****2.1 POLES**

- A. Wood Poles shall be furnished by FERMCO.

**2.2 CROSSARMS**

- A. Crossarms and Timbers: Straight-grained Southern pine, free of twists to within 0.1 inch per foot (8 mm per m) of length, with bends and twists in only one direction.
- B. Apply preservative to poles to AWPA C25 with minimum net retention of 8 lbs/cu ft (190 kg/cu m).
- C. Crossarm Dimensions: 4.25 x 5.25 inches x 9 feet.

**2.3 POLE HARDWARE**

- A. Miscellaneous Pole Hardware: Hot-dipped galvanized after fabrication.
- B. Crossarm Braces: Structural steel zinc coated to ASTM A675.
- C. Angle Braces: 60 inch span x 18 inches (1.5 m span x 450 mm), drop-formed in one piece from 1-3/4 x 1-3/4 inch (45 x 45 mm) angle.
- D. Flat Braces: 1/4 x 1-1/4 inch (6 x 32 mm).
- E. Eye Bolts and Nuts: ANSI C135.4.
- F. Anchor Rods and Nuts: ANSI C135.2
- G. Bolts and Nuts: ANSI C135.1

- H. Eyenuts and Eyelets: ANSI C135.5.
- I. Ground Rods: ANSI C135.30.
- J. Butt Plate: Copper.
- K. Bolt-type Insulator Pins: ANSI C135.17.
- L. Pole-top Insulator Pins: ANSI C135.22
- M. Spool Insulator Bolts: ANSI C135.31.
- N. Hot-line Clamps: Screw type with concealed threads. Fill thread chamber with corrosion-resistant compound.
- O. Secondary Racks: Furnish with spool insulators.
- P. Guy Strand: High strength 7-strand steel cable galvanized to ASTM A475, Class A or B.
- Q. Guy Termination: Automatic, Preformed or Three-bolt clamp type.
- R. Guy Guards: 8 foot (2 m) long Plastic, colored yellow.
- S. Ground Wire: Soft drawn copper conductors, 4 AWG minimum size.
- T. Air Terminal: ANSI/UL 96; 10 inch high copper air terminal.

#### 2.4 INSULATORS

- A. Insulators: Radio interference free wet process porcelain insulators with minimum wet flashover rating of 80 kV.
- B. Line Post Insulators: ANSI C29.7; Class 57.1.
- C. Suspension Insulators: ANSI C29.2; Class 52.9.
- D. Pin Insulators: ANSI C29.5; Class 55.5.
- E. Guy Strain Insulators: ANSI C29.4; Class 54.2.

#### 2.5 LINE CONDUCTORS

- A. Medium Voltage Overhead Line Conductors: Bare aluminum conductor steel reinforced.

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- B. Secondary Conductors: Aluminum multi-conductor cable with 600 volt cross-linked polyethylene insulation for phase conductors. Use bare ACSR messenger for equipment ground.

## 2.6 ARRESTERS AND CUTOUTS

- A. Surge Arresters: NEMA LA1; valve type, arranged for crossarm mounting, and rated 12 kV.
- B. Fused Cutouts: ANSI C37.42; drop-out fused cutouts rated 400 amperes at 14.4 kV ungrounded.
- C. Fuses: Type K rated as indicated.

- 2.7 Pole Mounted Distribution Transformer: single phase mineral oil filled, shelf cooled with primary bushings and secondary terminations, 125 kV BIL, temperature rise of 65°C above 30°C ambient, ratings as indicated. Provide primary taps with externally-operated tap changer and standard accessories with dial type thermometer.

- 2.8 Helical Screw Anchors: Galvanized steel, size as noted.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that site is ready to receive work.
- B. Verify field measurements are as shown on Drawings.
- C. Verify that required utilities are available, in proper location and ready for use.
- D. Beginning of installation means installer accepts existing conditions.

### 3.2 INSTALLATION

- A. Plug unused holes in poles using treated wood dowel pins. Treat field-cut gains and field-bored holes with preservative.
- B. Poles shall be set within plus or minus 1 foot transversely of the location indicated on the Drawings.
- C. Dig setting holes with a diameter not less than the pole diameter at the butt plus 12 inches, unless noted otherwise. Sufficient space shall be left around each pole to allow for efficient tamping and compaction of backfill.
- D. Pole shall be set within 3 inches of the depth specified in the table.
- E. Vertical alignment of all poles shall be within 3 inches of plumb or the amount of rake indicated on the Drawings.
- F. Backfill material shall be native soil. Soil shall be free of debris, organic material and rock larger than 1 inch size. Soil shall have a moisture content that will ensure good compaction.

- G. Place earth in maximum 12 inch layers. Tamping shall be done with air tampers only. Earth shall be banked around each pole to a height of 12 inches above grade.
- H. Identify each pole using aluminum marker stamped with characters 2-1/2 inches (60 mm) high minimum. Locate to provide maximum visibility [from roadway] and fasten with aluminum nails. Obtain identifying numbers from drawings.
- I. Set crossarms at right angles to line for straight runs; and to bisect the angle of turns in line direction.
- J. Provide two braces for each crossarm.
- K. Install conductors to ANSI/IEEE C2.
- L. Use small diameter steel pipe to verify area is free of underground obstructions prior to installations of anchors.
- M. Cross arms and other pole hardware shall be set within two (2) inches of dimensions specified on drawings.

3.3 POLE SETTING SCHEDULE

- A. Minimum depths in normal firm ground, measured from lower side of pole:

<u>OVERALL LENGTH</u>	<u>DEPTH - STRAIGHT LINES</u>	<u>DEPTH - CURVES</u>
45'	6'-6"	7'-6"
60'	8'-0"	9'-0"

END OF SECTION

SECTION 16462  
 DRY TYPE TRANSFORMER/PANELBOARDS

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Dry type, two-winding transformers integrated with primary and secondary main breakers and feeder breakers.

**1.2 RELATED SECTIONS**

- A. Section 16050 - Basic Electrical Materials and Methods.  
 B. Section 16170 - Grounding and Bonding.

**1.3 REFERENCES**

A. National Electrical Manufacturers Association (NEMA):

- |    |                |  |
|----|----------------|--|
| 1. | NEMA AB 1-93   | Molded Case Circuit Breakers and Molded Case Switches.   |
| 2. | NEMA PB 1-90   | Panelboards.   |
| 3. | NEMA PB 1.1-91 | General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less. |
| 4. | NEMA ST 20-92  | Dry Type Transformers for General Applications.  |
| 5. | NEMA 250-91    | Enclosures for Electrical Equipment (1000 Volts Maximum).  |

B. National Fire Protection Association (NFPA):

- |    |         |   |
|----|---------|---|
| 1. | NFPA 70 | National Electrical Code, 1996 Edition. |
|----|---------|---|

C. Underwriters Laboratories, Inc. (UL):

- |    |   |
|----|---|
| 1. | Electrical Construction Materials Directory-95. |
|----|---|

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#### 1.4

#### SUBMITTALS

- A. Product Data: Include outline and support point dimensions of enclosures and accessories; unit weight; voltage; kVA, number of phases, impedance ratings, and characteristics; X/R ratio; tap configurations; insulation system type; rated temperature rise; and main bus ampacity, integrated short circuit ampere rating, circuit breaker, arrangement, and sizes.
- B. Catalog cut sheets.
- C. Certificates of Conformance.
- D. Transformer Test Reports:
  - 1. Factory Test: NEMA ST 20. Indicate loss data; efficiency at 25, 50, 75, and 100 percent rated loads; and sound level.
  - 2. Field Test: Indicate primary and secondary voltages as measured.

#### 1.5

#### QUALITY ASSURANCE PROGRAM

- A. Manufacturer: Company specializing in manufacturing the products specified in this section, with minimum 3 years experience.
- B. Conform to requirements of NFPA 70.
- C. Furnish products listed in the UL Electrical Construction Materials Directory for the purpose specified and indicated.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver transformers/panelboards individually wrapped for protection and mounted on shipping skids.
- B. Accept transformers/panelboards on site. Inspect for damage.
- C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer/panelboards' internal components, enclosure, and finish.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Siemens.
- B. Westinghouse.
- C. Square D.

### 2.2 EQUIPMENT

- A. Two-winding transformers
  - 1. Description: NEMA ST 20, factory-assembled, air-cooled, dry type transformers; ratings as indicated on contract drawings.
  - 2. Insulation system and average winding temperature rise for rated kVA as follows:
    - a. 1-30 kVA: Class 185 with 115 degrees C rise.
    - b. 16-500 kVA: Class 220 with 115 degrees C rise.
  - 3. Case Temperature: Do not exceed 40 degrees C rise above ambient at warmest point.

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4. Winding Taps:
  - a. Transformers: NEMA ST 20. Transformers shall have four full current taps, two at 2-1/2 percent each above and two at 2-1/2 percent each below normal voltage.
5. Sound Levels: NEMA ST 20, not to exceed 85 dBA at 3 feet.
6. Basic Impulse Level: 10 kV.
7. Ground core and coil assembly to enclosure by means of a visible, flexible copper grounding strap.
8. Mounting: Suitable for wall or floor mounting.
9. Coil Conductors: Continuous windings with terminations brazed or welded.
10. Enclosure: NEMA ST 20. Provide lifting eyes or brackets.
11. Isolate core and coil from enclosure, using vibration-absorbing mounts.
12. Nameplate: Include connection data and overload capacity based on rated allowable temperature rise.

B. Branch Circuit Panelboards

1. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
2. Enclosure: NEMA PB 1; Type 3R conforming to NEMA 250.
3. Cabinet Size: As shown on manufacturer's drawings.
4. Cabinet Front: Hinged cover with paddle lock hinge.
5. Provide an integrated unit with transformer. Finish in manufacturer's standard gray enamel.
6. Provide panelboards with copper bus, ratings as scheduled on drawings. Provide copper ground bus in each panelboard.
7. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical.
8. Molded Case Circuit Breakers: NEMA AB 1; plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, rated for 75 degrees C copper conductors. Provide circuit breakers UL listed as Type SWD for lighting

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circuits. Provide UL Class A ground fault interrupter circuit breakers where required. Provide 20 percent spare breakers installed in the panelboard.

**PART 3 EXECUTION**

**3.1 ERECTION/INSTALLATION/APPLICATION**

- A. Install transformer/panelboards in accordance with NEMA PB 1.1.
- B. Install plumb, and in accordance with manufacturer's instructions, and as indicated on contract drawings.
- C. Height: 6 feet, 6 inches to top of transformer section.
- D. Provide grounding connections in accordance with Section 16170.
- E. Provide filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- G. Provide engraved plastic nameplates identifying transformer/panelboard equipment number.

**3.2 QUALITY CONTROL**

- A. Test according to general requirements of Section 16050.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, grounding, and conformance of installation to contract documents and manufacturer's instructions. Check tightness of wiring and mounting connections for circuit breakers and transformer prior to energizing.

- C. Record primary and secondary voltages; submit to the Construction Manager.
- D. Measure steady state load currents at each panelboard feeder. Rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

FIELD

LCP/PLC CABINET  
(FIELD LOCATE AT AWWT FACILITY)

AWWT DCS

1. FOF RTU2 PANEL WIRING DIAGRAM, SEE DRAWING DTSI-9361-32D.
2. RTU INPUT RESISTOR VALUES ARE IN OHMS.
3. TRANSMITTER OUTPUT SHALL BE PULSE-DURATION SIGNAL.
4. EACH SIGNAL SHALL HAVE DEDICATED METAL PAIR PHONE LINE.
5. \*RUN PERMISSIVE\* CONTROLLER RELAY (RPCR) SEE DRAWING 92X-5900-E-00324.
6. PROVIDE GROUND CABLE FOR LIGHTNING ARRESTER.
7. INSTALL FLOW METER INDICATORS ON THE LCP AT THE AWWT FACILITY (REFER TO SPECIFICATION 13401 SECTION 2.5 A).
8. INSTALL PILOT LIGHT ON THE LCP AT THE AWWT FACILITY (REFER TO SPECIFICATION 13401 SECTION 2.5 A).
9. INSTALL BUZZER ALARM ON THE LCP AT THE AWWT FACILITY (REFER TO SPECIFICATION 13401 SECTION 2.5 A).
10. INSTALL RECEIVER INSTRUMENT ADJACENT TO THE LCP AT THE AWWT FACILITY (REFER TO SPECIFICATION 13402 SECTION 2.1 H).
11. PROVIDE ONE SOURCE OF 120 VAC, 60HZ POWER TO ALL COMPONENTS WHICH MAKE UP THE PROGRAMMABLE LOOP CONTROLLER. INDIVIDUAL COMPONENTS POWER SUPPLIES WILL BE WIRED IN PARALLEL.

I/O LEGEND

- INTERNAL RTU WIRING PROVIDED BY THE RTU ASSEMBLER.
- EXTERNAL WIRING TO THE RTU CABINET FROM FIELD DEVICES PROVIDED BY THE SUBCONTRACTOR.
- [ ] INTERNAL RTU LINE SIDE FUSE PROVIDED BY THE RTU ASSEMBLER.
- [+] NON-FUSED POSITIVE TERMINAL
- [-] NON-FUSED NEGATIVE TERMINAL
- [SH] NON-FUSED SHIELD BUS
- [ ] FLOAT AND TAPE SHIELD (DO NOT GROUND AT THIS POINT)

REF DWG NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
DTSI-9361-32D	SOUTH CONTAIN. ANALOG INPUT WIRING DIAGRAM 1
DTSI-9361-64D	SWPB ANALOG INPUT WIRING DIAGRAM 1
92X-5900-E-00324	SINGLE LINE AND SCHEMATICS

PRELIMINARY  
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERMCO	DATE	INITIALS AND DATE
D	FINAL DESIGN	N/A		8/21/96	
C	ISSUED FOR EPA REVIEW	N/A		6/25/96	
B	ISSUED FOR DOE 90% DESIGN REVIEW	NA		5/17/96	
A	ISSUED FOR 90% DESIGN REVIEW	NA		5/10/96	

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

DRAWING TITLE  
**INSTRUMENTATION ANALOG I/O DIAGRAM SHEET 1**

FOR INFORMATION ONLY	183		
DRAWN BY J.H. DYER	DATE 06-27-96	LEAD ENGINEER JIM L. COOPER	DATE 5/25/96
PLANT/BLDG. NO.	FLOOR	SCALE NONE	SHEET NO. 2/85
SUBMITTED FOR APPROVAL	PERMCO CRU APPROVAL NA	PERMCO PROJECT NUMBER 20211	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER SRP/PO164	DOE PROJECT NO. WBS 1.1.1.2.3.6	FEMP PROJECT NO. 00-90701	DRAWING INDEX CODE NO. 92X-5900-N-00345	SHEET NO. N0003	REV. NO. D
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LEACHATE CONVEYANCE SYSTEM  
 EFFLUENT DISCHARGE  
 MAGNETIC FLOWMETER  
 LINE WW-478-A-1000-ET

120VAC, 60HZ FROM  
 EXISTING POWER PANEL  
 AT SOUTHEAST CORNER  
 OF B1 SURGE LAGOON

FIELD ROUTE  
 2-1/2 #12 & #11 AWG GND

FIELD ROUTE  
 2-1/2 #12

FIELD ROUTE  
 2-1/2 #12 & #11 AWG GND

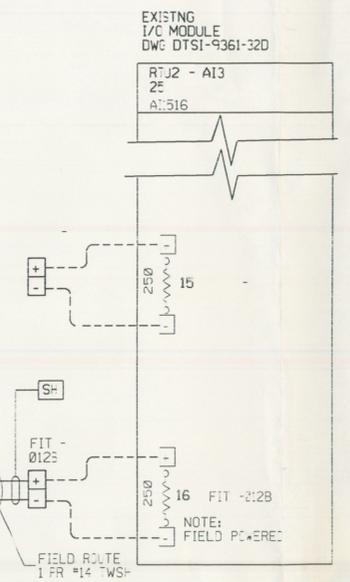
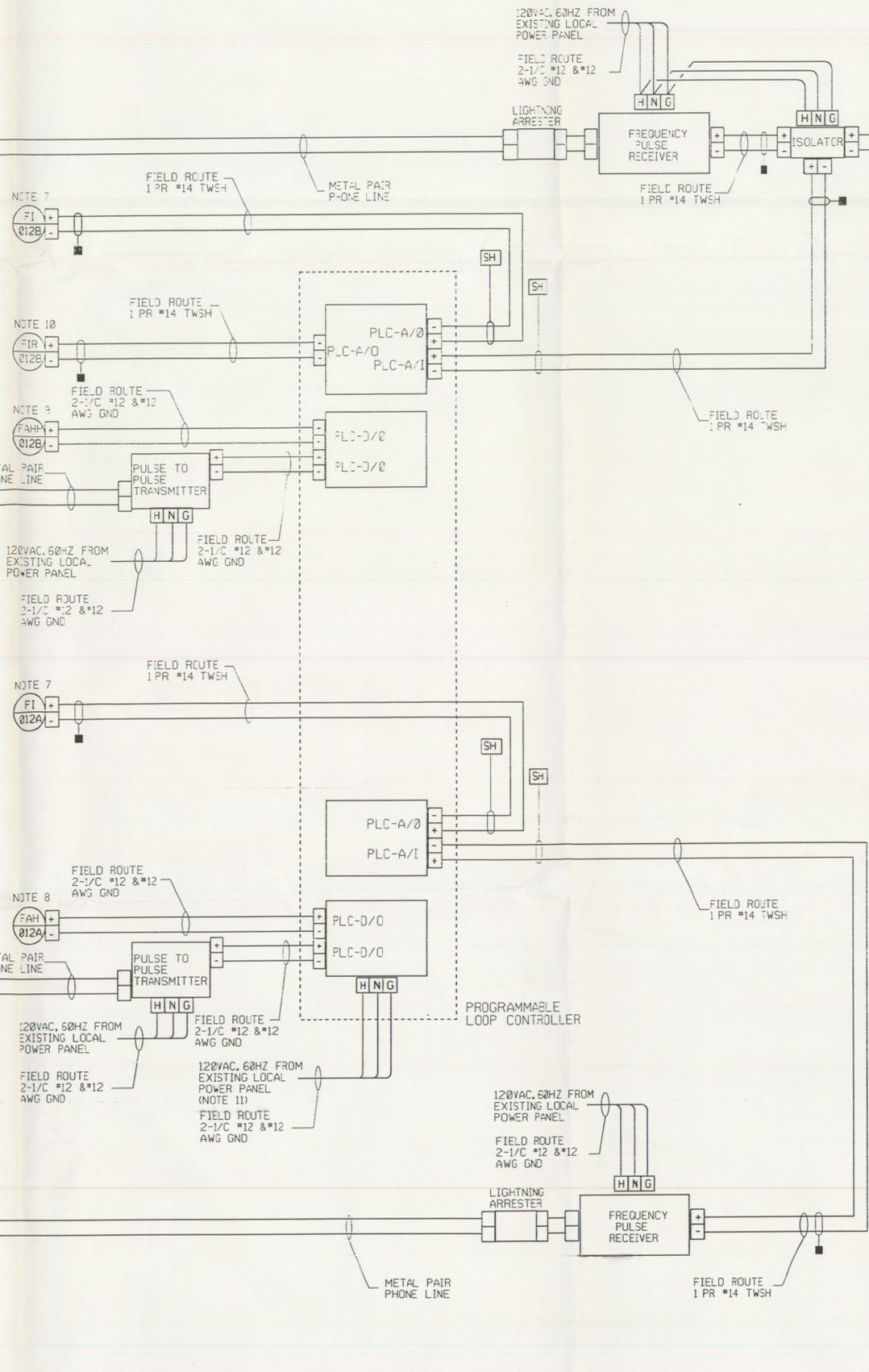
FIELD ROUTE  
 2-1/2 #12 & #11 AWG GND

FIELD ROUTE  
 2-1/2 #12 & #11 AWG GND

LEACHATE CONVEYANCE SYSTEM  
 PUMP DISCHARGE  
 MAGNETIC FLOWMETER  
 LINE WW-478-A-1000-ET

120VAC, 60HZ FROM  
 MINI POWER ZONE  
 AT PERMANENT LIFT  
 STATION STARTER RACK

FIELD ROUTE  
 2-1/2 #12 & #11 AWG GND



# UNITED STATES DEPARTMENT OF ENERGY

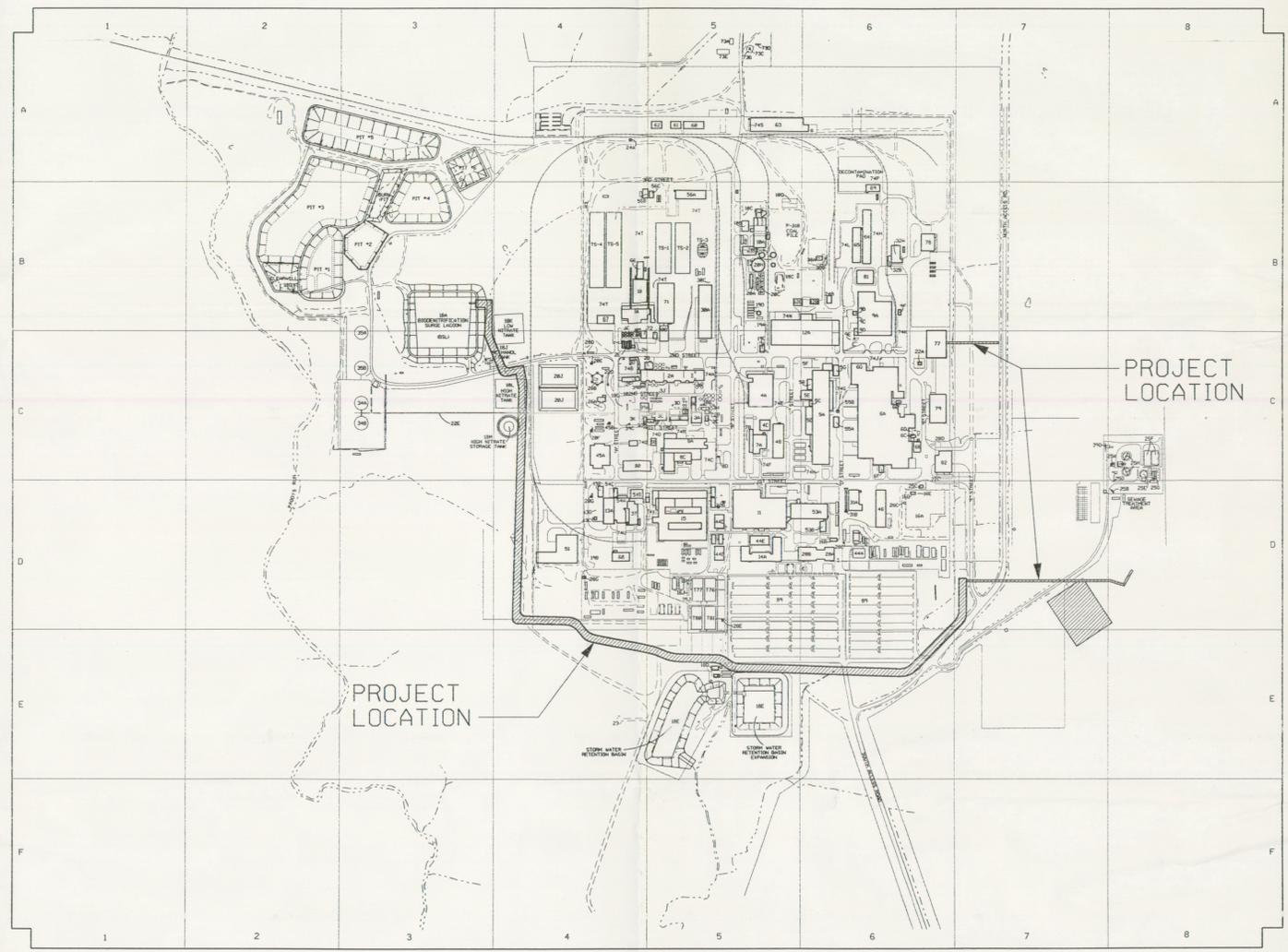
## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

### ON-SITE DISPOSAL FACILITY LEACHATE CONVEYANCE SYSTEM

#### SUBCONTRACT NUMBER 20211

#### HAMILTON COUNTY AND BUTLER COUNTY, OHIO

#### FINAL DESIGN PACKAGE



REF DWG NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-5900-X-00265	LEGEND AND SYMBOLS

PRELIMINARY  
NOT FOR CONSTRUCTION

FOR  
INFORMATION  
ONLY

E	ISSUED FOR FINAL DESIGN REVIEW	N/A	
D	ISSUED FOR EPA REVIEW	N/A	05/17/96
C	ISSUED FOR DOE 90% DESIGN REVIEW: UNCHECKED; REVISIONS IN PROGRESS	N/A	05/17/96
B	ISSUED FOR 90% DESIGN REVIEW	N/A	04/30/96
A	ISSUED FOR 30% DESIGN REVIEW	N/A	03/26/96

**UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

THIS DRAWING PREPARED BY  
**PARSONS**  
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CINCINNATI, OHIO

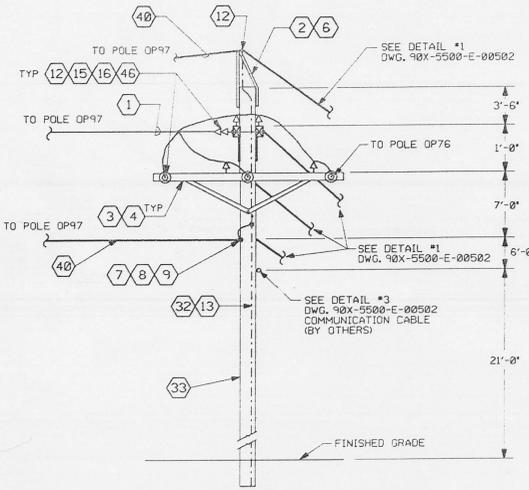
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**LEACHATE CONVEYANCE SYSTEM**

DRAWING TITLE  
**PROJECT TITLE SHEET** 184

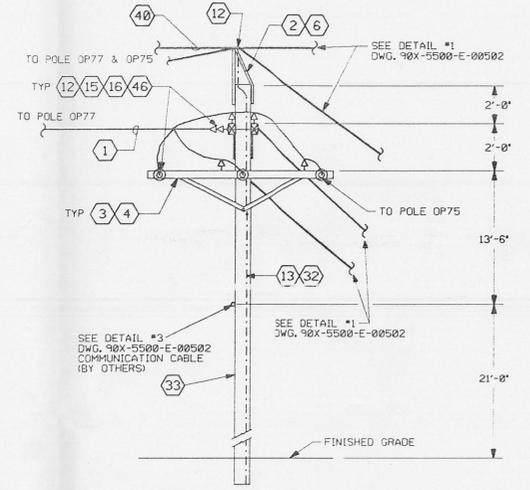
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SUBMITTED FOR APPROVAL		FERMCO CSU APPROVAL N/A		FERMCO PROJECT NO. 20211	

PREPARED UNDER PARSONS PROJECT ORDER NUMBER SRP/P0164	DOE PROJECT NO. WBS 1.1.1.2.3.6 00-90701	FEMP PROJECT NO. 92X-5900-X-00263	DRAWING INDEX CODE NO. X0001	SHEET NO. E
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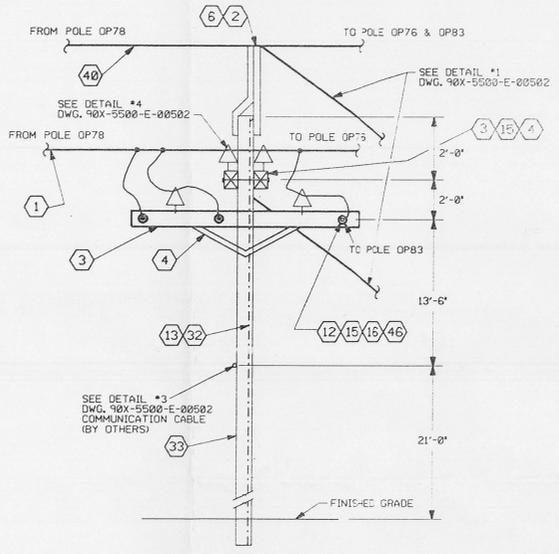
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The Ralph M. Parsons Company \* Parsons Main, Inc. \* Engineering-Science, Inc.  
ARCHITECTS - ENGINEERS  
CINCINNATI, OHIO



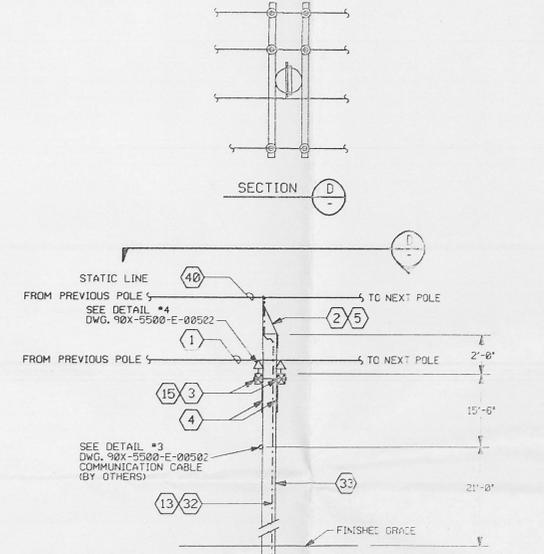
ELEVATION POLE OP75



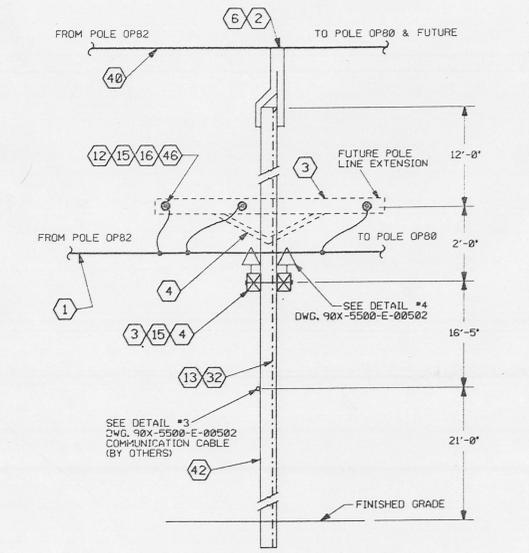
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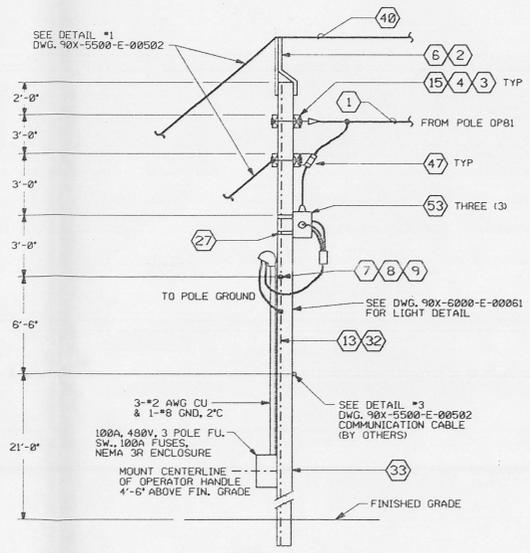
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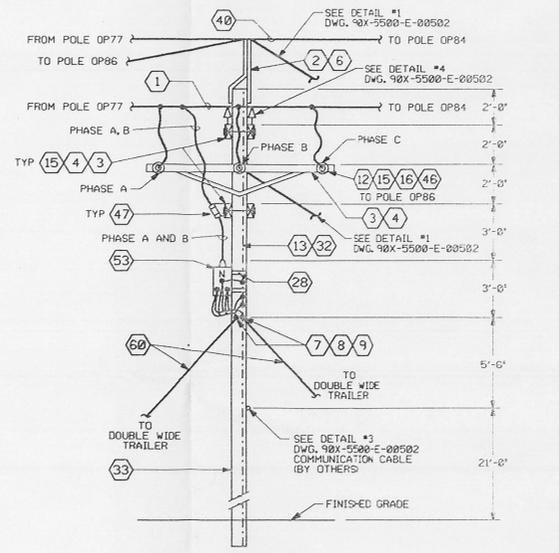
ELEVATION POLES OP78, OP79, OP80, OP84, OP86, OP93, OP95



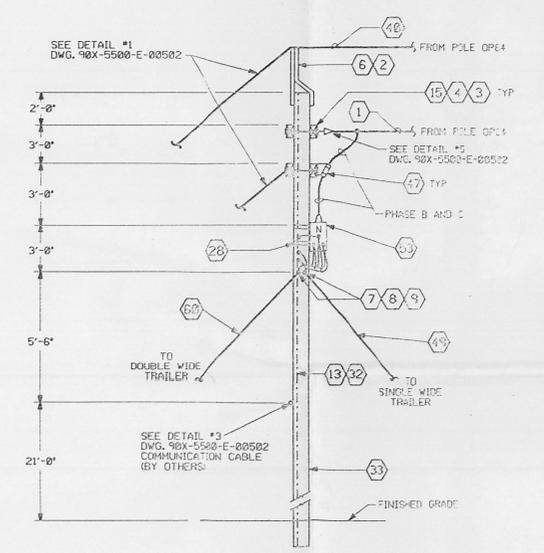
ELEVATION POLE OP81



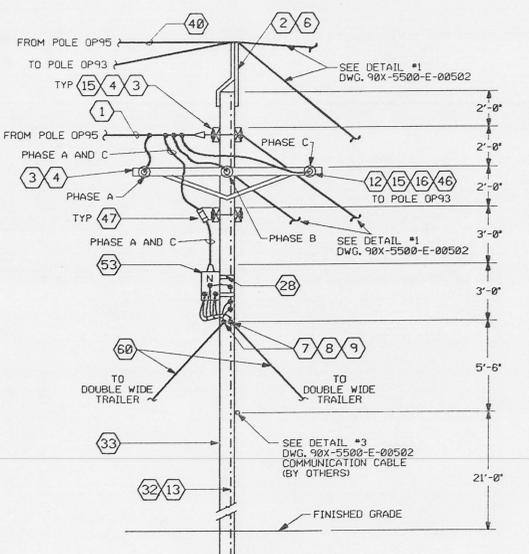
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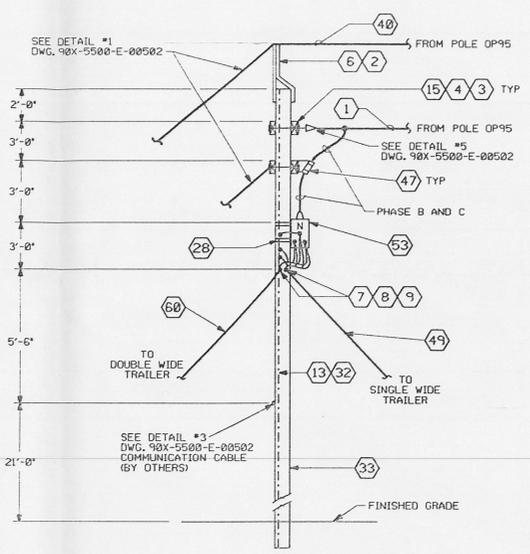
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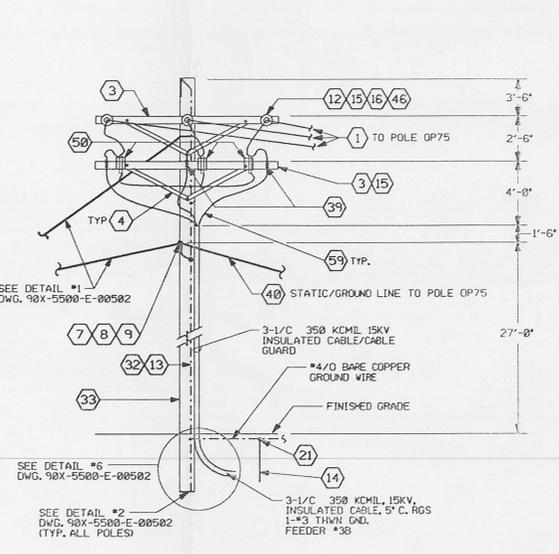
ELEVATION POLE OP85



ELEVATION POLE OP94



ELEVATION POLE OP96



ELEVATION POLE OP97

FOR INFORMATION ONLY

- LEGEND**
- AERIAL POWER CONDUCTOR, 366.4 KCMIL ACSR, MERLIN.
  - GROUND WIRE CLAMP, USED TO ATTACH STATIC WIRE TO BAYONET & POLE GROUND.
  - CROSSARM, 3/2" x 4 1/2" x 12' - 0", PRESSURE TREATED SOUTHERN PINE.
  - CROSSARM BRACE, HOT DIP GALVANIZED 1/2" x 1 1/2" STEEL, 50" SPAN x 15" DROP.
  - STATIC WIRE SUPPORT, STRAIGHT BAYONET TYPE.
  - STATIC WIRE SUPPORT, CORNER BAYONET TYPE.
  - T-BRACE, FOR STATIC WIRE OR MESSENGER WIRE DEAD-END.
  - EYE BOLT, OVAL EYE TYPE, FOR DEAD-END, 3/4" DIA., WITH ONE SQUARE NUT, ADDITIONAL NUTS, WASHERS, AND LENGTH AS REQUIRED.
  - GUY GRIP, FOR STATIC WIRE, PREFORMED WIRE TYPE.
  - WEATHERHEAD, CONDUIT, OUTDOOR, WEATHERTIGHT.
  - CLAMP, SUSPENSION, FOR 3/8" MESSENGER.
  - EYE NUT, 3/4" BOLT DIAMETER.
  - STAPLE, COPPER/CLAD, 1 1/2" LONG.
  - GROUND ROD, 3/4" DIAMETER X 10' LONG, COPPER/CLAD.
  - BOLTS, DOUBLE ARMING, SQUARE NUTS, 3/4" DIA X LENGTH AS REQUIRED.
  - DISTRIBUTION TYPE DEAD END GRIP, FOR USE ON 366.4 KCMIL ACSR CONDUCTOR.
  - ARMOR ROD FOR USE ON ITEM #1 THIS LIST.
  - 1/4" DIAMETER HELICAL SCREW TYPE GUY ANCHOR WITH MIN. PULLOUT CAPACITY OF 25,000 LBS.
  - COMPRESSION GROUND FITTING.
  - SPRINT-BOLT CONNECTOR, FOR OUTDOOR OVERHEAD CONDUCTOR INSTALLATIONS.
  - COMPRESSION GROUND FITTING, TO SECURE BARE COPPER CONDUCTOR TO 3/4" GROUND ROD.
  - NOT USED
  - NOT USED
  - GUY WIRE MARKER, HALF ROUND, 2" WIDE, 90" LONG, NY RESISTANT W/ HARDWARE.
  - NOT USED
  - TRIPLEEYE, GALVANIZED ANCHOR ROD, 1" DIA, LENGTH AS REQUIRED.
  - EQUIPMENT MOUNT FOR 3 TRANSFORMERS, DOUBLE BANDED, ALUMINUM CLUSTER MOUNT W/ GROUND LUG.
  - EQUIPMENT MOUNT FOR SINGLE TRANSFORMER, DOUBLE BANDED, ALUMINUM CLUSTER MOUNT W/ GROUND LUG.
  - GUY STRAIN INSULATOR, ANSI CLASS 55-4, FOR 3/4" GUY WIRE.
  - LASHING WIRE CLIP, SIZE AS REQUIRED.
  - CROSSARM CORNER TYPE PIN, MALLEABLE IRON, GALVANIZED, 1" THREAD MOUNTING HARDWARE.
  - \*4 AWG, BARE SOLID COPPER GROUND CONDUCTOR.
  - POLE, 4.5 FT. CLASS 2, PRESSURE TREATED SOUTHERN YELLOW PINE.
  - TIE ROD FOR ACSR CONDUCTOR TO PIN TYPE INSULATOR, SIZE TIE ROD TO FIT OVER ARMOR ROD.
  - 3/8" DIAMETER, 7 STRAND, HIGH STRENGTH, GALVANIZED STEEL STRAND.
  - NOT USED
  - 3/8" DIAMETER, 7 STRAND, HIGH STRENGTH, GALVANIZED STEEL STRAND.
  - CABLE SUPPORT, 1/2" CONDUIT TOP, OUTDOOR WEATHERTIGHT, SEAL WITH FILLING COMPOUND.
  - TERMINATOR, 15KV, 365 KCMIL COLE SHRINK, SILICONE RUBBER, SIZED TO FIT INSULATION DIAMETER.
  - 3/8" DIAMETER, 7 X 8, STRANDED CONSTRUCTION, GALVANIZED STEEL STRAND.
  - NOT USED
  - POLE, 60 FT. CLASS 2, PRESSURE TREATED SOUTHERN YELLOW PINE.
  - HIGH VOLTAGE FORGED STEEL PIN, FOR PIN TYPE INSULATORS 1" LEAD THREAD, LONG SHANK, WITH WASHERS AND NUTS AS REQUIRED.
  - SURGE ARRESTER, DIRECT CONNECTED, 15KV, RISER POLE TYPE, METAL OXIDE VALVE, WITH CROSSARM MOUNTING HARDWARE.
  - INSULATORS, PIN TYPE, 11.4 KV, GLAZED PORCELAIN, 1" THREADS ANSI CLASS 55-5, 1" NECK.
  - INSULATOR, DEAD-END TYPE, 6 1/2" LONG, 4 3/8" DIA, ANSI CLASS 52-9, CLEVIS TYPE WITH STEEL HARDWARE.
  - FUSED CUTOUT ARRESTER COMBINATION UNIT, CUTOUT RATED 15KV, 100 AMPS, 15,000 AMP 10, WITH CROSSARM MOUNTING HARDWARE. FOR ARRESTER, SEE ITEM 44, THIS MATERIAL LIST.
  - CABLE GUARD, 7" SHAPE, 14-GAUGE, HOT DIPPED GALVANIZED STEEL, 8 FT. LONG, 5 1/2" INSIDE DIAMETER, WITH STRAPS AND HARDWARE AS REQUIRED.
  - \*2 AL QUADRAPLEX
  - FUSED CUTOUT ARRESTER COMBINATION UNIT, CUTOUT RATED 15KV, 200 AMPS, 14,000 AMP 10, WITH CROSSARM MOUNTING HARDWARE. FOR ARRESTER, SEE ITEM 44, THIS MATERIAL LIST.
  - NOT USED
  - NOT USED
  - SINGLE PHASE, OIL FILLED, POLE MOUNTED TRANSFORMER, SEE 90X-5500-E-00580 FOR SIZE AND QUANTITY.
  - NOT USED
  - NOT USED
  - NOT USED
  - NOT USED
  - COPPER BUTT PLATE
  - 350 KCMIL 1/2" EPR SHIELDED MV90 CABLE INSULATED FOR 15KV, 100 PERCENT INSULATED LEVEL.
  - \*3/8" AL QUADRAPLEX

NOTES  
1. CONSTRUCT OVERHEAD LINES TO CLEAR ROADS BY 18' AND RAILROADS BY 24' AS A MINIMUM.

REVISIONS NO.      DATE      DWN. BY      APPD.      NO.      REVISIONS      DATE      DWN. BY      APPD.      REF. DWG. NO.		NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY	CIVIL & STR. ENGINEER: <i>[Signature]</i> INSTRUMENT MECHANICAL: <i>[Signature]</i> CHECKED: <i>[Signature]</i> APPROVED: <i>[Signature]</i>	APPROVAL SAFETY ENG. MAINTENANCE: <i>[Signature]</i> FIRE PROTECT. WASTE MGMT. SECURITY: <i>[Signature]</i> CRU: <i>[Signature]</i>	FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION Environmental Management Project U.S. DEPARTMENT OF ENERGY	FERMCO PROJECT NO. 20011 SOUTHEAST CORNER OF SITE LEACHATE CONVEYANCE SYSTEM ELECTRICAL DETAILS NO SCALE RES. #2971 DATE: 6/24/96 DRAWN: S.J. SHOCK	90X-5500-E-00502 90X-5500-E-00500	238930_3 FILE NAME: /RES297/90X-E0501.DGN
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- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE FOLLOWING DOCUMENTS:  
 EXISTING SITE DATA SOURCE (IN PLANT FILES)  
 FEMP CAD GRID/UTILITY DRAWINGS  
 FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
 PARSONS TOPOGRAPHY, 1992  
 B.L. PAYNE AND ASSOCIATES, TOPOGRAPHIC SURVEY 1996  
 WOOLPERT SURVEY, MARCH 1996
- THE LOCATION AND ELEVATIONS OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE SUB-CONTRACTOR SHALL FIELD VERIFY PRIOR TO START OF CONSTRUCTION.
- RECTANGULAR SHAPE INDICATES SHEET LIMITS WITH PROFILE NUMBER TO REFERENCE FOR ENLARGED PLAN AND PROFILE.
- ALL COORDINATES ARE IN NAD 1983. ALL ELEVATIONS IN NGVD 1927.
- THE SUB-CONTRACTOR SHALL VERIFY LOCATION OF CONTROLLED AREA WITH FERMCO PRIOR TO CONSTRUCTION.

FOR INFORMATION ONLY

REF DWG NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-5900-X-00265	LEGEND AND SYMBOLS
92X-5900-G-00254	PLAN AND PROFILE SHEET 1 OF 4
92X-5900-G-00261	PLAN AND PROFILE SHEET 2 OF 4
92X-5900-G-00266	PLAN AND PROFILE SHEET 3 OF 4
92X-5900-G-00262	PLAN AND PROFILE SHEET 4 OF 4

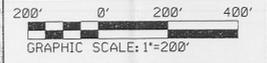
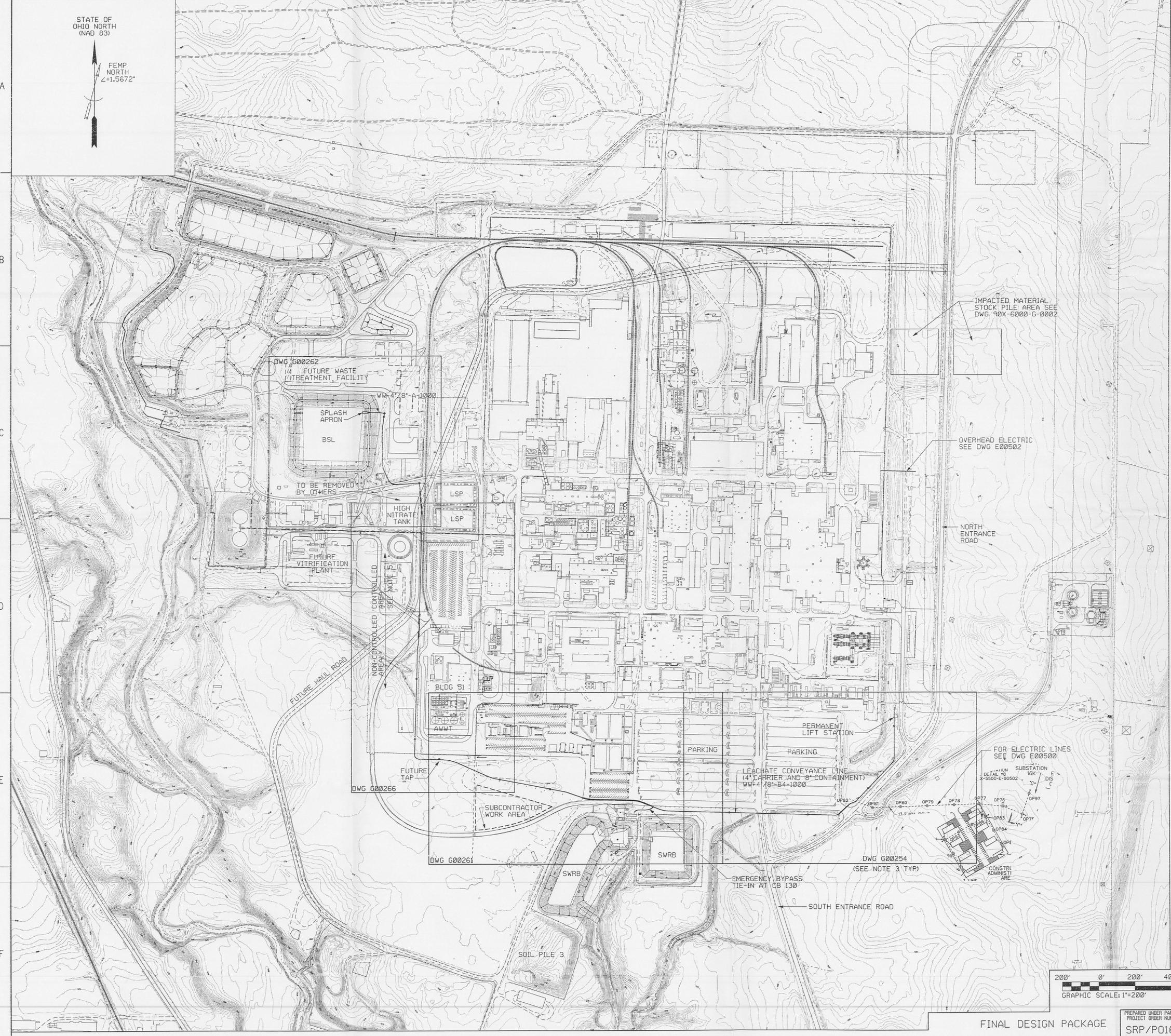
PRELIMINARY  
NOT FOR CONSTRUCTION

E	ISSUED FOR FINAL DESIGN REVIEW		N/A
D	ISSUED FOR EPA REVIEW		06/25/98
C	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS		05/17/98
B	ISSUED FOR 90% DESIGN REVIEW		04/30/98
A	ISSUED FOR 30% DESIGN REVIEW		03/26/98
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO DATE
			INITIALS AND DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

DRAWING TITLE		CIVIL MASTER PLAN		186	
DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
C.R. TOMONGIN	2-22-96			E. MELYNK	4/19/96
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS	1" = 200'	
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	N/A		FERMCO PROJECT NO.	
				20211	

A-E	DATE	DATE	DATE	SHEET NO.	REV. NO.
DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.			
	WBS 1.1.1.2.3.6	92X-5900-G-00251	G0001	E	
PROJECT ORDER NUMBER	SRP/P0164				



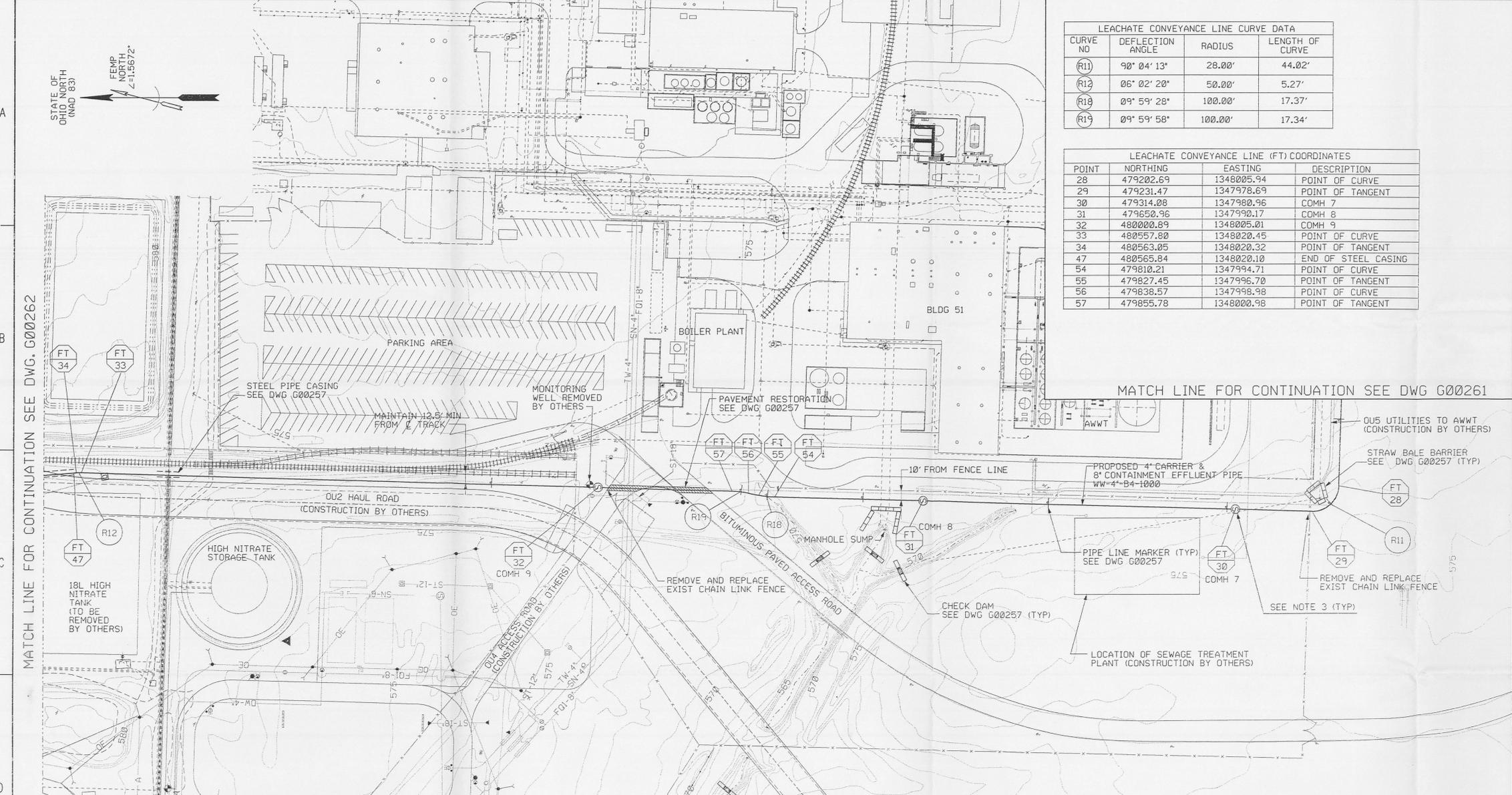
FINAL DESIGN PACKAGE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	SRP/P0164
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LEACHATE CONVEYANCE LINE CURVE DATA			
CURVE NO	DEFLECTION ANGLE	RADIUS	LENGTH OF CURVE
R11	90° 04' 13"	28.00'	44.02'
R12	06° 02' 20"	50.00'	5.27'
R18	09° 59' 28"	100.00'	17.37'
R19	09° 59' 58"	100.00'	17.34'

LEACHATE CONVEYANCE LINE (FT) COORDINATES			
POINT	NORTHING	EASTING	DESCRIPTION
28	479202.69	1348005.94	POINT OF CURVE
29	479231.47	1347978.69	POINT OF TANGENT
30	479314.08	1347980.96	COMH 7
31	479650.96	1347990.17	COMH 8
32	480000.89	1348005.01	COMH 9
33	480557.80	1348020.45	POINT OF CURVE
34	480563.05	1348020.32	POINT OF TANGENT
47	480565.84	1348020.10	END OF STEEL CASING
54	479810.21	1347994.71	POINT OF CURVE
55	479827.45	1347996.70	POINT OF TANGENT
56	479838.57	1347998.98	POINT OF CURVE
57	479855.78	1348000.98	POINT OF TANGENT

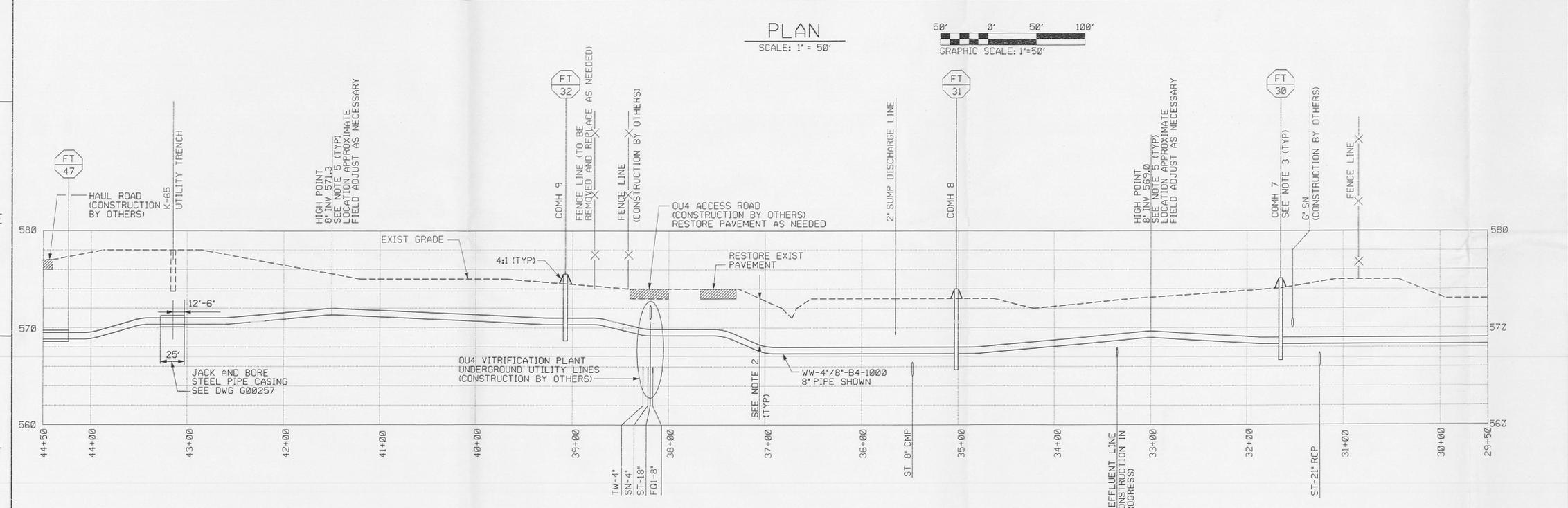
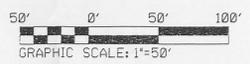
- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.  
EXISTING SITE DATA SOURCE (IN PLANT FILES)  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
PARSONS TOPOGRAPHY, 1992  
B.L. PAYNE AND ASSOCIATES, TOPOGRAPHIC SURVEY 1996  
WOOLPERT SURVEY MARCH 1996
- ALL HDPE LINE VERTICAL ALIGNMENT TO BE INSTALLED USING A MINIMUM 40' DIAMETER BEND. MAINTAIN A MINIMUM 36" COVER OVER TOP OF CONTAINMENT PIPE.
- SEE TABLE 1, DRAWING NO 92X-5900-G-00258 FOR SCHEDULE OF TOP OF LID AND INVERT ELEVATION AND DETAILS OF CLEANOUT-MANHOLES.
- THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE SUB-CONTRACTOR SHALL FIELD VERIFY PRIOR TO CONSTRUCTION.
- MAINTAIN PIPE ELEVATIONS AS SHOWN BETWEEN MANHOLES TO PERMIT DRAINAGE. THE LOCATION OF HIGH POINT IS APPROXIMATE. TO BE FIELD VERIFIED.
- FOR UNDERGROUND LEACHATE CONVEYANCE PIPING, USE HDPE SDR 11 FOR 4" CARRIER PIPE WITH PIPE CENTRALIZERS AND SDR 17 FOR 8" CONTAINMENT PIPE. INSTALL 6" WIDE PLASTIC TAPE WITH MAGNETIC TRACE WIRE 6" ABOVE ALL HDPE PIPE. INSTALL PIPE LINE SIGNS AS SHOWN (SEE DETAIL ON DRAWING 92X-5900-G-00257).
- ALL FITTINGS ON HDPE ARE TO BE MOLDED UNLESS OTHERWISE NOTED.
- FOR LOCATION OF PLAN IN REFERENCE TO THE LEACHATE CONVEYANCE LINE SEE THE MASTER PLAN, DRAWING 92X-5900-G-00261.



MATCH LINE FOR CONTINUATION SEE DWG. G00262

MATCH LINE FOR CONTINUATION SEE DWG G00261

PLAN  
SCALE: 1" = 50'



PROFILE  
SCALE: HOR 1" = 50'  
VERT 1" = 5'

REF DWG NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-5900-X-00265	LEGEND AND SYMBOLS
92X-5900-G-00261	MASTER PLAN
92X-5900-G-00261	PLAN AND PROFILE SHEET 2 OF 4
92X-5900-G-00262	PLAN AND PROFILE SHEET 4 OF 4
92X-5900-G-00257	DETAILS - SHEET 2 OF 3
92X-5900-G-00258	DETAILS - SHEET 3 OF 3

PRELIMINARY  
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	INITIALS AND DATE
E	ISSUED FOR FINAL DESIGN REVIEW	N/A
D	ISSUED FOR EPA REVIEW	N/A 06/25/96
C	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS	N/A 05/17/96
B	ISSUED FOR 90% DESIGN REVIEW	N/A 04/30/96
A	ISSUED FOR 30% DESIGN REVIEW	N/A 03/26/96

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
THIS DRAWING PREPARED BY  
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THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**  
DRAWING TITLE  
**CIVIL PLAN AND PROFILE ONLY**  
SHEET 3 OF 4  
FOR INFORMATION 187

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
C.R. TOMONGIN	2-22-96	E. MELNYK	04/19/96		
PLANT/BLDG. NO.	FLOOR	SCALE	AS SHOWN	FERMCO PROJECT NO.	
				20211	

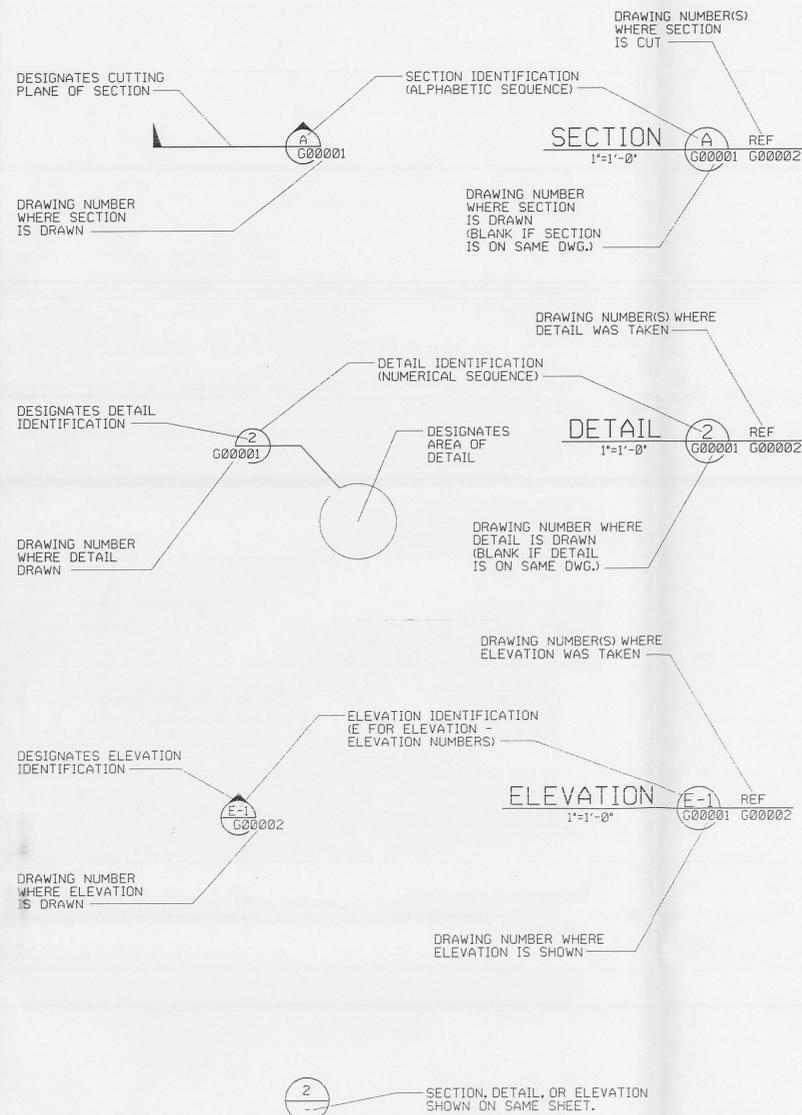
DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
1.1.1.1.2.3.6	00-90701	92X-5900-G-00266	G0004	E

FINAL DESIGN PACKAGE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER  
SRP/P0164

23930\_5

### GENERAL LEGEND



**NOTE:**

ABBREVIATED DRAWING NUMBERS WILL BE USED FOR ALL SECTIONS, DETAILS, ELEVATIONS, AND WITHIN NOTES AND CALL OUTS IN THE BODY OF THE DRAWING.  
 FOR EXAMPLE: 95X-5900-G-00002 = DRAWING NUMBER  
 G00002 = ABBREVIATED DRAWING NUMBER

**DIMENSIONING:**

DIMENSIONS AND/OR ELEVATIONS MARKED THUS (+/-) SHALL BE VERIFIED IN THE FIELD BY SUB-CONTRACTOR, BEFORE START OF CONSTRUCTION.  
 USE DIMENSIONS AS SHOWN, DO NOT SCALE.  
 NTS (NOT TO SCALE) IS SHOWN ONLY WHERE DIMENSION IS OBVIOUSLY OUT OF SCALE.

### CONSTRUCTION BY OTHERS

- CONTOUR - MAJOR & MINOR
- UTILITIES
- BUILDING/TRAILER/PAD
- ROADWAY/SIDEWALK

### UTILITY SYMBOLS

EXISTING		PROPOSED
--- ST ---	STORM SEWER	— ST —
--- SN ---	SANITARY SEWER	— SN —
--- FG ---	FUEL GAS	— FG —
--- DW ---	DRINKING WATER	— DW —
--- F01 ---	FIRE PROTECTION	— F01 —
--- LS ---	LIVE STEAM	— LS —
--- WS ---	WATER SUPPLY	— WS —
--- WR ---	COOLING WATER RETURN	— WR —
--- TW ---	PROCESS WATER	— TW —
--- CE ---	CONTAMINATE WATER	— CE —
--- FT ---	FILTRATE OR EFFLUENT	— FT —
--- DF ---	DEIONIZED FEED	— DF —
--- PW ---	DEIONIZED WATER	— PW —
--- BR ---	BRINE	— BR —
--- RW ---	RAW WATER	— RW —
--- A ---	ALARM	— A ---
--- CN ---	STEAM CONDENSATE	— CN ---
--- VE ---	VENT LINES	— VE ---
--- SD ---	SUB-SURFACE DRAINAGE	— SD ---
--- SL ---	SUMP LIQUOR	— SL ---
--- E ---	ELECTRICAL	— E ---
--- OE ---	OVERHEAD ELECTRICAL	— OE ---
--- T ---	TELEPHONE	— T ---
--- G ---	ELECTRIC GROUND	— G ---
--- PA ---	PLANT AIR	— PA ---
--- SA ---	INSTRUMENT AIR SUPPLY	— SA ---
---	ABANDONED	---

### BALLOON LEGEND

	PIV POST INDICATOR VALVE
	SMH SANITARY MANHOLE
	EMH ELECTRICAL MANHOLE
	TMH TELEPHONE MANHOLE
	CB STORM SEWER CATCH BASIN
	HFH HIGH PRESSURE FIRE HYDRANT
	LFH LOW PRESSURE FIRE HYDRANT
	FT COORDINATE POINT

DESIGNATES PIPELINE

### GRADING SYMBOLS

SEE DRAWING 90X-6000-X-00002 FOR GRADING SYMBOLS LEGEND

### SYMBOLS LEGEND

EXISTING		PROPOSED
	POST INDICATOR VALVE (PIV)	
	FIRE HYDRANT (FH)	
	MANHOLE (MH)	
	CATCH BASIN (CB)	
	LIGHT POLE	
	PIPE SUPPORT	
	ELECTRICAL MANHOLE	
	TELEPHONE MANHOLE	
	STREET WASHERS	
	VALVE BOX	
	MONITORING WELL	
	SURFACE DRAINAGE FLOW	
	POWER POLE	
	GRAVEL ROADWAY/DRIVEWAY	
	ASPHALT ROADWAY/DRIVEWAY	
	CONCRETE	
	BUILDING/TRAILER	
	RAILROAD TRACK	
	OU BOUNDARY	
	FENCE	
	TREE LINE	
	DECIDUOUS TREE	
	CONIFEROUS TREE	
	CENTERLINE DRAINAGE DITCH	
	RIVER/CREEK	
	TO BE REMOVED	
	SILT FENCE	
	ELECTRICAL TRANSFORMER	
	TRANSMISSION TOWER	
	HEADWALL	
	BENCH MARK	
	CONSTRUCTION/WIND BARRIER FENCE	
	SIGN	
	BOLLARD/GUARD POST	
	ELECTRICAL PULL BOX	
	SURVEY CONTROL POINT	
	ROAD CENTERLINE OR BASELINE	
	BEND	
	TEE	
	THRUST BLOCK	
	REDUCER	
	UNKNOWN	
	STRAW BALE SILT BARRIER	
	FENCE GATE	
	CHECK DAM	

### ABBREVIATIONS

AWWT	ADVANCE WASTE WATER TREATMENT
BSL	BIODENITRIFICATION SURGE LAGOON
COMH	CLEANOUT MANHOLE
DI	DUCTILE IRON
FT	EFFLUENT LINE
FML	FLEXIBLE MEMBRANE LINER
HDPE	HIGH DENSITY POLYETHYLENE
LSP	LIME SLUDGE POND
OD	OUTSIDE DIAMETER
ODOT	OHIO DEPARTMENT OF TRANSPORTATION
OSDF	ONSITE DISPOSAL FACILITY
OU	OPERABLE UNIT
PC	POINT OF CURVATURE
PI	POINT OF INTERSECTION
PS	POINT OF SWITCH
SCH	SCHEDULE
SWRB	STORMWATER RETENTION BASIN
STL	CARBON STEEL
TYP	TYPICAL
WWF	WELDED WIRE FABRIC

FOR INFORMATION ONLY

REF DWG NO.	DRAWING TITLE
92X-5900-X-00263	PROJECT TITLE SHEET
92X-5900-X-00264	DRAWING INDEX

**PRELIMINARY**  
 NOT FOR CONSTRUCTION

E	ISSUED FOR FINAL DESIGN REVIEW	N/A	
D	ISSUED FOR EPA REVIEW	N/A	06/25/96
C	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS	N/A	05/17/96
B	ISSUED FOR 90% DESIGN REVIEW	N/A	04/30/96
A	ISSUED FOR 30% DESIGN REVIEW	N/A	03/26/96
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
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 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

### LEGEND AND SYMBOLS

DRAWN BY K.L. RABBITT	DATE 02/16/96	LEAD ENGINEER	DATE	CHECKED BY G. MELNYK	DATE 4/19/96
PLANT/BLDG. NO.	FLOOR	SCALE	NONE	CLASS	
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL N/A	FERMCO PROJECT NO. 20211			

FINAL DESIGN PACKAGE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER SRP/P0164

DOE PROJECT NO. WBS 1.1.1.2.3.6 00-90701	DATE 00-90701	DRAWING INDEX CODE NO. 92X-5900-X-00265	SHEET NO. X0003	REV. NO. E
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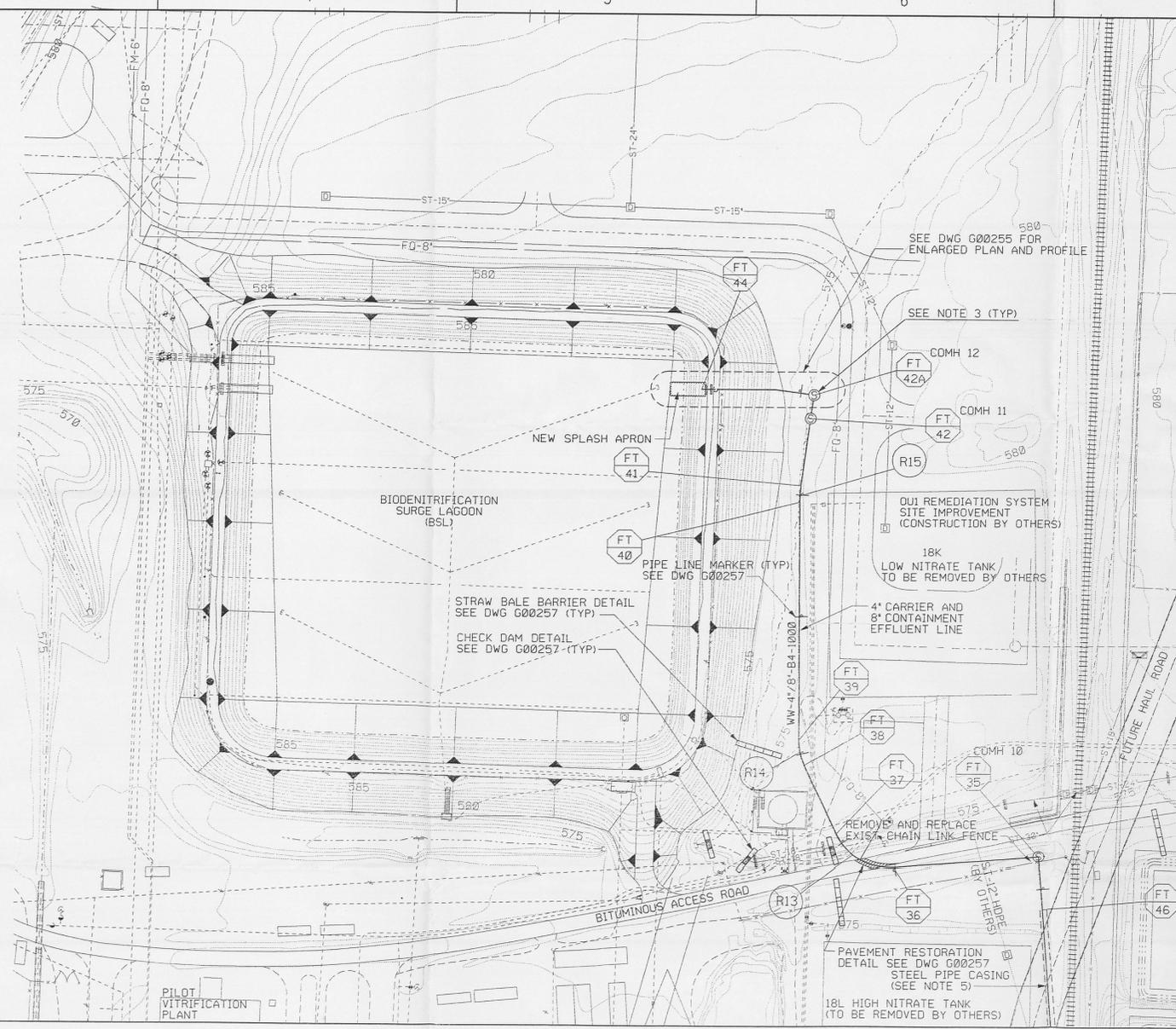
STATE OF OHIO NORTH (NAD 83)



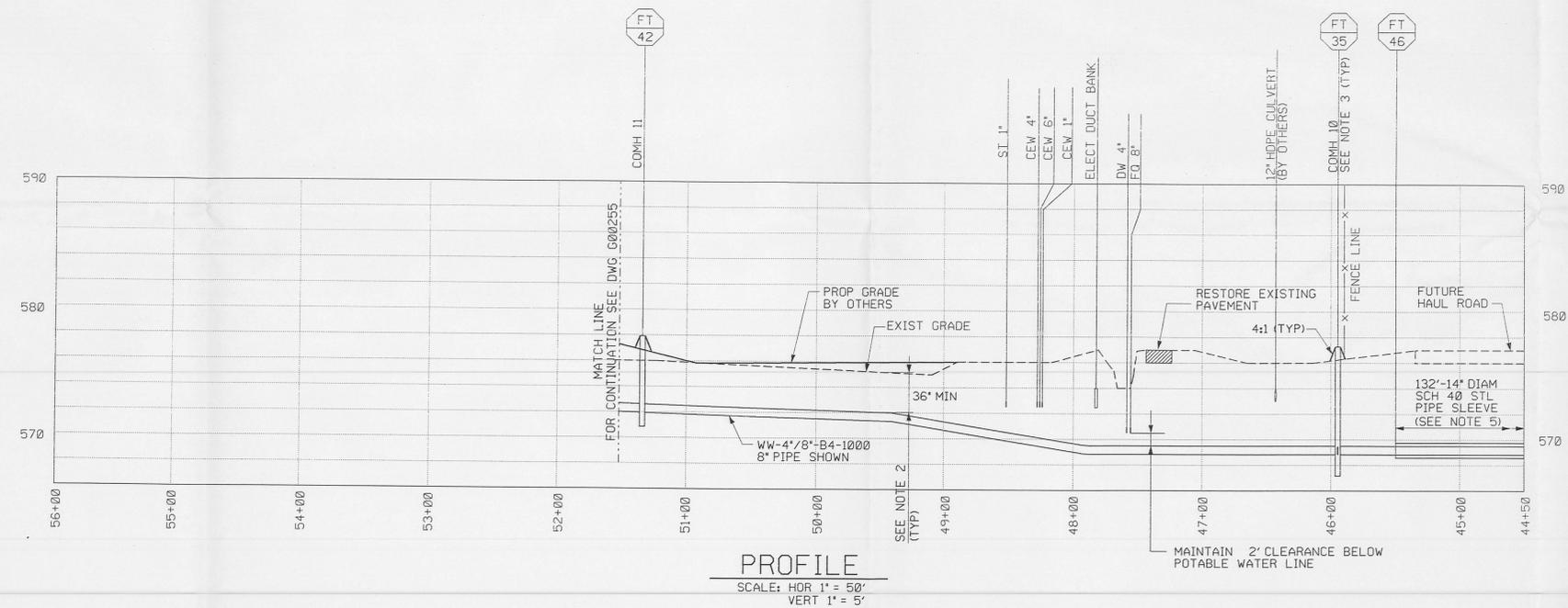
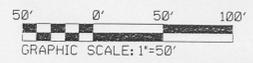
- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.  
EXISTING SITE DATA SOURCE (IN PLANT FILES)  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
B.L. PAYNE AND ASSOCIATES, TOPOGRAPHIC SURVEY 1996  
AERIAL TOPOGRAPHIC SURVEY  
WOOLPERT SURVEY MARCH 1996
- ALL HDPE PIPE VERTICAL ALIGNMENT TO BE INSTALLED USING A MINIMUM 40' DIAMETER BEND. MAINTAIN A MINIMUM 36" COVER OVER TOP OF PIPE.
- SEE TABLE 1 ON DRAWING 92X-5900-G-00258 FOR SCHEDULE OF TOP OF LID AND INVERT ELEVATION AND DETAILS OF CLEANOUT-MANHOLES.
- THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE SUB-CONTRACTOR SHALL FIELD VERIFY PRIOR TO CONSTRUCTION.
- CONTRACTOR SHALL VERIFY ELEVATIONS PRIOR TO WORK. TO INSTALL LEACHATE LINE, SLIP 8" HDPE THROUGH SLEEVE, TRIM ADD FUSION WELD BEADS ON EXTERIOR IF NECESSARY. REFERENCE MANUFACTURER INSTRUCTIONS FOR PROPOSED PULLING PROCEDURES AND PIPE BULKHEADS FOR PULLS.
- FOR UNDERGROUND LEACHATE CONVEYANCE PIPING, USE HDPE SDR 11 FOR 4" CARRIER PIPE WITH PIPE CENTRALIZERS AND SDR 17 FOR 8" CONTAINMENT PIPE. INSTALL 6" WIDE PLASTIC TAPE WITH MAGNETIC TRACE WIRE IN 6" ABOVE ALL HDPE PIPE. INSTALL PIPE MARKERS (SEE DETAIL ON DRAWING 92X-5900-G-00257) EVERY 200' EVERY MIDPOINT OF CURVES AND AT FUTURE TAP POINTS (10' FROM PAVEMENT EDGE).
- ALL BENDS AND FITTINGS ON HDPE ARE TO BE MOLDED UNLESS OTHERWISE NOTED.
- FOR LOCATION OF PLAN IN REFERENCE TO THE LEACHATE CONVEYANCE LINE SEE THE MASTER PLAN, DRAWING 92X-5900-G-00251.

LEACHATE CONVEYANCE LINE CURVE DATA			
CURVE NO	DEFLECTION ANGLE	RADIUS	LENGTH OF CURVE
R13	68° 59' 14"	50.00'	60.20'
R14	25° 09' 12"	50.00'	21.95'
R15	08° 08' 15"	100.00'	14.20'

LEACHATE CONVEYANCE LINE (FT.) COORDINATES			
POINT	NORTHING	EASTING	DESCRIPTION
35	480742.33	1348006.38	COMH 10
36	480732.87	1347885.65	POINT OF CURVE
37	480761.20	1347836.62	POINT OF TANGENT
38	480818.83	1347809.14	POINT OF CURVE
39	480840.07	1347804.27	POINT OF TANGENT
40	481041.79	1347803.07	POINT OF CURVE
41	481055.96	1347803.99	POINT OF TANGENT
42	481112.92	1347811.79	COMH 11
42A	481132.73	1347814.50	COMH 12
43	NOT USED		
44	481137.24	1347719.03	OUTLET
45	NOT USED		
46	480697.45	1348009.87	END OF STEEL CASING



PLAN  
SCALE: 1" = 50'



PROFILE  
SCALE: HOR 1" = 50'  
VERT 1" = 5'

REF DWG NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-5900-G-00265	LEGEND AND SYMBOLS
92X-5900-G-00251	MASTER PLAN
92X-5900-G-00255	DETAILS SHEET 1 OF 3
92X-5900-G-00257	DETAILS SHEET 2 OF 3
92X-5900-G-00258	DETAILS SHEET 3 OF 3
92X-5900-G-00266	PLAN AND PROFILE SHEET 3 OF 4

**PRELIMINARY**  
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
E	ISSUED FOR FINAL DESIGN REVIEW			N/A
D	ISSUED FOR EPA REVIEW			06/25/96
C	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS			05/17/96
B	ISSUED FOR 90% DESIGN REVIEW			04/30/96
A	ISSUED FOR 30% DESIGN REVIEW			03/26/96

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**  
DRAWING TITLE  
**CIVIL PLAN AND PROFILE SHEET 4 OF 4**

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
C.R. TOMONGIN	2-22-96	E. KUBRIN		E. KUBRIN	3/22/96
PLANT/BLDG. NO.	FLOOR	SCALE	AS SHOWN	FERMCO PROJECT NO.	
				20211	

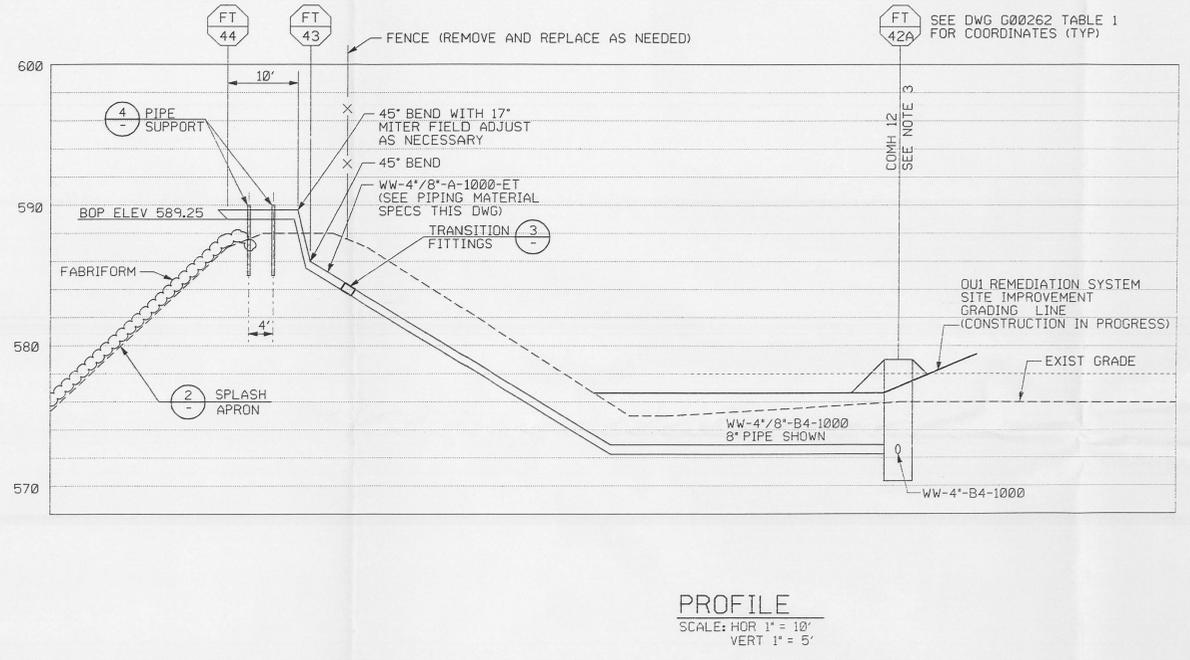
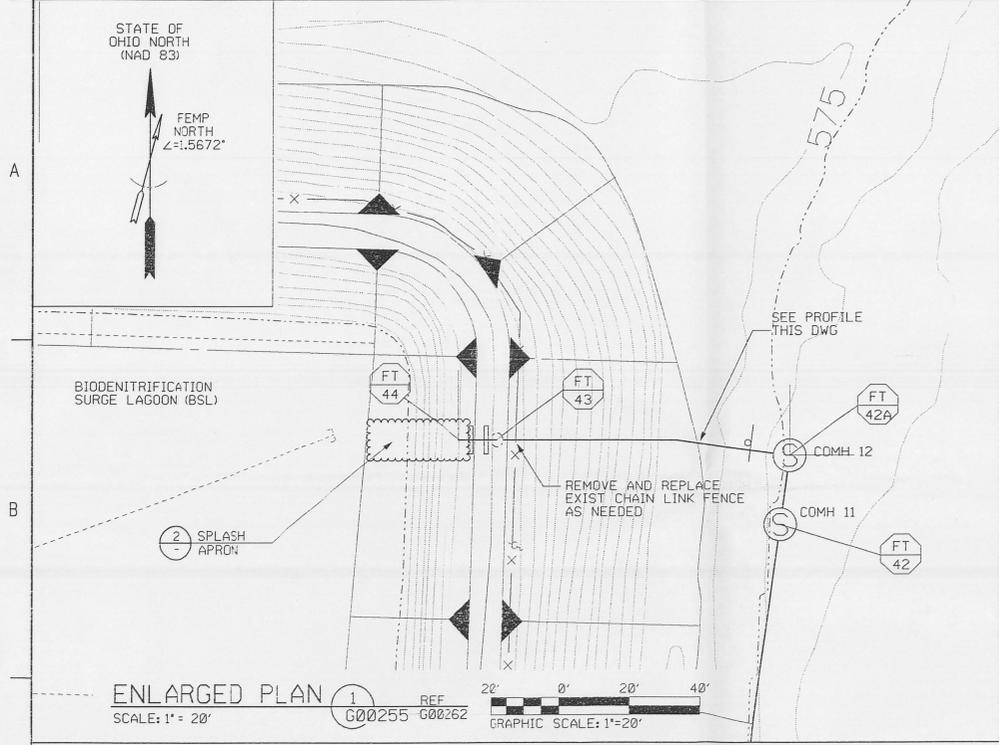
DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
WBS 1.1.1.2.3.6	00-90701	92X-5900-G-00262	G0005	E

FINAL DESIGN PACKAGE

SRP/P0164

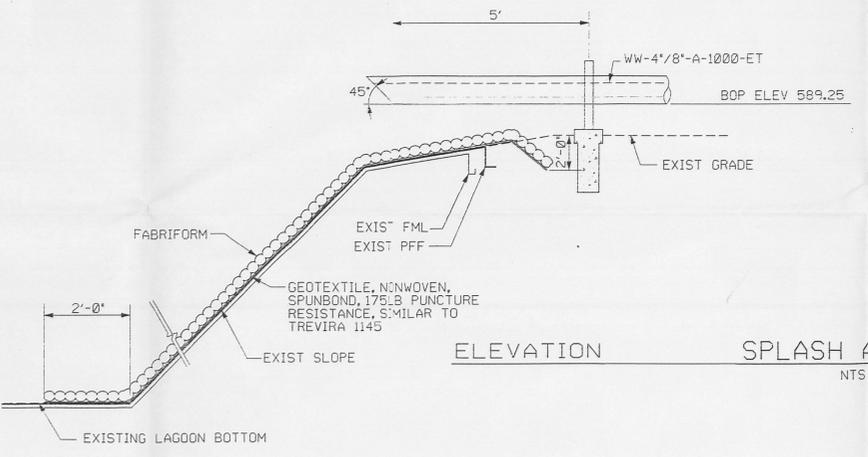
233930-7

- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.  
EXISTING SITE DATA SOURCE (IN PLANT FILES):  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
B.L. PAYNE AND ASSOCIATES, TOPOGRAPHIC SURVEY 1996  
92 AERIAL TOPOGRAPHY  
WOOLPERT SURVEY MARCH 1996
- MAINTAIN A MINIMUM 36" COVER OVER TOP OF PIPE.
- SEE TABLE 1, DRAWING NO 92X-5900-G-00258 FOR SCHEDULE OF TOP AND BOTTOM AND DETAILS OF CLEANOUT-MANHOLES.
- THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE CONTRACTOR SHALL FIELD VERIFY PRIOR TO CONSTRUCTION.
- ALL FITTINGS ON HOPE ARE TO BE MOLDED UNLESS OTHERWISE NOTED.

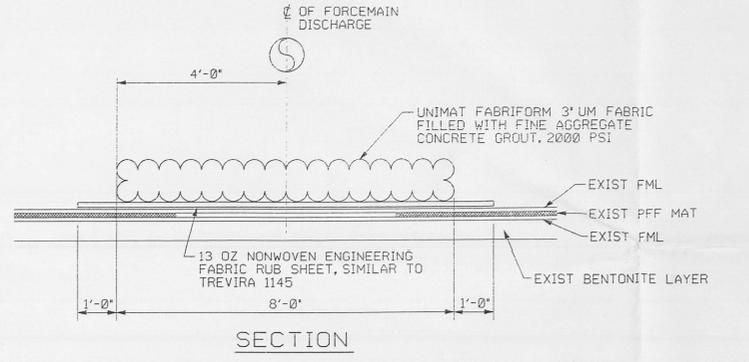


PROFILE  
SCALE: HOR 1" = 10'  
VERT 1" = 5'

- NOTES:
- CARBON STEEL PIPE SHALL BE INSULATED AND ELECTRIC TRACED TO A MINIMUM DEPTH OF 3'-0" BELOW GRADE.
  - UNDERGROUND STL CONTAINMENT PIPE SHALL BE BITUMINOUS COATED AND WRAPPED.
- ABOVE GRADE PIPING MATERIAL SPECIFICATIONS
- PIPE:  
DOUBLE CONTAINMENT PIPING:  
CONTAINMENT - 8" DIA., SCH 40; CARRIER - 4" DIA., SCH 40
- ASTM A-53 GRADE B, CARBON STEEL, STD. WT. BEVELED ENDS ELECTRIC TRACED AND INSULATED
- FITTINGS:  
SEAMLESS CARBON STEEL, STD. WT., BEVELED ENDS, ASTM A234 GR. WPB
- FLANGES:  
CLASS 150, CARBON STEEL, FF, ASTM A105, WE-DNECK STD. WT. BORE
- GASKETS:  
TEFLON, 1/8" THICK
- BOLTING:  
STUD BOLTS WITH HEAVY HEX NUTS, ASTM A33 GR 37  
ASTM A194 OR 2H
- INSULATION:  
CELLULAR GLASS, 2" THICK WITH ALUMINUM JACKET



ELEVATION SPLASH APRON (2)  
NTS



SECTION

FOR INFORMATION ONLY

REF DWG NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-5900-X-00265	LEGEND AND SYMBOLS
92X-5900-G-00251	MASTER PLAN
92X-5900-G-00262	PLAN AND PROFILE SHEET 4 OF 4
92X-5900-G-00257	DETAIL SHEET 2 OF 3
92X-5900-G-00258	DETAIL SHEET 3 OF 3
92X-5900-G-00254	PLAN AND PROFILE SHEET 1 OF 4

PRELIMINARY  
NOT FOR CONSTRUCTION

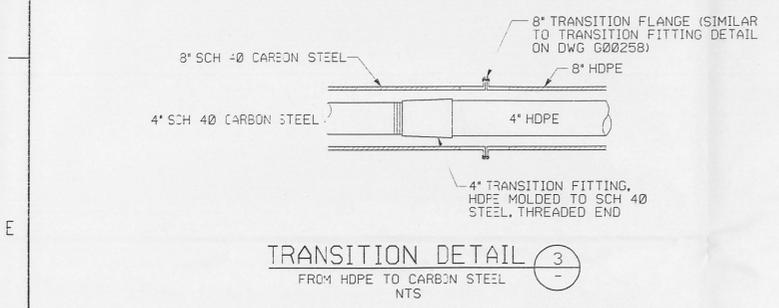
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	INITIALS AND DATE
D	ISSUED FOR FINAL DESIGN REVIEW		N/A
C	ISSUED FOR EPA REVIEW		N/A 03/25/96
B	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS		N/A 03/17/96
A	ISSUED FOR 90% DESIGN REVIEW		N/A 04/30/96

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

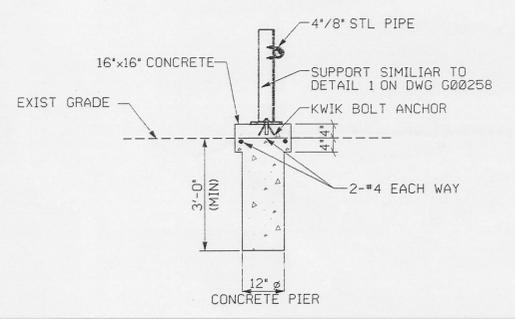
THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

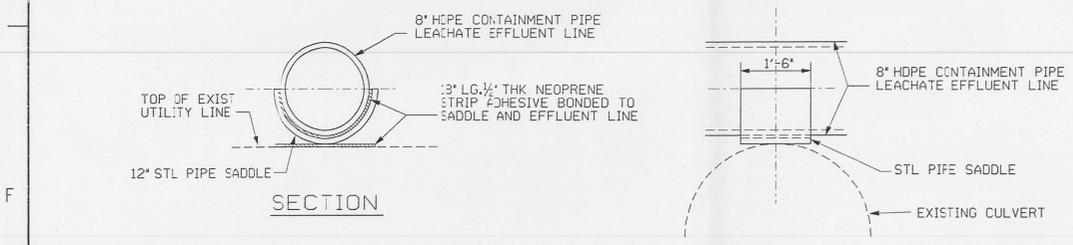
DRAWING TITLE			
<b>CIVIL DETAILS SHEET 1 OF 3</b>			
<b>190</b>			
DRAWN BY C.R. TOMONGIN	DATE 2-22-96	LEAD ENGINEER	CHECKED BY E. MELNYK
PLANT/BLDG. NO.	FLOOR	SCALE AS NOTED	CLASS
SUBMITTED FOR APPROVAL		FERNCO CRU APPROVAL N/A	FERNCO PROJECT NO. 20211



TRANSITION DETAIL (3)  
FROM HDPE TO CARBON STEEL  
NTS



PIPE SUPPORT (4)  
NTS

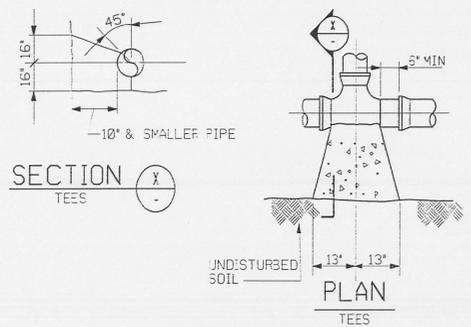


PIPE SADDLE (5)  
NTS

FINAL DESIGN PACKAGE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
SRP/PO164	WBS 1.1.1.2.3.6 00-90701	92X-5900-G-00255	G0025	D	

1. SUB-CONTRACTOR MAY IN GENERAL USE EITHER SEDIMENT FENCE OR STRAW BALES INTERCHANGEABLY FOR SEDIMENT CONTROL WHERE INDICATED ON THE DRAWING. WHERE CHECK DAMS ARE INDICATED, THE CHECK DAM DETAIL ON THIS SHEET MUST BE UTILIZED. STRAWBALES ARE PREFERRED AND SHOULD BE COMPOSTED AT THE END OF PROJECT, CONSISTENT WITH THE FERMCC WASTE MINIMIZATION PROGRAM.

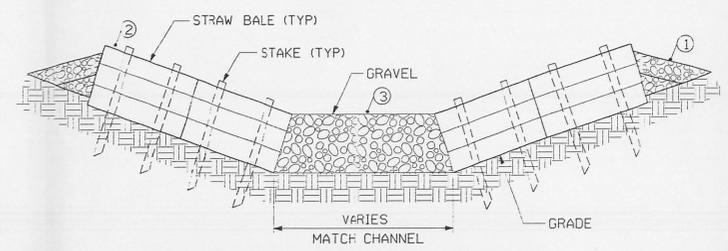


NOTE: BASED ON 100 PSI STATIC PRESSURE PLUS A.W.W.A. WATER HAMMER ALL BEARING SURFACES TO BE CARRIED TO UNDISTURBED GROUND, TYPE II 2000psf

PLAN & ELEVATION

CONCRETE THRUST BLOCK DETAIL

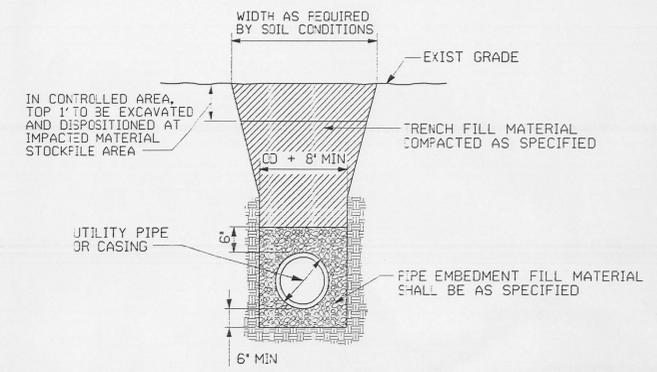
NTS



- ① ODOT ITEM 304 STABILIZED CRUSHED AGGREGATE (2-6" COURSES) ON FILTER FABRIC, ODOT ITEM 712.09, TYPE D.
- ② INSTALL STRAW BALE AS SHOWN ON DETAIL.
- ③ GRAVEL TO BE ODOT ITEM 601.07, TYPE D DUMPED ROCK, TOP WIDTH TO BE SAME AS STRAW BALES.

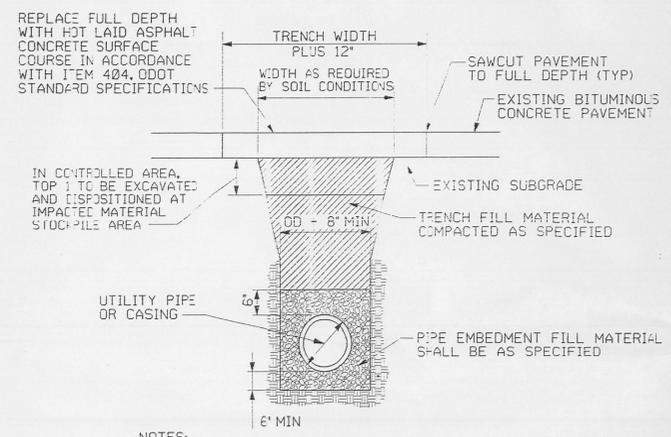
TYPICAL CHECK DAM DETAIL

NTS



TYPICAL PIPE BEDDING DETAIL

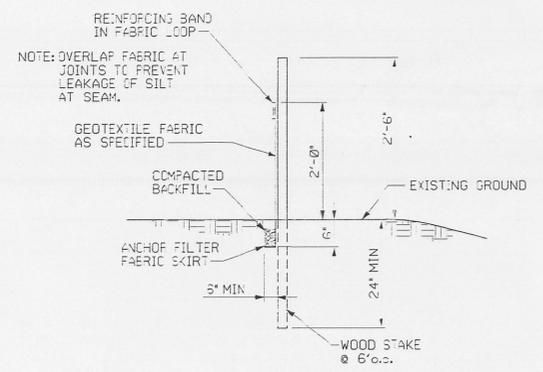
NTS



- NOTES:
- MATERIAL AND CONSTRUCTION OF THE ASPHALTIC CONCRETE PAVING SHALL COMPLY WITH THE REQUIREMENTS OF SECTIONS 404 AND 401 OF ODOT STANDARD SPECIFICATION.
  - COMPACT PAVEMENT BY ROLLING TO ACHIEVE EVEN AND SMOOTH FINISH, WITHOUT ROLLER MARKS. HAND-COMPACT IN AREAS INACCESSIBLE TO ROLLING EQUIPMENT.
  - PLACE IN LAYERS NOT TO EXCEED 2 INCHES COMPACTED DEPTH.
  - ADD TACK COAT ITEM 407, ODOT STANDARD SPECIFICATIONS BETWEEN LAYERS IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.

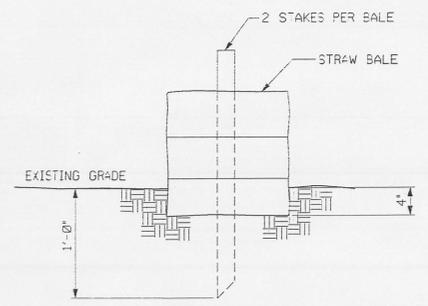
TYPICAL PAVEMENT RESTORATION DETAIL

NTS



TYPICAL SEDIMENT FENCE DETAIL

SEE NOTE 1

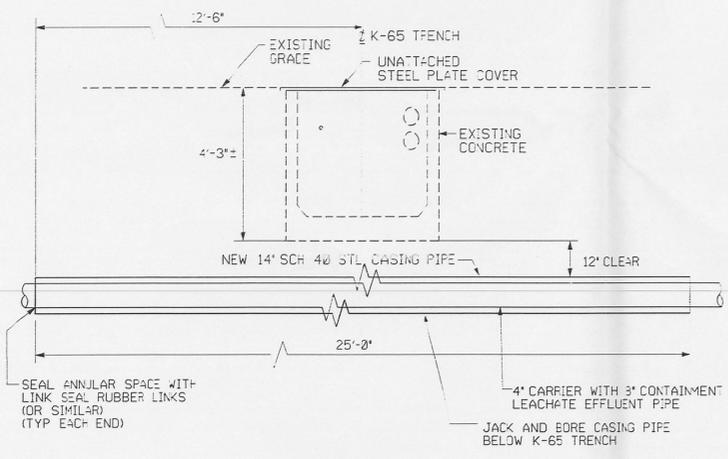


- NOTES:
- STRAW BALES TO BE USED WHEN NATURAL GROUND IS LEVEL OR SLOPING AWAY FROM PROJECT.
  - PLACE STRAW BALES APPROXIMATELY PARALLEL TO BOTTOM OF FILL SLOPE AND AROUND THE CATCH BASIN INLETS.
  - STRAW BALES SHALL BE AS SPECIFIED.
  - FOR EROSION CONTROL MAINTENANCE SEE SPECIFICATIONS.

TYPICAL STRAW BALE BARRIER DETAIL

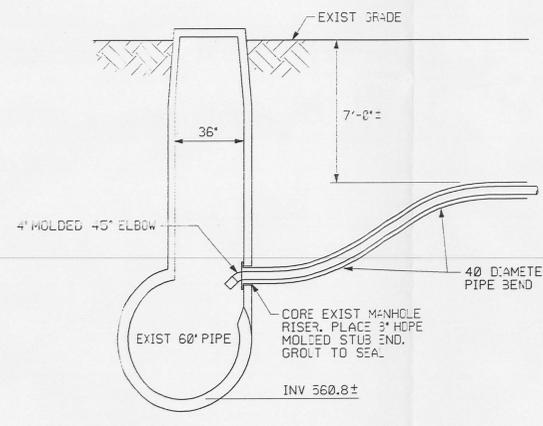
NTS

SEE NOTE 1



STEEL PIPE CASING

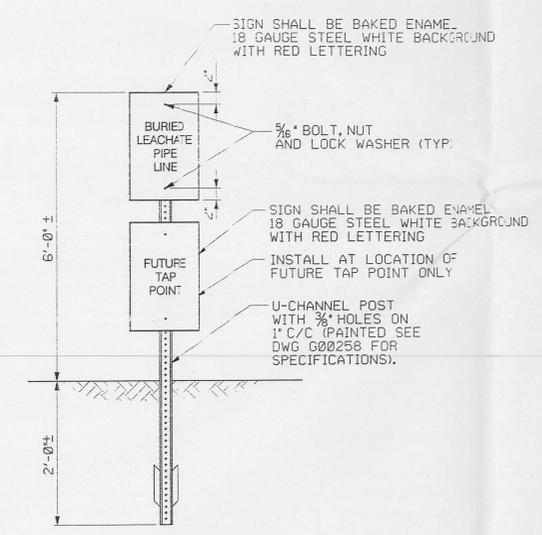
NTS



NOTE: MANHOLE CONFIGURATION IS ASSUMED - NO PLANS FOR ACTUAL MANHOLE WERE AVAILABLE. CONDITIONS NEED TO BE FIELD VERIFIED.

EXIST CATCH BASIN 130 DETAIL

NTS



TYPICAL PIPE LINE MARKER DETAIL

NTS

INSTALL AS SHOWN ON PLANS, GENERALLY AT EVERY 200' AND AT MIDPOINT OF CURVES.

FINAL DESIGN PACKAGE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER SRP/P0164

FOR INFORMATION ONLY

PRELIMINARY NOT FOR CONSTRUCTION

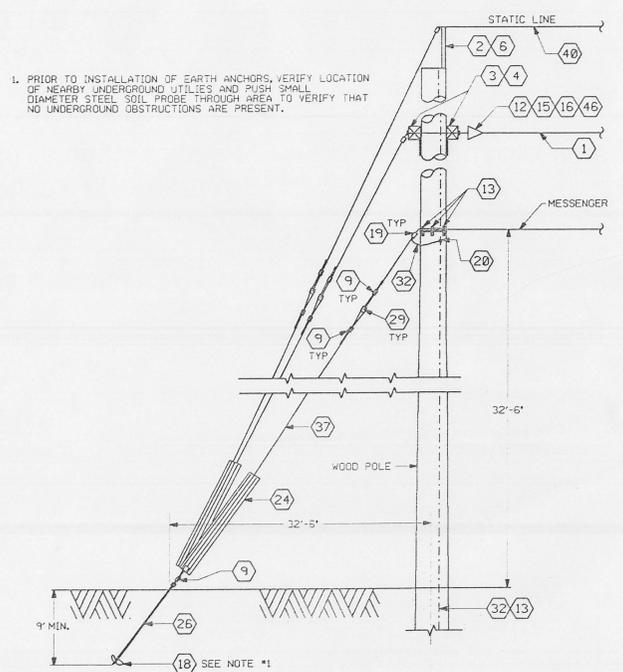
REF DWG NO.	DRAWING TITLE
92X-5900-X-02264	DRAWING INDEX
92X-5900-X-02265	LEGEND AND SYMBOLS
92X-5900-G-02258	DETAILS - SHEET 3 OF 3

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	INITIALS	DATE
D	ISSUED FOR FINAL DESIGN REVIEW		N/A
C	ISSUED FOR EPA REVIEW		06/25/96
B	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED REVISIONS IN PROGRESS		05/17/96
A	ISSUED FOR 90% DESIGN REVIEW		04/30/96

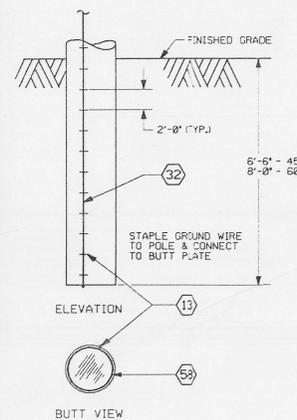
UNITED STATES DEPARTMENT OF ENERGY  
 FERNALD ENVIRONMENTAL MANAGEMENT PROJECT  
 THIS DRAWING PREPARED BY  
 PARSONS  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
 LEACHATE CONVEYANCE SYSTEM

DRAWING TITLE			
CIVIL DETAILS SHEET 2 OF 3			
DRAWN BY C.R. TOMLIN	DATE 2-22-95	SCALE	CLASS
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
SUBMITTED FOR APPROVAL	FERMCC CRU APPROVAL N/A	FERMCC PROJECT NO. 20211	

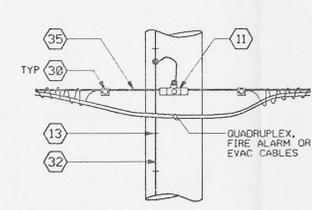
DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
	WBS 1.1.1.2.3.6	00-9C7C1	92X-5900-G-02257	0007 D



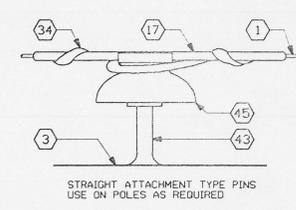
**DETAIL #1**  
TYPICAL GUY



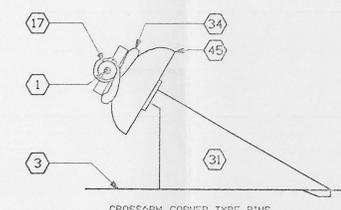
**DETAIL #2**  
POLE GROUNDING



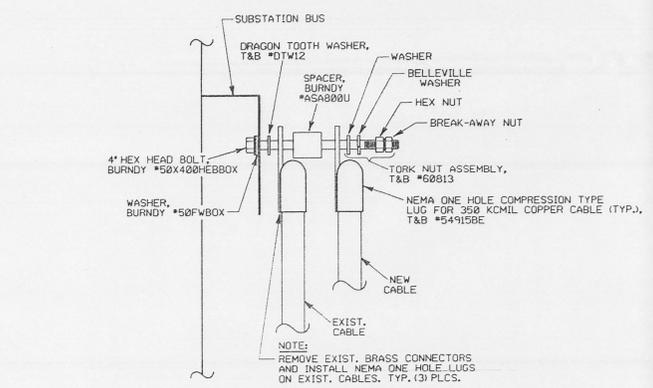
**DETAIL #3**  
TELEPHONE WIRING  
(BY OTHERS - TYP.)



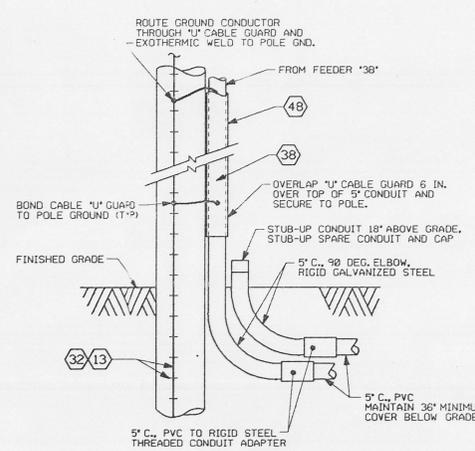
**DETAIL #4**  
INSULATOR (STRAIGHT)



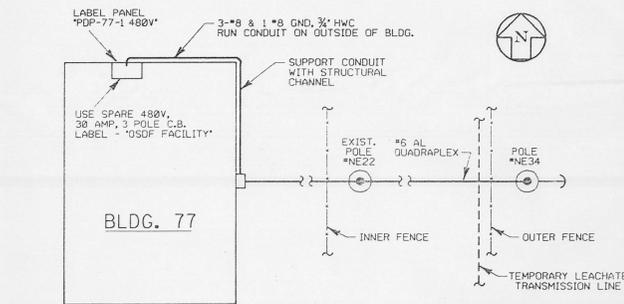
**DETAIL #5**  
INSULATOR (CORNER)



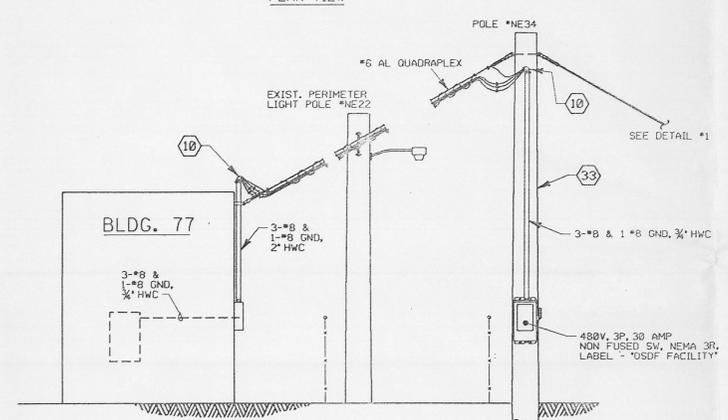
VIEW "B"-"B"



**DETAIL #6**  
POLE OP89



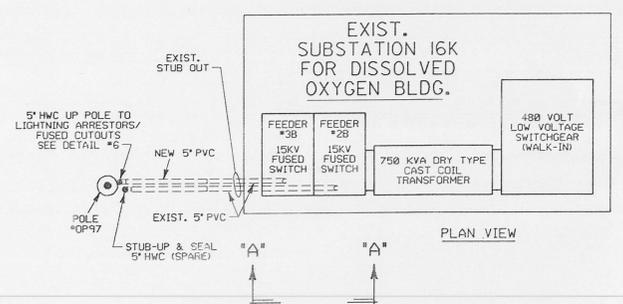
PLAN VIEW



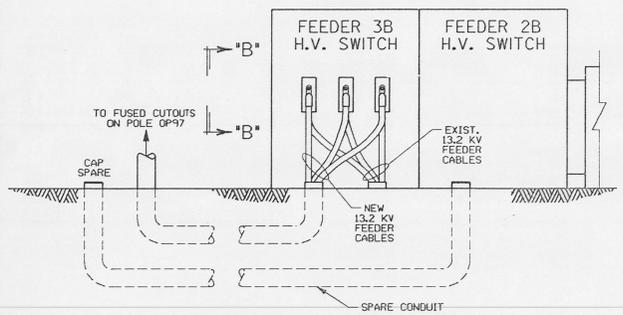
ELEVATION

NOTES:  
1. WIRING TO BE COPPER WITH THIN INSUL. UNLESS OTHERWISE STATED.  
2. GROUND WIRES TO BE COPPER.

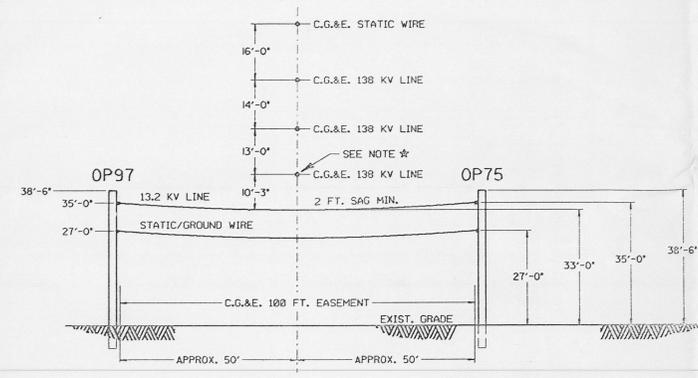
**DETAIL #7**



**DETAIL #8**  
TIE-IN TO SUBSTATION



VIEW "A"-"A"  
ELEVATION



VIEW "C"-"C"  
CLEARANCE UNDER C.G.&E. LINES  
(SEE DWG. 90X-5500-E-00500)  
SCALE: 1" = 20'-0"

- LEGEND**
- 1 AERIAL POWER CONDUCTOR, 366.4 KCML ACSR, MERLIN.
  - 2 GROUND WIRE CLAMP, USED TO ATTACH STATIC WIRE TO BAYONET & POLE GROUND.
  - 3 CROSSARM, 3 1/2" x 4 1/2" x 1 1/2" - 0", PRESSURE TREATED SOUTHERN PINE.
  - 4 CROSSARM BRACE, HOT DIP GALVANIZED 1/2" x 1 1/2" STEEL, 60" SPAN x .8" DROP.
  - 5 STATIC WIRE SUPPORT, STRAIGHT BAYONET TYPE.
  - 6 STATIC WIRE SUPPORT, CORNER BAYONET TYPE.
  - 7 THIMBLE, FOR STATIC WIRE OR MESSENGER WIRE DEAD-END.
  - 8 EYE BOLT, OVAL EYE TYPE, FOR DEAD-END, 3/4" DIA., WITH ONE SQUARE NUT, ADDITIONAL NUTS, WASHERS, AND LENGTH AS REQUIRED.
  - 9 GUY GRIP, FOR STATIC WIRE, PREFORMED WIRE TYPE.
  - 10 WEATHER-HEAD, CONDUIT, OUTDOOR, WEATHERTIGHT.
  - 11 CLAMP, SUSPENSION, FOR 3/4" MESSENGER.
  - 12 EYENUT, 1/2" BOLT DIAMETER.
  - 13 STAPLE, COPPER, 1 1/2" LONG.
  - 14 GROUND ROD, 3/4" DIAMETER X 18" LONG, COPPERWELD.
  - 15 BOLTS, DOUBLE ARMING, SQUARE NUTS, 5/8" DIA X LENGTH AS REQUIRED.
  - 16 DISTRIBUTION TYPE DEAD END GRIP, FOR USE ON 366.4 KCML ACSR CONDUCTOR.
  - 17 ARMOR ROD FOR USE ON ITEM #1 THIS LIST.
  - 18 1 1/4" DIAMETER HELICAL SCREW TYPE GUY ANCHOR WITH MIN. PULLOUT CAPACITY OF 25,000 LBS.
  - 19 COMPRESSION GROUND FITTING.
  - 20 SPLIT-BOLT CONNECTOR, FOR OUTDOOR OVERHEAD CONDUCTOR INSTALLATIONS.
  - 21 COMPRESSION GROUND FITTING, TO SECURE BARE COPPER CONDUCTORS TO 5" GROUND ROD.
  - 22 NOT USED.
  - 23 NOT USED.
  - 24 GUY WIRE MARKER, HALF ROUND, 2" WIDE, 96" LONG, UV RESISTANT W/HARDWARE.
  - 25 NOT USED.
  - 26 TRIPLEEY, GALVANIZED ANCHOR ROD, 1" DIA., LENGTH AS REQUIRED.
  - 27 EQUIPMENT MOUNT FOR 3 TRANSFORMERS, DOUBLE BANDED, ALUMINUM CLUSTER MOUNT W/GND. LUG.
  - 28 EQUIPMENT MOUNT FOR SINGLE TRANSFORMER, DOUBLE BANDED, ALUMINUM CLUSTER MOUNT W/GND. LUG.
  - 29 GUY STRAIN INSULATOR, ANSI CLASS 54-4, FOR 5/8" GUY WIRE.
  - 30 LASHING WIRE CLIP, SIZE AS REQUIRED.
  - 31 CROSSARM CORNER TYPE PIN, MALLEABLE IRON, GALVANIZED, 1" THREAD MOUNTING HARDWARE.
  - 32 #4 AVG. BARE SOLID COPPER GROUND CONDUCTOR.
  - 33 POLE, 45 FT, CLASS 2, PRESSURE TREATED, SOUTHERN YELLOW PINE.
  - 34 TIE ROD FOR ACSR CONDUCTOR TO PIN TYPE INSULATOR, SIZE TIE ROD TO FIT OVER ARMOR ROD.
  - 35 3/4" DIAMETER, 7 STRAND, HIGH STRENGTH, GALVANIZED STEEL STRAND.
  - 36 NOT USED.
  - 37 5/8" DIAMETER, 7 STRAND, HIGH STRENGTH, GALVANIZED STEEL STRAND.
  - 38 CABLE SUPPORT, 5" CONDUIT TOP, OUTDOOR, WATER TIGHT, SEAL WITH FILLING COMPOUND.
  - 39 TERMINATOR, 18KV, 350 KCML, COLD SHRINK, SILICONE RUBBER, SIZED TO FIT INSULATION DIAMETER.
  - 40 3/4" DIAMETER, 7 x 8, STRANDED CONSTRUCTION, GALVANIZED STEEL STRAND.
  - 41 NOT USED.
  - 42 POLE, 60 FT, CLASS 2, PRESSURE TREATED, SOUTHERN YELLOW PINE.
  - 43 HIGH VOLTAGE FORGED STEEL PIN, FOR PIN TYPE INSULATORS 1" LEAD THREAD, LONG SHANK, WITH WASHERS AND NUTS AS REQUIRED.
  - 44 SURGE ARRESTER, DIRECT CONNECTED, 12KV, RISER POLE TYPE, METAL OXIDE VALVE, WITH CROSSARM MOUNTING HARDWARE.
  - 45 INSULATORS, PIN TYPE, 14.4 KV, GLAZED PORCELAIN, 1" THREAS ANSI CLASS 55-5, 1" NECK.
  - 46 INSULATOR, DEAD-END TYPE, 6 1/2" LONG, 4 1/2" DIA, ANSI CLASS 52-9, CLEVIS TYPE WITH STEEL HARDWARE.
  - 47 FUSED CUTOUT ARRESTER COMBINATION UNIT, CUTOUT RATED 15KV, 100 AMPS, 16,000 AMPS IC, WITH CROSSARM MOUNTING HARDWARE. FOR ARRESTER, SEE ITEM 44, THIS MATERIAL LIST.
  - 48 CABLE GUARD, U SHAPED, 14-GAUGE, HOT DIPPED GALVANIZED STEEL, 8 FT. LONG, 5 1/2" INSIDE DIAMETER, WITH STRAPS AND HARDWARE AS REQUIRED.
  - 49 #2 AL QUADRAPLEX
  - 50 FUSED CUTOUT ARRESTER COMBINATION UNIT, CUTOUT RATED 15KV, 200 AMPS, 14,000 AMPS IC, WITH CROSSARM MOUNTING HARDWARE. FOR ARRESTER, SEE ITEM 44, THIS MATERIAL LIST.
  - 51 NOT USED.
  - 52 NOT USED.
  - 53 SINGLE PHASE, OIL FILLED, POLE MOUNTED TRANSFORMER, SEE 90X-5500-E-00500 FOR SIZE AND QUANTITY.
  - 54 NOT USED.
  - 55 NOT USED.
  - 56 NOT USED.
  - 57 NOT USED.
  - 58 COPPER BUTT PLATE
  - 59 350 KCML 1/2" EPR SHIELDED MV90 C<sub>90</sub> E INSULATED FOR 15KV, 133 PERCENT INSULATED LEVEL.
  - 60 #3/0 AL QUADRAPLEX

**NOTES**

1. CONSTRUCT OVERHEAD LINES TO CLEAR ROADS BY 18' AND RAILROADS BY 24' AS A MINIMUM.

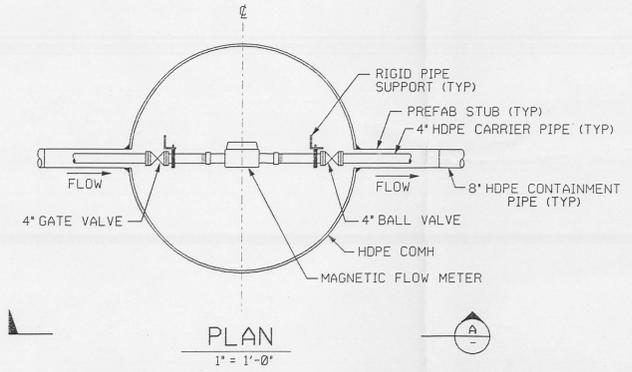
FOR  
INFORMATION  
ONLY

197

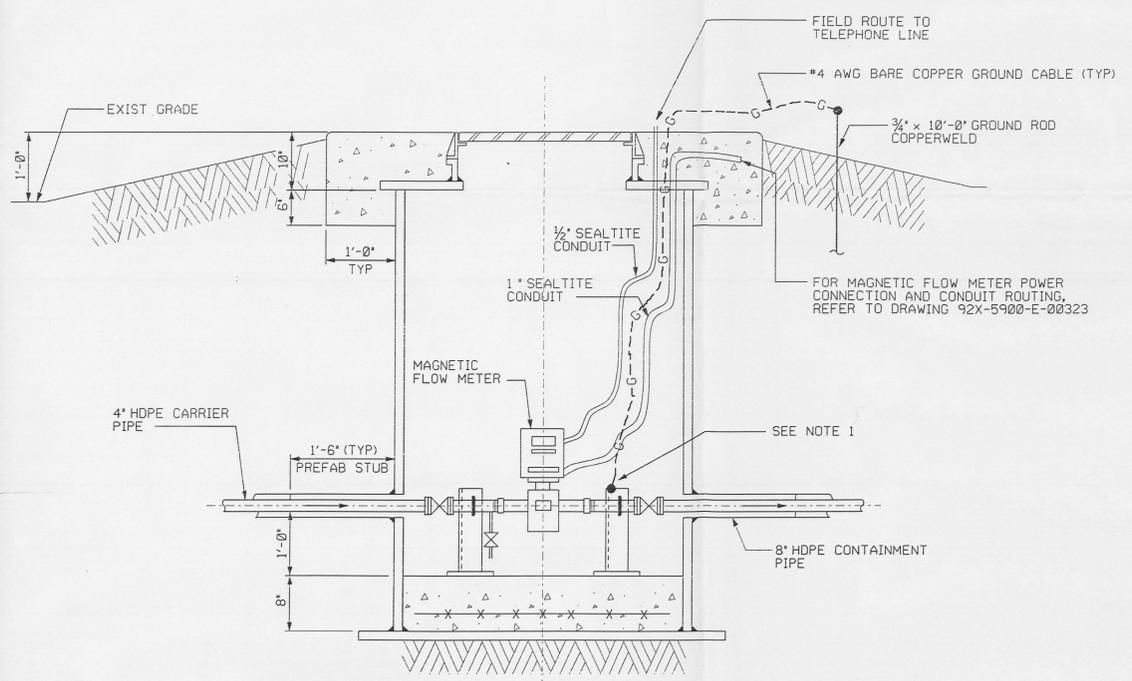
NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY		CONFIGURATION REVISIONS DRAWING		APPROVALS		FERMCO PROJECT NO. 2011 SOUTHEAST CORNER OF SITE															
				<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>CIVIL &amp; STR. ENGINEER</td> <td>SAFETY ENG. MAINTENANCE</td> </tr> <tr> <td>ELECTRICAL ENGINEER</td> <td>O.A.</td> </tr> <tr> <td>INSTRUMENT MECHANICAL</td> <td>FIRE PROTECT.</td> </tr> <tr> <td></td> <td>WASTE MANGE</td> </tr> <tr> <td></td> <td>SECURITY</td> </tr> <tr> <td></td> <td>OSDF</td> </tr> </table>		CIVIL & STR. ENGINEER	SAFETY ENG. MAINTENANCE	ELECTRICAL ENGINEER	O.A.	INSTRUMENT MECHANICAL	FIRE PROTECT.		WASTE MANGE		SECURITY		OSDF	<b>BERNARD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION</b> Environmental Management Project <b>U.S. DEPARTMENT OF ENERGY</b>		<b>LEACHATE CONVEYANCE SYSTEM ELECTRICAL DETAILS</b> SCALE: AS NOTED 90X-5500-E-00502 0	
CIVIL & STR. ENGINEER	SAFETY ENG. MAINTENANCE																				
ELECTRICAL ENGINEER	O.A.																				
INSTRUMENT MECHANICAL	FIRE PROTECT.																				
	WASTE MANGE																				
	SECURITY																				
	OSDF																				
NO. REVISIONS DATE, DWN. BY APPD. NO.		NO. REVISIONS DATE, DWN. BY APPD. NO.		REF. DWG. NO.		RES #2910 DATE 6/4/96 DRAWN S.J.SMOCK															

1. PROVIDE AND INSTALL GROUNDING CONNECTION FOR MAGNETIC FLOW METER PER MANUFACTURER'S RECOMMENDATIONS. CONNECT #4 AWG BARE COPPER GROUND CABLE TO THE NEAREST GROUND SYSTEM. GROUNDING RING SHALL BE 304SS, .080" THICK, TYPICAL.
2. PROVIDE AND INSTALL INSTRUMENT MOUNTING STAND AS REQUIRED.

FOR INFORMATION ONLY



PLAN  
1" = 1'-0"



TYPICAL MANHOLE SECTION  
1" = 1'-0"

FOR MANHOLE DETAILS SEE TYPE 5 PLAN ON DRAWING G00258.

REF SHEET NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-5900-G-00258	DETAILS - SHEET 3 OF 3

PRELIMINARY  
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
D	FINAL DESIGN		N/A	8/21/96
C	ISSUED FOR EPA REVIEW		N/A	6/25/96
B	ISSUED FOR DOE 90% DESIGN REVIEW		AN	5-17-96
A	ISSUED FOR 90% DESIGN REVIEW		NA	5/10/96

**UNITED STATES  
DEPARTMENT OF ENERGY**  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

DRAWING TITLE					
INSTRUMENTATION INSTRUMENT INSTALLATION MANHOLE DETAIL					193
DRAWN BY J.H. DYER	DATE 05-08-96	LEAD ENGINEER	DATE	CHECKED BY JIM L. COOPER	DATE 6/25/96
PLANT/BLDG. NO.	FLOOR	SCALE 1" = 1'-0"	CLASS		
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL NA	FERMCO PROJECT NUMBER 20211		

FINAL DESIGN PACKAGE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER SRP/PO164	DOE PROJECT NO. WBS 1.1.1.2.3.6 00-90701	FEMP PROJECT NO. 92X-5900-N-00347	DRAWING INDEX CODE NO.	SHEET NO. N0004	REV. NO. D
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23920 11

- FOR PUMP CONTROLS AND INDICATORS, SEE DRAWING 92X-5900-E-00324.
- SEE CIVIL DRAWING 92X-5900-3-00258 FOR DETAILS AND LOCATIONS OF CLEANOUT MANHOLES. ONLY MANHOLES CONTAINING SPECIAL FEATURES ARE SHOWN ON THIS P&ID.
- PROVIDE REDUCER IF NECESSARY TO SUIT ACTUAL PUMP INSTALLATION.
- SEE DRAWING 90X-6000-M-00048 FOR LOCATION AND CONNECTION TO LIC-110.
- FY-012A AND FY-012B IS A SOFTWARE FUNCTION MONITORING THE DIFFERENTIAL FLOWRATE OF FLOW ELEMENTS FE/FIT-012A AND FE/FIT-012B.
- FSH-012A IS A SOFTWARE FUNCTION ALARMING WHEN THE FLOWRATE DIFFERENTIAL BETWEEN FI-012A AND FI-012B IS GREATER THAN 5%.
- FSH-012B IS A SOFTWARE FUNCTION STOPPING PMP-001 AND PMP-002, I/A ZS-010, WHEN THE FLOWRATE DIFFERENTIAL BETWEEN FI-012A AND FI-012B IS GREATER THAN 10%.
- LOCATED ON THE LCP AT THE AWWT FACILITY.
- PERMANENT LIFT STATION CONTROLS, LSH-110 AND LSL-110 ARE SHOWN ON DRAWING 90X-6000-E-00347.
- ALARM LOCATED AT THE PUMP STATION AREA.

FOR INFORMATION ONLY

LAST VALVE NUMBER: V124

REF DWG NO.	DRAWING TITLE
92X-5900-E-00324	ELECTRICAL SINGLE LINE & SCHEMATICS
92X-5900-3-00258	CIVIL DETAILS, SHEET 3 OF 3
92X-5900-4-00330	SYMBOLS AND LEGEND SHEET
92X-5900-4-00234	DRAWING INDEX
90X-6000-E-00247	LEACHATE TRANSMISSION SYSTEM ELECTRICAL DETAILS IV
90X-6000-M-00248	LEACHATE TRANSMISSION SYSTEM PIPING AND INSTRUMENTATION DIAGRAM

PRELIMINARY  
NOT FOR CONSTRUCTION

E	FINAL DESIGN	N/A
D	ISSUED FOR EPA REVIEW	N/A 06/25/96
C	ISSUED FOR DOE 90% DESIGN REVIEW. UNCHECKED. REVISIONS IN PROCESS	N/A 05/17/96
B	ISSUED FOR 90% DESIGN REVIEW	N/A 04/30/96
A	ISSUED FOR 30% DESIGN REVIEW	N/A 03/26/96

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO  
 PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

DRAWING TITLE					
MECHANICAL PROCESS PIPING AND INSTRUMENTATION DIAGRAM LEACHATE CONVEYANCE SYSTEM					
DRAWN BY P. A. WILSON	DATE 03/11/96	LEAD ENGINEER K. MORRIS	DATE	CHECKED BY K. MORRIS	DATE 05/08/96
PLANT/BLDG. NO.	FLOOR	SCALE	NONE		CLASS
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL N/A		FERMCO PROJECT NUMBER 20211	

DOE PROJECT NO.	DATE	FERMCO PROJECT NO.	DATE	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
WBS 1.1.1.1.23.6		00-90701		92X-5900-N-00322	N0002	E

FINAL DESIGN PACKAGE

PREPARED UNDER PARSONS PROJECT ORDER NUMBER  
SRP/PO164

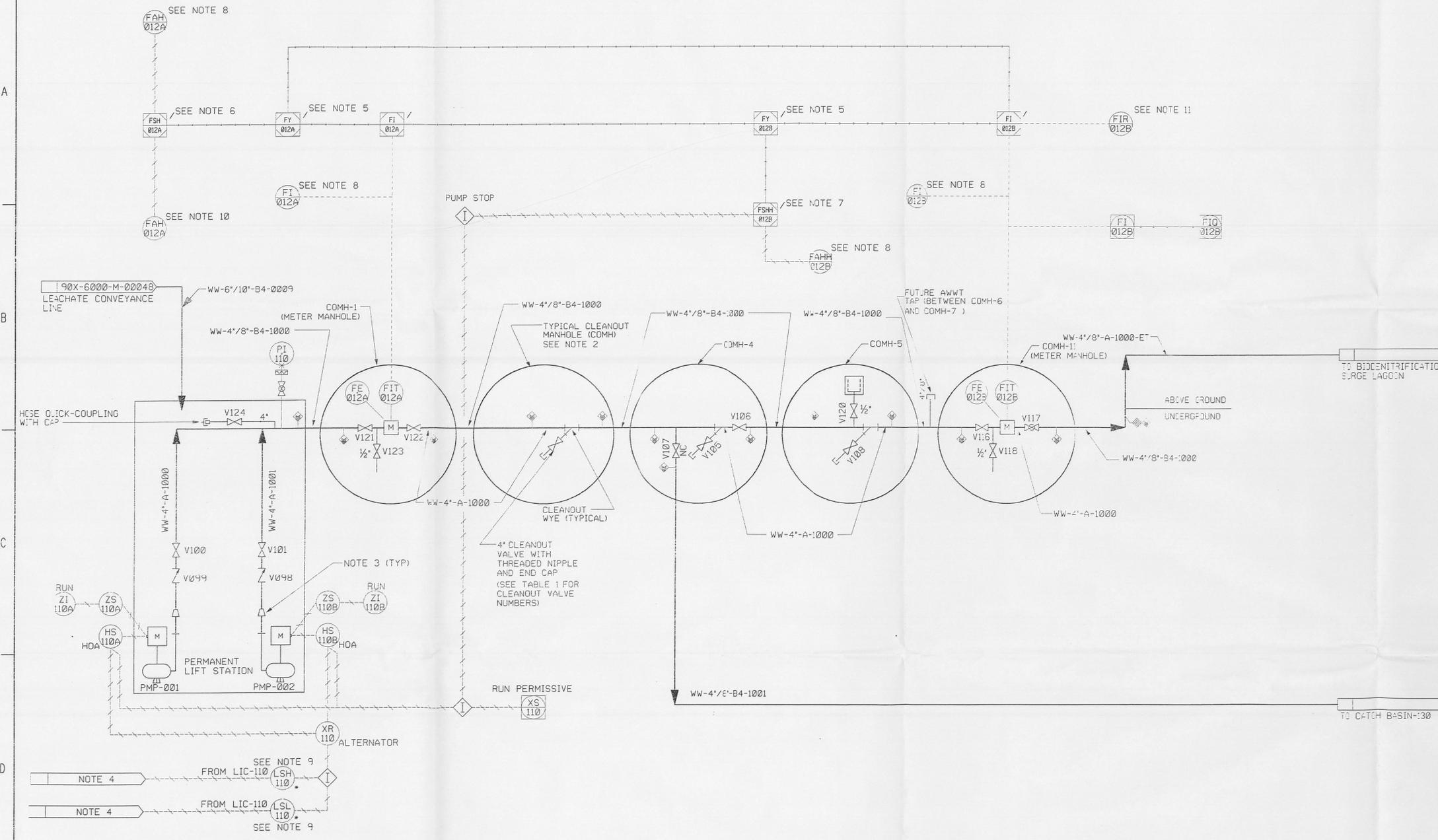


TABLE 1

CLEANOUT MANHOLE NO.	CLEANOUT VALVE NO.
COMH-1A	V102
COMH-2	V103
COMH-3	V104
COMH-4	V105
COMH-5	V108
COMH-6	V109
COMH-7	V110
COMH-8	V111
COMH-9	V112
COMH-10	V113
COMH-12	V119

A  
B  
C  
D  
E  
F

A  
B  
C  
D  
E  
F

NOTES

453

- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.  
 EXISTING SITE DATA SOURCE (ON PLANT FILLS)  
 C.R. TOMANGIN (UTILITY DRAWINGS)  
 FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
 PARSONS TOPOGRAPHY, 1992  
 B.L. PAYNE AND ASSOCIATES, TOPOGRAPHIC SLAVEY 1996  
 WOOLPERT SURVEY, MARCH, 1996
- ALL HOPE LINE VERTICAL ALIGNMENT TO BE INSTALLED USING A MINIMUM 40' DIAMETER BEND, MAINTAIN A MINIMUM 36" COVER OVER TOP OF PIPE.
- SEE TABLE 1. DRAWING NO. 92X-5900-G-00256 FOR SCHEDULE OF TOP OF LID AND INVERT ELEVATION AND DETAILS OF CLEANOUT-MANHOLES.
- THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE CONTRACTOR SHALL FIELD VERIFY PRIOR TO CONSTRUCTION.
- MAINTAIN PIPE ELEVATIONS AS SHOWN BETWEEN MANHOLES TO PERMIT DRAINAGE. LOCATION OF HIGH POINT IS APPROXIMATE, TO BE FIELD VERIFIED.
- FOR UNDERGROUND LEACHATE PIPE INSTALLATIONS, USE HDPE SDR 41 FOR CLEANOUT PIPE, INSTALL 6" WIDE PLASTIC TAPE WITH MAGNETIC TRACE WIRE 6" ABOVE ALL HOPE PIPE. INSTALL PIPE LINE SIGNS AS SHOWN (SEE DETAIL ON DRAWING 92X-5900-G-00257).
- ALL FITTINGS ON HOPE ARE TO BE MOLDED UNLESS OTHERWISE NOTED.
- FOR LOCATION OF PLAN IN REFERENCE TO THE LEACHATE CONVEYANCE SYSTEM, SEE THE MASTER PLAN, DRAWING 92X-5900-G-00251.
- FIELD LOCATE FIBER OPTIC LINE BEFORE INITIATING CONSTRUCTION.

FOR INFORMATION ONLY

PRELIMINARY NOT FOR CONSTRUCTION

DRAWING TITLE

REF. DWG. NO.	DRAWING INDEX
92X-5900-X-00224	CRAMING INDEX
92X-5900-X-00235	LEGEND AND SYMBOLS
92X-5900-G-00251	MASTER PLAN
92X-5900-G-00254	PLAN AND PROFILE SHEET 1 OF 4
92X-5900-G-00256	PLAN AND PROFILE SHEET 3 OF 4
92X-5900-G-00257	DETAILS - SHEET 2 OF 3
92X-5900-G-00258	DETAILS - SHEET 3 OF 3

UNITED STATES DEPARTMENT OF ENERGY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

PARSONS

THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO

LEACHATE CONVEYANCE SYSTEM

PLAN AND PROFILE SHEET 2 OF 4

195

DATE: 04/19/96

CHECKED BY: E. MELNYK

DATE: 2-22-96

LEAD ENGINEER: C.R. TOMANGIN

DATE: 2-22-96

DATE: 08/17/96

DATE: 08/30/96

DATE: 03/26/96

ISSUED FOR: FINAL DESIGN REVIEW

ISSUED FOR: EP-2 REVIEW

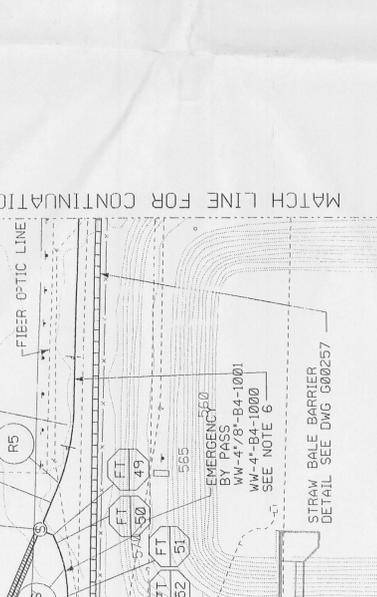
ISSUED FOR: DOE 90% DESIGN REVIEW; UNCHECKED REVISIONS IN PROGRESS

ISSUED FOR: 90% DESIGN REVIEW

ISSUED FOR: 30% DESIGN REVIEW

CURVE NO.	DEFLECTION ANGLE	RADIUS	LENGTH OF CURVE
R5	21° 18' 01"	150.00'	55.76'
R6	21° 33' 30"	150.00'	56.44'
R7	17° 43' 58"	200.00'	61.90'
R8	08° 21' 55"	200.00'	29.20'
R9	13° 18' 34"	200.00'	46.46'
R10	22° 37' 39"	200.00'	78.98'
R11	21° 55' 15"	100.00'	38.40'
R12	43° 35' 43"	300.00'	22.76'

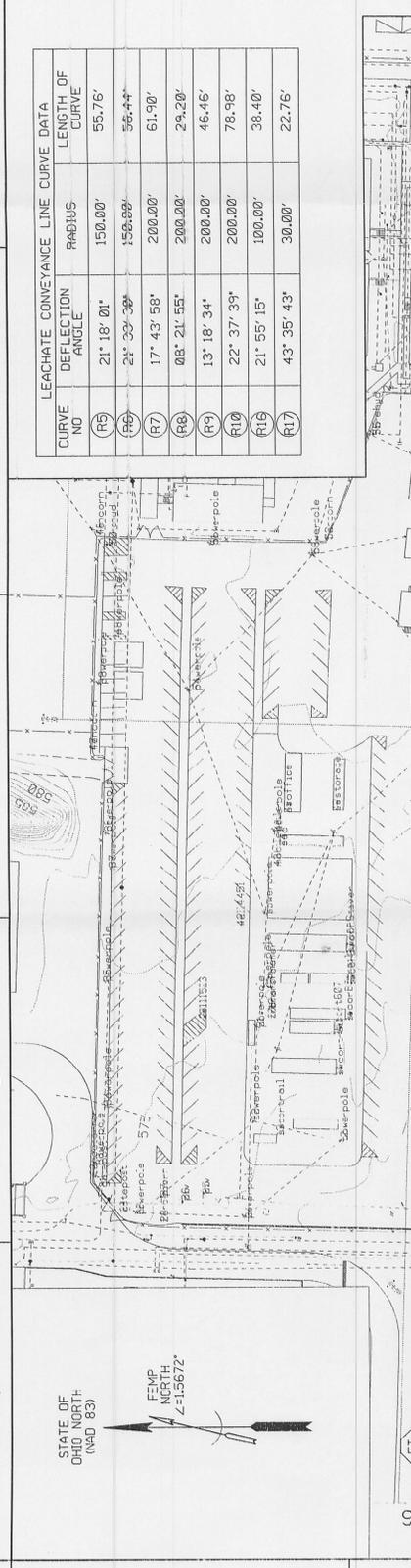
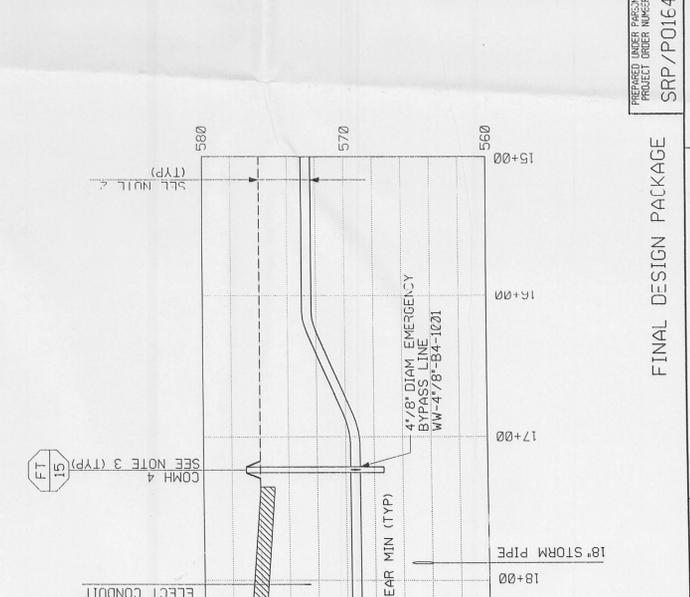
POINT	NORTHING	EASTING	DESCRIPTION
13	478916.18	1349368.67	POINT OF CURVE
14	478926.06	1349304.52	POINT OF TANGENT
15	478936.06	1349265.72	COMH 4 WITH BYPASS LINE
16	478946.06	1349220.55	POINT OF CURVE
17	478956.06	1349175.75	POINT OF TANGENT
18	478966.06	1348959.62	POINT OF CURVE
19	478976.06	1348698.96	POINT OF TANGENT
20	479013.90	1348624.43	POINT OF CURVE
21	479021.46	1348746.28	POINT OF TANGENT
22	479035.52	1348722.75	COMH 5
23	479046.54	1348444.96	POINT OF CURVE
24	479052.54	1348424.62	POINT OF TANGENT
25	479106.46	1348380.66	POINT OF CURVE
26	479181.84	134822.44	POINT OF TANGENT
27	479199.26	1348135.92	POINT OF CURVE
28	479199.88	1348112.60	FUTURE TAP
29	479226.85	1349281.81	MOLDED 45" EL
30	479242.54	1349276.07	POINT OF CURVE
31	479238.55	1349238.55	POINT OF TANGENT
32	479289.73	1349289.73	POINT OF CURVE
33	479317.25	1349289.73	POINT OF TANGENT
34	479309.40	1349163.07	POINT OF CURVE



BY-PASS PROFILE (SEE DWG 00257) SCALE: HOR 1" = 50' VERT 1" = 5'

PLAN SCALE: 1" = 50'

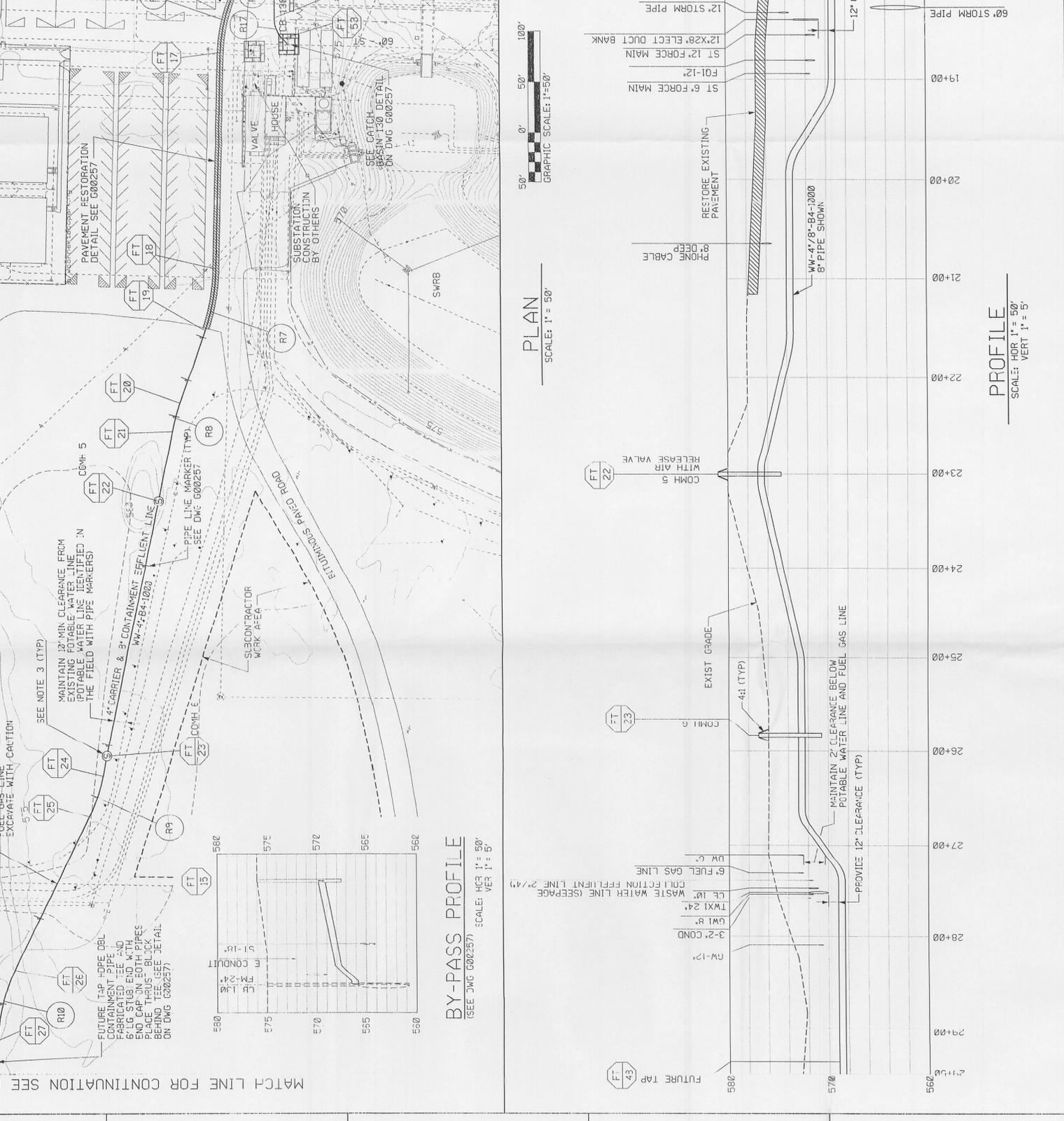
PROFILE SCALE: HOR 1" = 50' VERT 1" = 5'



BY-PASS PROFILE (SEE DWG 00257) SCALE: HOR 1" = 50' VERT 1" = 5'

PLAN SCALE: 1" = 50'

PROFILE SCALE: HOR 1" = 50' VERT 1" = 5'



INDEX OF DRAWINGS

INDEX CODE NO.	FERMCO DWG. NO.	SHEET NO.	REVISION NO.	DRAWING TITLE	REMARKS
	92X-5900-X-00263	X0001	E	PROJECT TITLE SHEET	
	92X-5900-X-00264	X0002	E	DRAWING INDEX	
	92X-5900-X-00265	X0003	E	LEGEND AND SYMBOLS	
	92X-5900-G-00251	G0001	E	CIVIL - MASTER PLAN	
	92X-5900-G-00254	G0002	E	CIVIL - PLAN AND PROFILE - SHEET 1 OF 4	
	92X-5900-G-00261	G0003	E	CIVIL - PLAN AND PROFILE - SHEET 2 OF 4	
	92X-5900-G-00266	G0004	E	CIVIL - PLAN AND PROFILE - SHEET 3 OF 4	
	92X-5900-G-00262	G0005	E	CIVIL - PLAN AND PROFILE - SHEET 4 OF 4	
	92X-5900-G-00255	G0006	D	CIVIL - DETAILS - SHEET 1 OF 3	
	92X-5900-G-00257	G0007	D	CIVIL - DETAILS - SHEET 2 OF 3	
	92X-5900-G-00258	G0008	D	CIVIL - DETAILS - SHEET 3 OF 3	
	92X-5900-E-00323	E0001	D	ELECTRICAL - PLANS - LEACHATE CONVEYANCE SYSTEM	
	92X-5900-E-00324	E0002	E	ELECTRICAL - SINGLE LINE AND SCHEMATICS - PERMANENT LIFT STATION	
	92X-5900-E-00325	E0003	D	ELECTRICAL - ELEVATION AND DETAILS - LEACHATE CONVEYANCE SYSTEM	
	90X-5500-E-00500		C	LEACHATE CONVEYANCE SYSTEM - ELECTRICAL SITE PLAN AND SINGLE LINE	
	90X-5500-E-00501		C	LEACHATE CONVEYANCE SYSTEM - ELECTRICAL DETAILS	
	90X-5500-E-00502		C	LEACHATE CONVEYANCE SYSTEM - ELECTRICAL DETAILS	
	92X-5900-N-00330	N0001	E	MECHANICAL PROCESS - PIPING AND INSTRUMENTATION DIAGRAM - SYMBOLS AND LEGEND SHEET	
	92X-5900-N-00322	N0002	E	MECHANICAL PROCESS - PIPING AND INSTRUMENTATION DIAGRAM - LEACHATE CONVEYANCE SYSTEM	
	92X-5900-N-00345	N0003	D	INSTRUMENTATION - ANALOG I/O DIAGRAM - SHEET 1	
	92X-5900-N-00347	N0004	D	INSTRUMENTATION - INSTRUMENT INSTALLATION - MANHOLE DETAIL	

REF DWG NO.	DRAWING TITLE
92X-5900-X-00263	PROJECT TITLE SHEET
92X-5900-X-00265	LEGEND AND SYMBOLS

**PRELIMINARY**  
 NOT FOR CONSTRUCTION

E	ISSUED FOR FINAL DESIGN REVIEW	N/A	
D	ISSUED FOR EPA REVIEW	N/A	06/25/96
C	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS	N/A	05/17/96
B	ISSUED FOR 90% DESIGN REVIEW	N/A	04/30/96
A	ISSUED FOR 30% DESIGN REVIEW	N/A	03/26/96

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE	INITIALS AND DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC. CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM 196**

DRAWING TITLE  
**DRAWING INDEX**

DRAWN BY K.L. RABBITT	DATE 02/16/96	LEAD ENGINEER E. MELNYK	DATE 4/19/96	CHECKED BY E. MELNYK	DATE 4/19/96
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS	NONE	
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL N/A	FERMCO PROJECT NO. 20211		

A-E	DATE	DATE	DATE	SHEET NO.	REV. NO.

FINAL DESIGN PACKAGE

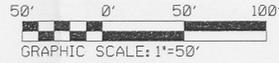
PREPARED UNDER PARSONS PROJECT ORDER NUMBER SRP/P0164	DOE PROJECT NO. WBS 1.1.1.2.3.6 00-90701	FEMP PROJECT NO. 92X-5900-X-00264	DRAWING INDEX CODE NO. X0002	SHEET NO. E
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- EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.  
EXISTING SITE DATA SOURCE (IN PLANT FILES)  
FEMP CADD GRID/UTILITY DRAWINGS  
FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS  
PARSONS TOPOGRAPHY, 1992  
B.L. PAYNE AND ASSOCIATES, TOPOGRAPHIC SURVEY 1996  
WOOLPERT SURVEY, MARCH 1996
- ALL HDPE PIPE VERTICAL ALIGNMENT TO BE INSTALLED USING A MINIMUM 40' DIAMETER BEND. MAINTAIN A MINIMUM 36" COVER OVER TOP OF CONTAINMENT PIPE.
- SEE TABLE 1 ON DRAWING 92X-5900-G-00258 FOR SCHEDULE OF TOP OF LID AND INVERT ELEVATION AND DETAILS OF CLEANOUT-MANHOLES.
- THE LOCATION AND ELEVATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE SUB-CONTRACTOR SHALL FIELD VERIFY PRIOR TO CONSTRUCTION.
- MAINTAIN PIPE ELEVATIONS AS SHOWN BETWEEN MANHOLES TO PERMIT DRAINAGE TO MANHOLES. NO SAGS ARE TO BE CREATED BETWEEN MANHOLES. THE LOCATION OF HIGH POINT IS APPROXIMATE AND SHALL BE FIELD VERIFIED BY THE SUB-CONTRACTOR.
- FIELD VERIFY EXISTING TOPOGRAPHY OF AREA BEFORE START OF CONSTRUCTION.
- SEE DRAWING 90X-6000-M-00009 AND 90X-6000-M-00052 FOR DETAILS AND LOCATION OF PERMANENT LIFT STATION.
- FOR UNDERGROUND LEACHATE CONVEYANCE PIPING, USE HDPE SDR 11 FOR 4" CARRIER PIPE AND SDR 17 FOR 8" CONTAINMENT PIPE. INSTALL 6" WIDE PLASTIC TAPE WITH MAGNETIC TRACE WIRE 6" ABOVE ALL HDPE PIPE. INSTALL PIPE LINE SIGNS AS SHOWN (SEE DETAIL ON DRAWING 92X-5900-G-00257).
- ALL FITTINGS ON HDPE ARE TO BE MOLDED UNLESS OTHERWISE NOTED.
- FOR LOCATION OF PLAN IN REFERENCE TO THE LEACHATE CONVEYANCE LINE SEE THE MASTER PLAN, DRAWING 92X-5900-G-00251.
- LIMIT OF ADDITIONAL COVER GRADING, SIDE SLOPES TO BE MAXIMUM 3:1. REGRADE DRAINAGE SWALES AS REQUIRED TO MAINTAIN DRAINAGE. PIPE ARCH CULVERT TO BE MAINTAINED.
- CONTRACTOR SHALL EXCAVATE AND CONFIRM LOCATION AND DEPTH OF FIBER OPTIC LINE PRIOR TO ANY CONSTRUCTION OF THE LEACHATE CONVEYANCE LINE.
- LOCATION OF TIE-IN POINT IS DEPENDENT ON FABRICATION DETAILS OF LIFT STATION. LOCATION TO BE FIELD DETERMINED.
- EXISTENCE OF FIELD FEATURE TO BE FIELD VERIFIED (ON SITE FILES, NOT VISIBLE IN FIELD).

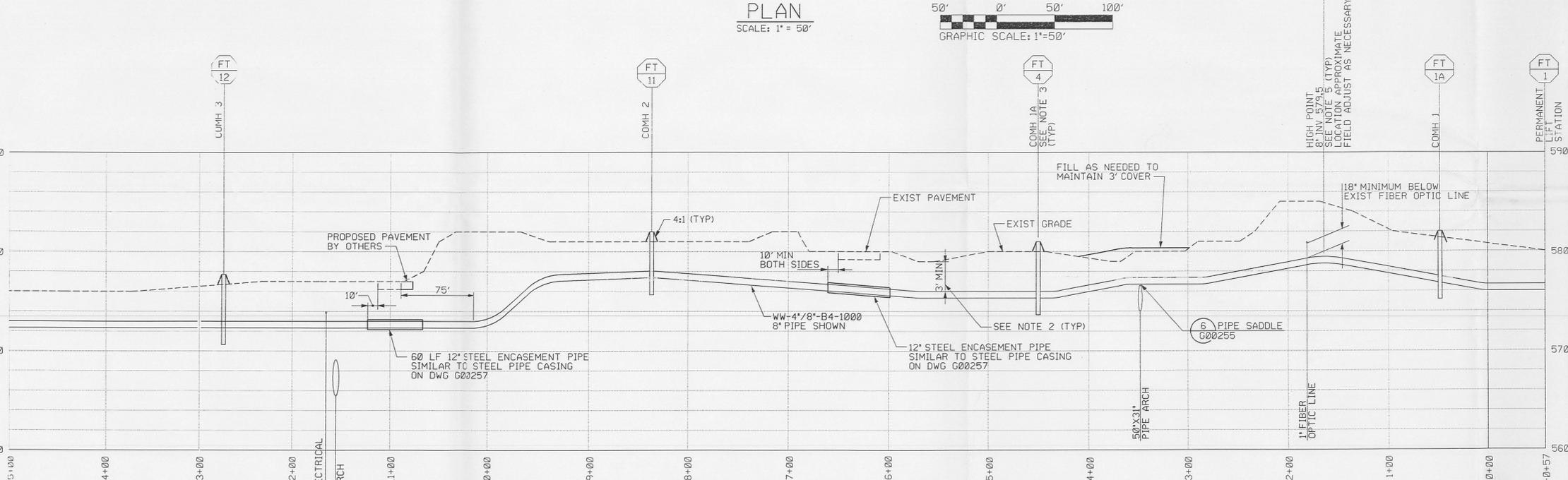
CURVE NO	DEFLECTION ANGLE	RADIUS	LENGTH OF CURVE
(R1)	43° 05' 27"	50.00'	36.74'
(R2)	25° 56' 10"	40.00'	18.08'
(R3)	22° 27' 27"	40.00'	15.65'
(R4)	45° 00' 33"	40.00'	31.36'

POINT	NORTHING	EASTING	DESCRIPTION
1	SEE NOTE 13		LIFT STATION
1A	479384.90	1350612.97	COMH 1
2	479210.93	1350612.97	POINT OF CURVE
3	479176.76	1350599.47	POINT OF TANGENT
4	479037.86	1350469.53	COMH 1A
5	478968.60	1350404.69	POINT OF CURVE
6	478958.58	1350389.80	POINT OF TANGENT
7	478953.57	1350376.73	POINT OF CURVE
8	478945.27	1350363.56	POINT OF TANGENT
9	478897.31	1350312.90	POINT OF CURVE
10	478886.39	1350284.33	POINT OF TANGENT
11	478890.29	1350141.86	COMH 2
12	478905.84	1349705.08	COMH 3

PLAN SCALE: 1" = 50'



PROFILE SCALE: HOR 1" = 50' VERT 1" = 5'



PRELIMINARY NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERMID	DATE
E	ISSUED FOR FINAL DESIGN REVIEW		N/A	
D	ISSUED FOR EPA REVIEW		N/A	06/25/98
C	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS		N/A	05/17/98
B	ISSUED FOR 90% DESIGN REVIEW		N/A	04/30/98
A	ISSUED FOR 30% DESIGN REVIEW		N/A	03/26/98

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
 THIS DRAWING PREPARED BY  
**PARSONS**  
 THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
 CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM 197**  
 DRAWING TITLE  
**CIVIL PLAN AND PROFILE SHEET 1 OF 4**

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
C.R. TOMONGIN	2-22-96			E. MELYNK	4/19/96
PLANT/BLDG. NO.	FLOOR	SCALE	AS SHOWN	CLASS	

DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
	WBS 1.1.1.2.3.6 00-90701	92X-5900-G-00254	G0002	E

SRP/PO164

FINAL DESIGN PACKAGE

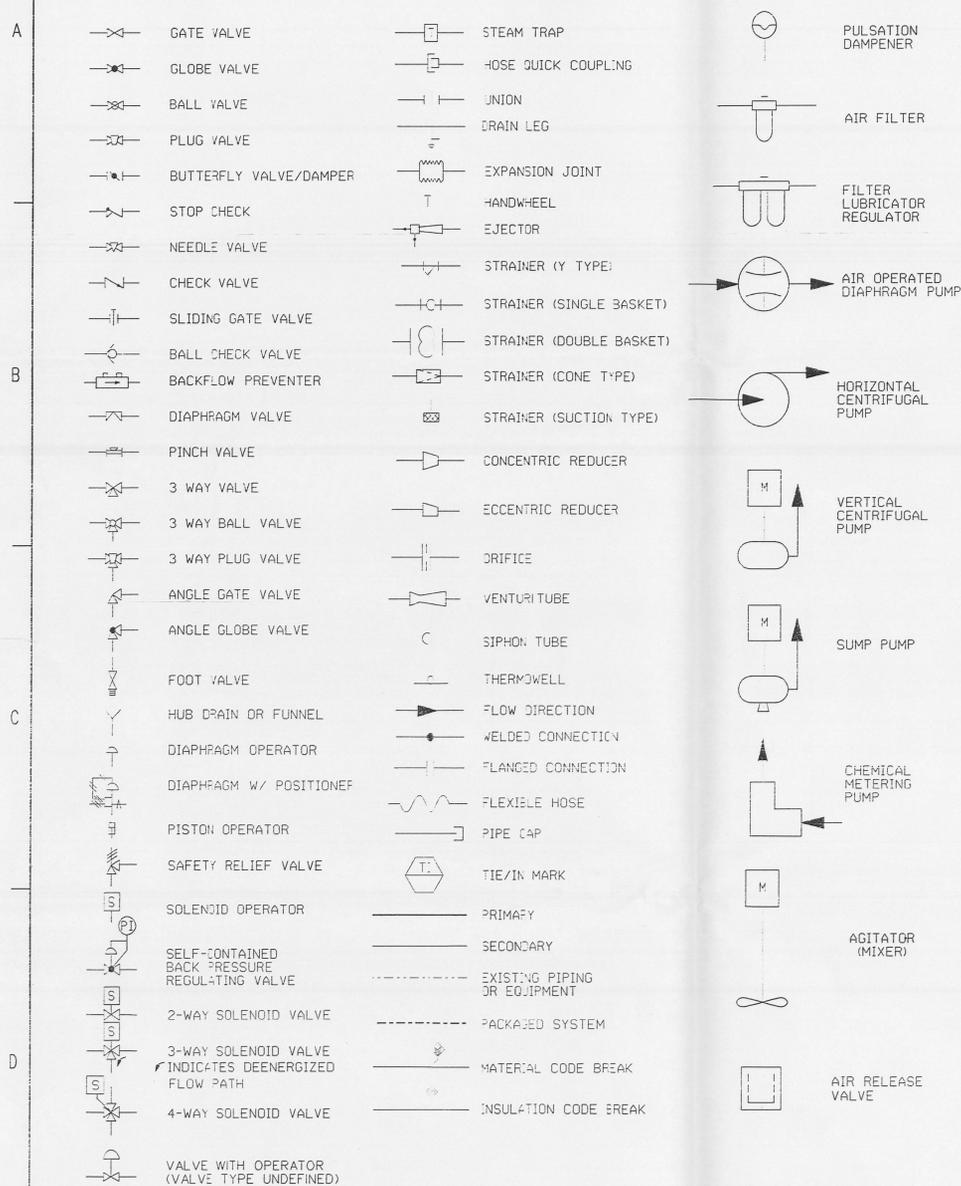
233930-15

MATCH LINE FOR CONTINUATION SEE DWG G00261



ESH

PIPING SYMBOLS



ABBREVIATIONS

BTU	BRITISH THERMAL UNIT
CU FT	CUBIC FEET
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
KW	KILOWATT
LB/HR	POUNDS PER HOUR
SCFM	STD. CUBIC FT/MINUTE
NO	NORMALLY OPEN
NC	NORMALLY CLOSED
FO	FAIL OPEN
FC	FAIL CLOSED
AO	AIR TO OPEN
AC	AIR TO CLOSE
IA	INSTRUMENT AIR
ET	ELECTRIC TRACED AND INSULATED
ST	STEAM TRACED AND INSULATED
EF	EXHAUST FAN
GV	GRAVITY VENTILATOR
UH	UNIT HEATER
RED	REDUCER
ECC	ECCENTRIC
TBD	TO BE DETERMINED
TF	TOP FLAT
TYP	TYPICAL
MATL	MATERIAL
MED	MEDIUM
CO	CARBON MONOXIDE
RH	RELATIVE HUMIDITY
CFM	CUBIC FEET/MINUTE
SF	SOUTH FIELD
IFA	INACTIVE FLYASH PILE
COMH	CLEAN OUT MANHOLE
HDPE	HIGH DENSITY POLYETHYLENE
CS	CARBON STEEL
LCP	LOCAL CONTROL PANEL

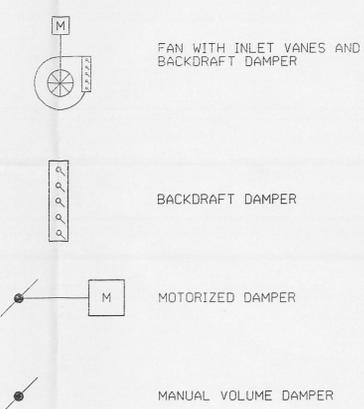
INSTRUMENTATION SPECIAL DESIGNATIONS

DESIGNATION	FUNCTION/ABBREVIATION
Σ/N OR AVG	AVERAGING
± OR BI	BIAS
1:1, 1:3, 2:1 (TYP)	BOOST, GAIN OR ATTENUATE (INPUT:OUTPUT)
Δ OR ΔIF	DIFFERENTIAL
÷ OR DIV	DIVIDE
√ OR SQ. RT.	EXTRACT SQUARE ROOT
X OR MUL	MULTIPLY
N	RAISE TO POWER
REV	REVERSING
Σ OR SUM	SUMMING
L	LOW
LL	LOW LOW
H	HIGH
HH	HIGH HIGH
HL	HIGH LOW
∫	INTEGRATE (TIME INTEGRAL)
∫	PROPORTIONAL
Y	UNDETERMINED COMPUTING RELAY
HDA	HAND-OFF-AUTO
≠	EXISTING INSTRUMENT TO BE RELOCATED
I/P	CURRENT TO PNEUMATIC TRANSDUCER
RUN	RUNNING
OA	OFF-AUTO
OCA	OPEN-CLOSE-AUTO
I/O	INPUT / OUTPUT
*	EXISTING INSTRUMENT
UD	UP/DOWN
EW	EAST/WEST
I/I	CURRENT TO CURRENT

PIPING SPECIFICATIONS

FLOWING MEDIUM	MED CODE	MATL CODE
BACK WASH	BW	T
CHILLED WATER	CHS, CHR	A
CHLORINE	CL	B1
CONDENSATE	LC	W, T
CONDENSER WATER	CWS, CWR	A
COOLING WATER	WS, WR	A
DRAIN	DR	A, T
THICKENER OVERFLOW	TO	T
FILTRATE EFFLUENT	FT	A
FLOCCULANT	FL	A
FLUSH WATER	FW	T
FORCE MAIN	FM	M, B4
INSTRUMENT AIR	IA	T
OFF-GAS	OG	T
NITRIC ACID	AN	T1
PERCHED GND WATER	PGW	B
PHOSPHORIC ACID	PAPH	T1
PLANT AIR	PA	W
POLISHED WATER	PW	A
POTABLE WATER	DW	W, B, B3
PROCESS WATER	TW	A
PROCESS WASTEWATER	CE	A
RAW WATER	RW	A
RECYCLE WATER	RC	T, B2
SCRUBBER RECYCLE	RSL	T
SLURRY	SL	T
SODIUM CARBONATE	SC	A
SODIUM HYDROXIDE	NA	T
SODIUM SILICATE	SS	A
STORM WATER	ST	A
SULFURIC ACID	SB	T1
SUMP DISCHARGE	SU	T
VACUUM	V	A
VENTILATION AIR	VE	T
WASTE WATER	WW	W, B4, A **

SINGLE LINE AIR DUCT SYMBOLS

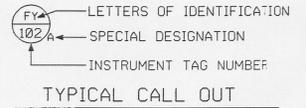
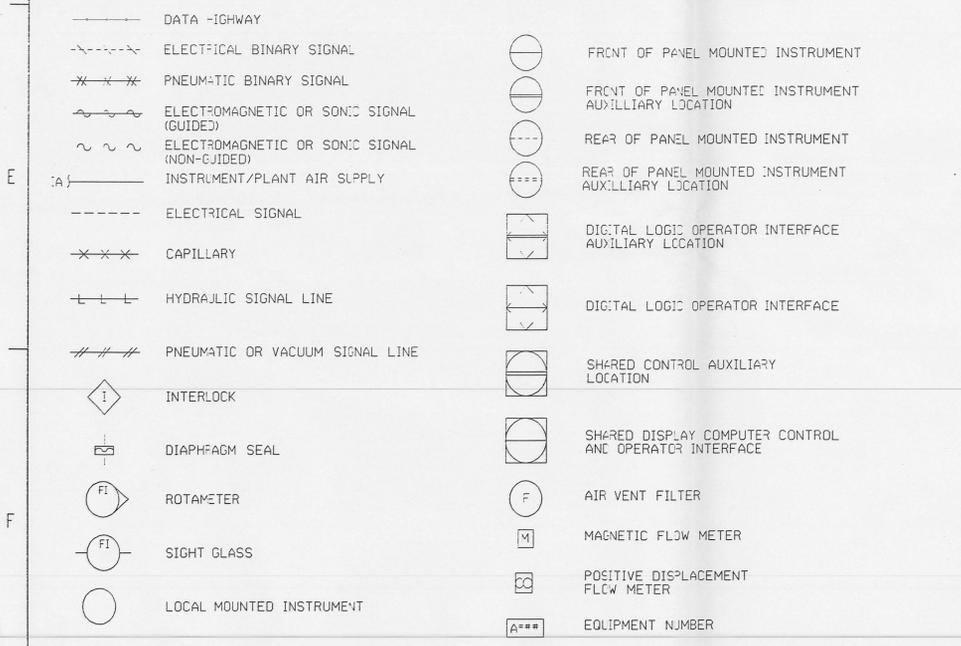


EXAMPLE: CE-4/8"-A-100-ET

A - A53 SEAMLESS STEEL PIPE  
 B - PVC  
 B1 - PVDF  
 B2 - PVDF, 100 PSI  
 B3 - CPVC  
 B4 - HDPE  
 L - FIBERGLASS REINFORCED PLASTIC  
 M - DUCTILE IRON  
 T - 304L, STAINLESS STEEL PIPE  
 T1 - 316L, STAINLESS STEEL PIPE  
 W - A53, GR. A, GALVANIZED STEEL PIPE

\*\* SEE NOTE 1

INSTRUMENT SYMBOLS



LETTERS OF INSTRUMENT IDENTIFICATION

LETTER	FIRST LETTER	2ND LETTER	3RD OR 4TH LETTER
	MEASURED OR INITIATING VARIABLE	MODIFIER	READ OUT OR PASSIVE FUNCTION
A	ANALYSIS	ALARM	ALARM
B	BURNER FLAME	----	----
C	CAMERA	CONTROLLER	CONTROLLER
D	DENSITY	DIFFERENTIAL	----
E	VOLTAGE	ELEMENT	ELEMENT
F	FLOW RATE	RATIO (FRACTION)	----
G	GAGING (DIM)	VIEWING DEVICE	GLASS
H	HAND (MANUAL)	----	HIGH
I	CURRENT (ELECT)	INDICATE	INDICATE
J	POWER	SCAN	----
K	TIME	----	----
L	LEVEL	LIGHT	LOW
M	MOIST OR HUMIDITY	----	----
N	----	----	----
O	OBSERVATION	----	ORIFICE
P	PRESSURE OR VACUUM	----	POINT (TEST)
Q	QUANTITY OR EVENT	TOTALIZER	----
R	RADIOACTIVITY	RECORDER	----
S	SPEED OR FREQUENCY	SAFETY/SWITCH	SWITCH
T	TEMPERATURE	TRANSMITTER	TRANSMITTER
U	USER'S GUIDE	----	MULTIFUNCTION
V	VISCOSITY	----	VENT, VALVE
W	WEIGHT OR FORCE	WELL	----
X	UNCLASSIFIED	----	UNCLASSIFIED
Y	RELAY	RELAY	----
Z	POSITION	----	----

- CONTAINMENT PIPE SHALL BE PROVIDED FOR LEACHATE CONVEYANCE SYSTEM, EXCEPT WITHIN PERMANENT LIFT STATION AND CLEANOUT MANHOLES.
- THIS LEGEND APPLIES TO DRAWING 92X-5900-N-00322.

REF DWG NO.	DRAWING TITLE
92X-5900-N-00322	PIPING AND INSTRUMENTATION DIAGRAM LEACHATE CONVEYANCE SYSTEM
92X-5900-X-00264	DRAWING INDEX

PRELIMINARY  
NOT FOR CONSTRUCTION

FOR INFORMATION ONLY

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	PERMCO	DATE
E	FINAL DESIGN			N/A
D	ISSUED FOR EPA REVIEW			06/25/96
C	ISSUED FOR DOE 90% DESIGN REVIEW. UNCHECKED, REVISIONS IN PROCESS			05/17/96
B	ISSUED FOR 90% DESIGN REVIEW			04/30/96
A	ISSUED FOR 30% DESIGN REVIEW			03/26/96

UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
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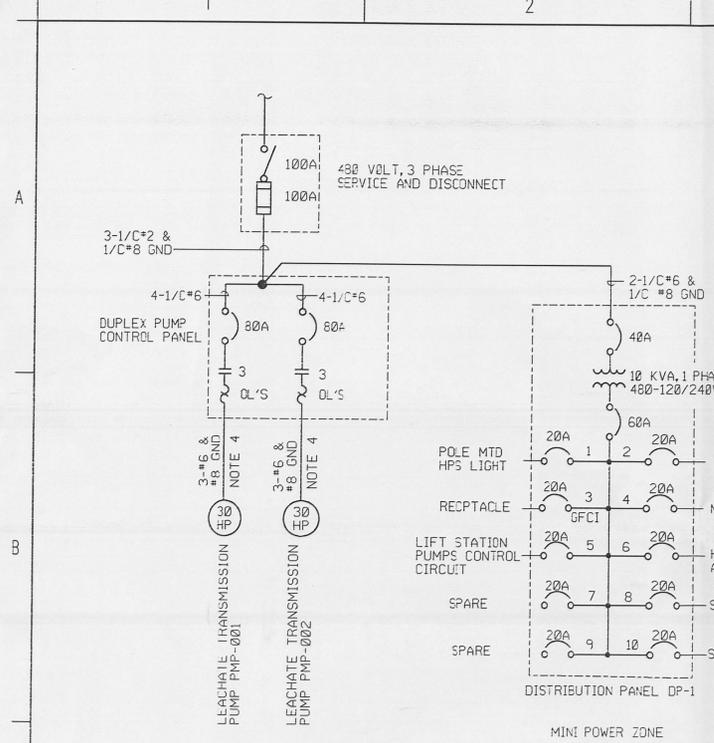
PROJECT NAME  
LEACHATE CONVEYANCE SYSTEM 198

DRAWING TITLE MECHANICAL PROCESS PIPING AND INSTRUMENTATION DIAGRAM SYMBOLS AND LEGEND SHEET					
DRAWN BY P. A. WILSON	DATE 03/12/96	LEAD ENGINEER	DATE	CHECKED BY K. MORRIS	DATE 05/08/96
PLANT/BLDG. NO.	FLOOR	SCALE	NONE	CLASS	
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL N/A	FERMCO PROJECT NUMBER 20211			

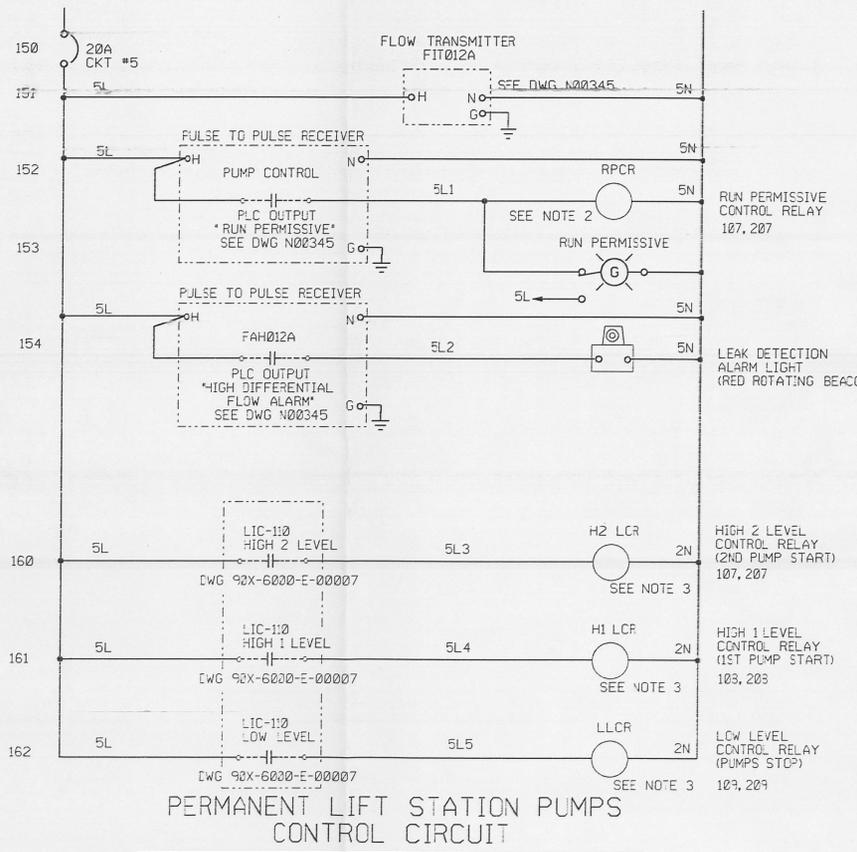
A-E	DATE	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
		WBS 1.1.1.2.3.6 00-90701	92X-5900-N-00330	N0001	E

FINAL DESIGN PACKAGE

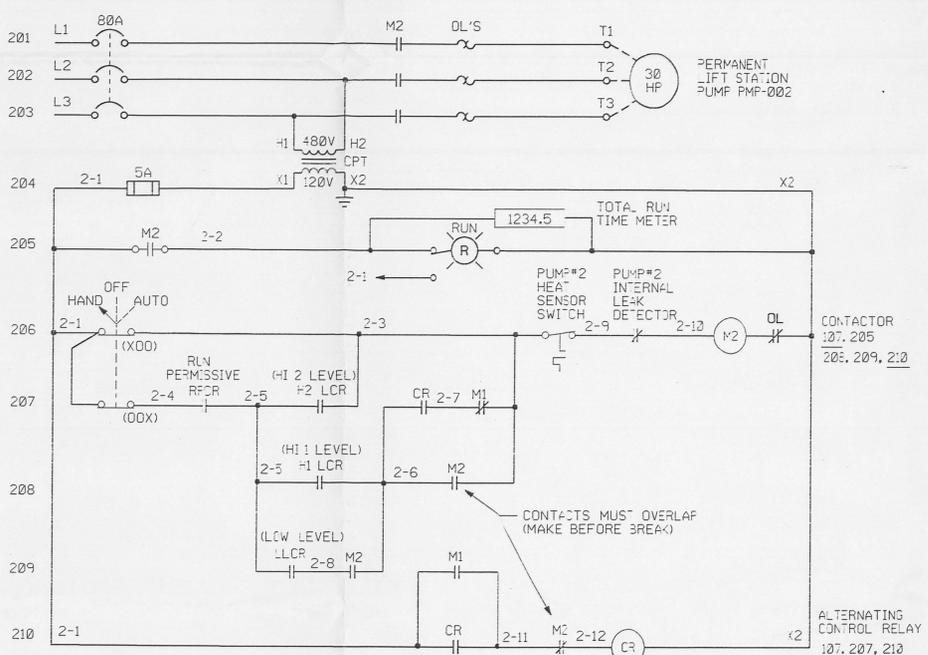
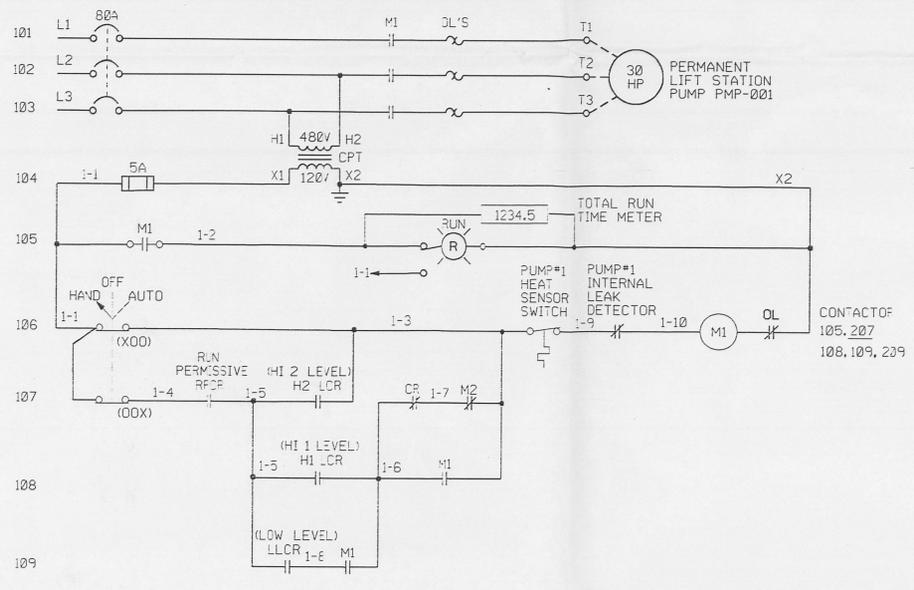
PREPARED UNDER PARSONS PROJECT ORDER NUMBER  
SRP/P0164



SINGLE LINE DIAGRAM



PERMANENT LIFT STATION PUMPS CONTROL CIRCUIT



PERMANENT LIFT STATION PUMPS SCHEMATIC DIAGRAMS

**OPERATION:**  
 THE DUPLEX PUMP CONTROL PANEL WILL AUTOMATICALLY ALTERNATE MOTOR OPERATION. THE CONTROLLER OPERATES ONE MOTOR AND THEN THE OTHER ON EACH SUCCESSIVE CLOSING OF HIGH LEVEL SIGNAL.  
 IF ONE MOTOR IS RUNNING AND ITS DISCONNECT SWITCH IS OPENED, AN OVERLOAD RELAY TRIPS, OR THE STARTER IS DE-ENERGIZED FOR ANY REASON, THE OTHER MOTOR WILL AUTOMATICALLY BE STARTED.  
 FAILURE OF A PUMP MAY BE DETECTED BY PERIODIC TESTING AND MONITORING OF TOTAL RUN TIME METERS.  
 FLOW FROM THE PERMANENT LIFT STATION AND OUTPUT FLOW AT THE BIOSURGE LAGOON ARE COMPARED BY A COMPUTER LOCATED AT THE AWWT FACILITY.  
 FOLLOWING A TIME DELAY TO ALLOW FOR PUMP STARTUP,  
 A DISCREPANCY OF 5% (APPROX 10 CFM) WILL ACTIVATE AN ALARM LIGHT INDICATING A LEAK.  
 A DISCREPANCY OF 10% (APPROX 20 CFM) WILL RESULT IN DE-ENERGIZING RELAY "RPCR", AND SHUTDOWN THE LIFT STATION PUMPS.

DURING HIGH FLOW PERIODS, IF ONE PUMP IS UNABLE TO HANDLE THE INFLOW, AND LEVEL IN THE LIFT STATION CONTINUES TO RISE AND THE HIGH 2 LEVEL IS REACHED, THE SECOND PUMP WILL START. BOTH PUMPS WILL CONTINUE TO RUN UNTIL THE WATER LEVEL REACHES THE LOW LEVEL, STOPPING BOTH PUMPS.

- NOTES:**
1. THE PUMP CONTROL PANEL SHALL BE FURNISHED WITH THE FOLLOWING OPTIONS:  
 MOTOR CIRCUIT PROTECTORS, 480/120V CONTROL POWER TRANSFORMERS AND FUSES, HAND-OFF-AUTO SELECTOR SWITCHES, RUN INDICATING LIGHTS AND TOTAL RUN TIME METERS, MOUNTED IN A NEMA 4 STAINLESS STEEL ENCLOSURE.
  2. HIGH LEVEL RELAYS "H1 LCR", "H2 LCR", AND LOW LEVEL RELAY "LLCR" ARE CONTROLLED BY THE LEACHATE COLLECTION MAN-HOLE LEVEL CONTROLLER LIC-110 SHOWN ON DRAWING 92X-6000-E-00007.
  3. INFLOW TO THE PERMANENT LIFT STATION IS STOPPED BY A HIGH-HIGH LEVEL RELAY (H1) WHICH CLOSSES A MOTOR OPERATED VALVE AND CONTROLS VISUAL AND AUDIBLE ALARMS. SEE DRAWING 92X-6000-E-00007.

FOR INFORMATION ONLY

- NOTES
1. SEE DRAWING 92X-5900-E-00323 FOR ELECTRICAL PLAN AT PERMANENT LIFT STATION.
  2. INSTALL A SQUARE D TYPE KP12P14V20 OR EQUAL (120 VOLT DPDT PLUG IN RELAY) IN STARTER CABINET. ALSO INSTALL A 120VOLT, GREEN PILOT LIGHT, SQUARE D #KPI1031 OR EQUAL IN THE STARTER DOOR.
  3. INSTALL THREE SQUARE D TYPE KP12P14V20 OR EQUAL RELAYS IN THE LEVEL CONTROL CABINET. SEE DWG 92X-6000-E-00007.
  4. PUMP IS FURNISHED WITH 40 FOOT LONG SUBMERGIBLE POWER CABLE CONTAINING 3 #8 (PWR), 2 #10 (CNTRL), 1 #8 (GND), & 1 #10 (GC) CONDUCTORS. NOMINAL DIA OF CABLE IS 1.22 INCHES.

REF DWG NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-6000-E-00007	ELECTRICAL DETAILS IV
92X-5900-E-00323	PLANS PERMANENT LIFT STATION AND BIOSURGE LAGOON
92X-5900-N-00345	ANALOG I/C DIAGRAM

PRELIMINARY  
 NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	INITIALS AND DATE
E	FINAL DESIGN	N/A	2/21/96
D	ISSUED FOR EPA REVIEW	N/A	2/25/96
C	ISSUED FOR D/E 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS	N/A	2/17/96
B	ISSUED FOR 90% DESIGN REVIEW	N/A	4/30/96
A	ISSUED FOR 30% DESIGN REVIEW	N/A	3/26/96

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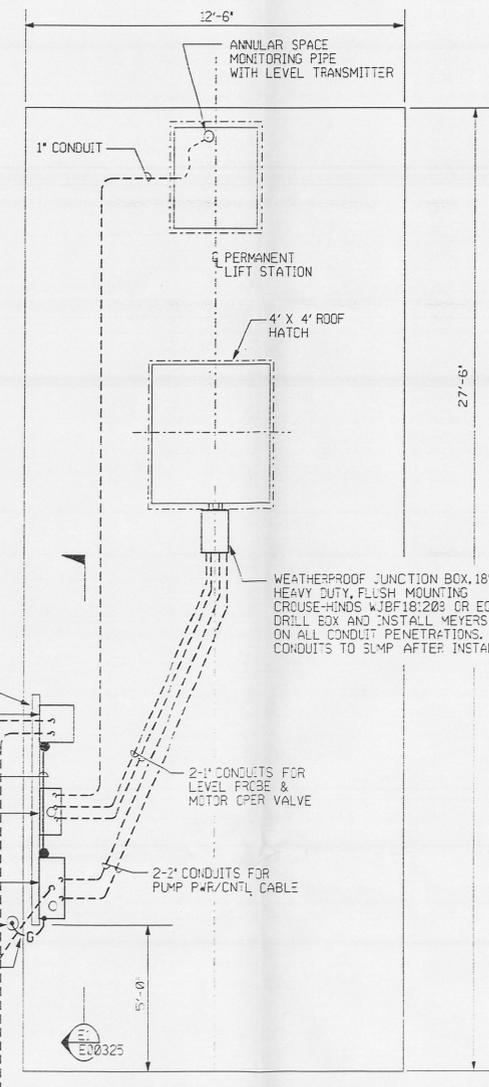
PROJECT NAME  
 LEACHATE CONVEYANCE SYSTEM 199

DRAWING TITLE			
ELECTRICAL SINGLE LINE AND SCHEMATICS PERMANENT LIFT STATION			
DRAWN BY: R PROSKI	DATE: 3/1/96	LEAD ENGINEER: J.L. COOPER	DATE: 3/25/96
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS
SUBMITTED FOR APPROVAL	FERNCO CRU APPROVAL: N/A	FERNCO PROJECT NUMBER: 20211	

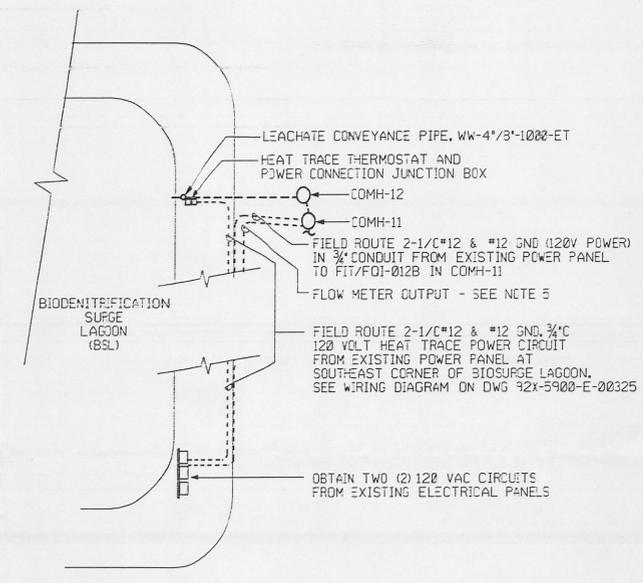
PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DATE	TRUMP PROJECT NO.	DRAWING REVISION CODE NO.	SHEET NO.	REV. NO.
SRP/P0164		W35 1.1.1.2.3.5 00-3070	92X-5900-E-00324 E0002 E		

FINAL DESIGN PACKAGE

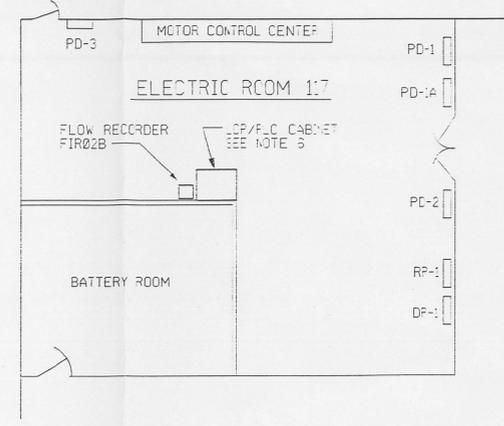
- EQUIPMENT RACK AT PERMANENT LIFT STATION TO BE FIELD FABRICATED AND LOCATED AS SHOWN.
- CONDUITS TO BE FIELD ROUTED. EMBEDDED CONDUITS SHALL BE A MINIMUM OF 18" BELOW GRADE.
- EXPOSED PIPE AT BIOSURGE LAGOON SHALL BE HEAT TRACED. EXTEND HEAT TRACE CABLE 3'-0" BELOW GRADE.
- SEE CIVIL DRAWING 94X-5900-G-00262 FOR LEACHATE CONVEYANCE PIPE LOCATION AND DETAILS AT THE BIO SURGE LAGOON.
- FIELD ROUTE FLOW METER OUTPUT SIGNAL WIRES TO NEAREST TELEPHONE LINE INTERFACE POINT.
- LOCATE THE LCP/PLC CABINET AND FLOW RECORDER F1R02B AT TENTATIVE LOCATION AT THE AWWT AS SHOWN. COORDINATE FINAL LOCATION AND CONNECTION TO 120 VOLT POWER WITH THE AWWT FACILITY MANAGER AT TIME OF CONSTRUCTION FOR APPROVAL OF EQUIPMENT LOCATIONS AND WORK TO BE PERFORMED IN THIS AREA.



PLAN  
PERMANENT LIFT STATION  
NTS



PLAN  
AT BIODENITRIFICATION SURGE LAGOON  
NTS



PARTIAL PLAN AT AWWT BUILDING  
NTS

REF SHEET NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-5900-E-00325	ELEVATION AND DETAILS
92X-5900-G-00262	CIVIL - PLAN & PROFILE
92X-5500-E-00500	ELECTRICAL SITE PLAN AND SINGLE LINE
92X-5500-E-00501	ELECTRICAL EST-ILS

PRELIMINARY  
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OF REVISION PURPOSE - DESCRIPTION	DATE	INITIALS AND DATE
D	FINAL DESIGN	N/A	8/2/94
C	ISSUED FOR EPA REVIEW	N/A	6/25/94
B	ISSUED FOR DOE 50% DESIGN REVIEW - UNCHECKED; REVISIONS IN PROGRESS	N/A	5/17/94
A	ISSUED FOR 90% DESIGN REVIEW	N/A	4/30/94

**UNITED STATES  
DEPARTMENT OF ENERGY  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

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CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

DRAWING TITLE  
**ELECTRICAL PLANS  
PERMANENT LIFT STATION AND BIOSURGE LAGOON**

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
F. PROCKI	4/23/94	J.L. COOPER	4/24/94		
PLANT/BLDG. NO.	FLOOR	SCALE	NONE	CLASS	
SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NUMBER	N/A	20211	

**FOR  
INFORMATION  
ONLY**

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DATE	FERMCO PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
SRP/PC164	11/12/93	WBS 11-12-36	CO-90-01	92X-5900-E-00323	E0001

- FINAL DIMENSION OF LENGTH OF STEEL FITTINGS AND VALVES IN THE MANHOLES WILL VARY DUE TO EXPANSION AND CONTRACTION OF HDPE PIPE. AFTER COMPLETE BURIAL OF PIPE AND MANHOLE, ALLOW 5 DAYS BEFORE SETTING FITTINGS AND ANCHOR SUPPORTS. EACH MANHOLE WILL NEED A SEPARATE MEASUREMENT.

METAL PIPING SPECIFICATION NOTES

- MATERIALS:
  - 4" METAL CARRIER PIPE SHALL BE SEAMLESS, CARBON STEEL ASTM A-53, GRADE B SCHEDULE 40, BEVELED ENDS. 1/2" THREADED PIPE SHALL BE THE SAME EXCEPT SCHEDULE 80
  - FITTINGS SHALL BE SEAMLESS CARBON STEEL BUTT WELD, ASTM A234, GRADE WPB. ELBOWS SHALL BE SHORT RADIUS.
  - FLANGES SHALL BE CLASS 150, CARBON STEEL, FF, ASTM A105, WELDNECK STD. 4T BORE.

- FABRICATION: ALL WELDING ELECTRODES SHALL BE IN ACCORDANCE WITH AWS A5.1.
- TESTING: CARRIER PIPE SHALL BE HYDROSTATICALLY TESTED TO 130 PSIG. THE TEST PRESSURE SHALL BE MAINTAINED FOR A MINIMUM OF TEN MINUTES PRIOR TO VISUAL INSPECTION.

GENERAL STEEL NOTES

- FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL BE IN ACCORDANCE WITH AISC MANUAL OF STEEL CONSTRUCTION, NINTH EDITION.
- MATERIAL SHALL MEET THE REQUIREMENTS OF THE FOLLOWING SPECIFICATIONS:
  - STRUCTURAL STEEL - ASTM A36
  - WELDING - AWS D11 CLASS E70XX (ELECTRODES)
  - ANCHOR STUD, WEDGE NUT AND WASHER SHALL BE AISI 316
  - STAINLESS STEEL CONFORMING TO ASTM A276 (STUD); ASTM F594 (NUT); AND ASTM A240 (WASHER)

- SHOP AND FIELD PAINTING SPECIFICATION: FOR STEEL PLATE AND SHAPES, PIPE AND FITTINGS
  - A) PREPARE SURFACES IN ACCORDANCE WITH STEEL STRUCTURES PAINTING COUNCIL (SSPC) SP-6.
  - B) PRIME ALL BARE METAL IN CONTACT WITH CONCRETE/GROUT WITH ONE COAT TNEC SERIES 66 EPOXYLINE PRIMER. APPLY TWO COATS OF TNEC SERIES 66 HI-BUILD EPOXYLINE FOR THE FINISH COAT. FOLLOW SSPC PAINT 13 AND PAINT 20.

- THE VALVE SPECIFICATIONS INCLUDE THE FOLLOWING: CHECK - SWING CHECK, IRON BODY, BRONZE TRIM, 45 DEGREE SWING DISC AND SEAT, CLASS 125 FLANGE ENDS; CONFORMING TO AWWA C508.

- 4" GATE - IRON BODY, BRONZE TRIM, RISING STEM, SINGLE WEDGE, RESILIENT SEAT, CLASS 125 FLANGE ENDS; CONFORMING TO AWWA C509.

- 4" BALL VALVE - CLASS 150, CARBON STEEL, RF FLANGE, ASTM A216, GRADE WCB, REINFORCED TFE SEATS, CHROME-PLATED BALL, WRENCH OPERATOR

- 1/2" GATE - CLASS 150, BRONZE, T-THREADED ENDS, ASTM B62, RISING STEM.

- AIR RELEASE - CAST IRON BODY AND TOP, STAINLESS STEEL TRIM AND BALL FLOAT, Buna-N SEAT, AND NPT THREADED INLET.

- PROTECTIVE COATINGS FOR VALVES:
  - INTERIOR - FACTORY APPLIED HEAT-CURED EPOXY COATING CONFORMING TO AWWA C550
  - EXTERIOR - TWO COATS OF FACTORY APPLIED ZINC CHROMATE PRIMER AND TWO COATS FINISH COATING IN ACCORDANCE WITH METAL PAINTING SPECIFICATIONS.

ERECTION/INSTALLATION NOTES

- ALL PIPING, FITTINGS, COMPONENTS, WELDING, BONDING, FABRICATION, ERECTION, AND ASSEMBLY SHALL BE IN ACCORDANCE WITH ASME B31.3.
- ALL FLANGED JOINTS SHALL BE ASSEMBLED IN ACCORDANCE WITH AWWA B31.3.
- FABRICATE, INSTALL AND TEST HDPE PIPE MATERIALS IN ACCORDANCE WITH DETAILED SPECIFICATIONS.

REF DWG NO.	DRAWING TITLE
92X-5900-X-20264	DRAWING INDEX
92X-5900-X-20265	LEGEND AND SYMBOLS
92X-5900-N-20347	INSTRUMENTATION - INSTRUMENT INSTALLATION MANHOLE DETAIL

D	ISSUED FOR FINAL DESIGN REVIEW	N/A
C	ISSUED FOR EPA REVIEW	N/A
B	ISSUED FOR DOE 90% DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS	05/17/98
A	ISSUED FOR 90% DESIGN REVIEW	04/30/98

REV. NO. ISSUE OR REVISION PURPOSE - DESCRIPTION INITIALS AND DATE

**UNITED STATES DEPARTMENT OF ENERGY**  
**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**  
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PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

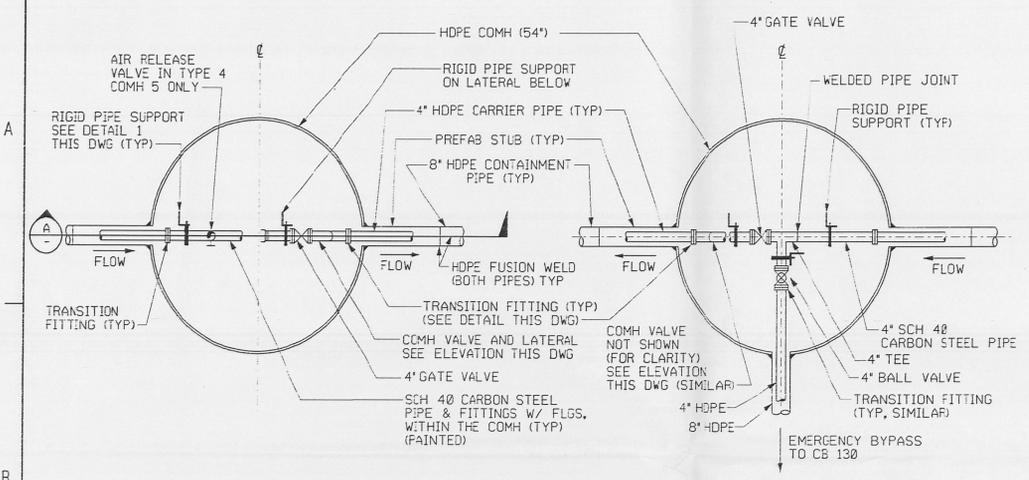
DRAWING TITLE  
**CIVIL DETAILS**  
 SHEET 3 OF 3

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
D.R. FOX	04/18/98			E. MELNYK	04/19/98

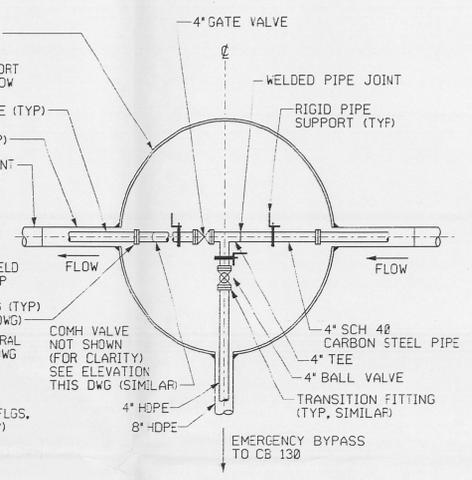
PLANT/EDC. NO.	FLOOR	SCALE	CLASS

SUBMITTED FOR APPROVAL	FERMCO CRU APPROVAL	FERMCO PROJECT NO.
	N/A	20211

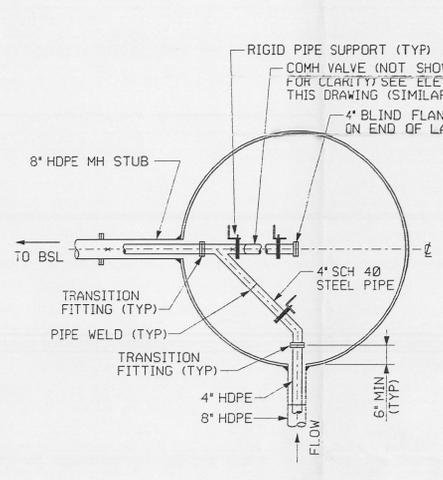
A-E	DATE	TEMP PROJECT NO.	DRAWING REVISION NO.	SHEET NO.	REV. NO.
		WBS 1.1.1.2.3.6	00-907C1	92X-5900-G-00258	G0008



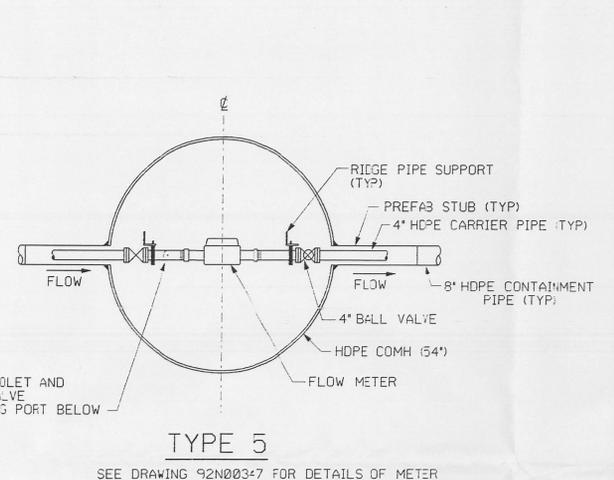
**TYPE 1 & 4**  
 (TYPE 1 & 4 SAME EXCEPT TYPE 4 HAS AIR RELEASE VALVE)



**TYPE 2**



**TYPE 3**

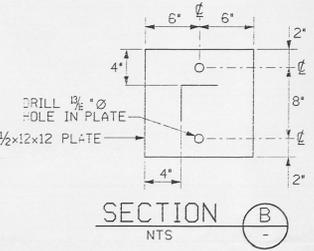


**TYPE 5**  
 SEE DRAWING 92N0037 FOR DETAILS OF METER

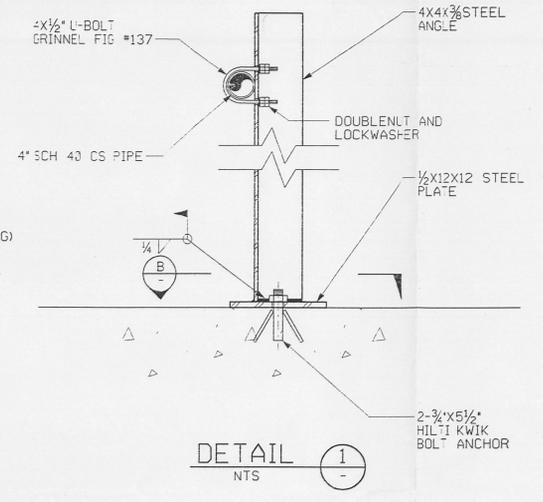
- VALVE IDENTIFICATION**
- EACH VALVE SHALL BE IDENTIFIED WITH ITS UNIQUE VALVE NUMBER.
  - LABEL SIZE SHALL BE BASED ON USING 1/2" LETTERS.
  - LABELS SHALL BE CONSTRUCTED OF NONREFLECTIVE MATERIALS. BLACK CHARACTERS ON A WHITE BACKGROUND OR WHITE CHARACTERS ON A BLACK BACKGROUND OFFER THE BEST CONTRAST AND LEGIBILITY. IF WHITE-ON-BLACK ENGRAVED LABELS ARE USED, A CLEAR OVERCOATING SHALL BE APPLIED TO PREVENT DIRT FROM OBSCURING THE WHITE ENGRAVED CHARACTERS.
  - LABELS, INCLUDING ADHESIVES AND OTHER MEANS OF ATTACHMENT, SHALL BE MADE FROM CORROSION-RESISTANT MATERIALS THAT ARE COMPATIBLE WITH THE COMPONENT AND ENVIRONMENT WHERE THEY ARE USED.

**TYPICAL CLEANOUT MANHOLE PLANS**

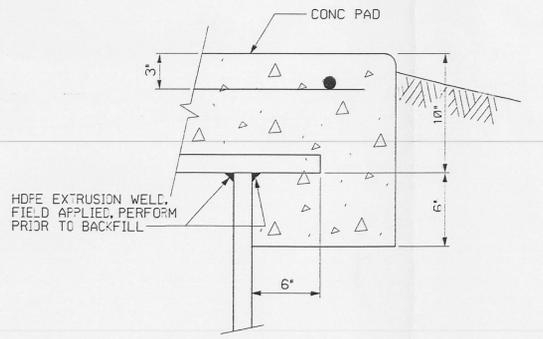
NTS  
 NOTE: SEE TABLE 1 FOR TYPE OF SPECIFIC COMH



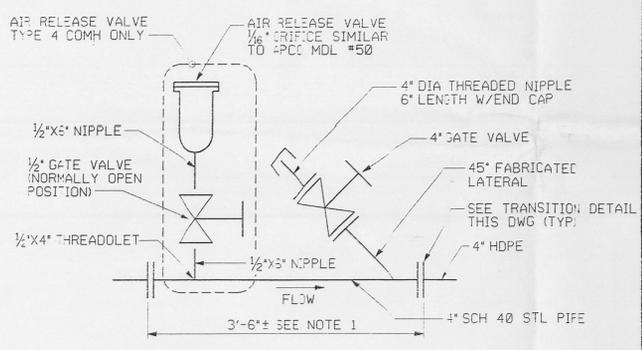
**SECTION B**  
 NTS



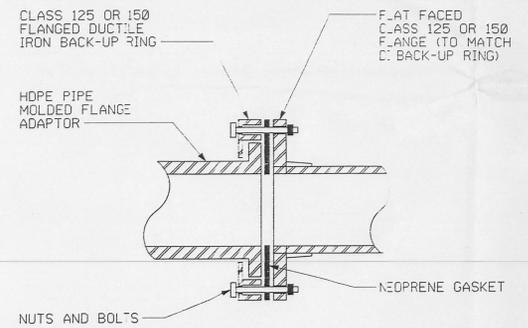
**DETAIL 1**  
 NTS



**DETAIL 2**  
 NTS



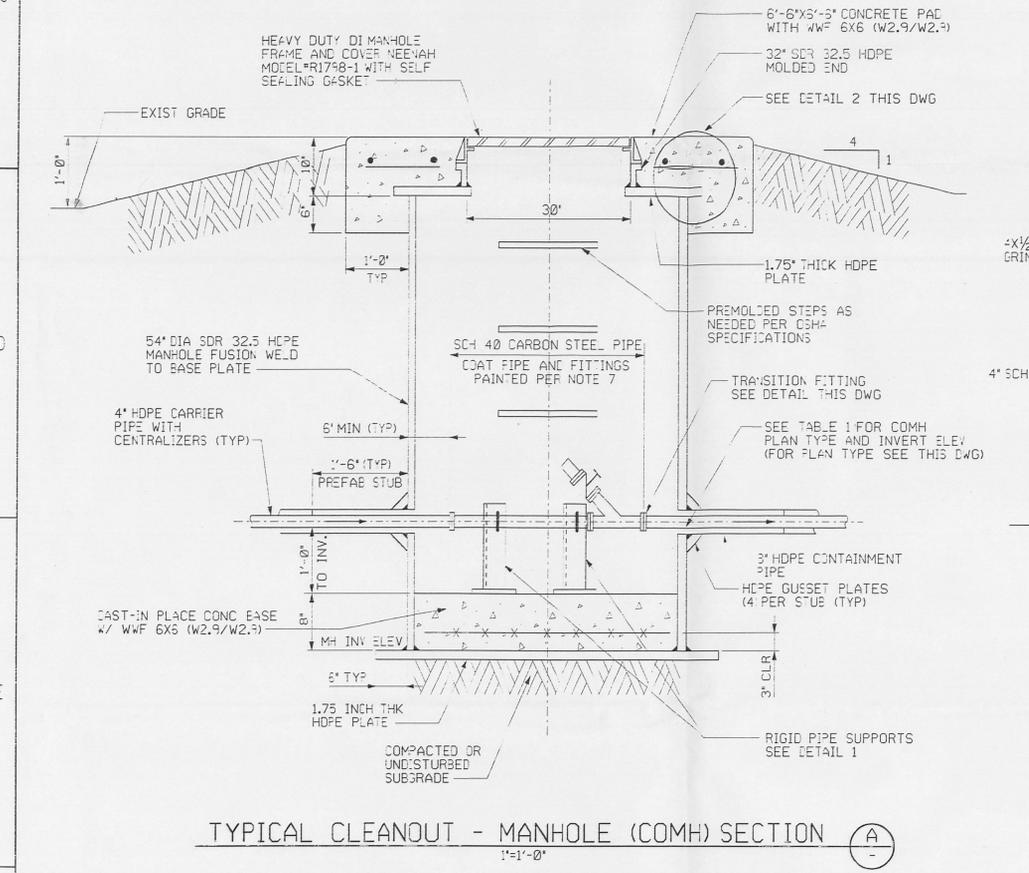
**TYPICAL COMH VALVE ELEVATION**  
 NTS



**TYPICAL TRANSITION FITTING DETAIL**  
 NTS

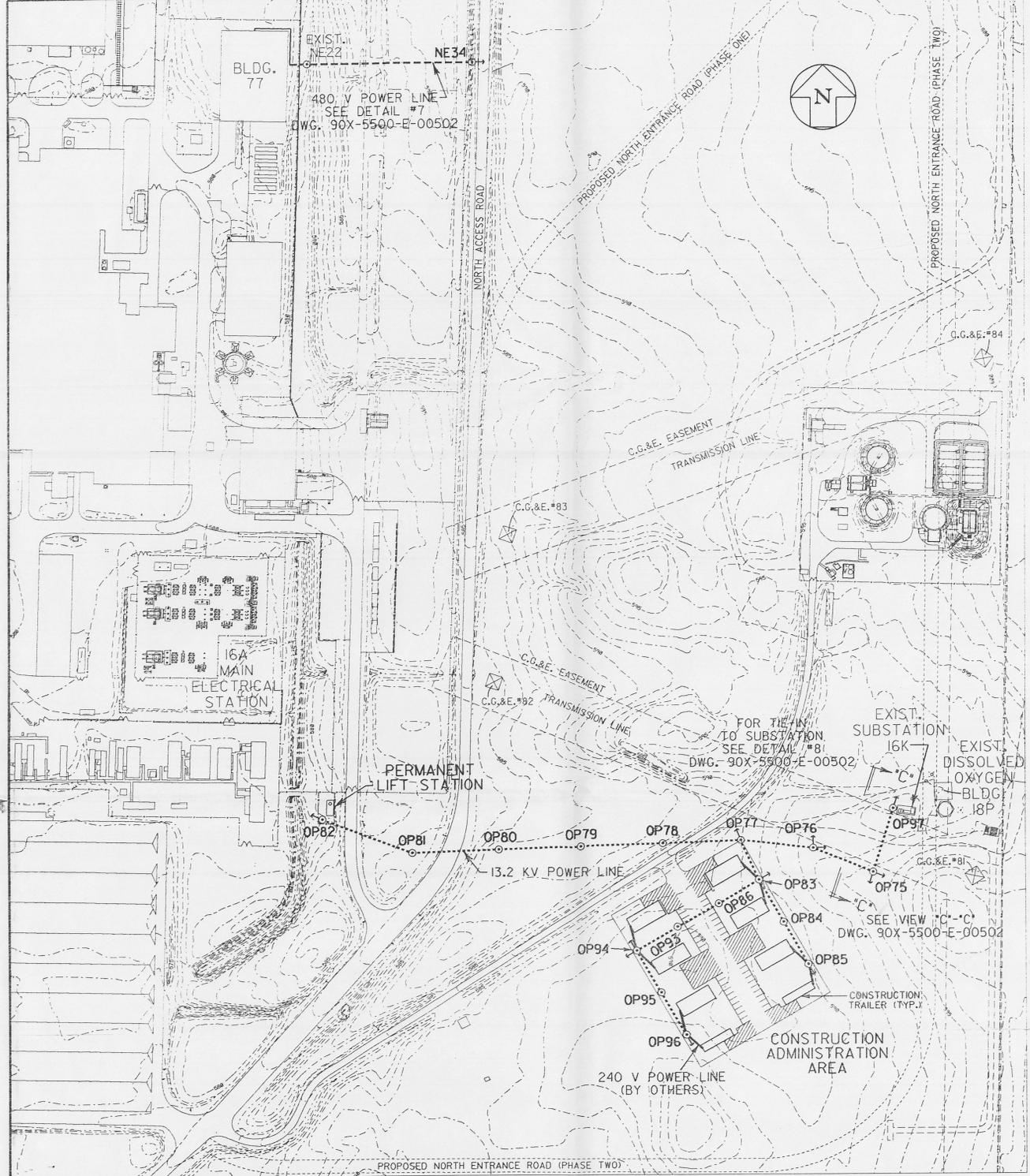
**PRELIMINARY**  
 NOT FOR CONSTRUCTION

FINAL DESIGN PACKAGE SRP/P0164



**TYPICAL CLEANOUT - MANHOLE (COMH) SECTION**  
 1"=1'-0"

TABLE 1 CLEANOUT - MANHOLE (COMH)				
COMH#	TOP OF LID ELEV	INVERT ELEV	PLAN TYPE	
1	582.00	575.16	TYPE 1	
1A	581.00	573.67	TYPE 1	
2	582.00	575.67	TYPE 1	
3	577.50	570.67	TYPE 1	
4	577.00	567.33	TYPE 2	
5	581.00	574.67	TYPE 4	
6	577.00	570.67	TYPE 1	
7	575.50	566.67	TYPE 1	
8	574.00	565.67	TYPE 1	
9	575.50	568.67	TYPE 1	
10	577.25	567.16	TYPE 3	
11	577.83	570.83	TYPE 1	
12	575.00	569.45	TYPE 1	

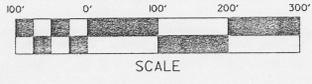


**NEW POLE COORDINATES**

**EXISTING POLE COORDINATES**

	EASTING	NORTHING	
NE34	1350863.22	480830.30	POLE WITH GUY
OP75	1351586.37	479361.52	POLE WITH GUY
OP76	1351480.00	479405.44	POLE WITH GUY
OP77	1351350.00	479420.00	POLE WITH GUY
OP78	1351210.00	479415.00	
OP79	1351062.50	479410.00	
OP80	1350915.00	479405.00	
OP81	1350760.00	479400.00	
OP82	1350594.36	479463.75	POLE WITH GUY
OP83	1351382.45	479348.20	POLE WITH GUY
OP84	1351426.45	479271.98	
OP85	1351470.45	479195.77	POLE WITH GUY
OP86	1351309.14	479305.90	
OP93	1351235.82	479263.54	
OP94	1351162.51	479221.21	POLE WITH GUY
OP95	1351206.51	479145.00	
OP96	1351250.51	479068.79	POLE WITH GUY
OP97	1351622.81	479475.84	POLE WITH GUY

	EASTING	NORTHING
NE22	1350571.82	480829.84

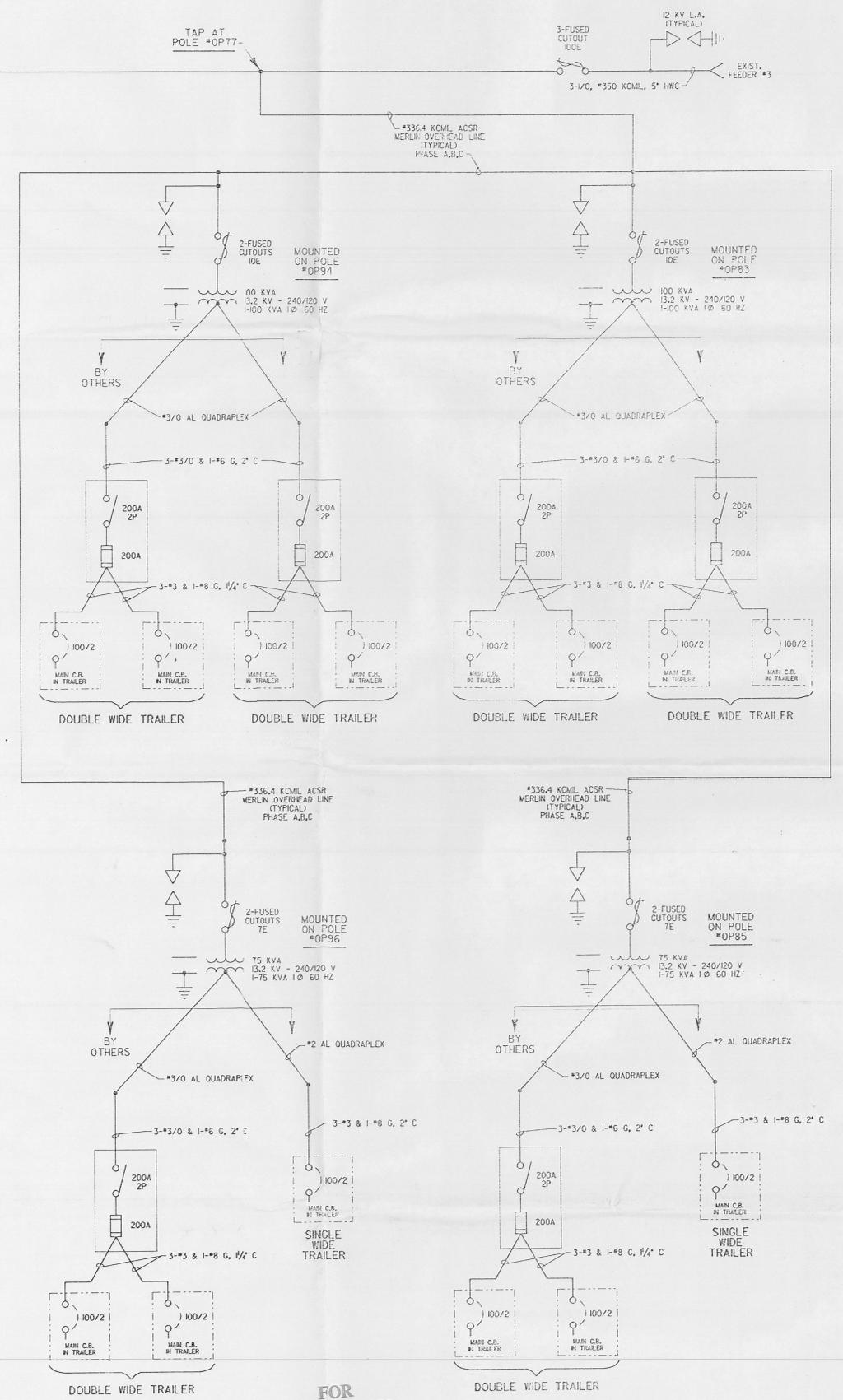


**LEGEND**

- ⊙ ELECTRIC POLE
- ⊙-> ELECTRIC POLE WITH GUY
- 13.2 KV 3Ø 60 HZ PRIMARY LINE (FEEDER 3B) (OVERHEAD)
- 240 V 1Ø 60 HZ DISTRIBUTION LINE (OVERHEAD) BY OTHERS
- 480 V 3Ø 60 HZ (OVERHEAD)
- OP75 OUTSIDE PRODUCTION AREA POLE (#75)
- NE34 NORTHEAST POLE (#34)
- ▨ FIRE LANE - NO PARKING

**ELECTRICAL LEGEND**

- ⊖ SWITCH
- ⊖ CIRCUIT BREAKER (C.B.)
- ⊖ FUSED CUTOUT
- ⊖ FUSE
- ⊖ GROUND
- ⊖ LIGHTNING ARRESTOR (L.A.)
- ⊖ SINGLE PHASE TRANSFORMER WITH PHASE TO PHASE PRIMARY AND SECONDARY WITH NEUTRAL CENTER TAP
- ⊖ 3-SINGLE PHASE TRANSFORMERS WITH DELTA CONNECTED PRIMARIES AND WYE CONNECTED SECONDARIES



FOR INFORMATION ONLY

NO.	REVISIONS	DATE	DWN. BY	APPD. NO.	REVISIONS	DATE	DWN. BY	APPD. NO.	REF. DWG. NO.

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

CONSTRUCTION MANAGEMENT DRAWING

APPROVALS:

CIVIL & STR. ENGINEER	DATE	SAFETY ENG. MAINTENANCE	DATE
ELECTRICAL ENGINEER	10/26/96	FIRE PROTECT.	
INSTRUMENT MECHANICAL	10/26/96	WASTE MANAGE.	
SECURITY		CRJ	
		OSDF	

RES \*291 DATE 6/7/96 DRAWN S.J.SMOCK

FERMCO RESTORATION MANAGEMENT CORPORATION

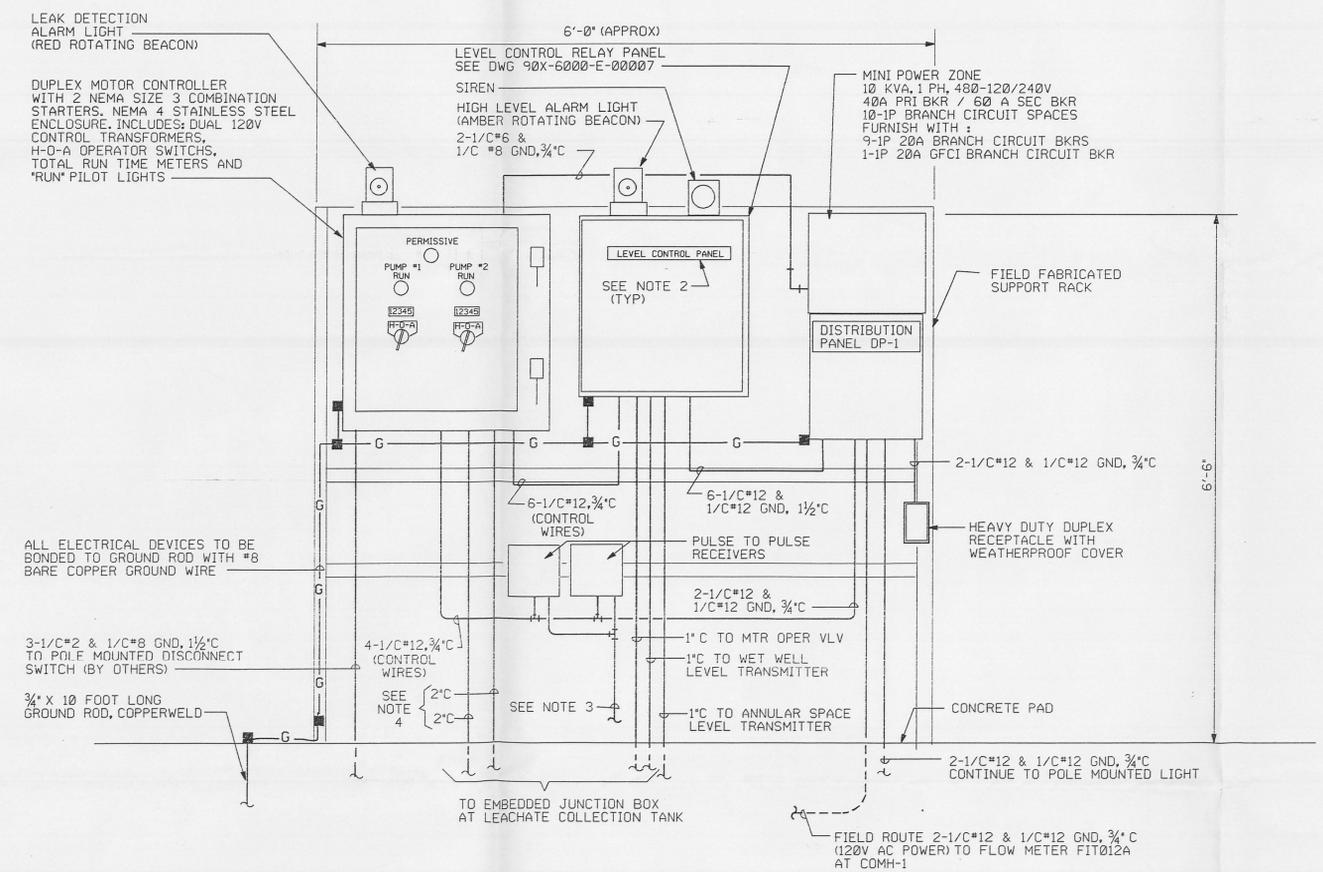
Environmental Management Project

U.S. DEPARTMENT OF ENERGY

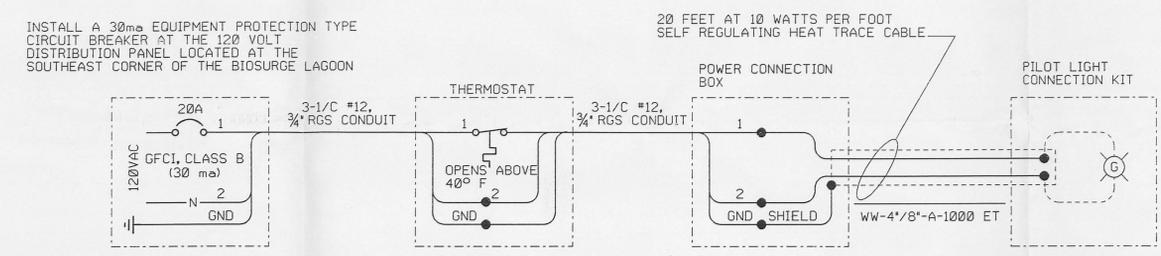
LEACHATE CONVEYANCE SYSTEM ELECTRICAL SITE PLAN AND SINGLE LINE SCALE: 1" = 100'-0"

90X-5500-E-00500 0

- SEE 92X-5900-E-00323 FOR PLANS AT THE PERMANENT LIFT STATION AND AT THE BIO SURGE LAGOON.
- SUBCONTRACTOR SHALL PROVIDE AND INSTALL NAMEPLATES FOR ALL PANELS AND CONTROLS. NAMEPLATES SHALL BE WHITE LAMACOID WITH 3/16 (MIN) HIGH BLACK LETTERING.
- FIELD ROUTE A TWO PAIR TELEPHONE CABLE TO NEAREST TELEPHONE LINE INTERFACE POINT.
- 2" CONDUITS CONTAIN PUMP VENDOR SUPPLIED CABLE. PUMPS ARE FURNISHED WITH 40 FOOT LONG SUBMERSABLE POWER CABLE CONTAINING 3-#6 (PWR), 2-#10 (CNTL), 1-#8 (GND), & 1-#10 (GC) CONDUCTORS. NOMINAL DIA OF CABLE IS 1.22 INCHES.



PERMANENT LIFT STATION  
EQUIPMENT RACK  
ELEVATION E1 REF  
NTS E00325 E00323



HEAT TRACING CIRCUIT  
WIRING DIAGRAM

REF DWG NO.	DRAWING TITLE
92X-5900-X-00264	DRAWING INDEX
92X-5900-E-00323	POWER PLANS
90X-6000-E-00007	ELECTRICAL DETAILS IV

PRELIMINARY  
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
D	FINAL DESIGN		N/A	8/21/96
C	ISSUED FOR EPA REVIEW		N/A	8/25/96
B	ISSUED FOR 90% DOE DESIGN REVIEW; UNCHECKED; REVISIONS IN PROGRESS		N/A	5/17/96
A	ISSUED FOR 90% DESIGN REVIEW		N/A	4/30/96

**UNITED STATES  
DEPARTMENT OF ENERGY**  
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY  
**PARSONS**  
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.  
CINCINNATI, OHIO

PROJECT NAME  
**LEACHATE CONVEYANCE SYSTEM**

DRAWING TITLE ELECTRICAL ELEVATION AND DETAILS <span style="float: right;">203</span>					
DRAWN BY R. PROSKI	DATE 4/22/96	LEAD ENGINEER	DATE	CHECKED BY J.L. COOPER	DATE 4/24/96
PLANT/BLDG. NO.	FLOOR	SCALE	CLASS	NONE	FERMCO PROJECT NUMBER 20211
SUBMITTED FOR APPROVAL		FERMCO CRU APPROVAL		FERMCO PROJECT NUMBER 20211	

FOR  
INFORMATION  
ONLY