

TECHNICAL SPECIFICATIONS
ON-SITE DISPOSAL FACILITY
ENHANCED PERMANENT LEACHATE
TRANSMISSION SYSTEM
VALVE HOUSES 7 AND 8

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Fernald Environmental Management Project
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(Fluor Fernald, Inc. Project No. 20112)

INFORMATION ONLY

Prepared by

Fluor Fernald Inc.

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**ON-SITE DISPOSAL FACILITY
ENHANCED PERMANENT LEACHATE TRANSMISSION
SYSTEM SPECIFICATIONS
VALVE HOUSES 7 AND 8
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT**

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SECTION 02050**DEMOLITION****PART 1 GENERAL****1.01 SCOPE**

- A. This section includes the requirements of site preparation for installation of Valve Houses 7 & 8 and includes but is not limited to:
1. surveying
 2. clearing and grubbing;
 3. excavation;
 4. stockpiling of excavated soils;
 5. cutting and removal of existing HDPE Leachate transmission pipe;
 6. stubout of new RLCS, LCS, and LDS pipes for Cells 7 & 8;
 7. segregation, containerization, and disposal of debris;
 8. placement and compaction of bedding and backfill material; and
 9. other work ancillary work.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 - Surveying
- B. Section 02110 – Clearing, Grubbing, and Stripping
- C. Section 02200 - Earthwork
- D. Section 02215- Trenching and Backfilling
- E. Section 02270 – Surface-water Management and Erosion Control
- F. Section 02605 – High-Density Polyethylene (HDPE) Pipes and Fittings
- G. Part 6 – Statement of Work
- H. Part 8 – Environmental Health & Safety/Training Requirements

1.03 SUBMITTALS

- A. Submit to Construction Manager for review plan for Valve House tie-ins testing within 45 calendar days from Notice to Proceed. Plan should include all significant elements, including but not limited too: excavation, packer setup and execution, removal of existing LTS pipe, procedures for removal and disposal of all potentially radiologically affected liquid, and installation and testing of new pipe.
- B. Submit to Construction Manager for review details including shop drawings for inflatable packer assembly within 30 calendar days from Notice to Proceed.
- C. Submit to Construction Manager for review details drawings of the proposed equipment and suitable evidence of experience from link-seal manufacturer within 30 calendar days from Notice to Proceed.
- D. Provide a list of equipment, description of construction methods for demolition and tie-in, and other required information for demolition and tie-in in the Contractor's Earthwork Work Plan specified in Section 02200.
- E. Submit to Construction Manager for review plan and details for cutting active HDPE pipe and tie-in of new process piping in valve houses within 30 days from Notice to Proceed.

1.04 HEALTH & SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Furnish material for embedment fill meeting the requirements of Section 02215.
- B. Use previously excavated backfill material for placement and compaction to final grade, or other material for trench backfill specified in Section 02215.
- C. Furnish HDPE pipes, fittings, and appurtenances as specified in Section 02605.

2.02 EQUIPMENT

- A. Furnish equipment necessary to perform work specified in this section.

PART 3 EXECUTION**3.01 GENERAL**

- A. Review existing site utility drawings and identify and stake existing utilities in the vicinity of the work.
- B. Protect utilities in area of excavation
- C. Do not damage or disturb survey benchmarks, finished construction, existing structures, except as otherwise noted on the Construction Drawings.
- D. Dust control shall be in accordance with Part 6 of the Contract Documents.

3.02 SITE PREPARATION

- A. Replace construction safety fence that becomes disturbed during construction activities. Provided construction safety fence, signs, and barricades as specified Section 02200.
- B. Install, inspect, and maintain surface-water management and erosion controls in accordance with Section 02270.
- C. Perform clearing, grubbing, and stripping to limits identified by the Construction Manger and in accordance with Section 02110.

3.03 EXCAVATION

- A. Excavate designated areas to the subgrade elevations and excavation limits shown on the Construction Drawings. Stockpile excavated materials in accordance with Section 02200.
- B. Minimize sloughing and caving of the excavations.

- C. Do not remove excavated material from the site or dispose of soil except as approved by the Construction Manager.
- D. Excavate or trench as specified in Section 02200 and Section 02215.
- E. Remove the concrete encasement around HDPE pipe as shown on the Construction Drawings. Do not damage HDPE pipe during removal of concrete encasement. Remove rubble to a stockpile approved by the Construction Manager.
- F. As HDPE pipe is unearthed at Valve Houses for, and during construction of foundations, provide support to HDPE pipe so that flow can be maintained without placing undue stress on exposed pipe.
- G. Active HDPE pipe exposed in weather below freezing shall be protected to prevent freezing.

3.04 EXCAVATION DEWATERING

- A. Manage groundwater seepage and surface-water runoff in excavations in accordance with Section 022200.

3.05 STOCKPILING

- A. Stockpile excavated soils as specified in Section 02200, or as otherwise directed by the Construction Manager.

3.06 CUTTING OF HDPE PIPE

- A. Notify the Construction Manager and review plan for cutting of HDPE pipe in valve houses one week prior to planned activity.
- B. Coordinate outage and cutting of the HDPE pipe with the Construction Manager.
- C. New process piping shall be fabricated, tested, and ready for installation in the valve houses prior to cutting active HDPE pipe to minimize the outage to not more than two days.

- D. Contractor shall coordinate with the Construction Manager the draining of upstream pipe to minimize water present in the pipe. Pipe shall be cut and removed in accordance with the Construction Drawings, Part 8 of the Contract Documents, or as directed by the Construction Manager. Pipe shall be cut in a manner to collect all potentially radiologically affected liquid as directed by the Construction Manager.
- E. Piping removed and liquids collected from cutting of pipe shall be disposed as directed by the Construction Manager.

[END OF SECTION]

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

- A. This section includes the requirements of surveying, including, but not limited to:
1. establishing temporary control benchmarks;
 2. establishing a horizontal and vertical project control system based on the existing benchmarks and surveying required for the layout of the project;
 3. surveys for quantity determinations;
 4. setting limits and boundaries of construction activities;
 5. performing support surveys and surveys for conformance checks, “red line” drawings, and to determine measurement quantities for periodic progress payments and final payments; and
 6. preparing and furnishing “red line” drawings and sketches.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02050 - Demolition
- B. Section 02110 – Clearing, Grubbing, and Stripping
- C. Section 02200 - Earthwork
- D. Section 02215- Trenching and Backfilling
- E. Section 02230 – Road and Parking Area Restoration
- F. Section 02270 – Surface-water Management and Erosion Control
- G. Section 02605 – High-Density Polyethylene (HDPE) Pipes and Fittings
- H. Section 03100 - Concrete
- I. Section 13120 – Pre-Engineered Buildings

- J. Part 6 – Statement of Work
- K. Part 8 – Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. National Geodetic Survey (NGS) Standards.

1.04 QUALIFICATIONS

- A. Oversight for the survey work shall be provided and certified by a Land Surveyor licensed in the State of Ohio. 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 at least 5 years of experience in construction surveying.
- C. Work performed in referencing or re-establishment of survey monuments shall be stamped and certified by a Land Surveyor licensed in the State of Ohio.

1.05 SUBMITTALS

- A. Submit a copy of Land Surveyor's license and a résumé of the person supervising the surveys to the Construction Manager within 15 calendar days from Notice to Proceed.
- B. Submit two copies of the survey field notes, sketches, and drawings for the following surveys to the Construction Manager within one week of performance:
 - 1. preliminary surveys;
 - 2. intermediate surveys;
 - 3. written statement and surveys for conformance checks and "red line" drawings;
 - 4. survey at completion of the Contract;
 - 5. measurement and payment surveys; and
 - 6. final surveys.
- C. On request by the Construction Manager, submit documentation verifying accuracy of survey work.
- D. Upon completion of the survey work, provide the Construction Manager the original field notes, layout, computations, certified and stamped sketches and drawings in a format approved by the Construction Manager.

- E. One complete set of final “red-line” drawings and survey notes certified and stamped by a Land Surveyor licensed in the State of Ohio shall be submitted to the Construction Manger within 15 days of completion of the project. Drawings shall be the same scale as the Construction Drawings. Survey notes shall include a point listing with coordinates, elevation, and description.
- F. Provide list of equipment, description of surveying methods. And other required information to perform surveying work with the Contractor’s Earthwork Plan specified in Section 02200.

1.06 PROJECT RECORD DOCUMENTS

- A. Maintain on site, a complete, accurate log documenting survey work as it progresses.
- B. Maintain on site, a plan showing all site reference points, survey control points, and benchmarks with coordinates.
- C. Maintain on site, an accurate and current set of mark-up “red-line” drawings showing as-built conditions. “As-built” information shall be marked-up on “red-line” drawings within one week of completion of construction, as specified in Part 6 of the Contract Documents.

1.07 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & Safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS AND SURVEY INSTRUMENTS

- A. Provide materials as required to properly perform the surveys, including, but not limited to , personal protective equipment, instruments, laser survey equipment, tapes, rods, measures, mounts and tripods, stakes and hubs, nails, ribbons, other reference markers, and all else as required.
- B. They 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 feet and with a setting accuracy of ± 0.8 seconds.

PART 3 EXECUTION**3.01 GENERAL**

- A. Maintain accurate and complete notes of surveys.
1. Handwritten survey field notes and information shall be document. A copy of the numbered, dated, and signed documentation shall be given to the Construction Manager weekly or upon request by the Construction Manager. Survey notes shall be legibly recorded. Notation shall be consistently applied to survey work. The survey benchmarks on the field notes, sketches, and drawings.
 2. Electronically collected field survey information shall be stored for retrieval and submittal if requested by the Construction Manager, during the period of performance of the Contractor's work.
 - a. Electronic format for printed output of data collector field survey notes shall be compatible with the approved field notation format.
 - b. Electronic format for printed output of data collector survey work shall be compatible with the Contractor's computer equipment and software specified in this Section of verifying and checking the work. A copy of the data disk shall be submitted to the Construction Manager weekly.
- B. During construction, survey notes shall be retained by the Contractor and Land Surveyor. During construction, the Contractor and/or Land Surveyor shall submit surveys to the Construction Manager for review and approval prior to burial of piping.
- 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. Perform conformance checks as specified in this Section. Conformance check surveys for elevation and horizontal coordinates shall be recorded to the nearest 0.01 feet 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 feet and 0.05 feet, respectively.
- F. Final "red-line" drawings and sketches shall be certified for method 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 Contractor shall allow the Construction Manager one calendar day between Monday through Friday for review of conformance surveys. The Contractor shall be responsible for rework and/or construction delays caused by survey or staking errors.

- H. Set slope and offset stakes in accordance with accepted surveying practices, provisions herein, and subject to Construction Manager review.
- I. Set grade and slope 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. Use a total station for setting and checking piping system alignments. Use a laser survey gun to assist with setting and checking the elevation of bedding prior to placing the pipes as well as to set the top of the pipe. In addition, the surveyor shall verify lines and grades of the bedding and the top of the pipe (after pipe has been backfilled to top of pipe elevation) at a spacing no more than 25 feet. This is to ensure correct pipe grade has been maintained during the backfilling operation.
- K. Upon completion of the work, the Contractor shall provide the Construction Manager with original survey field notes, layouts, and computations 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.
- L. Protect benchmarks and survey control points. Replace disturbed survey control points and benchmarks at no additional cost.
- M. Establish temporary control points, as necessary, to support construction work activities.
- N. Use only the benchmarks, coordinates, and elevations recognized by Fluor Fernald for control points. Temporary control points or markers shall be set based on surveys that reference the accepted benchmarks.
- O. Survey control points, accuracy, and documentation:
 - 1. Record the following information in survey notebooks for each control point established:
 - a. designation of control point;

- b. coordinates based on state Planar North American Datum (NAD) 1983 Ohio south;
 - c. elevation based on National Geodetic Vertical Datum (NGVD);
 - d. date of establishment;
 - e. description and sketch of the control point location;
 - f. control points referenced to a minimum of three features that can be seen from the control point; and
 - g. field notes for work performed to establish the control point including the coordinates and elevation of the control points referenced.
2. Document survey work in field books using the format and procedures described below:
- a. title and consecutive field book 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 recorded;
 - 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.

3.02 SUPPORT SURVEYS

A. Preliminary Surveys:

1. Verification of the Existing Conditions:
 - a. Prior to the start of clearing and earthwork activities, verify the accuracy of the existing conditions shown on the Construction Drawings and Reference Drawings. Immediately notify the Construction Manager in writing of deviations from the existing conditions indicated on the Construction Drawings which affect construction cost and/or schedule.
2. Verify the existing benchmarks, structures, utilities, wells, topography, surface-water management and erosion control measures, construction and radiological control fences, sedimentation basins and appurtenances, and drainage features, and existing stockpiles of materials and quantities shown on the Construction Drawings, Reference Drawings, or specified in the Contract. Notify the Construction Manager of any differences or conflicts with work included in this Contract.
3. Establish construction limits required for installation of the construction fence.

4. Establish location for the installation of the surface-water management and erosion control measures specified in Section 02270.
5. Clearing Limit Staking: Stake clearing limits as specified in Section 02110.
6. 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.
7. 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 lath shall be provided with each stake. Flagging color shall be designated by the Contractor.

B. Final Surveys:

1. Final topography shall be surveyed at nominal 50-foot intervals. Additionally, the following points shall be surveyed as applicable:
 - a. grade breaks;
 - b. points of horizontal curvature and tangency; and
 - c. points of stationing equation.
2. Structures: survey 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: Survey ditches, channels, and culverts.

3.03 SURVEYS FOR MEASUREMENT AND PAYMENT

- A. Perform surveys for periodic progress payments and final payment to determine quantities of work and percent of completed work. Measurement for quantities shall be as specified in Part 6 of the Contract Documents.
- 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 “RED-LINE” DRAWINGS

- A. Survey the following to verify the locations, lines, and grades achieved during construction for conformance checks and “red line” drawings;
1. for berms, ditches, roads. And other earthwork specified in Sections 02200 and 02230:
 - a. original grade surface;
 - b. compacted surface of cut slopes; and
 - c. finished grade surface;
 2. for culverts and other surface-water management and erosion control structures specified in Sections 02270 and 02721:
 - a. original grade surface;
 - b. pipe inverts; and
 - c. finished grade surface;
 3. for the subgrade specified in Section 02200:
 - a. prepared subgrade surface; and
 4. for the piping specified in Section 02605:
 - a. finished grade surface; and
 - b. piping system.
- B. Survey plans for the items described in this Section shall include the following:
1. North arrow, graphical scale, title block, and legend;
 2. Northing and Easting grid lines;
 3. spot grade location and elevation on plan;
 4. location of structures;
 5. labeled components; and
 6. for pipe profiles;
 - a. original grades with stationing;
 - b. final grades with stationing; and
 - c. pipe with inverts, slopes, pipe, material, pipe size, and length of pipe.
- C. Perform conformance checks and “red-line” surveying immediately upon completion of a given installation to facilitate progress and avoid delaying commencement of the next installation. Provide the following locations (coordinates and elevations) for survey points. (Additional survey points spaced not more than 25 feet apart or as directed shall be taken at the top of any underground pipes, fittings, valves, tees, or other appurtenances;
1. a line of survey points spaced not more than 25 feet apart or as directed shall be taken at the top of any underground pipes, fittings, valves, tees, or other appurtenances;
 2. pipe terminations as shown on the Construction Drawings; and

3. at the base top and corners of the valve houses as 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, and transporting and stockpiling these materials.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 - Surveying
- B. Section 02200 - Earthwork
- C. Section 02270 - Surface-Water Management and Erosion Control
- D. Section 02930 - Vegetation
- E. Part 6 - Statement of Work
- F. Part 8 - Environmental Health & Safety/Training Requirements

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.
- 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.

Impacted material is material requiring disposal in the On-Site Disposal Facility (OSDF). Impacted material shall be as identified in the field by the Construction Manager.

1.04 SUBMITTALS

- A. Provide list of equipment, description of construction methods, and other required information to perform clearing, grubbing, and stripping with the Contractor's Earthwork Work Plan specified in Section 02200.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

Section not used.

2.02 EQUIPMENT

- A. Furnish equipment to perform the clearing, grubbing, and stripping activities as specified in this Section.

PART 3 EXECUTION

3.01 GENERAL

- A. Dust control for clearing, grubbing, and stripping activities shall be as specified in Part 6 of the Contract Documents.

3.02 SURFACE-WATER MANAGEMENT AND EROSION CONTROL

- A. Prior to performing clearing, grubbing, and/or stripping, install surface-water management and erosion controls specified in Section 02270.

3.03 CLEARING AND GRUBBING

- A. Perform clearing and grubbing to the limits identified by the Construction Manager.
- B. Perform clearing and grubbing as separate activities.
- C. In impacted areas identified by the Construction Manager, perform clearing of materials, 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 material as possible. Cleared material smaller than 1 inch in maximum dimension need not be chipped. Handle chipped material as non-impacted, unless otherwise directed by the Construction Manager.

- F. Stockpile cleared and grubbed materials in the designated stockpile area as shown on the Construction Drawings or as directed by the Construction Manager. Stockpiling cleared and grubbed materials shall be as specified in Section 02200.
- G. After completion of grubbing, fill and compact depressions outside the grading limits. Material type and degree of compaction shall meet the requirements specified for compacted fill in Section 02200. Match fill elevation to the surrounding grade and grade to drain.

3.04 STRIPPING

- A. Perform stripping to the limits identified by the Construction Manager. Transport stripped material to the Contractor's Work area and stockpile in accordance with the approved Contractor's Earthwork Work Plan in Section 02200. 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 topsoil separately from roots, grass, and other organics. These latter materials may be stockpiled with non-impacted grubbing material. Stockpiling shall be as specified in Section 02200.
- 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 stockpiles 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 area in accordance with Section 02270. Stabilize in accordance with Section 02930.

3.05 SURVEY 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, surface-water control, excavation, dewatering, stockpiling, subgrade preparation, compacted fill, and clayey rockfill.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02050 - Demolition
- B. Section 02100 - Surveying
- C. Section 02110 – Clearing, Grubbing, and Stripping
- D. Section 0215 – Trenching and Backfilling
- E. Section 02230 – Road and Parking Area Restoration
- F. Section 02270 – Surface-Water Management and Erosion Control
- G. Section 02271 – Riprap
- H. Section 02605 – High Density Polyethylene (HDPE) Pipes and Fittings
- I. Section 02714 – Geotextiles
- J. Section 02721 – Culverts
- K. Section 02930 – Vegetation
- L. Section 03100 – Concrete
- M. Part 6 – Statement Work
- N. Part 8 – Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
1. ASTM D 422. Standard Test Method for Particle-Size Analysis of Soils.
 2. ASTM D 698. Test Method for Laboratory Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 3. ASTM D 2487. Standard classification of Soils for Engineering Purposes (Unified Soil Classification System).
 4. ASTM D 1556. Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 5. ASTM D 2216. Standard Test Method for Laboratory Determination of Water (Moisture) content of Soil and Rock by Mass.
 6. ASTM D 2922. Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 7. ASTM D 2937. Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
 8. ASTM D 3017. Standard Test Methods for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 9. ASTM D 4318. Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 10. ASTM D 4643. Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method

1.04 SUBMITTALS

- A. Within 15 calendar days from Notice to Proceed, submit to the Construction Manager for review Contractor's Earthwork Work Plan. The Contractor's Earthwork Work Plan shall include, at a minimum:
1. list of equipment and description of construction methods proposed for the scope specified in this Section and in Sections 02050, 02110, 02230, 02270, 02605, 02714, 023721, 02930, and 03100;
 2. location of equipment services area and fueling station;
 3. plan for coordination of survey requirements for the site work;
 4. plan for locations and establishment and maintenance procedures for soil stockpile areas;
 5. plan for coordination of site work activities with surface-water management and erosion control measures;
 6. schedule for earthwork activities;
 7. borrow requirements;
 8. plan for coordination of dust control including location, type, and size of water tank;
 9. plan and measures for cold weather (below 32 degrees Fahrenheit) site work activities.
 10. plan for installation and maintenance of construction safety fence;
 11. location of construction laydown area;
 12. location of stockpiles for material generated from clearing, grubbing, and stripping operations;

13. location of separate stockpiles for impacted and non-impacted material generated from excavation and trenching activities;
14. layout and typical cross sections of roads within the Contractor's work area;
15. construction site access and haul road layout;
16. construction utilities layout including construction power and water;
17. description of methods for installation and removal of sheeting and bracing for trenching including methods to fill voids left from removal of sheeting and bracing;
18. plan for coordination of the Contractor's Earthwork Work Plan with the Contractor's Quality Assurance Work Plan specified in Part 6 of Contract Documents.

1.05 EXISTING CONDITIONS

- A. Existing site surface and subsurface conditions, based on available site data, are indicated on the Construction Drawings, Reference Drawings, and specified in this Section.
- B. Verify existing conditions as specified in Section 02100.
- C. The approximate locations of all known underground and above ground utility lines 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. Groundwater 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.

1.06 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Obtain material for use as compacted fill from piping system excavation and trenching, and from stockpiles and borrow areas shown on the Construction Drawings, and other areas identified by the Construction Manager.

- B. Suitable fill material for compacted fill and trench backfill shall be free of debris, foreign objects, large rock fragments, organics, and other deleterious materials. Visible rock particles shall be maximum dimension of 5 inches for nominal 8-inch. (± 1 -inch) thick loose lifts and 3 inches for nominal 4-inch (± 1 -inch) thick loose lifts. Fill material shall conform to GC, SC, SM, ML, CL, or CH according to the Unified Soil Classification System (per ASTM D 2487).
- C. Clayey rockfill: The reject material from clay screening operations may be substituted for compacted fill material below base aggregate elevations in the road, and other fill areas. Use of clayey rockfill as specified in this Section shall be approved by the Construction Manager.
- D. Construction safety fence for activities with duration less than 30 calendar days shall be orange, high density polyethylene, 4-foot height, opening size approximately 4 inches by $\frac{1}{2}$ inch, minimum tensile strength of 2000 pounds per foot of width
- E. Contractor shall furnish and install signs for construction safety fence in accordance with Part 8 of the Contract Documents.

2.02 EQUIPMENT

- A. Furnish equipment necessary to perform work specified in this Section.

PART 3 EXECUTION

3.01 GENERAL

- A. Dust control shall be in accordance with Part 6 of the Contract Documents.
- B. Install surface-water management and erosion controls as specified in Section 02270.

3.02 SITE PREPARATION

- A. Install construction safety fence at the construction limits in accordance with the Contractor's Earthwork Work Plan and Part 8 of the Contract Documents. Relocate construction safety fence as approved by the Construction Manager. Provide construction safety fence, signs, and barricades around trenches and excavated areas as specified in Part 8 of the Contract Documents.
- B. Maintain and repair construction safety fence for the duration of the Contract. Fencing shall be maintained so as to minimize vertical sagging.
- C. Install, maintain, and inspect surface-water management and erosion controls specified in Section 02270.

- D. Prior to earthwork activities, perform clearing, grubbing, and stripping in accordance with Section 02110.
- E. Construction roads and parking area restoration in accordance with the Construction Drawings and Section 02230.
- F. Locate existing manholes, catch basins, drop inlet structures, monitoring wells, piezometers, lysimeters, utilities, and other subsurface structures, in the work area. Protect and maintain or abandon these structures and utilities during excavation and grading activities as indicated on the Construction Drawings or as directed by the Construction Manager.

3.03 SURFACE-WATER MANAGEMENT AND EROSION CONTROL

- A. Install surface-water management and erosion controls in and around work areas to control runoff and erosion and to prevent surface-water runoff into excavations in accordance with Section 02270.

3.04 EXCAVATION

- A. Excavate designated areas to subgrade elevations or excavation limits shown on the Construction Drawings. Stockpile excavated material in the Contractor Work Area for use in subsequent construction as specified by this Section or at location approved by the Construction Manager. Prepare the subgrade in accordance with this Section.
- B. Excavate and remove material within the excavation limits, including rock encountered, regardless of type, character, composition, and condition.
- C. Blasting, including use of explosives or explosive devices, shall not be permitted.
- D. 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 On-Site Disposal Facility (OSDF). The Construction Manager will direct the Contractor to separately stockpile any material not meeting the OSDF WAC. The Construction Manager will assume responsibility for management and disposal of this material. Stockpile excavated impacted material meeting the OSDF WAC in accordance with the Contractor's Earthwork Work Plan.
- E. Minimize sloughing and caving of the excavation. Over-excavate and fill areas of the excavation that caves or sloughs with compacted fill in accordance with this Section.
- F. Do not remove soil from the site or dispose of soil included in this Contract except as approved in writing by the Construction Manager.

- G. Perform activities in such a manner that hauling equipment transporting non-impacted materials do not operate on roads used to haul impacted material.
- H. Stabilize disturbed areas in accordance with Section 02930.

3.05 EXCAVATION DEWATERING

- A. Anticipate seepage of groundwater into, and accumulation of surface-water runoff in excavations. Manage groundwater and surface-water runoff in excavations in accordance with this Section.
- B. Collect water that accumulates in the excavation in a toe drain, or other suitable sump, and pump to the former production area storm drain control system, the existing interim leachate transmission system, or other location(s) as 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 Contractor's work area. Locate stockpiles in accordance with the approved Contractor's Earthwork Work Plan specified in this Section.
- 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 this Section.
- C. Construct stockpiles on grades 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 or placed in the stockpile.
- D. Install surface-water management and erosion control measures at the stockpile areas in accordance with Section 02270. Stabilize stockpiles in accordance with Section 02930.

3.07 SUBGRADE SURFACE PREPARATION

- A. Subgrade material shall consist of soil relatively free of debris, foreign objects, organics, and other deleterious material.

- B. 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 Section. 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 parking area restoration alignments to at least 98 percent of the standard Proctor maximum dry density (ASTM D 698).
- C. 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 this Section.
- D. In excavations or other areas where water accumulates, implement measures to remove the water in accordance with this Section. Maintain the subgrade surface to be free of standing water and in a firm condition by proofrolling the surface using equipment approved by the Construction Manager. Maintain dewatered areas in this condition until overlying construction is complete.
- E. Manage surface-water runoff as specified in Section 02270.

3.08 COMPACTED FILL

- A. Use fill material that meets the requirements of this Section. Place the fill to the limits and grades shown on the Construction Drawings.
- B. Place compacted fill material on surfaces which are free of debris, branches, vegetation, mud, ice, or other deleterious materials.
- C. Place compacted 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 visible rock particles with a maximum dimension larger than 5 inches for nominal 8-inch (\pm 1 inch) thick loose lifts. For nominal 4-inch (\pm 1-inch) thick loose lifts, the maximum rock particle size shall be 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 dozer.
- 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 or raking. Soil clumps, consisting of an agglomeration of 3-inch clods, or smaller, will not be considered a clod for purpose of this Section.

- H. Except as specified in this Section, compact fill material in each lift to at least 95 percent of its Standard Proctor maximum dry density (ASTM D 698).
- I. Moisture condition the soil as needed to achieve the compaction requirements of this Section. Use a water spraying system for wetting. During wetting or drying, regularly disk, 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 or place fill material on frozen subgrade or previously placed compacted fill.
- K. Do not compact fill material at temperatures below 32 degrees Fahrenheit, unless authorized in writing by the Construction Manager.
- L. Do not place fill during periods of precipitation. Placement may occur during periods of misting or drizzle but only if authorized by the Construction Manager.
- M. Rework compacted fill that does not meet the required compaction.

3.09 CLAYEY ROCKFILL

- A. Visible rock particles with maximum dimension greater than 12 inches shall be removed from the clayey rockfill and stockpiled for future use in areas as designated by the Construction Manager. Clayey rockfill shall be placed in maximum 12-inch thick loose lifts and compacted with a minimum of 4 passes of a Caterpillar 815 compactor or approved equal. Final lift surface of compacted rockfill shall be proofrolled as specified in this Section. Any compacted clayey rockfill material exhibiting excessive pumping or rutting (rut greater than 2 inches in depth) due to wet material or insufficient compaction shall be dried and recompact or removed from the fill. Clayey rockfill shall be used only as allowed by this Section or as otherwise approved in writing by the Construction Manager

3.10 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will perform conformance testing on compacted fill materials to establish compliance with this Section: The conformance testing to be performed and the minimum testing frequencies shall be:
 1. Particle-size analysis (sieve only) (ASTM D 422) at 1 test per 5,000 yd³;
 2. Atterberg Limits (ASTM D 4318) at 1 test per 5,000 yd³;
 3. Moisture content (ASTM D 2216 or ASTM D 4643) at 1 test per 5,000 yd³;
 4. Soil classification (ASTM D 2487) at 1 test per 5,000 yd³; and
 5. Standard Proctor compaction (ASTM D 698) and 1 test per 5,000 yd³.

- B. CQC Consultant will perform testing on compacted fill lifts to establish compliance with this Section. The performance testing to be performed and the minimum testing frequencies shall be as follows:
1. for compaction around each valve house and east of each valve house around the RLCS, LCS, and LDS piping:
 - a. in-situ moisture (ASTM D 3717) at 5 tests per area per lift; and
 - b. in-situ density (ASTM D 2922) at 5 tests per area per lift;
 2. prepared subgrade for the LTS pipe line:
 - a. in-situ moisture (ASTM D 3017) at 1 test per 500 ft² per lift; and
 - b. in-situ density (ASTM D 2922) at 5 tests per 500 ft² per lift; and
- C. If CQC Consultant's performance tests indicate that any portion of the compacted fill does not meet the requirements of this Section, the Construction Manager will delineate the extent of the nonconforming area. Rework the nonconforming area until it meets the requirements of this Section.
- D. CQC Consultant will monitor proofrolling of compacted clayey rockfill final lift surface and provide documentation to the Construction Manager.
- E. Contractor shall allow CQC Consultant to perform testing specified in this Section.

3.11 SURVEY CONTROL

- A. Survey the locations, limits and grades of excavations, stockpiles, prepared subgrade, compacted fill, and compacted clayey rockfill in accordance with Section 02100.

3.12 TOLERANCES

- A. Perform the earthwork construction to within ± 0.3 feet of the grades indicated on the construction drawings except for the roads for which earthwork construction shall be within -0.3 to $+0.1$ feet of the grades indicated.

[END OF SECTION]

SECTION 02215
TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes trenching, and backfilling including embedment fill 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 02605 - High Density Polyethylene (HDPE) Pipes and Fittings
- E. Section 02721 - Culverts
- F. Part 6 – Statement of Work
- G. Part 8 – Environmental Health & Safety/Training Requirements

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. Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (680 kN-m/m³))
 - 3. ASTM D 2487. Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 4. ASTM D 2922. Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

5. ASTM D 3017. Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- 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.

1.04 SUBMITTALS

- A. For each source of embedment fill material, submit the following to the Construction Manager for review within 30 calendar days from Notice to Proceed:
 1. the source of the embedment fill material;
 2. written certification and test results conducted in accordance with ASTM C 136 and ASTM D 2487; and
 3. a 50-pound representative sample of the embedment fill for visual examination and testing, if necessary.
- B. Provide a list of equipment, description of construction methods for trenching and backfilling, and other required information for trenching and backfilling in the Contractor's Earthwork Work Plan specified in Section 02200.

1.05 EXISTING CONDITIONS

- A. Existing site surface and subsurface conditions, based on available site data, are indicated on the Construction Drawings and Reference Drawings.
- B. Verify the existing conditions as specified in Section 02100.
- 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. Groundwater 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.

1.06 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Furnish natural sand embedment fill material for HDPE pipe meeting the gradation requirements of Section 703.06 of the Ohio DOT Specifications unless otherwise indicated on the Construction Drawings or specified in this Section. Gradation testing shall be in accordance with ASTM C 136.
- B. Furnish trench backfill material for HDPE pipe and valve houses that meets the material requirements for compacted fill specified in Section 02200. Obtain backfill material from piping system excavation, trenching, or existing stockpiles shown on the Construction Drawings, or as directed by the Construction Manager.
- C. Furnish material for compacted fill in accordance with Section 02200.
- D. Furnish a minimum 4-inch wide plastic underground marker tape with suitable warning legend to mark all HDPE pipes and any other underground utilities as shown on the Construction Drawings.
- E. Furnish 14-gauge insulated stranded copper wire as shown on the Construction Drawings.

2.02 EQUIPMENT

- A. Furnish equipment necessary to perform the work specified in this Section.
- B. Furnish hand compaction equipment such as walk-behind padfoot compactors, hand tamper, or vibratory plate compactors for compaction in areas inaccessible to large compaction equipment.

PART 3 EXECUTION

3.01 GENERAL

- A. Verify existing conditions as specified in Section 02100.
- B. Review existing site utility drawings and identify and stake existing above and below ground utilities in vicinity of trenching as approved by Construction Manager.
- C. In areas of trenching and backfilling, maintain and protect existing above and below ground utilities.
- D. Do not damage or disturb survey benchmarks, finished construction, and existing utilities and structures.
- A. Dust control for trenching and backfilling shall be in accordance with Part 6 of the Contract Documents.

3.02 TRENCHING

- A. Trench for placement of pipes and valve houses to the depths and minimum dimensions shown on the Construction Drawings. Stockpile excavated material from trenching in accordance with Section 02200.
- B. Use sheeting and bracing or other method approved by the Construction Manager where necessary to maintain the safety and stability of slopes and trenches and to protect adjacent utilities and structures. Satisfy applicable local, state, and federal requirements for slope and trench sheeting and bracing, including requirements of the 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 in accordance with Section 02200.
- C. Protect and maintain the trench bottom. Remove rock fragments or raveled materials that collect on the trench bottom. Backfill any overexcavation with compacted fill in accordance with Section 02200. Excavate any soft subgrade encountered at the trench bottom and backfill to subgrade elevation with compacted fill as specified in Section 02200.

- D. Excavate valve houses to a minimum of 6 inches below foundation grades and backfill with compacted fill to the foundation grades shown on the Construction Drawings. Compacted fill shall be in accordance with Section 02200.
- E. Where trenches will be excavated in fill areas, perform trenching only after compacted fill has reached at least 12 inches above top of the pipe.
- F. Limit the maximum length of open trench to 200 feet in advance and 200 feet behind pipe installation unless otherwise approved by the Construction Manager.
- G. Continuously dewater trenches and valve house excavations. Perform dewatering 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 trench bottom or sideslope; Remove materials that are frozen, wet or soft as specified in this Section.
3. Do not disturb or damage piping in trench during backfilling.
4. Do not use compaction equipment which exerts greater than 10 pounds per square inch ground pressure over piping that is covered by less than 12 inches of backfill material.

B. Placement of embedment fill for pipes and culverts:

1. Place embedment fill in 7-inch (± 1 -inch) thick loose lifts to the elevation of the bottom of the pipe or culvert.
2. Compact embedment fill with a minimum of 4 passes of a vibratory plate compactor prior to placing pipe.
3. Place pipe or culvert on top of the compacted embedment fill.
4. Install 14-gauge insulated stranded copper wire to top of pipe as shown on the Construction Drawings. Use cable tie-wraps at 5-foot intervals to tie copper wire to pipe prior to backfilling.
5. For pipes 12 inches in diameter or less, place additional embedment fill on the sides and gently hand tamp the fill around the sides as needed to ensure that intimate contact between the pipe and the pipe embedment fill is maintained below the spring line of the pipe. Continue placing 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 walk-behind pad-foot compactor, hand tamper or vibratory plate compactor, as appropriate. Place embedment fill above the top of pipe to a depth of 12 inches in

- two 7-inch \pm 1-inch thick loose lifts. Compact each lift of embedment fill with a minimum of 4 passes of a walk-behind pad-foot compactor, hand tamper or vibratory plate compactor, as appropriate.
6. For pipes or culverts greater than 12 inches in diameter, place embedment fill in 7-inch \pm 1-inch thick loose lifts to the limits shown on the Construction Drawings. Compact each lift with a minimum of 4 passes of a vibratory plate compactor.
- C. Placement of trench backfill material for pipes and culverts:
1. After placement and compaction of embedment fill to the limits shown on the Construction Drawings, place the first lift of backfill material in a 12-inch thick loose lift. Place subsequent lifts of trench backfill material in 8-inch \pm 1-inch thick loose lifts.
 2. Compact backfill material in each lift to at least 95 percent of its standard Proctor maximum dry density (ASTM D 698) as specified in Section 02200.
- D. Placement of trench backfill material for valve houses:
1. Place trench backfill material within 3 feet radius of valve houses or as directed by the Construction Manager.
 2. Place backfill material in 8-inch \pm 1-inch thick loose lifts.
 3. Compact backfill material in each lift to at least 95 percent of the standard Proctor maximum dry density (ASTM D 698) as specified in Section 02200.
- E. Place underground marker tape in trench backfill 12 inches below finished grade above all HDPE pipes, electrical conduits, control cables, and underground utilities.

3.04 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will perform conformance testing on the embedment fill and trench backfill materials to establish compliance with this Section and Section 02200, as applicable. Conformance testing for trench backfill material shall be same as for compacted fill specified in Section 02200. The conformance testing and minimum testing frequencies for embedment fill material shall be:
1. particle-size analysis (ASTM C 136) at 1 test per 1,000 yd³; and
 2. soil classification (ASTM D 2487) at 1 test per 1,000 yd³.
- B. CQC Consultant will perform performance testing on the compacted trench backfill and compacted fill to establish compliance with this Section and Section 02200, as applicable. Performance testing for compacted fill shall be as specified in Section 02200. The performance testing and minimum testing frequencies for compacted trench backfill shall be:

1. in-situ moisture (ASTM D 3017) at 1 test per 100 lineal feet per lift; and
 2. in-situ density (ASTM D 2922) at 1 test per 100 lineal feet per lift.
- C. Contractor shall allow CQC Consultant to perform testing specified in this Section.

3.05 SURVEY CONTROL

- A. Survey the locations, limits, and grades of the compacted backfill in accordance with Section 02100.
- B. Survey the locations, limits, and grades of pipes and conduits, in accordance with Section 02100.

3.06 TOLERANCES

- A. Trench bottom shall be within 0 to +0.2 feet of the depth indicated on the Construction Drawings.
- B. Embedment fill for pipes, conduits, and culverts shall be placed within 0 to +0.2 feet of the depth indicated on the Construction Drawings.

[END OF SECTION]

SECTION 02270**SURFACE-WATER MANAGEMENT AND EROSION CONTROL****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes use of silt fence, erosion mat, construction entrances, diversions, ditches, channels, berms, and sedimentation basins for surface-water management and erosion control.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 - Surveying
- B. Section 02110 - Clearing, Grubbing, and Stripping
- C. Section 02200 - Earthwork
- D. Section 02271 - Riprap
- E. Section 02721 - Culverts
- F. Section 02930 - Vegetation
- G. Surface-Water Management and Erosion Control (SWMEC) Plan
- H. Part 6 - Statement of Work
- I. Part 8 - Environmental Health & Safety/Training Requirements

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. Submit to the Construction Manager for review within 15 calendar days from Notice to Proceed Contractor's Surface-Water Management and Erosion Control (SWMEC) Work Plan that shall be in accordance with Rainwater and Land Development [1996] and the Surface-Water Management and Erosion Control Plan and shall include but is not limited to the following:
 - 1. descriptions of the surface-water management and erosion control measures to be implemented throughout the duration of the Contract;

2. a list of equipment, description of methods, and other required information for installing and maintaining surface-water management and erosion control measures as specified;
 3. drawings showing, in plan view, the location and sequencing of the surface-water management and erosion control measures and other required information for installation of surface-water management and erosion control measures;
 4. drawings showing details of the surface-water management and erosion control measures; and
 5. calculations supporting the use of surface-water management and erosion control measures.
- B. 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 for products used for surface-water management and erosion control measures; and
 2. Certification from the supplier or Manufacturer that products meet the product requirements of this Section.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

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 nonwoven fabric consisting of long chain polymeric filaments or polyester yarns;
 2. be inert to chemicals commonly found in soils and to hydrocarbons;
 3. be resistant to mildew, rot, insects, and rodent attack; and
 4. have fabric and fence post properties and minimum dimensions in accordance with this Section and Rainwater and Land Development [1996].

2.02 EROSION MAT

- A. furnish erosion mat as manufactured by American Excelsior Company, Curlex II matting or approved equal.

- B. Furnish erosion mat that will resist degradation for a minimum 6-month period after installation.
- C. Furnish erosion mat capable of resisting unit shear stresses generated by water flowing across its upper surface of 1.55 pounds per square foot.

2.03 STABILIZATION

- A. Materials for stabilization including interim vegetation and crusting agent shall be as specified in Section 02930.
- B. Riprap shall be as specified in Section 02271.

2.04 OTHER MATERIALS

- A. Materials for berms shall be as specified for compacted fill in Section 02200.
- B. Construction entrances shall be in accordance with Rainwater and Land Development [1996].
- C. Diversions shall be in accordance with Rainwater and Land Development [1996].
- D. Materials for other surface-water management and surface water management and erosion controls shall be in accordance with Rainwater and Land Development [1996].

2.05 EQUIPMENT

- A. Furnish equipment necessary to perform work specified in this Section.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Silt Fence
 - 1. Install silt fence in accordance with, and at the locations required by the approved Contractor's SWMEC Work Plan.

- B. Erosion Mat
1. Provide erosion mat at the locations shown approved Contractor's SWMEC Work Plan. Begin installation in an area within 48-hours after seeding has been completed
 2. Place erosion mat on a prepared surface that is free of deleterious vegetation, trash, ruts, and rocks.
 3. Overlap adjacent erosion mats in a manner such that they are shingled in the direction of water flow.
 4. Install and staple erosion mats in accordance with the Manufacturer's recommendations.
- C. Apply crusting agents in accordance with Section 02930. Areas of crusting agent application shall be approved in advance by the Construction Manager.
- D. Stabilize and vegetate disturbed areas as specified in Section 02930.
- E. Construct channels, ditches and berms as shown on the Construction Drawings and in accordance with the approved Contractor's SWMEC Work Plan. Earthwork for channel, ditches, and berms shall be as specified in Section 02200.
- F. Install construction entrance in accordance with the approved Contractor's SWMEC Work Plan.
- G. Install additional surface-water management and surface-water management and erosion controls as required by Rainwater and Land Development [1996].

3.02 ADDITIONAL REQUIREMENTS

- A. Prevent the run-off of polluting substances such as silt, clay, fuels, oils, and contaminated soils into water supplies and surface waters.
- 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 surface-water management and erosion control measures as needed throughout the duration of the Contract in accordance with the approved Contractor's SWMEC Work Plan.

3.04 INSPECTIONS

- A. Inspect surface-water management and erosion control measures including sedimentation basins to evaluate their effectiveness and need for maintenance. Any required repairs to the surface-water management and erosion control measures and existing sedimentation basins shall be initiated upon discovery, but no later than 24 hours after discovery. Inspections shall occur, at a minimum, at the following frequencies:
1. weekly;
 2. daily after each rain event exceeding 0.5 inches; and
 3. at least daily during prolonged rainfall events.
- B. Records of inspections shall be kept on file on-site by Contractor and shall be submitted monthly to the Construction Manager. The records of inspection shall include the following:
1. summary of the scope of the inspection;
 2. name of inspector;
 3. inspection date;
 4. purpose of the inspection (i.e., regular weekly, following storm, etc.);
 5. observations relative to performance of the erosion/sediment control measures;
 6. any necessary corrective actions;
 7. corrective actions completed and their performance; and
 8. inspection location.

[END OF SECTION]

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

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

1.02 RELATED SECTIONS AND PLANS

- A. Section 02205 - Demolition
B. Section 02100 - Surveying
C. Section 02200 - Earthwork
D. Section 02215 - Trenching and Backfilling
E. Section 03100 - Concrete
F. Part 6 - Statement of Work
G. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of the American Society for Testing and Materials (ASTM) Standards:
1. ASTM D 638. Standard Test Method for Tensile Properties of Plastics.
 2. ASTM D 790. Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 3. ASTM D 1238. Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
 4. ASTM D 1248. Standard Specification for Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable.

5. ASTM D 1505. Standard 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.
 41. 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.
- B. Latest version of the American National Standards Institute (ANSI) Standard:
1. ANSI B16.1. Standard Specifications for Cast-Iron Pipe Flanges and Flange Fittings.
- C. "Committee Report: Design and Installation of PE Pipe", Journal of American Water Works Association (AWWA), Vol 91, Issue 2, 1999, pp. 92 - 100 [AWWA, 1999].

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 HDPE pipes, support centralizers, fittings, supports, and appurtenances;
 2. a list of materials to be furnished with the names of the suppliers and the delivery dates of the materials to the site;
 3. procedures to be used for hydrostatic and pneumatic testing of the dual containment pipes and fittings;
 5. origin (resin supplier's name, resin production plant) and identification (brand name, number) of the polyethylene resin used;
 6. 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;
 7. pipe joining equipment and procedures for butt-fusion welding (including plate temperature and fusion pressures); and

8. pipe welding training plans and certification (pipe welding training shall be conducted on-site and shall be observed by CQC Consultant and Fluor Fernald personnel; and shall be on the actual fusion equipment to be used for production welding).
- 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 pipes, fittings, supports, and appurtenances.
 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 Contract, and to include certification that no reclaimed polymer is added to the resin during the manufacturing of the HDPE products to be used for this project; and
 2. results of tests specified in Table 02605-1 of this Section conducted by the Manufacturer to verify the quality of the resin used to manufacture the HDPE products assigned to the project.
 - C. Submit to the Construction Manager for review at least 30 calendar days prior to installation of any material specified in this Section, Manufacturer's written certification of compliance with this Section 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 pipes, fittings, and appurtenances:
 - a. dimensional check; and
 - b. material quality check.
 - D. Submit to the Construction Manager for review at least 14 calendar days prior to installation documentation of training and certification of personnel qualified for performing HDPE pipe joining operations as specified in this Section.
 - E. Submit to Construction Manager within one week after performance of work, results of all tests specified in this Section.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 HDPE COMPOUND**

- A. Furnish HDPE 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 meeting the specified 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 PPI Rating of PE 3408. Furnish material meeting the specified property values listed in Table 02605-2.
- C. Furnish HDPE welding rod material compatible with HDPE pipe and fittings specified in this Section.

2.02 HDPE PIPES, FITTINGS, AND APPURTENANCES

- A. Unless otherwise shown on the Construction Drawings, furnish HDPE pipe and fittings that have a maximum Standard Dimension Ratio (SDR) of 11 and conform to ASTM F 714.
- B. Furnish HDPE pipes in standard laying lengths of nominal 40 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.

2.04 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 pipe and fittings with the carrier pipe/fitting ends extending 6 inches beyond the containment pipe/fitting ends. Provide pipe in nominal lengths of 40 feet, and allow for field adjustment of pipe length.
- C. Furnish pre-fabricated dual containment fittings with the carrier fitting factory installed within the containment fitting, with all necessary support centralizers installed for piping to be used between the On-Site Disposal Facility (OSDF) cells and the valve houses as shown on the Construction Drawings.
- D. Fabricate all carrier to carrier and containment to containment joints using thermal butt-fusion procedures recommended by the Manufacturer and as required by this Section. Electrofusion couplings are not permitted. 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.
- E. For pipe designated as centralized (i.e., LDS, RLCS, and LCS only), as shown on the Construction Drawings, 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. For all other dual containment HDPE Leachate Transmission System (LTS) pipe, centralizers are not required as shown on the Construction Drawings.

2.05 IDENTIFICATION

- A. Continuously indent print or other permanent method of identification per manufacturer's standard 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.

2.06 EMBEDMENT FILL AND BACKFILL MATERIALS

- A. Furnish embedment fill materials in accordance with Section 02215.
- B. Furnish trench backfill materials in accordance with Section 02215.

PART 3 EXECUTION**3.01 GENERAL**

- A. Perform HDPE pipe joining operations with trained and certified personnel as specified in this Section. Training and certification shall be provided by pipe manufacturer on-site (FEMP site) prior to start of activity. Fluor Fernald personnel and CQC Consultant shall be present during training.

3.02 HANDLING OF 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 measures required by the Manufacturer. Pipe ends shall be capped or protected to prevent nesting or entrance of foreign matter until pipe is used in field fabrication.
- 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 or non-conforming pipes and fittings.
- E. Whenever pipe laying is not actively in progress, close the open ends of all installed pipes using watertight plugs.

3.03 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. Perform trenching and backfilling of all installed pipe, fittings, and appurtenances in accordance with Section 02215.
5. Do not lay pipe until the Construction Manager has approved the bedding conditions.
6. Install HDPE pipe and fittings in accordance with the Manufacturer's recommendations and the requirements of this Section.
7. Provide all necessary adapters and/or fittings required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.
8. Install 14-gauge insulated stranded copper wire to top of pipe as shown on the Construction Drawings and as specified in Section 02215.
9. Install pipe and fittings to the lines and grades shown on the Construction Drawings.
10. Place and compact embedment fill and trench backfill material as shown on the Construction Drawings and in accordance with Section 02215.

B. Install marker tape in accordance with Section 02215 and shown on the Construction Drawings.

C. Perform testing of all installed HDPE pipe, fittings, and appurtenances in accordance with this Section.

3.04 HDPE PIPE JOINTS, FITTINGS, AND APPURTENANCES CONNECTIONS

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

B. Notify the Construction Manager at least one day prior to any pipe joining to allow scheduling of monitoring by CQC Consultant. All pipe joining shall be performed in the presence of the CQC Consultant unless otherwise authorized in writing by the Construction Manager.

- C. 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 (below 40°F) or hot (above 104°F) weather joining, use 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.
- D. Prior to joining, clean the joint area to be free of moisture, dust, dirt, debris of any kind, and foreign material.
- E. Joining equipment shall be approved for the applicable field joining process which is thermal butt-fusion. Fusion apparatus shall be automated devices equipped with gauges giving the applicable temperatures and pressures.
- F. 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. CQC Consultant shall observe trial joining and shall visually check joining integrity including bead height, and that heat fusion equipment is meeting conditions recommended by the pipe manufacturer including, but not limited to, temperature, alignment, and interfacial pressure.
- a. The bent strap test specimen is prepared from the trial butt fusion spool after it has been allowed to cool to ambient temperature. A test strap that is at least 6" or 15 pipe wall thicknesses long on each side of the fusion, and about 1" or 1.5 wall thicknesses wide is cut out of the trial fusion pipe. The strap is then bent so the ends of the strap touch. Any disbondment at the fusion is unacceptable, and indicates poor fusion quality. If failure occurs, fusion procedures and/or machine set-up should be changed, and a new trial fusion and bent strap test specimen shall be prepared and tested. Field fusion should not proceed until a test joint has passed the bent strap test.
- G. Join HDPE carrier and containment pipe sections using butt-fusion procedures. Fabricate joints in compliance with ASTM D 2657, ASTM F 1055, the Manufacturer's recommendations, and the requirements of this Section.

- H. 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 Schedule 40 carbon steel lap joint flange. Outside diameter and drillings shall comply with ANSI B 16.1.
 3. Use Type Schedule 40 carbon steel flange bolts, nuts and washers that meets the requirements of ANSI B 16.1. Lubricate bolt threads prior to attaching nuts. Tighten bolts to a torque of 100 ± 5 foot-pounds.
- I. Bolt HDPE flange adapter and Schedule 40 carbon 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 at 1 and 4 hours after initial tightening.

3.05 FIELD TESTING AND INSPECTION

- A. Notify the Construction Manager a minimum of 24 hours in advance of any pipe testing or pipe inspection.
- B. Provide testing apparatus, including pumps, hoses, gauges with pressure relief valves, taps, plugs, drains, temporary connections, and fittings to perform testing in accordance with this Section.
- C. Test gauges shall be calibrated within one year of date of test. Calibration shall be traceable to national or industry standards.
- D. HDPE Pipe and Fittings Hydrostatic Testing:
1. Pressure test installed HDPE solid wall, carrier, and containment pipe with a minimum 6 inches of initial backfill placed over the containment pipe. Leave joints, fittings, and flanged connections of containment pipe uncovered so that they can be visually inspected for any leaks.
 2. Perform tests in the presence of the CQC Consultant and in accordance with the detailed test procedure submitted by the Contractor in accordance with this Section. Containment pipe testing shall not proceed until carrier pipe has been successfully tested.
 3. Test HDPE solid wall carrier pipe at 60-psig internal pressure. Test carrier pipe in accordance with the approved Contractor's testing procedure and as specified in this Section. Containment pipe shall be at atmospheric pressure when testing carrier pipe.
 4. Test HDPE containment pipe at 15-psig internal pressure. Test containment pipe in accordance with the approved Contractor's testing procedure and as specified

- in this Section. Carrier pipe shall be at atmospheric pressure when testing containment pipe.
5. Initial expansion phase: Allow the pipe to stand at the specified internal pressure until stabilization is reached. Add sufficient make-up water to the pipe four times at one-hour intervals to return to the test pressure. Stabilization is achieved if there is no further change in pressure over a one-hour period. The initial expansion phase shall not exceed 4 hours.
 6. Actual test phase: Start the test after the fourth addition of make-up water in the initial expansion phase. Perform test for 1, 2, or 3 hours. At the end of the test phase, add make-up water to return the pipe pressure to the test pressure. A passing test is considered to require less make-up water than listed in Table 02605-3 and no visible leaks.
 7. Alternative Test: Perform initial expansion phase test at 70-psig internal pressure for carrier pipe, and 25-psig internal pressure for containment pipe. Maintain test pressure over a 4-hour period as specified in this Section. Drop test pressure by 10 psi in accordance with recommendations of AWWA [1999]. If the pressure remains steady (i.e., within 5 percent of the target value), for an hour, and there are no visible leaks, passing results have been achieved.
 8. Identify any leaks, remove the water, and make repairs to the pipe. Retest the pipe until passing results are achieved.
 9. No final hydrostatic testing of HDPE pipe stub-outs for the RLCS, LCS, LDS in Valve Houses 7 and 8 shall be performed.
- E. HDPE Pipe and Fittings Pneumatic Testing:
1. Contractor shall perform pre-installation above ground and final air pressure testing (at 15-psig internal pressure) for the RLCS, LCS, and LDS pipes for Cells 1, 2, and 3. LTS carrier pipe between Valve House 6 & 7, 7 & 8 and Valve House 8 and Central Valve House shall be air pressure tested. Pneumatic testing shall be performed as follows:
 - a. Gradually increase the pressure to one-half of the full pneumatic test pressure. Pause for 15 minutes to allow the pipe strains to become somewhat equalized and to detect any possible major leaks by means of soap bubbles or monitoring of test gauge.
 - b. Gradually increase the pressure to the full pneumatic test pressure. Hold the pressure for 15 minutes.
 - c. If the gauge pressure does not drop below the full pneumatic test pressure, and no leaks are detected, the pipe shall be considered to have passed the pressure/leak test.

F. 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. Following completion of final testing and installation of the trench backfill, inspect the LTS, LDS, LCS, and RLCS carrier pipes using a video camera for the completed piping systems in the presence of the CQC Consultant. Provide the completed inspection video to the CQC Consultant.
3. Repair any pipe sections where greater than 4 percent pipe diameter deflection from vertical is observed.

G. 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 this Section.

3.06 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will be present during all HDPE pipe joining and performance testing specified in this Section to evaluate compliance with this Section.
- B. If the performance testing and evaluation indicates that any portion of the work does not meet the requirements of this Section, the Construction Manager will delineate the extent of the nonconforming work.

3.07 SURVEY CONTROL

- A. Survey location and elevation of the pipes, and appurtenances in accordance with Section 02100.

- B. Survey the top of HDPE containment pipe on no greater than 25-foot centers and at valve house and control valve house inlets and outlets in accordance with Section 02100.

3.08 TOLERANCES

- A. Install HDPE pipes to within 0.1 feet of bottom of pipe elevations of the containment pipes as indicated on the Construction Drawings.
- B. Provide positive slope of gravity lines at all locations to within 10 percent of the values indicated on the Construction Drawings.

TABLE 02605-1

**REQUIRED HDPE 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 ²	110,000	ASTM D 790
Tensile Strength	4 or 5	minimum	lb/in ²	3,000	ASTM D 638
Environmental Stress Crack	3	minimum	hrs	F ₂₀ > 192	ASTM D 1693
Hydrostatic Design Basis at 73°F	4	minimum	lb/in ²	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 ²	110,000	ASTM D 790
Tensile Strength	4 or 5	minimum	lb/in ²	3,000	ASTM D 638
Environmental Stress Crack	3	minimum	hrs	F ₂₀ > 192	ASTM D 1693
Hydrostatic Design Basis at 73°F	4	minimum	lb/in ²	1,600	ASTM D 2837
UV Stabilizer	C	minimum	% Carbon Black	2	ASTM D 1603

TABLE 02605-3
ALLOWANCE* FOR EXPANSION
UNDER TEST PRESSURE FOR AMBIENT CONDITIONS⁺
Allowance for Expansion
(U.S. Gallons / 100 Feet of Pipe)

Nominal Pipe Size (Inches)	1 Hour Test	2 Hour Test	3 Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.30	2.10
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.8	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

*These allowances only apply to the actual test phase and not to the initial expansion phase. They also assume pipe is being tested at a maximum design pressure equal to 1.5 times the pressure rating. If the pipe is being tested at a lower system design pressure, the allowance should be reduced by the ratio of the system design pressure to the maximum design pressure.

⁺When testing at temperatures below ambient (approximately 75°F), less pipe expansion takes place, resulting in lower requirements for make-up water. For a test temperature of about 68°F, the values in this table should be multiplied by a reduction factor of 0.75. For 50°F, this factor is 0.50.

The above footnotes are in accordance with the recommendation of AWWA [1999].

[END OF SECTION]

SECTION 02714**GEOTEXTILES****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes geotextile products furnished and installed by the Contractor.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02200 - Earthwork
B. Section 02215 - Trenching and Backfilling
C. Section 02271 - Riprap
D. Part 6 - Statement of Work
E. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
1. ASTM D 3786. Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric-Diaphragm Bursting Strength Test Method.
 2. ASTM D 4355. Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-ARC type apparatus).
 3. ASTM D 4491. Standard Test Method for Water Permeability of Geotextiles by Permittivity.
 4. ASTM D 4533. Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 5. ASTM D 4632. Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
 6. ASTM D 4751. Standard Test Method for Determining Apparent Opening Size of a Geotextile.

7. ASTM D 4833. Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
8. ASTM D 4873. Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls.
9. ASTM D 5261. Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.

1.04 SUBMITTALS

- A. Submit the following to Construction Manager for review within 30 calendar days from Notice to Proceed:
 1. product name;
 2. geotextile manufacturing capabilities, including;
 - a. daily production capacity available for this contract; and
 - b. manufacturing quality control procedures;
 3. certification of minimum average roll values (95 percent lower confidence limit) and the corresponding test procedures for all geotextile properties listed in Table 02714-1;
 4. projected geotextile delivery dates; and
 5. recommended long-term storage requirements.

- B. Submit to Construction Manager for review at least 14 calendar days prior to transporting geotextile to the site, manufacturing quality control certificates signed by the quality control manager applicable to each roll of geotextile as specified in this Section. The submittal shall include a list of roll numbers to be shipped indicating which rolls were sampled and tested. The certificates shall state that the geotextiles are continuously inspected and are needle-free. The quality control certificates shall also include:
 1. lot, roll numbers, and other identification;
 2. sampling procedures; and
 3. results of quality control tests, including descriptions of test methods used (the Manufacturer quality control tests to be performed are given in this Section).

PART 2 PRODUCTS**2.01 GEOTEXTILE**

- A. Contractor shall furnish geotextile products that meet the following requirements:
1. minimum average roll values (95 percent lower confidence limit) meeting or exceeding the required property values specified in Table 02714-1; and
 2. manufactured from first quality polymers, with not more than 20 percent reclaimed polymer used in production.
- B. If Contractor elects to sew, Contractor shall furnish polymeric threads for stitching that are ultra-violet (UV) light stabilized to at least the same requirements as the geotextile to be sewn. Threads shall be polyester or polypropylene threads that have a minimum size of 2,000 denier.

2.02 MANUFACTURING QUALITY CONTROL

- A. Sample and test the geotextile to demonstrate that the material conforms to the requirements of this Section. Do not supply any geotextile roll that does not comply with the manufacturing quality control requirements.
1. Perform manufacturing quality control tests to demonstrate that properties conform to the values specified in Tables 02714-1. Perform the following manufacturing quality control tests at a maximum interval of one test for each 50,000 square feet manufactured. All tested rolls of material used to certify compliance shall be delivered to the site. Test data for rolls not delivered to the site will not be accepted.

<u>Test</u>	<u>Procedure</u>
Mass per unit area	ASTM D 5261
Grab strength	ASTM D 4632
Tear strength	ASTM D 4533
Puncture strength	ASTM D 4833
Burst strength	ASTM D 3786

2. Perform additional manufacturing quality control tests on geotextile filter properties only, at a maximum interval of one test for each 100,000 square feet manufactured to demonstrate that its apparent opening size (ASTM D 4751) and permittivity (ASTM D 4491) conform to the values specified in Table 02714-1. All tested rolls

of material used to certify compliance shall be delivered to the site. Test data for rolls not delivered to the site will not be accepted.

- B. If a geotextile sample fails to meet the quality control requirements of this Section, sample and test rolls manufactured at the same time and in the same lot as the failing roll. Continue to sample and test the rolls until the extent of the failing rolls are bracketed by passing rolls. Do not supply failing rolls.

2.03 PACKAGING

- A. Geotextiles rolls shall be wrapped in relatively impermeable and opaque protective covers. Covers that become torn or damaged shall be repaired by the Contractor with similar materials.
- B. Geotextile rolls shall be marked or tagged in accordance with ASTM D 4873 with the following information:
 - 1. manufacturer's name;
 - 2. product identification;
 - 3. lot or batch number;
 - 4. roll number; and
 - 5. roll dimensions.
- C. If manufacturing quality control sampling is less than 100 percent of rolls, identify sampled rolls with a highly-visible mark or label, distinct from unsampled rolls.
- D. Geotextile rolls not labeled in accordance with this Section or on which labels are illegible at the time of delivery to the site shall be rejected and replaced by Contractor. Notify the Construction Manager of any rolls not labeled in accordance with this Section.

2.04 SHIPPING

- A. Geotextile rolls shall not be shipped prior to final evaluation of Manufacturer's quality control submittals specified in this Section.

2.05 HANDLING AND STORAGE

- A. Contractor shall unload, handle, and place the geotextile material in storage. Handling shall be performed such that damage to geotextile material does not occur.

- B. Maintain a program for protection and preservation of geotextile to include, but not be limited to:
1. protection from sunlight, moisture, excessive heat or cold, puncture, mud, dirt, and dust or other damaging or deleterious conditions: follow all geotextile manufacturer recommendations for handling and storage;
 2. storage of rolls on palates or other elevated structures; and
 3. do not store rolls directly on the ground.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Do not commence geotextile installation until the CQC Consultant completes performance evaluation of previous work, including evaluation of Contractor's survey results for previous associated work.
- B. Handle geotextiles so as to ensure they are not damaged.
- C. Take precautions to prevent damage to subgrade including rutting during placement of the geotextiles. Refer to Section 02200 for the subgrade preparation.
- D. Do not expose geotextile after removing its opaque cover for a period in excess of 10 calendar days unless the manufacturer has supplied written authorization allowing a greater time, and that the warranty is still in effect.
- E. If white colored geotextiles are used, take precautions against "snowblindness" of site and access personnel.
- F. Take care not to entrap stones, excessive dust, or moisture in the geotextiles during placement.
- G. Anchor or weight geotextile with sandbags, or equivalent as approved by the Construction Manager, to prevent damage from wind. Install such sandbags during placement and maintain them until overlying material is placed. Immediately remove any damaged or leaking sandbags.
- H. Examine the geotextile surface after installation to ensure that no potentially harmful foreign objects are present. Remove any such objects and replace any damaged geotextiles.

3.02 SEAMS AND OVERLAPS

- A. Continuously overlap geotextile seams and pin with minimum 8-inch tee pins at intervals not to exceed 10 feet and as necessary to ensure that a 24-inch overlap is maintained.
- B. Do not install horizontal seams on slopes that are steeper than 10 horizontal to 1 vertical. Seams shall be along, not across, the slopes.
- C. When approved in writing by the Construction Manager and the geotextile manufacturer, an alternate to pinning nonwoven geotextiles is sewing in accordance with the manufacturer's recommendation and as specified in this Section.

3.03 REPAIR

- A. Repair holes or tears in the geotextiles using a patch made from the same geotextile material. Extend geotextile patches a minimum of 1 foot beyond the damaged area. Pin geotextile patches into place no closer than 1 inch from any panel edge. Should tear exceed 50 percent of the width of the roll, cut across entire width and seam as an end seam.
- B. Remove any soil or other material that may have penetrated the torn geotextiles.

3.04 PLACEMENT OF AGGREGATE AND RIPRAP MATERIALS

- A. Place materials on top of geotextiles as shown on the Construction Drawings in such a manner as to ensure that:
 - 1. the geotextiles and the subgrade are not damaged; and
 - 2. slippage does not occur between the geotextile and the subgrade during placement.
- B. Do not drive equipment directly on the geotextile. Only use equipment above a geotextile that meets the following ground pressure requirements:

<u>Maximum Allowable Equipment Ground Pressure (pounds per square inch)</u>	<u>Minimum Thickness of Overlying Fill (inches)</u>
<5	12

<10	18
<20	24
>20	36

- D. Place aggregate over geotextile separators to limits shown on the Construction Drawings. Place base aggregate over geotextile in accordance with Section 02230.

3.06 CONSTRUCTION QUALITY REQUIREMENTS

- A. The CQC Consultant will review Manufacturer's quality control data and submittals, and monitor geotextile installation as specified in this Section.

TABLE 02714-1

REQUIRED PROPERTY VALUES FOR GEOTEXTILE

PROPERTIES	QUALIFIER	UNITS ⁽⁵⁾	SPECIFIED ⁽⁴⁾ VALUES	TEST METHOD
Type				
Nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd ²	7	ASTM D 5261
Filter Requirements⁽⁶⁾				
Apparent opening size (O ₉₅)	maximum	mm	0.212	ASTM D 4751
Permittivity	minimum	sec ⁻¹	0.5	ASTM D 4491
Mechanical Requirements				
Grab strength	minimum	lb	180	ASTM D 4632 ⁽¹⁾
Tear strength	minimum	lb	75	ASTM D 4533 ⁽²⁾
Puncture strength	minimum	lb	75	ASTM D 4833 ⁽³⁾
Burst strength	minimum	psi	350	ASTM D 3786
Durability				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

- (1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
- (2) Minimum value measured in machine and cross machine direction.
- (3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
- (4) All values represent minimum average roll values.
- (5) mm = millimeter
% = percent
oz/yd² = ounce per square yard
sec = second
lb = pound
psi = pound per square inch
- (6) Filter requirements apply only to geotextile installed under riprap.

[END OF SECTION]

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

- A. This Section includes soil stabilization which consists of establishing vegetation by seeding and/or application of crusting agent. The work in this Section includes, but is not limited to, soil preparation, interim seeding, application of fertilizer, application of mulches, and application of crusting agent.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02270 - Surface-Water Management and Erosion Control
- B. Part 6 - Statement of Work
- C. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. *Rainwater and Land Development*, 2nd ed., 1996, Ohio Department of Natural Resources [Rainwater and Land Development, 1996].
- B. *Identification and Listing of Hazardous Waste* Title 40, Code of Federal Regulations (CFR), Part 261, Subpart C.

1.04 SUBMITTALS

- A. Submit the following to the Construction Manager for review within 30 calendar days from Notice to Proceed:
 - 1. proposed mixes and application rates for seed, mulch, fertilizer, and crusting agent;
 - 2. manufacturer's product data and recommended methods of application for seed, mulch, fertilizer, and crusting agent;

3. product data for fertilizer shall also include chemical analysis including uranium analysis to assure there is no resultant or derived uranium from fertilizer use, unless waived by Construction Manager; and
 4. material safety data sheet (MSDS) for fertilizer, mulch binder, and crusting agent.
- B. Submit to the Construction Manager at least 10 calendar days before seeding a plan showing seeding area and a written statement of any proposed changes to seed mix and application rate of seed mix and/or associated materials (i.e., fertilizer, mulch, and mulch binder). Choice of seeding type shall follow the site seeding requirements specified in this Section and as approved by the Construction Manager.
- C. Submit the following to the Construction Manager for review within 15 calendar days before seeding:
1. certificate stating seed mixture, guaranteed percentages of purity, weed content, germination of seed, name of seller, test date for the seed, and the net weight and date of shipment;
 2. manufacturer's certificate stating the available nutrients contained in the proposed fertilizer;
 3. manufacturer's certificate stating that the fiber matrix (wood fibers) meets the requirements of this Section;
 4. manufacturer's certificate stating the mulch binder meets the requirements of this Section;
 5. manufacturer's certificate stating the crusting agent meets the requirements of this Section; and
 6. documentation of the straw to be used for mulch; this documentation shall verify that the straw is weed free in accordance with the requirements of this Section.
- D. Provide a list of equipment, description of construction methods, and other required information to perform soil stabilization and vegetation in the Contractor's Earthwork Work Plan specified in Section 02200.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver containerized materials in uniform packages bearing the name of the manufacturer, the net weight, and a statement of content. Deliver containerized materials to the site in original, properly labeled, unopened, clean containers each showing the manufacturer's guaranteed analysis conforming to applicable regulations and standards.
- B. Store materials in a dry area in a manner to prevent physical damage.

1.06 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be in accordance with Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Furnish seed labeled in accordance with U.S. 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. Each variety of seed shall have a purity of not less than 90 percent by weight, a percentage of germination not less than 80 percent by weight, and a weed to seed content of not more than 0.75 percent by weight and contain no noxious weeds. Furnish seed mixtures having seed proportioned by weight in accordance with Table 02930-1.
- B. Furnish mulch meeting the following requirements:
1. Mulch shall be straw or wood cellulose fiber, free of clay, stone, foreign substances, and free of weeds.
 2. Straw shall not contain sticks larger than ¼-inch diameter or other materials that may prevent matting down during application. Use straw that is free from mold and other objectionable material for placing with mulch blower equipment or other equipment as approved by the Construction Manager. Straw shall be generally 6 inches or more in length. Straw shall be:
 - a. weed free straw from the Minnesota Crop Improvement Association certified weed free straw vendors;
 - b. straw that has been inspected and determined to be weed free by Central Ohio Seed Testing; or
 - c. native prairie grass mulch.Documentation verifying the straw has passed field inspection shall accompany the material upon delivery to the site and be in an air-dry condition.
 3. Mulch applied by hydrospraying shall be a bonded fiber matrix containing wood fibers held together with a hydrocolloid-based binder, which upon drying becomes insoluble and non-dispersible. The fibers shall be composed of 100 percent wood or wood by-products and shall be 100 percent biodegradable. Use a bonded fiber matrix containing a green dye that will provide for easy visual inspection for uniformity of slurry spread. The bonded fiber matrix, 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>Item</u>	<u>Specification Limit</u>
Particle Length	0.4 inch (maximum)
Particle Thickness	0.047 inch (maximum)
PH	4.0 to 8.5
Ash Content	1.6 % (maximum)
Water Holding Capacity (based on fiber dry weight)	500 % (minimum)
Moisture Content	12 % ± 3 % (by weight)

- C. Mulch binder agent shall be as approved by the Construction Manager and shall meet the following requirements:
1. The mulch binder shall be hydrocolloid base (guar gum) and shall not dissolve or disperse upon rewetting.
 2. The mulch binder shall not have hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261, Subpart C, for a hazardous waste in either its pre-applied or cured states.
 3. The mulch binder shall have a flash point greater than 200°F. The mulch binder shall be neither a flammable nor combustible liquid per Department of Transportation (DOT) definition. The mulch binder must not be susceptible to significant deterioration from exposure to the elements, including sunlight.
 4. The mulch binder shall be provided in concentrated solution and prepared so that it will not change during transportation or storage.
- D. The crusting agent shall be as approved by the Construction Manager and shall meet the following criteria:
1. pine sap emulsion comprised of a 100 percent organic emulsion produced from naturally occurring resins (pine sap); or a mixture of Conwed Fiber's Enviroblend hydraulic mulch and Finn Corporation's A-500 Hydro-Stik tacking agent (mulch binder); or an approved equal;
 2. not comprised of chloride, lignosulfonate, petroleum, or asphaltic-type emulsions;
 3. provide dust suppression and surface stability for exposed soils, both disturbed and undisturbed soils, and exposed coal fired ash (fly ash);
 4. compatible with application via a hydro seeder, and must not require intense cleaning of equipment after application;
 5. non-tracking (i.e., will not stick to boots or tires) once cured;

6. not have hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261, Subpart C, for a hazardous waste in either its pre-applied or cured states;
 7. have a flash point greater than 200 °F;
 8. be neither a flammable nor combustible liquid per DOT definition; and
 9. not be susceptible to significant deterioration from exposure to the elements, including sunlight.
- E. Erosion mat shall be in accordance with Section 02270.
- F. Fertilizer:
1. Furnish commercial grade fertilizer, uniform in composition that meets the requirements of all State and Federal regulations and standards of the Association of Agricultural Chemists.
 2. Fertilizer shall be slow release complete fertilizer.
 3. Fertilizer shall contain 22-5-10; and shall contain not less than 1 percent added sulfur and not more than 8 percent added iron, or an approved equal.
 4. Fertilizer must have MSDS submitted in accordance with this Section.
 5. Fertilizer shall be applied at a rate of 150 lbs/acre at the time of seedbed preparation.
- G. Obtain water from the on-site sources shown on the Construction Drawings or specified in Part 6 of the Contract Documents, unless otherwise approved by the Construction Manager.

2.02 EQUIPMENT

- A. Provide equipment of size and type to perform work specified in this Section.

PART 3 EXECUTION

3.01 GENERAL

- A. Stabilization of disturbed areas by vegetating or by use of a crusting agent shall be performed at completion of excavation or within 7 calendar days of knowing a disturbed area will be idle for more than 45 calendar days, whichever is sooner.
- B. Crusting agents may be used as a temporary measure prior to placement of interim vegetation after approval for the area by the Construction Manager.

- C. Interim vegetation, as specified in this Section, is required for all areas and soil piles, which are scheduled to be disturbed in future. Fertilizer shall be used for interim vegetation as specified in this Section.
- D. Disturbed areas which are scheduled to be significantly disturbed after initial stabilization and/or need effective erosion control immediately, are to be stabilized with the interim seed mix rate specified in this Section. Soil piles, which require effective erosion control immediately, are to be stabilized with the interim seed mix rate or a crusting agent as specified in this Section.
- E. Stabilization of permanent slopes between 2H:1V and 3H:1V (horizontal to vertical) shall utilize an erosion mat as specified in Section 02270 after application of seed mixture.
- F. Area(s) to be seeded shall be generally free of debris, rock, root material, and other objects that may impede soil preparation and seeding activities. Perform soil preparation by tilling/cultivating, to a depth of approximately 2 inches, to eliminate uneven areas and low spots. Maintain lines, levels and contours.
- G. Repeat cultivation in areas where equipment used for hauling and spreading has compacted the area(s) to be seeded.

3.02 APPLICATION

- A. The seeding season, for interim vegetation specified in this Section, is year round. However, if seeding is contemplated during the winter months (December – March), then field conditions should be assessed for ability to provide soil to seed contact. If field conditions do not support the ability to provide soil to seed contact then the area shall be stabilized with a crusting agent followed by seeding during conditions conducive to adequate soil to seed contact.
- B. Apply fertilizer, seed, and mulch to disturbed areas and areas excavated and graded under this Contract requiring seeding unless otherwise directed by the Construction Manager. Apply mulch within 24 hours of seeding; do not seed areas in excess of that which can be mulched within 24 hours. Winter application of seed and related materials are subject to adjustment as directed by the Construction Manager.
- C. Apply seed using either the drilling, broadcasting, or hydroseeding method, as described below:
 - 1. Seed drilling method:
 - a. This method may be used for applying the seed mix in all accessible areas unless otherwise approved by the Construction Manager.

- b. Prepare area to be seeded by loosening the soil to a minimum depth of 3 inches.
 - c. Apply commercial grade, slow release complete fertilizer at a rate of 150 lbs/acre at the time of preparing the seedbed for seeding.
 - d. Install seed with a seed drill to obtain a final planting depth of $\frac{1}{4}$ to $\frac{1}{2}$ inch using the seed rates indicated in Table 02930-1. All seed drilling shall be done at a right angle to surface drainage.
 - e. Mulch and disc-anchor the area using weed free mulch at a rate of 2.0 tons per acre. Spread straw mulch, either by hand or by blowing method, at the rate of 2 air-dried tons per acre. During June through September, increase straw mulch application rate to 3 air-dried tons per acre. Application of straw mulch by the blowing method is exempt from the dust control requirements specified in Part 6 of the Contract Documents. When interseeding with the seed drill, mulch may not be required if 90 percent ground cover exists.
2. Broadcast Seeding Method:
- a. This method may be used for interim vegetation and can be performed with the use of mechanical "cyclone" seeders, by hand seeding or by any other method that scatters seed over the soil surface.
 - b. Prepare the area to be seeded by loosening the soil to a minimum depth of 3 inches. This is critical to allow seeds to filter into the soil to avoid washout from runoff.
 - c. Apply commercial grade, slow release complete fertilizer at a rate of 150 lbs/acre at the time of preparing the seed bed for seeding.
 - d. Install seed by broadcasting evenly over the entire site using the seed rates indicated in Table 02930-1.
 - e. Rake the area after seeding.
 - f. Mulch and disc-anchor using weed free mulch at a rate of 2.0 tons per acre. Spread straw mulch, either by hand or by blowing method, at the rate of 2 air-dried tons per acre. During June through September, increase straw mulch application rate to 3 air-dried tons per acre. Application of straw mulch by the blowing method is exempt from the dust control requirements specified in Part 6 of the Contract Documents.
3. Hydroseeding Method:
- a. This method may be used for interim vegetation. Hydroseeding shall be a two-step process. The seed shall be applied first followed by the separate application of the mulch. This is to ensure soil to seed contact.
 - b. The mixture tank shall be cleaned prior to use to ensure remnant seed is not introduced to the proposed seed mixture.
 - c. Prepare area to be seeded by loosening the soil to a minimum depth of 3 inches. This is critical to allow seeds to filter into the soil to avoid washout from runoff.

- d. Apply commercial grade, slow release complete fertilizer at a rate of 150 lbs/acre. The fertilizer is to be mixed and applied with the mulch.
- e. Install seed by hydroseeding evenly over the entire area using the seed rates indicated in Table 02930-1. Use a fan-type nozzle with approximately 500 gallons of water per acre to ensure even distribution.
- f. Rake the area where accessible following seeding.
- g. Apply sprayed mulch at a net dry weight of 2,000 pounds per acre minimum and 100 percent continuous coverage. Mix the mulch with water at a ratio of 50 pounds of mulch per 100 gallons of water.

E. Application of Crusting Agent:

1. Apply crusting agent in accordance with manufacturer's directions.
2. Unless otherwise specified by the manufacturer, dilute concentrated pine sap emulsion to ratio of 4 parts water to 1 part concentrate. Apply diluted pine sap emulsion at a rate of 2,500 gallons per acre.
3. Apply a mixture of Conwed Fiber's Enviroblend hydraulic mulch and Finn Corporation's A-500 Hydro-Stik mulch binder, using the hydroseeder, at the rate of 1,000 lbs/acre on flat surfaces; and 1,125 lbs/acre on slopes greater than 3H:1V. The mixture rate for each product shall be 20 lbs/acre on flat surfaces and 30 lbs/acre on greater than 3H:1V slopes for the hydraulic mulch; and 20 lbs/acre on flat surfaces and 30 lbs/acre on slopes greater than 3H:1V for the Hydro-Stik mulch binder.

3.04 MAINTENANCE

- A. Maintain the vegetated areas in satisfactory condition until acceptance of the vegetation by the Construction Manager. Maintenance of the vegetated areas includes repairing eroded areas, revegetating when necessary, watering, and mowing (if applicable). A satisfactory condition of vegetated area is defined as follows:
 1. an area shall have a predominant stand of the seeded vegetation;
 2. within 3 weeks, germination must occur over 90 percent of the area with no single bare area greater than 3 square feet; and
 3. within 3 months, 90 percent of the area must be covered with mature vegetation.
- B. The above timeframes for germination and coverage requirements are to be delayed during dormant season (November - 15 March) application of the seed. The performance criteria shall be measured at the beginning of the growing season (April 1) for seed applied during the previous dormant season.
- C. Areas that fail to meet these requirements shall be repaired or reseeded as necessary to produce an acceptable stand of vegetation, as specified in this Section.

- D. The acceptance inspection will be performed by the Construction Manager who will determine whether repair of vegetated areas or revegetation is required.
- E. Maintain areas with a crusting agent to ensure proper erosion control. The crusting agent shall be reapplied to eroded and bare areas as necessary.

3.05 WARRANTY

- A. Vegetated areas shall be subject to a warranty period of not less than 12 months from initial establishment of vegetation over 100 percent of the areas seeded.
- B. At the end of the warranty period, the Construction Manager will perform an inspection of the area. Seeded areas not demonstrating satisfactory condition of vegetation as specified herein, shall be repaired, reseeded and maintained to meet all requirements as specified herein at the Contractor's expense.

3.06 ACCEPTANCE

- A. The vegetated areas shall be accepted at the end of the warranty period if a satisfactory condition exists as defined in this Section.
- B. After all disturbed areas are stabilized and all necessary corrective work has been completed, the Construction Manager will certify in writing the final acceptance of the vegetated areas.

TABLE 02930-1
SEED MIXES FOR INTERIM VEGETATION

Interim Seed Mixture	
Species	lb/ac
ReGreen	50
Annual Rye Grass	20
Canada Wild Rye	20

[END OF SECTION]

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

- A. This Section includes all labor, materials and services required for placement of concrete, concrete reinforcement, concrete forms, cast-in-place concrete, and precast concrete structures.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02100 - Surveying
- B. Section 02200 - Earthwork
- C. Section 02215 - Trenching and Backfilling
- D. Section 03100 - Concrete Protective Liner
- E. Part 6 - Statement of Work
- F. Part 8 - Environmental Health & Safety/Training Requirements

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, Plain, 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 C 618. Standard Specification for Coal Fly Ash and Raw or Calcimined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 13. ASTM C 1107. Standard Specification for Packaged Dry, Hydraulic-Cement Concrete (Non-Shrink).
 14. ASTM C 1240. Standard Specification for Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout.
- C. Latest version of American Association of State Highway and Transportation Officials (AASHTO) Standards:
1. AASHTO M 199. Standard Specification for Precast Reinforced Concrete Manhole Sections.

1.04 SUBMITTALS

- A. Submit the following to the Construction Manager for review within 30 calendar days from Notice to Proceed:
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 in this Section.
 - 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, or other time intervals approved by Construction Manager, 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. Shop drawings for gravity inlet structures.
 6. Procedures for concrete placement during hot weather (ACI 305) and cold weather (ACI 306).
 7. Sample of preformed expansion joint sealer for concrete.
 8. Sample of dumbbell type waterstop.
 9. Formwork design showing incorporation of the concrete protective liner. The plan shall demonstrate form rigidity, and outside forming of the concrete protective liner. Contractor shall provide written confirmation from concrete protective liner Installer that the formwork design is compatible with the concrete protective liner.
- B. Provide list of equipment, description of construction methods, and other required information related to concrete placement in the Contractor's Earthwork Work Plan specified in Section 02200.

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 concrete protective liner manufacturer approved 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. Cast-in-place concrete shall consist of the mix design specified in Table 03100-1, and shall satisfy the requirements of the concrete protective liner manufacturer.
2. 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.
3. Furnish polyethylene sheet for vapor barriers with a 6-mil minimum thickness between concrete floor slab 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.
4. Furnish damp proofing concrete sealant Conseal CS-55 water based concrete coating as manufactured by Concrete Sealants, Inc. or approved equal.
5. Furnish a curing compound conforming to the requirements of ASTM C 309 and that does not impair natural bonding characteristics of subsequent coatings.
6. In construction joints between floor slab and walls, the concrete shall be clean and rough, with amplitude not less than ¼ inch. In construction joints between

interacting walls, the joint shall be made with a shear key as shown on Construction Drawings.

7. Water stop as specified in this Section shall be provided at all construction joints.

D. Furnish precast concrete structure conforming to AASHTO M 199.

E. Grout

1. Non-Shrinking Grout for Pipe Penetrations and Corrugated Metal Pipe (CMP)/Precast Concrete Joints:
 - a. Mix and place as recommended by the manufacturer and in accordance with ASTM C 1107.
 - b. Furnish flowable nonmetallic grout, manufactured by one of the following:
 - (1) Five Star 100 Grout, U.S. Grout Corporation;
 - (2) Masterflow 713 Grout, Master Builder's Company; or
 - (3) Sauereisen F-100, Sauereisen Cements Company.

F. 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 shown or specified on the Construction Drawings.
3. Use in conformance with manufacturer's instructions.

G. 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 length of bars.

H. Waterstop

1. Waterstop manufactured by Green Streak made of PVC, Type 741 Dumbbell with centerbulb.

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 and in accordance with the requirements of ACI 318.

- 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 reinforcement 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 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 have been inspected by CQC Consultant and approved by the Construction Manager.
- 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 and ACI 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. Join the concrete fully around pipes.

3.05 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.
- D. Apply damp proofing concrete sealant as specified herein on the exterior of valve house foundation walls as shown on the Construction Drawings.
 - 1. Verify surface preparation of concrete foundation wall prior to application of sealant. Surface condition, ambient temperatures, and humidity are to be within the installation directions provided by the sealant manufacturer.
 - 2. Monitor the application of the sealant coating per manufacturer's direction.
 - 3. During backfill operations around valve houses and control valve house, monitor equipment operations to assure no damage is done to protective coating. Any scrapes occurring to coated surface shall be immediately repaired prior to continuing backfill.

Verify the surface preparation of steel and metal structures is consistent with the manufacturer's literature.

3.07 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will perform inspection of prepared subgrade, formwork, reinforcing steel layout, and other scheduled structures specified in this Section and shown on Construction Drawings prior to concrete placement.
- B. CQC Consultant will perform conformance testing on concrete samples during concrete placement.
 - 1. Samples shall be taken for temperature, slump (ASTM C 143), air entrainment (ASTM C 231), and three test cylinders for compression strength (ASTM C 39) tests.
 - 2. Samples shall be taken at a minimum frequency of one for each 100 yd³ of each concrete mix design placed in any one day.

- C. Contractor shall allow CQC Consultant to perform testing specified in this Section.

3.08 SURVEY

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

3.09 TOLERANCE

- A. Install concrete structures to within ± 0.1 feet of the elevations indicated on the Construction Drawings.

TABLE 03100-01
CONCRETE MIX DESIGN

Portland Cement, ASTM C 150 Type II	564 lb/yd ³
Pozzolan: Fly Ash, ASTM C 618 Class F or Silica Fume, ASTM C 1240	80 – 110 lb/yd ³ 28 lb/yd ³
Coarse Aggregate, SSD* ASTM C 33	1900 lb/yd ³ , 1 inch maximum size
Fine Aggregate, SSD ASTM C 33	1250 lb/yd ²
Water/(Content + Pozzolan) (total water content will vary depending on type and amount of pozzolan used)	0.38
High-Range Water Reducing Admixture (HRWRA)	Per specified slump requirements
Air Entraining Admixture (AEA) ASTM C 231	Sufficient to produce 5% ±1% air at point of delivery
Slump – ASTM C 143	4 inches ± 1 inch
Unit Weight, Fresh Concrete	138 – 155 lb/ft ³
Compressive Strength, 28 days (minimum) ASTM C 39	4000 psi
SSD* - saturated, surface dry condition	

[END OF SECTION]

SECTION 03110
CONCRETE PROTECTIVE LINER

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes materials and installation of concrete protective liner in Valve Houses 7 and 8

1.02 RELATED SECTIONS AND PLANS

- A. Section 03100 - Concrete
- B. Section 13120 - Pre-Engineered Buildings
- C. Section 13130 - Steel Stairs, Molded Grating, and Handrail Assemblies
- D. Section 15060 - Process Piping and Appurtenances
- D. Part 6 - Statement of Work
- E. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of the American Society for Testing and Materials (ASTM) Standards:
1. ASTM D 256. Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
 2. ASTM D 638. Standard Test Method for Tensile Properties of Plastics.
 3. ASTM D 1238. Standard 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. Standard Test Methods for Density of Plastics by Density-Gradient Technique.
 6. ASTM D 5199. Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembrane.

1.04 SUBMITTALS

- A. Submit the following to the Construction Manager for review within 45 calendar days of Notice to Proceed:
1. a list of materials and components to be furnished with the names of the supplier and the delivery dates of the materials to the site;
 2. manufacturing capabilities, including:
 - a. daily production capacity available for this Contract;
 - b. manufacturing quality control procedures; and
 - c. list of material properties, including test method, to which are attached concrete protective liner samples;
 3. a list of 5 completed facilities for which polyethylene concrete protective liner has been manufactured, including 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. thickness and surface area of concrete protective liner provided;
 4. origin (resin supplier's name, resin production plant) and identification (brand name, number) of the polyethylene resin used;
 5. certification that HDPE welding rod is compatible with this Section and consists of the same or compatible resin as used to manufacture the concrete protective liner for this project;
 6. minimum Manufacturer certifiable values and the corresponding test procedures for the material properties listed in Table 03110-1, submit values that are specific to the resin used in manufacture;
 7. manufacturer's long-term storage requirements;
 8. required manufacturer's installation procedures for installation of concrete protective liner;
 9. setting bed anchoring system details documentation demonstrating the ability to withstand a hydrostatic uplift of 5 psi; and
 10. certification from the manufacturer/fabricator of the concrete protective liner that the fabrication is in accordance with the provisions of this Section.
- B. Submit to Construction Manager for review at least 21 calendar days prior to transporting any concrete protective liner to the site the following documentation on the resin used to manufacture the concrete protective liner:
1. copies of quality control certificates issued by the resin supplier including the production dates and origin of the resin used to manufacturer the concrete protective liner for this Contract;
 2. results of tests conducted to verify the quality of the resin used to manufacture the concrete protective liner shall be assigned to the project; and

3. certification that no reclaimed polymer is added to the resin during the manufacturing of the concrete protective liner to be used for this project.
- C. Submit to Construction Manager for review the following documentation on concrete protective liner production at least 21 calendar days prior to transporting any concrete protective liner to the site;
1. manufacturing certificates for each shift's production of concrete protective liner, signed by the Manufacturer quality control manager; and
 2. certificate shall include:
 - a. resin lot, batch, roll numbers, and other identification;
 - b. sampling procedures; and
 - d. results of quality control tests, including descriptions of the test methods used (the Manufacturer quality control tests to be performed are given in this Section).
- D. Submit to the Construction Manager for review the following information from the Installer within 14 calendar days prior to mobilization of the Installer to the site:
1. layout drawings showing the installation layout identifying geomembrane panel configurations, dimensions, details, locations of seams, as well as any variance or additional details which deviate from the Construction Drawings; the layout drawings shall be adequate for use as a construction plan and shall include dimensions, details, etc.; the layout drawings shall become part of the Contract;
 2. installation schedule;
 3. copy of Installer's letter of approval or license by the Manufacturer;
 4. installation capabilities, including:
 - a. information on equipment proposed for this project;
 - b. average daily production anticipated for this project; and
 - c. quality control procedures to include quality control organization;
 5. a list of 5 completed facilities for which the Installer has installed a polyethylene geomembrane, including the following information for each facility:
 - a. the name and purpose of the facility, its location, and dates of installation;
 - b. the names of the owner, project manager, and concrete protective liner manufacturer;
 - c. name and qualifications of the supervisor of the installation crew;
 - d. thickness and surface area of installed concrete protective liner;
 - e. type of seaming and type of seaming apparatus used;
 - f. duration of installation;
 - g. resumes of the Installer Superintendent and quality control chief to be assigned to this project, including dates and duration of employment; and
 - h. resumes and certifications of all personnel who will perform seaming operations on this project.

- E. Submit to the Construction Manager for review at least 14 calendar days prior to geomembrane placement, a Certificate of Calibration less than 12 months old for the field tensiometer. Tensiometer shall be calibrated within one year of date of test. Calibration shall be traceable to national or industry recognized standards where possible.
- F. Submit to Construction Manager for review written confirmation, signed by the Installer, of compatibility of concrete protective liner with the concrete formwork design specified in Section 03100 within 30 calendar days of Notice to Proceed.
- G. Within 14 calendar days of completion of the concrete protective liner installation, submit to the Construction Manager results of tests and inspection documentation specified in this Section.

1.04 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 MATERIALS

2.01 RESIN

- A. Manufacture concrete protective liner from new, first-quality polyethylene resin. No reclaimed polymer shall be added to the resin. The use of polymer recycled during the manufacturing process is permitted if performed with appropriate cleanliness and if the recycled polymer during the manufacturing process does not exceed 2 percent by weight of the total polymer weight.
- B. High density polyethylene (HDPE) resin will have the following properties:
 - 1. Density: 0.935 minimum (ASTM D 1505)
 - 2. Melt Flow Index: 1.0 g/10 min., maximum (ASTM D 1238 Condition E)
- C. Extrudate welding material (welding rod) shall be of the same resin or compatible compound as the concrete protective liner supplied by the Manufacturer and shall be delivered in original sealed containers. Each container shall have a label bearing the brand name, Manufacturer's lot number and directions as to proper storage. The manufacturer shall provide certification statement that the HDPE welding material is compatible with this Section and of the same or compatible resin as the concrete protective liner.

2.02 CONCRETE PROTECTIVE LINER

- A. The concrete protective liner shall be chemical resistant thermoplastic, made of HDPE, and shall meet the specified minimum property values listed in Table 03110-1 (ASTM D 1248).
- B. The concrete protective liner, as indicated on the Construction Drawings, shall consist of fabricated assemblies with integral anchoring systems including all necessary plastic welding rods, connecting couplings, spark strip conductors, and other materials as required to complete the installation.
- C. Concrete protective liner sheet shall be Anchorlok as provided by Atlas Minerals & Chemicals, Inc., or approved equal.
- D. Reinforced Concrete and Setting Bed Material:
 - 1. Use setting bed material(s) as required by the Manufacturer for floor system. Contractor shall assume that a hydrostatic uplift of 5 psi is a possibility and install setting bed and anchoring system as recommended by Manufacturer.
 - 2. Concrete protective liner shall be installed on walls at the time the walls are placed with the concrete protective liner immediately adjacent to the inside wall form. Height of liner shall be four feet eleven inches minimum.

2.03 MANUFACTURING QUALITY CONTROL

- A. Resin:
 - 1. Sample and test resin at a minimum frequency of one test per rail car to demonstrate that the resin complies with the requirements of this Section. Perform tests on resin after the addition of additives to the virgin resin. Certify in writing that the resin meets the requirements of this Section.
 - 2. Do not use any noncomplying resin.
- B. Concrete Protective Liner Sheets/Panels:
 - 1. Continuously monitor for concrete protective liner defects during manufacture.
 - 2. Do not supply concrete protective liner that exhibits any defects.
 - 3. Regularly monitor for concrete protective liner thickness during manufacture.
 - 4. Do not supply concrete protective liner that fails to meet the specified maximum thickness.
 - 5. Sample and test the concrete protective liner to demonstrate that its properties conform to the values specified in Table 03110-1. Perform tests at a maximum interval of one test for each 100,000 square feet manufactured. All tested sheets or

panels of material used to certify compliance shall be delivered to the site. Test data for sheets or panels not delivered to the site will not be accepted.

6. If a concrete protective liner sample fails to meet the quality control requirements of this Section, sample and test sheets or panels manufactured, in the same resin lot or batch, and at the same time, as the failing sheet or panel. Continue to sample and test the sheets/panels until the extent of the failing sheets/panels are bracketed by passing results. Do not supply any failing sheets/panels.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. All sheets/panels and components shall be packaged to protect materials in transit.
- B. Deliver material to the site with proper cartage bearing the manufacturer's labels identifying type and color of the material.

3.02 PROJECT/SITE CONDITIONS

- A. Environmental Requirements:
 1. Temperature: Air temperature during product placement shall be above freezing. Air temperature during welding shall be at least 60 degrees Fahrenheit. Consult Manufacturer's data sheets for additional information on temperatures.
 2. Relative Humidity: Relative humidity above 80 percent can be deleterious to welds. Test welds shall be made by a qualified welder on sheet stock if relative humidity is questionable. The weld shall be evaluated for "cold strength" by bending the sheet. If the weld breaks, welding shall be suspended until relative humidity drops.
 3. Ventilation: Low velocity ventilation shall be provided in the areas where the product is to be installed in order to remove fumes from cleaning agents that may be required.
 4. Illumination: Sufficient illumination, as recommended by the welding supervisor and identified in Part 8 of the Contract Documents, shall be made available at all times during the welding and the inspection of all welds.

3.03 EXAMINATION

- A. Verification of Conditions:
 1. Verify that installed product to be welded has no defects or errors that would result in poor or potentially defective application or cause latent defects in workmanship.

2. Verify that surfaces to be welded are dry.

B. Moisture Content Tests:

1. Examine the work for moisture exuding from behind the sheet before and during welding. No welding is permitted when moisture is observed.

3.04 PREPARATION

A. Weather:

1. Protect all work during welding from water, precipitation, drafts, wind, and direct sunlight.

B. Surface Preparation:

1. Clean surfaces to be welded using a metal edge plastic scraping tool. Cement, soil, and other contaminants shall be removed with water or appropriate cleaning agents approved by the Manufacturer. Scrape only deep enough to remove the "gloss" from the product surface.

2. Welding rods shall be cleaned by scraping.

3. Beveled edges may be provided where needed. Saws, routers, scrapers or sanders may be used for beveling edges prior to welding.

3.05 INSTALLATION

A. Special Techniques:

1. Extrusion Welds: Extrusion weld joints may be used between vertical and horizontal surfaces.

2. Fabrication: Three welding systems are used; Butt, Rod and Extrusion Welding. Butt welding is used for shop fabrication. Rod and extrusion welding are used for on site fabrication.

3. Tools and Equipment:

a. all welding shall be performed by approved seaming technicians as specified in this Section; and

b. all spark testing shall be done by approved seaming technicians as specified in this Section.

3.06 FIELD QUALITY CONTROL

A. Perform a trial weld at the beginning of each day. Trial weld coupon shall be accepted by passing spark test as defined by the Manufacturer at the recommended voltages provided by the Manufacturer.

- B. In the event of humidity in excess of 80 percent, perform a "cold strength" test. If the weld breaks, suspend welding operations until relative humidity drops and a successful "cold strength" test is performed.
- C. Prior to any welding of protective liner panels, verify and document:
 - 1. the absence of moisture on or behind the joining surfaces;
 - 2. climate conditions are conducive to joining panel sections per the Manufacturer's instructions;
 - 3. joining surfaces are clean; and
 - 4. beveled edges have been prepared where required.
- D. Perform the spark test as defined by the Manufacturer at the recommended voltages provided by the manufacturer on the root pass of the weld. Any portions of the weld that display failure through the spark test shall be reworked and re-tested until passing results are achieved. Additionally, this test shall be repeated on completed welds.
- E. Spark testing shall be required on 100 percent of all welds.
- F. Final acceptance by the Owner of liner system will be a satisfactory examination of all joints / welds using the Low Voltage (Wet Sponge) Pinhole Test method.
- F. Manufacturer's Field Quality Control:
 - 1. From inception of design to completed installation, the concrete protective liner shall be supervised and quality controlled by the approved Manufacturer's installer as specified in this Section.

3.07 CLEANING

- A. Cleaning Equipment:
 - 1. Product surfaces shall be washed, using water, wiping cloths and sponges to remove soil. Hoses shall not be used to wash or rinse surfaces unless welding is completed.

3.08 PROTECTION

- A. Replacement: In the event of damage, all repairs and replacements will be made immediately and to the satisfaction of the Construction Manager.

3.09 CONSTRUCTION QUALITY CONTROL

- A. CQC Consultant will monitor installation of concrete protective liner to establish compliance with this Section.

TABLE 03110

PROPERTIES OF CONCRETE PROTECTIVE LINER

PROPERTY	UNITS	VALUE	TEST METHOD
Thickness	mm	5	ASTM D 5199
Density	g/cm ³	0.945	ASTM D 1505
Tensile Stress at yield	psi	2000	ASTM D 638
Elongation at yield	%	12	ASTM D 638
Elongation at break	%	200	ASTM D 638
Notch Impact Strength	ft. lb. / in. of notch	6.5	ASTM D 256

[END OF SECTION]

SECTION 08110**STANDARD STEEL DOORS AND FRAMES****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor and material necessary to install steel doors and frames.
- B. Products furnished but not installed under this Section:
Section 13120 - Pre-Engineered Buildings: Furnish templates for door and frame preparation.

1.02 RELATED SECTIONS AND PLANS

- A. Section 09900 - Painting
- B. Section 13120 - Pre-Engineered Buildings
- C. Part 6 - Statement of Work
- D. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of American National Standards Institute (ANSI) Standards:
 - 1. ANSI A 117.1. Buildings and Facilities – Providing Accessibility and Usability for Physically Handicapped People.
- B. Latest version of American Society for Testing and Materials – (ASTM) Standards:
 - 1. ASTM A 653/A 653M-98 Standard Specification Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. Latest version of Steel Door Institute (SDI) Standards:
 - 1. ANSI/SDI-100 Standard Steel Doors and Frames.

- D. Door Hardware Institute (DHI):
1. The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames, and Builder's Hardware.

1.04 SUBMITTALS

- A. Submit the following to the Construction Manager within 45 days from Notice to Proceed:
1. Shop Drawings: Indicate door and frame elevations, internal reinforcement, closure method, and finish.
 2. Product Data: Indicate door and frame configurations and location of cut-outs for hardware, including locks, and reinforcement.
 3. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of ANSI/SDI-100 and ANSI A 117.1.
- B. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The listing of equipment suppliers below in no way precludes the Contractor from proposing alternate suppliers of any of the equipment to be furnished within the scope of this Section. This list of suppliers is intended to identify the type of equipment and general quality of that equipment that will be included.
1. Steelcraft
 2. Republic Builders Products
 3. Amweld

2.02 MATERIALS

- A. Exterior Doors Nonthermally Broken: SDI-100 Grade II Model 1.

- B. Frames: 16-gauge metal with a 2-inch face.

2.03 ACCESSORIES

- A. Face: Steel sheet in accordance with ANSI/SDI-100.
- B. Core: Polyurethane with vertical steel stiffeners.
- C. Silencers: Resilient rubber, fitted to drilled hole.
- D. Locks and Hardware: All locks are to be keyed the same.
- E. Removable Stops: Rolled steel shape, mitered corners; prepared for countersunk style screws.
- F. Window: Small, wired glass window to allow viewing through door.
- G. Labels: Containing the valve house number; constructed of nonreflective materials; black characters on white background, minimum character height of 3 inches.

2.04 FABRICATION

- A. Fabricate doors and frames with hardware reinforcement welded in place.
- B. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.
- C. Configure exterior doors and frames with special profile to receive recessed weatherstripping.
- D. Terminate door stops 6 inches above finished floor. Cut stop at a 45-degree angle and close. Doors, in addition to having locks, shall be fitted with mechanism to lock doors in an open position, to be accomplished by mechanical means.
- E. Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors without mullions.

- F. Finish:
1. Steel Sheet: Galvanized to ASTM A 653.
 2. Primer: Air dried.
 3. Factory Finish: Baked enamel. Color shall be determined by Construction Manager in conjunction with shop drawing approvals.
 4. Provide one gallon of touch-up paint.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site in a manner that protects material from weather and protects from physical damage.
- B. Protect doors with resilient packaging sealed with heat-shrunk plastic.
- C. Break seal on site to permit ventilation.

3.02 PROJECT CONDITIONS

- A. Verify that field measurements are as indicated on shop drawings.
- B. Coordinate the work for door opening construction, door frame, and door hardware installation with pre-engineered building erection.

3.03 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable.
- B. Coordinate the work for door opening construction, door frame, and door hardware installation with pre-engineered building erection.

3.04 INSTALLATION

- A. Install doors and frames in accordance with ANSI/SDI-100 and DHI requirements.
- B. Coordinate installation of glass and glazing.

- C. Coordinate installation of doors and frames with installation of hardware.
- D. Install roll-formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.
- E. Paint frames in accordance with Section 09900.
- F. Touch up factory finished doors in accordance with Manufacturer's recommendations.

3.05 FIELD QUALITY ASSURANCE

- A. Maximum Diagonal Frame Distortion: 1/16 inch measured with straight edge, corner to corner.

3.06 ADJUSTING

- A. Adjust door for smooth and balanced movement.

[END OF SECTION]

SECTION 09900**PAINTING****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor, material, equipment, tools, and services required to complete painting work shown on the Construction Drawings and/or as specified in this Section.
- B. Except as otherwise specified in this Section, include all necessary preparation and complete finishing of the following:
 - 1. All unfinished interior and exterior surfaces including carbon steel piping in valve houses and control valve house, and external bollards and mechanical equipment with shop-primed surfaces; and
 - 2. Color coding or indication of specified piping.
- C. Surfaces that do not require painting in this Section shall be:
 - 1. Stainless steel and aluminum; and
 - 2. Factory finished items.

1.02 RELATED SECTIONS AND PLANS

- A. Section 08110 - Standard Steel Doors and Frames
- B. Section 15060 - Process Piping and Appurtenances
- C. Section 16050 - Basic Electrical Materials and Methods
- D. Section 16130 - Outlets, Junctions, and Pull Boxes
- E. Section 16160 - Manual Disconnect Switches and Electrical Panels
- F. Part 6 - Statement of Work
- G. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of American Society for Testing and Materials (ASTM) Standards:
 - 1. ASTM D 16. Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. Latest version of National Paint and Coatings Association (NPCA) Guide to U.S. Government Paint Specifications (NPCA Specifications).
- C. Latest version of Painting and Decorating Contractors of America (PDCA) Architectural Specifications Manual (PDCA Architectural Specification Manual).
- D. Latest version of Steel Structures Painting Council (SSPC) Steel Structures Painting Manual (SSPC Painting Manual):
 - 1. Paint 22. Epoxy-polyamide Paints (Primers, Intermediate, and Topcoat).
 - 2. Paint 104. White or Tinted Alkyd Paint.
 - 3. SP-2. Hand Tool Cleaning.
 - 4. SP-3. Power Tool Cleaning.
 - 5. SP-6. Commercial Blast Cleaning.
- E. Latest version of Federal Specifications (Fed. Spec.):
 - 1. Fed. Spec. MIL-C-82407. Epoxy for Steel Structures.
 - 2. Fed. Spec. TT-E-487E. Enamel, Floor and Deck.
 - 3. Fed. Spec. TT-E-489. Enamel, Alkyd, Gloss.
 - 4. Fed. Spec. TT-E-505A. Finish Coating, Gloss Alkyd.
 - 5. Fed. Spec. TT-P-664C. Primer Coating, Synthetic, Rust Inhibiting, Lacquer Resisting.
- F. Latest version of Federal Standards (FS):
 - 1. FS No.59SA. Colors.

1.04 SUBMITTALS

- A. Submit to the Construction Manager for review data on all finishing products, including Material Safety Data Sheet (MSDS) for each product used within 30 calendar days from Notice to Proceed.
- B. Submit to the Construction Manager for review two sets of samples illustrating range of colors and textures available for each surface finishing product scheduled within 30 calendar days from Notice to Proceed; allow color selection by Construction Manager.

- C. Submit to the Construction Manager for review Manufacturer's instructions indicating special surface preparation procedures and substrate conditions requiring special attention within 30 calendar days from Notice to Proceed.
- D. Submit to Construction Manager for review documentation meeting the following requirements within 30 days from Notice to Proceed:
 - 1. manufacturing capabilities, including manufacturing the products specified in this Section with minimum 3 years documented experience; and
 - 2. capabilities of Applicator performing the work of this Section with minimum 3 years documented experience approved by Manufacturer.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Coatings shall be ready mixed, except field-catalyzed coatings. Process pigments to a soft paste consistency capable of being readily and uniformly dispersed to a homogeneous coating, good flow and brushing properties, capable of drying or curing free of streaks or sags. Coatings shall be compatible. All coatings (i.e., primer and finish coats) shall be free of lead and chromates, and be non-carcinogenic.
- B. Accessory materials shall be linseed oil, shellac, turpentine, paint thinners, and other materials not specifically indicated but required to achieve the finishes specified of commercial quality.
- C. Patching materials shall be latex filler.
- D. Fastener head cover materials shall be latex filler.
- E. Follow NPCA guide for government specifications for the following paints and paint types:
 - 1. Finish coating, gloss alkyd, conforming to Fed. Spec. TT-E-505A;
 - 2. Primer coating, alkyd, rust inhibiting, conforming to Fed. Spec. TT-P-664C;
 - 3. Epoxy-polyamide coating conforming to Fed. Spec. MIL-C-82407; and
 - 4. Enamel, alkyd, floor and deck coating conforming to Fed. Spec. TT-E-487E.

PART 3 EXECUTION**3.01 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect, and handle products to site.
- B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, clean-up requirements, color designation, and instructions for mixing and reducing. Labels to be kept readable at all times.
- D. Store paint materials at a minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit, in ventilated area and a paint storage safety cabinet as required by manufacturer's instructions and where directed by the Construction Manager. Keep storage space clean and accessible. Oil or paint-soaked rags or waste shall be placed in tight-covered metal containers or removed from the premises at the close of each day's work. Take every precaution to avoid damage by fire. In no case shall the amount of materials stored exceed that permitted by local ordinances.

3.02 SITE CONDITIONS

- A. Exterior painting shall not be done during or immediately following rainy or frosty weather, or when the temperature is below 50 degrees Fahrenheit or likely to drop to freezing during the drying period. Avoid the application of treatments while surfaces are exposed to hot sun, or when temperature is above 90 degrees Fahrenheit or likely to be, during the drying period.
- B. Interior work shall be done only when the building has been thoroughly dried out by natural or artificial heat, and when the work area is properly heated and ventilated, clean, and as dust-free as possible. Apply interior finishes only when a room temperature of at least 60 degrees Fahrenheit can be maintained during application of treatments and until coatings are dry.
- C. Before commencing work on surfaces of any type, the Contractor shall carefully inspect same and be satisfied that they are dry and in all other respects suitable to receive the specified treatment.

- D. Application of any coating to a surface will constitute acceptance of the surface by the Contractor. If, after treatment, the completed finish (or any portion thereof) blisters, checks, peels, or otherwise shows indication of dampness or other irregular condition of surface, the Contractor shall remove the applied treatment and refinish the part affected at no additional cost. Contractor shall determine dryness of all moisture-holding materials by use of a reliable electronic moisture meter.

3.03 PREPARATION

A. General:

1. Contractor shall be responsible for proper preparation of all surfaces to receive the particular treatment specified.
2. Contractor shall employ all usual preparatory measures common to painters' work, as well as such special procedures specified in this Section.

B. Structural Steel:

1. Prepare surfaces in accordance with SP-6 prior to shop primer coat. Minimum field assembly surface preparation shall comply with no less than SP-2 or SP-3 for touch-up. Spot-prime all bare metal areas immediately with compatible, rust inhibiting primer. Prepare steel for final coat.

C. Prime-Coated Miscellaneous and Ornamental Ferrous Metal:

1. Prepare surfaces of miscellaneous and ornamental ferrous metal items such as steel door frames, hollow metal doors, exposed lintels, railings, ornamental brackets, etc., as specified in this Section for exposed-to-view structural steel parts.
2. Fill any open joints and bare tool marks in parts furnished in manufacturer's baked-on prime coat with mineral filler, to make inconspicuous; sand smooth, then spot prime.

D. Caulking:

1. Perform caulking as required.
2. Use a resin-base, gun type, elastic caulking compound, free of volatile thinners; add no thinner.
3. Apply with gun and follow with tool, as required, to form a smooth coved fillet of the minimum required width, at projecting, overlapping, and fully recessed frames. Fill flush and tool slightly concave where frame is flush or just scant of flush. Apply well in advance of scheduled paint treatment; compound must have formed a firm, dust-free surface skin before prime coat is applied. Avoid smearing adjacent wall and/or metal; clean off any misplaced compound at once.

3.04 APPLICATION

- A. All work shall be done by skilled painters in a workmanlike manner; all coats flowed on, or brushed out, to a uniform film. Completed work shall be free of runs, sags, blocked angles, raised grain, and all other evidence of poor or careless workmanship. Follow PDCA Architectural Specifications Manual.
- B. Tint all undercoats toward the color of the final coat, with shade of each coat sufficiently different from that of work in place to permit easy identification.
- C. Allow sufficient time before recoating to ensure proper drying of the preceding coat.
- D. Exercise care to avoid getting material on a surface not intended to receive it. Remove any misplaced material or resultant stain, leaving the surface in proper condition.
- E. General:
 - 1. Following surface preparation as specified, apply coats or treatments as listed below on the several kinds of surfaces that require to be treated. All coats to be applied in thicknesses specified by the product data sheets.
 - 2. Refer to related Sections, Construction Drawings and shop drawings for door frames, trim, mechanical and electrical work, ductwork, piping, electrical conduit, mechanical system devices, heating units, grilles, etc.
 - 3. All coats specified in this Section are in addition to primer, sealer, or other preparatory or protective coats specified in other sections of this specification package or in Part 6 of the Contract Documents.
- F. Structural Steel:
 - 1. Finish Treatment: Two coats alkyd gloss enamel.
- G. New Work:
 - 1. Exposed miscellaneous steel items:
 - a. Primer: One coat primer.
 - b. Finish treatment: Two coats exterior gloss alkyd enamel.
 - 2. Mechanical equipment items:
 - a. Finish treatment: First coat alkyd gloss enamel.
 - b. Second coat: Alkyd gloss enamel.
 - 3. Pipe, Valves, and Fittings -Carbon Steel:
 - a. Two coats of epoxy-polyamids coating. Dry film thickness of 4 mils per coat.
 - 4. Other Piping, Electrical Conduit in Exposed Locations:
 - a. Primed: One coat primer.
 - b. Finish Treatment: Two coats alkyd gloss enamel.
 - 5. Pipe Covering in Exposed Locations:

- a. Primer: One coat primer.
- b. Finish Treatment: Two coats alkyd gloss enamel.

H. Miscellaneous Fabricator-Primed Ferrous Metals:

- 1. Includes prime-coated equipment items and their supports. These shall receive one coat of metal primer, approved by the Construction Manager, followed by the treatment specified in this Section.

I. Steel ladders, steel grating, and other similarly located parts:

- 1. Two coats alkyd porch and floor enamel.

J. Mechanical equipment items furnished in prime coat

- 1. Finish treatment: Two coats alkyd gloss enamel.

K. Factory applied finishes which are damaged shall have prime and finish coats applied.

3.05 CLEANING

- A. As work proceeds, promptly remove paint where spilled, splashed, or splattered.
- B. During progress of work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and materials which may constitute a fire hazard; place in closed metal containers as directed by the Construction Manager.

3.06 PROTECTION

- A. Provide clean drop cloths and other protection approved by Construction Manager to protect floors, doors, and other parts from damage. Where any work is accidentally splattered, clean promptly, and leave in satisfactory condition.

3.07 FIELD QUALITY CONTROL

- A. Verify the surface preparation of steel and metal structures and application of treatment is consistent with the Manufacturer's literature.

[END OF SECTION]

SECTION 10211
METAL WALL LOUVERS

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes all labor and materials for installation of intake and exhaust louvers and damper assembly.

1.02 RELATED SECTIONS AND PLANS

- A. Section 13120 - Pre-Engineered Buildings
- B. Section 15500 - Heating
- C. Section 15865 - Fans
- D. Part 6 - Statement of Work
- E. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of Air Movement Control Association (AMCA) Standards:
 - 1. AMCA 500 Test Method for Louvers, Dampers, and Shutters.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate the louver layout plan and elevations; opening and clearance dimensions; tolerances; head, jamb, and sill details; blade configuration; bird screens; blankout areas required; and frames. Submit shop drawings prior to installation.
- B. Product Data: Provide data to Construction Manager prior to installation, describing design characteristics, maximum recommended air velocity, maximum free area, materials, and finishes.

- C. Maintenance Data: Include lubrication schedules and adjustment requirements at completion of work.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

- A. Louver: to permit passage of air at a velocity as required by AMCA 500 without blade vibration or noise.
- B. Louver: Dimensions - 24" x 24", 35 percent free air minimum.
- C. Perform work in accordance with AMCA Certification for Louvers.

2.02 MANUFACTURERS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years documented experience, including the following.
 1. Airolite Co.;
 2. Louvers & Dampers, Inc.;
 3. Ruskin; and
 4. Other manufacturers who meet or exceed the requirements of this Specification.

2.03 MATERIALS

- A. Furnish and install extruded aluminum drainable blade combination louver/shutters similar to Type K827 for exhaust air flow and KN 827 for intake air flow, as manufactured by the Airolite Company, Marietta, Ohio. Louvers shall be 4 inches deep and assembled entirely by welding. Blades and frame shall be rigid extruded aluminum, alloy 6063-T5. All louver/shutters shall be factory finished after assembly with a Kynar® 500 equivalent coating in a color selected from the manufacturer's chart. Louvers shall be fixed on the outside with shutter damper assemblies which open. In

the direction of airflow. Louvers shall have screens. Color shall be selected by Construction Manager during shop drawing review.

- B. Louvers shall bear AMCA Licensed Ratings Seals for air performance and water penetration ratings.
- C. Bird Screen: Interwoven wire mesh of aluminum, 0.063-inch-diameter wire, 1/2-inch open weave, and diagonal design.
- D. Backdraft Damper: Shall be extruded aluminum with linkage concealed in frame, mounted behind the cover (see Section 15500 for coordination).
- E. Sealant: Furnish elastomeric type sealant with no oil or asphalt in composition.

2.04 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Zinc chromate, alkyd type.
- C. Flashings: Of same material as louver frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings. Verify that prepared openings and flashings are ready to receive work and that opening dimensions are as indicated on shop drawings.
- B. Coordinate the work with fabrication and installation of metal siding.

3.02 INSTALLATION

- A. Install louver assembly in accordance with Manufacturer's instructions.
- B. Install louvers level and plumb.

- C. Install flashings and align louver assembly to ensure that moisture is shed from flashings and diverted to exterior.
- D. Secure louvers in opening framing with concealed fasteners.
- E. Install bird screen and frame to interior of louver.

3.03 ADJUSTING

- A. Adjust backdraft dampers for freedom of movement of control mechanism. Lubricate operating joints.

3.04 WARRANTY

- A. Provide standard 20-year warranty at completion of work.
- B. Include warranty coverage for degradation of siliconized polyester finish.

[END OF SECTION]

SECTION 13120
PRE-ENGINEERED BUILDINGS

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes all labor, materials, equipment, tools, and services required for fabrication (where necessary) and erection of pre-engineered buildings.
- B. All buildings to be assembled complete. Contractor shall decide which building components cannot be assembled in the factory and have them shipped to the job site for assembly.

1.02 RELATED SECTIONS AND PLANS

- A. Section 08110 - Standard Steel Doors and Frames
- B. Section 10211 - Metal Wall Louvers
- C. Section 15500 - Heating
- D. Part 6 - Statement of Work
- E. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of American Institute of Steel Construction (AISC) Standards:
 - 1. AISC S335. Specification for Structural Steel Buildings.
- B. Latest version of American Iron and Steel Institute (AISI) Standards:
 - 1. AISI SG-673. Design of Cold-Formed Steel Part II Structural Members, Cold-Formed Steel Design Manual
- C. Latest version of American Society of Civil Engineers (ASCE) Standards:
 - 1. ASCE 7. Minimum Design Loads for Buildings and Other Structures.

- D. Latest version of American Society for Testing and Materials (ASTM) Standards:
1. ASTM A 36/36M. Standard Specification for Carbon Structural Steel.
 2. ASTM A 153/153M. Standard Specification for Zinc (Hot Dip) on Iron and Steel Hardware.
 3. ASTM A 307. Standards Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 4. ASTM A 325. Standard Specification for Structural Bolts, Steel, Heat-Treated 120/105 ksi, Minimum Tensile Strength.
 5. ASTM A 653. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. Latest version of American Welding Society, Inc. (AWS) Standards:
1. AWS D1.1. Structural Welding Code.
- F. Latest version of International Conference of Building Officials (ICBO):
1. Uniform Building Code (UBC).
- G. Latest version of Building Officials and Code Administrator International (BOCA):
1. Ohio Basic Building Code (OBBC).
- H. Latest version of Metal Building Manufacturer's Association (MBMA) Low-Rise Building Systems Manual (MBMA Low-Rise Building Systems Manual).

1.05 SYSTEM DESCRIPTION

- A. Design Requirements:
1. Pre-engineered, shop-fabricated, structural steel building frame. Work of this section begins at the top of the concrete foundation slab except as specified herein.
 - a. Primary Framing: The buildings covered by these specifications shall be of self-framing design using the roof and wall panels as the primary structural supporting members.
 - b. Horizontal Dimensions: As shown on drawings.
 - c. Height from Slab to Eave: As shown on drawings.
 - d. Roof Slope: As shown on drawings.
 2. Prefinished metal wall and roof panels.
 3. Gutters and downspouts.
 4. Building and its components shall be weathertight under loads and exposure conditions required herein.

B. Design Criteria:

1. Except as otherwise specified herein, prefabricated metal building shall be designed, fabricated, and erected in accordance with requirements of MBMA Low-Rise Building Systems Manual.
2. Structural steel sections or welded-up plate sections shall be designed in accordance with AISC S335.
3. Cold-formed steel structural members shall be designed in accordance with AISI SG-673.
4. Roof and wall panels shall be cold-formed and shall be designed in accordance with AISI SG-673.

C. Performance Requirements:**1. Design Loads:**

- a. Dead load shall include weight of building construction plus all collateral loads.
- b. Live loads shall be as defined and stated in ASCE 7 unless specified otherwise herein.
- c. Vertical Live Loads:
 - i. Primary Framing (Frames): 20 psf uniformly distributed over the roof area, which it supports.
 - ii. The vertical live loads shall be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.
- d. Wind Loads:
 - i. The site-specific basic wind speed shall be 80 mph per OBBC Section 1112.3.2. The importance factor, "I," shall 1.07 for Category II. Use exposure G for velocity pressure coefficient.
 - ii. Load shall be proportioned and applied as horizontal and uplift forces according to the requirements of ASCE 7.
- e. Snow Loads:
 - i. The ground snow load shall be 25 psf per OBBC Section 1112.2.
 - ii. Roof snow loads, including balanced and unbalanced loads, shall be determined in accordance with ASCE 7. The importance factor for snow loads shall be 1.0.
- f. Auxiliary and Collateral Loads:
 - i. Other static load shall be considered as a part of the design requirements and shall be combined with the design loads (wind, live, etc.) as prescribed in contract documents.
 - ii. Static Loads: 5 psf on purlins and frames.
- g. Combination of Loads: The combining of normal and auxiliary loads for design purposes shall be as prescribed and recommended by the MBMA Low Rise Building Systems Manual and the UBC, whichever produces the greater effect.
- h. Deflection:
 - i. Roof panels shall not deflect more than 1/180 of span under design loads.
 - ii. Roof purlins shall not deflect more than 1/180 of span under design loads.

- iii. Girts shall not deflect more than $1/180$ of span under design loads.
2. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
 3. Assembly shall permit movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects, when subject to temperature range of 100 degrees Fahrenheit.

1.06 SUBMITTALS

- A. Submit to Construction Manager for review within 45 calendar days from Notice to Proceed the following:
 1. Shop Drawings:
 - a. indicating location, arrangement, dimensions, materials, finishes, anchorage, fastenings, closures, sealants, accessories, and relation to adjacent work;
 - b. indicating vertical and horizontal loads and forces at bearing on concrete foundation slab;
 - c. indicating framing anchor bolt settings, sizes, and locations from foundation loads; and
 - d. shop drawings shall be signed and sealed by a licensed structural engineer and certified by the Manufacturer.
 2. Product Data: Submit manufacturer's data on:
 - a. prefinished sheet-metal items (including profiles); and
 - b. accessories.
 3. Manufacturer's Installation Instructions: Submit installation and erection requirements for information only.
 4. Samples: Submit complete set of manufacturer's standard finishes to indicate color. Finish shall be actual materials on metal. Size shall be not less than 3 inches by 5 inches.
 5. Design Calculations: Submit set of design calculations to confirm compliance with structural requirements of this Section. Calculations shall be signed and sealed by a licensed structural engineer.

1.06 QUALITY ASSURANCE

- A. Design of Structural and Building Components:
 1. Design of structural systems and building components shall be performed by a structural engineer experienced in the design of pre-engineered, prefabricated metal building systems and who is licensed and registered in the State of Ohio.
 2. Engineer's signature and seal shall be placed on calculations and engineering drawings required to be submitted herein.
 3. Design shall include confirmation that building will perform as required under the design loads required in this Section.

1.08 WARRANTY

- A. Warranty: Include coverage for exterior prefinished surfaces to cover prefinished color coat against chipping; cracking; or crazing, blistering, peeling, chalking, or fading.

1.09 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Standard: For purposes of designating type and quality of the pre-engineered, prefabricated metal building and its accessories specified in this Section and Part 6 of the Contract Documents are based on products and systems as manufactured by Parkline, Inc., Winfield, West Virginia 25213.

2.02 MATERIALS

- A. Fasteners:
1. Fasteners for primary framing shall comply with the requirements of ASTM A 325. Provide equivalent nuts and washers. Bolts, nuts, and washers shall be galvanized to provide for requirements of ASTM A 153.
 2. Fasteners for secondary framing shall comply with the requirements of ASTM A 307. Bolts, nuts, and washers shall be galvanized to comply with the requirements of ASTM D 153.
 3. Fasteners for roof covering, wall covering, trim and flashing, gutters and downspouts, and other sheet metal work shall be AISI Alloy Type 302 or 304 as specified in ASTM A 666. Provide with neoprene gaskets where used to make weathertight.
- B. Sealants: Tube sealant shall be a synthetic elastomer-based material which becomes tack-free in less than 2 hours at 75 degrees Fahrenheit but retains flexibility. Service range shall be from -30 degrees Fahrenheit to +160 degrees Fahrenheit.
- C. Tape Mastic: Preformed butyl-rubber based compound. Compound shall be nonhardening, noncorrosive to metal, and shall have excellent adhesion properties. Service range shall be from -30 degrees Fahrenheit to +160 degrees Fahrenheit.
- D. Resilient Closures: Preformed to match panel configuration. Closed-cell sponge of Ethylene Propylene Diene Monomer.
- E. Gutter Sealant: Manufacturer's standard.

- F. Wall and Roof Insulation: Manufacturer's standard R-13 Roll-in and retainer clips.

2.03 ACCESSORIES

- A. Trim and Flashing: Trim, flashing, and metal closures shall be fabricated from the same sheet metal material (thickness, composition, and finish) as required for wall panels.
- B. Gutters and Downspouts:
1. Fabricate from same material and finish as required for roofing metal.
 2. Form sections of gutters and downspouts in maximum possible lengths. Hem exposed edges.
 3. Fabricate support straps of same material and finish as roofing metal.
- C. Finishes:
1. Primary framing, purlins, girts, and miscellaneous secondary framing shall be cleaned and primed with shop primer.
 2. Exterior finish color shall be as follows:
 - Walls – Laurel Green
 - Trim – Arctic White
 - Doors – Laurel Green

2.04 FABRICATION

- A. Primary Framing:
1. Fabricate from structural steel plate, bar, tube, or rolled structural shapes complying with the requirements of ASTM A 36 or better.
 2. Fabricate components in accordance with the requirements of AISC S 335.
- B. Purlins: Cold-formed steel. Configuration and thickness shall be manufacturer's standard. Finish shall be factory-applied shop primer.
- C. Girts: Cold formed steel. Configuration and thickness shall be manufacturer's standard. Finish shall be factory-applied shop primer.
- D. Framed Openings:
1. Provide framed openings for doors, louvers, etc., as shown on subcontract drawings and as specified herein.
 2. Openings shall be designed to structurally support the panels or framing which they replace and shall support the equipment for which they are provided.
 3. Include framing, clips, and fasteners as necessary to install the opening.
- E. Roof Panels:
1. Roof panels shall be supplied in a single continuous length from eave line to ridge line and shall be designed to tightly interlock so that no fasteners are required at intermediate points along the panel side laps.

2. Roof panels shall be a maximum of 16 inches wide with a flat surface between the interlocking side ribs. The interlocking ribs shall be a minimum of 3 inches high and shall be turned upward. All roof panels shall be factory punched for connection at the eave line of the building.
3. Roof panels shall be minimum 24-gauge steel coated on both sides with a corrosion-resistant aluminum-zinc alloy applied by a continuous hot-dipping process. Coating weight shall be a minimum of 0.32 ounces of aluminum-zinc alloy per square foot of coated sheet (both sides) equivalent to about 0.80-mil thickness on each side. Minimum yield strength of panel material shall be 50,000 psi.

F. Wall Covering:

1. Exterior wall panels of the building shall be a single continuous length from the base channel to the roof line of the building at the sidewalls and endwalls of the building except where interrupted by wall openings.
2. Wall panels shall be 16 inches wide with a 3-inch deep, inward-turned interlocking side rib. Wall panels shall contain two $\frac{3}{4}$ -inch-deep by 3-1/8-inch-wide fluted recesses, each starting 2-7/16 inches from each panel edge.
3. Wall panels shall be fastened internally to the base channel and eave cap of the building with 3/8-inch diameter electrogalvanized machine bolts placed within the panel interlock. The fastening system shall be designed so that no wall fasteners are exposed on the exterior surfaces of the walls.
4. Wall panels shall be minimum 24-gage galvanized steel conforming to ASTM A 525 specifications with the galvanized coating conforming to G90 (1-1/4 ounce) standards. Minimum yield strength of panel material shall be 40,000 psi. Panel material shall be embossed with a random pattern pebble embossure of approximately 0.007-0.008 inch depth.
5. The bases of the wall panels shall be closed off with closure plugs conforming to the panel profile.

2.05 ELECTRICAL PANELS

- A. Coordinate location of electrical panels and accessories with the pre-engineered buildings.

2.06 EQUIPMENT

- A. Furnish equipment necessary to perform work specified in this Section.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Site Assembled Buildings:

1. Deliver and store prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed.
2. Stack materials on platforms or pallets above grade or on concrete slab, covered with opaque tarpaulins or other approved weather-resistant ventilated covering.
3. Store metal sheets and panels if subjected to water accumulation so they will drain freely. Do not store sheets and panels in contact with other materials that might cause staining.
4. Damaged material must be reported to determine if replacement is required.
5. Inspect panels to prevent moisture between panels, and secure as required.

3.02 EXAMINATION

- A. Installation and erection of work of this Section shall be in accordance with the requirements of Part 6 of the Contract Documents and approved submittals.

3.03 ERECTION/INSTALLATION

- A. Installation and erection of work of this Section shall be in accordance with the requirements of Part 6 of the Contract Documents and approved submittals.

Work shall be plumb and level, true to line and plane, rigid, and weathertight.

- C. Work shall be free of rattles and loose components. Allow for expansion and contraction to prevent damage to components.
- D. Prefinished surfaces shall be free of dents, scars, and blemishes. Repairs (if allowed by Construction Manager) shall match adjacent finish and shall match durability of adjacent finishes.
- E. Framing members: $\frac{1}{4}$ inch from level, $\frac{1}{8}$ inch from plumb.
- F. Siding and Roofing: $\frac{1}{8}$ inch from true position.
- G. Manufacturer shall supply 1 gallon of touch-up paint for each Valve House.

3.04 FIELD QUALITY CONTROL

- A. Verify tightness of bolted connections by turn of nut method. Check 50 percent of each connection. Any bolts found loose in any given connection will require all bolts in that connection to be re-tightened.
- B. Check interior of building against voids and gaps that would allow daylight through any undesirable location. In this event, caulk, flash, or otherwise seal off this void.
- C. Touch up any portion of painted steel or panels that has become damaged or scraped during installation.

3.05 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will monitor installation and performance verification as specified in this Section.

[END OF SECTION]

SECTION 13130
STEEL STAIRS,
MOLDED GRATING, AND HANDRAIL ASSEMBLIES

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes all labor, material, equipment, and services required to fabricate (where necessary) and install alternating steel stairs with handrail by Lapeyre, and Fiberglass Reinforced Plastics (FRP) grating including FRP Pultruded Square Tube Handrail, including all appurtenances, accessories, and incidentals necessary to produce a complete operable and serviceable installation as shown on the Construction Drawings as specified herein, and in accordance with the requirements of the Contract.

1.02 RELATED SECTIONS AND PLANS

- A. Section 03110 - Concrete Protective Liner
- B. Section 09900 - Painting
- C. Part 6 - Statement of Work
- D. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of American Society for Testing Materials (ASTM) Standards:
1. ASTM A 513. Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
 2. ASTM A 569. Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
 3. ASTM A 780. Standard Test Method for Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coating and Electrical Insulating Materials.
 4. ASTM D 495. Standard Test Method for High Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation.

5. ASTM D 635. Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 6. ASTM D 638. Standard Test Method for Tensile Properties of Plastics.
 7. ASTM D 696. Standard Test Method for Coefficient of Linear Thermal Expansion for Plastics between -30°C and 30°C with Vitreous Silica Dilatometer.
 8. ASTM D 790. Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics.
 9. ASTM D 2344. Standard Test Method for Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short Beam Method.
 10. ASTM E 84. Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Underwriters Laboratory (UL) Classification for:
1. Load Carrying Capacity;
 2. Surface Burning Characteristics; and
 3. Slip Resistance.
- C. Latest version of Occupational Health and Safety Administration (OSHA); Federal Register, Volume 39, No. 125, Section 1910.23

1.04 SUBMITTALS

- A. Submit to Construction Manager for review the following within 45 calendar days from Notice to Proceed:
1. shop drawings of all stair assemblies, fabricated gratings, and accessories specified in this Section;
 2. name and qualifications of Manufacturer with at least 5 years of experience in successful design and manufacture of similar products and systems.
 3. Manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, connection details, and supporting structural members;
 4. Manufacturers' published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports, anchor systems and their allowable load tables, and design calculations; and
 5. Manufacturer's installation instructions.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Lapeyre Stair, Inc., 220-R Lailram Lane, Harahaw, Louisiana 70123.
- B. Grating, posts and handrails to be provided by Fibergrate Systems or approved equal.

2.02 MATERIALS

- A. Stairs: Lapeyre stair, 56 incline, Section No. 05517, Carbon Steel with Safety Yellow Powder Coat. Stainless steel components: Natural Finish. Stairs: with treads capable of withstanding a concentration of 1,000-pound load without deformation; and handrail capable of withstanding a load of 200 lb applied in any direction at any point on the rail.
 - 1. Treads: 13 Gauge 10 10/15 HRPO per ASTM A 569.
 - 2. Landings and Foot Stampings: 11 Gauge 10 10/15 per ASTM A 569.
 - 3. Stringers:
 - a. 3 x 1 3/4-inch x 11 Gauge 10 10/15 for 56-degree stairs over 10 vertical feet.
 - 4. Handrails: 1 1/2-inch OD x 0.083-inch tube thickness 10 10/15 CS per ASTM A 569 cold drawing, fully annealed tube per ASTM A 513.
 - 5. Miscellaneous materials: Rubber Spine: hollow neoprene. Rubber Feet Divider: solid neoprene.
- B. Grating, Posts, and Handrails: General:
 - 1. All FRP Grating items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Construction Drawings.
 - 2. All posts, and rails are to be structural shapes manufactured by the pultrusion process. The structural shapes shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements, and dimensions as necessary.

to meet the design requirements and dimensions specified in the Contract Documents.

3. The completed handrail installation shall meet the following load requirements with a minimum factor of safety of 2.0:
 - a. Concentrated Load: 200 lb applied in any direction at the top rail.
 - b. Uniform Load: 50 lb/lf on the top rail in any direction.
 - c. Loads are not concurrent.
4. Fiberglass reinforcement shall be continuous roving in sufficient quantities as needed by the application and/or physical properties required.
5. Resin shall be with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required. Grating shall be Underwriters Laboratory (UL) classified.
6. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
7. All grating products shall have a flame spread rating of 25 or less per ASTM E 84 Tunnel Test. Gratings shall also have tested burn time of less than 30 seconds and an extent of burn rate of less than or equal to 10 millimeters per ASTM D 635.
8. All mechanical grating clips shall be manufactured of Type 316 SS. Rivets shall be 18-8 metal.

C. Molded FRP Grating and Handrails:

1. Grating shall be of one piece molded construction with tops and bottoms of bearing bars and cross bars on the same plane. Grating shall be square mesh with mesh openings and grating thickness to be determined by manufacturer to accommodate loading required herein. Grating shall be reinforced with continuous rovings of equal number of layers in each direction. The top layer shall not be more than 3/16-inch below the top surface of the grating so as to provide maximum stiffness and to prevent resin chipping of unreinforced surfaces. Percentages of glass shall not exceed 35 percent so as to achieve maximum corrosion resistance. After molding, no glass fibers shall be visible on any surface of bearing bars or cross bars.
2. Top and bottom rails are to be 1.75 x 0.125-inches wall square tube. The posts are to be 2.125 x 0.1875-inch wall square tube and kickplate is to be ½-inch deep x 4-inches wide with two reinforcing ribs.
3. Pultruded structural shapes used in the handrail are to have the minimum longitudinal mechanical properties specified in Table 13130-1.
4. Non-slip surfacing: Grating shall be manufactured with a concave profile on the top of each bar providing maximum slip resistance.

5. Fire Rating: Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E 84.
6. Resin System: The resin system used in the manufacture of the grating shall be compatible with the grating.
7. Color: Color shall be Safety Yellow.
8. Thickness: 1-1/2-inch thickness with a tolerance of plus or minus 1/16 inch.
9. Load/Deflection: Specified design loads for grating system consist of 100 lb/ft² live load and self-weight of entire grating system including handrails, all appurtenances and accessories. Non-system loads, such as light fixtures, shall also be considered. Deflection must be less than span length/240 assuming specified design loads. Grating load/deflection requirements at the required span shall not be less than manufacturer's published maximum recommended loads.

2.03 FABRICATION

- A. Fabricate alternating tread steel stairs to conform with performance and construction requirements, and in accordance with approved shop drawings of dimensional prints. Fabricate and shop-assemble to extent possible. Gas metal arc weld carbon steel with treads spot-welded to stringers and bolt-on handrails with bolts included.
- B. Grating shall meet the dimensional requirements and tolerances specified. The contractor shall verify they meet these requirements. Contractor shall assure correct size and locations for holes and cutouts before fabrication.
 1. Each grating section shall be readily removable, except where indicated on the drawings. Grating openings which fit around protrusions (pipes, valves, etc.) shall be discontinuous at approximately the centerline of opening so each section is readily removable. Gratings shall be fabricated free from warps, twists or other defects.
 2. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the Construction Contractor.
 3. Hardware: Type 316 SS hold down clips shall be provided and spaced at a maximum of 4 feet apart with a minimum of 4 per piece of grating, or more if recommended by the manufacturer.
- C. The handrail post/rail connection is to be fabricated such that the rails are unbroken and continuous through the post without the use of packs or splices. The bottom rail is to be installed through the post at a prepared hole made to fit the outside dimensions of the rail. The top rail is to fit into a machined, u-shaped pocket formed into top of the post

such that the rail is located at the center of the post. All exposed post corners are to be radiused to eliminate sharp edges. The rails are to be joined to the post through a combination of bonding and riveting. No sharp, protruding edges are to remain after assembly of the handrail. Spacing of the posts shall not exceed 6 feet. The bases of the posts are to be attached according to the contract drawings. The bases of the posts are to be reinforced to a height of 10 inches using a high strength epoxy compound. When required, rails are to be spliced at a distance of 1/4 to 1/3 of the post spacing from the posts using a 6-inch length of 1.5 x 1/8-inches FRP square tube bonded and riveted into place using epoxy adhesive and non-metallic fasteners. All shop fabricated cuts are to be coated with a vinyl ester resin to provide maximum corrosion resistance. Field cuts are to be similarly coated by the contractor in accordance with the manufacturers instructions.

PART 3 EXECUTION

3.01 DELIVERY AND STORAGE

- A. **Delivery of Materials:** Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, fasteners, parts, hardeners, resins and their catalysts, shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
- B. **Storage of Products:** All materials shall be carefully handled to prevent abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in a dry indoor storage facilities between 70 and 85 degrees Fahrenheit until they are required.

3.02 PREPARATION

- A. Inspect prefabricated products for visible defects including foreign inclusions, delamination, blisters warps, bubbles, pits, etc.
- B. Coordinate start and installation of stairs, and grating with all other related and adjacent work. Installation shall not begin until the adjacent and related construction has progressed to the point that installation will not be interfered with.

3.03 INSTALLATION

- A. Install stairs and gratings in accordance with manufacturers' assembly drawings.
- B. If stair bumper has not been factory installed, install the self-adhesive bumper.
- C. Secure stair with not less than 2 bolts or studs at top.
- D. Secure stair at bottom as shown on Construction Drawings.
- E. Touch up any damaged paint or chipped or abraded surfaces and to factory-like finish.
- F. Touch-up any galvanized surfaces using galvanized repair paint in accordance with ASTM A 780.
- G. Paint any unfinished components in accordance with Section 09900.
- H. Lock all grating panels securely in place with hold-down fasteners as specified.

3.04 FIELD QUALITY CONTROL

- A. Verify tightness of anchors and associated hardware. Retighten as necessary.
- B. Verify that there is no damage to concrete protective liner during installation of stair system at the attachment point to the floor of the valve and control valve houses as shown on the Construction Drawings.
- C. Touch up any portion of painted steel handrail that is damaged or scraped during installation.

3.05 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will monitor installation of stair system to establish compliance with this Section.

TABLE 13130-1
MINIMUM MECHANICAL PROPERTIES

Property	Method	Units	Value
Tensile Strength	ASTM D 638	psi	30,000
Tensile Modulus	ASTM D 638	psi	2.5×10^6
Flexural Strength	ASTM D 790	psi	30,000
Flexural Modulus	ASTM D 790	psi	1.8×10^6
Flexural Modulus (Full Section)	N/A	psi	2.8×10^6
Short Beam Shear (Transverse)	ASTM D 2344	psi	4,500
Shear Modulus (Transverse)	N/A	psi	4.5×10^5
Coefficient of Thermal Expansion	ASTM D 696	in/in/°F	8.0×10^{-6}
Flame Spread	ASTM E 84	N/A	25 or less

[END OF SECTION]

SECTION 15060

PROCESS PIPING AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes all labor, materials, equipment, and services necessary to install process piping and appurtenances within the valve houses.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02605 – High Density Polyethelene (HDPE) Pipes and Fittings
- B. Section 15070 – Tanks, Flexible Hose, and Tank Transfer Pumps
- C. Section 15080 – Valves
- D. Section 16900 – Controls, Instrumentation, and Flow Meters
- E. Part 6 – Statement of Work
- F. Part 8 – Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of American National Standards Institute (ANSI) Standard:
 - 1. ANSI A13.1 Standard Specification for Piping and Piping Systems.
- B. Latest version of American Petroleum Institute (API) Standard:
 - 1. API 1104 Standard Specification for Welding of Pipeline and Related Facilities.
- C. Latest version of American Society of Mechanical Engineers (ASME) Standards:
 - 1. ASME B 2.1. Standard Specification for Pipe Threads.
 - 2. ASME B 16.1. Standard Specification for Cast Iron Pipe Flanges and Flanged Fittings.
 - 3. ASME B 31.3. Standard Specification for Category D Piping.
 - 4. ASME B 31.9. Building Services Piping.

- D. 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. Standard Specifications for Seamless and Welded Austenitic Stainless Steel Pipes.
 3. ASTM A 53. Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
 4. ASTM A 403. Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
- E. Latest version of National Electrical Manufacturers' Association (NEMA) Standard:
1. NEMA ICS 6 Industrial Control and Systems-Enclosures.
- F. Latest version of American Institute of Steel Construction (AISC) Manual of Steel Construction (AISC Manual of Steel Construction).

1.04 SUBMITTALS

- A. Submit to the Construction Manager for review shop drawings with the type of construction materials, manufacturer and catalog or model number, electrical characteristics, etc. for products specified in this Section within 45 calendar days from Notice to Proceed.
- B. Submit to the Construction Manager for review shop drawings with dimensions, ratings, mounting requirements, clearances, components interface, wiring diagrams and other information required for complete installation within 45 calendar days from Notice to Proceed.
- C. Submit to the Construction Manager for review a list of materials, to be furnished with the names of the suppliers and the delivery dates of the materials to the sites, and procedures to be used for pressure testing of the process piping and appurtenances specified in this Section.
- D. Submit "Record" copies of all shop drawings to the Construction Manager before final inspection and acceptance.
- E. Submit to the Construction Manager four copies of complete operating instructions, installation and maintenance instructions, and spare parts bulletins upon completion of the work.
- F. Submit to Construction Manager for review test results and inspection documentation specified in this Section within 14 days after completion of work.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Document.

PART 2 PRODUCTS**2.01 PROCESS PIPING AND APPURTENANCES**

- A. Furnish process pipe and tube of type, joint type, grade, size and weight (wall thickness or class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined for installation requirements, and comply with governing regulations and industry standards.
- B. Process piping and fittings shall be of Schedule 40, carbon steel construction, unless otherwise shown on the Construction Drawings.
- C. Process piping shall be 3-inch diameter minimum unless otherwise shown on the Construction Drawings, or approved by the Construction Manager.
- D. Piping, fittings, gaskets and other wetted parts shall be compatible with the materials being handled.
- E. Schedule 40 carbon steel pipe and fittings shall comply with ASTM A 53. Weld neck flanges shall be used.

2.02 PIPE HANGERS, INSERTS, AND SUPPORTS

- A. Pipe hangers, inserts and supports shall conform to MSS SP-58 and SP-69. Provide support at spacings not exceeding manufacturer's recommendations or as shown on Construction Drawings.
- B. Pipe Stanchion supports shall be adjustable pipe saddle supports with nipple reducer assembly and pipe stands, and have a U-bolt yoke such as Grinnel Figure 264 and Grinnel Figure 259 assembly, or approved equal.

000129

2.03 VENT PIPE AND SUPPORT

- A. Vent Pipe for Tanks:
1. Design, fabrication, and erection of structural steel for vent pipe and support shall be in accordance with AISC Manual of Steel Construction.
 2. Vent pipe shall be seamless, PVC conforming to ASTM D1784 and ASTM D1785,
 3. Fittings shall be PVC conforming to ASTM D2466
 4. All primers and cements shall be compatible. Visually inspect all solvent welds.
 5. Pipe supports shall be galvanized steel two-hole strap fastener with carbon steel drop-in-anchors for concrete fastening.
 6. Vent pipe shall be completed with a mushroom-type insect screen.

2.04 FLANGE GASKETS

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

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory applied plastic end caps on each length of pipe and tube. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Exercise care in transporting and handling to avoid damage to pipe and fittings.
- C. Materials shall be identified, inspected, controlled, and protected in a manner that will ensure conformance with the codes and standards specified in this Section.
- D. Care shall be taken in the storage and handling of all material so that contamination by grease, moisture, or other foreign matter does not occur. Materials shall be stored off the ground, protected from the weather, and handled so that physical damage to the material does not occur.

3.02 GENERAL

- A. Install pipe groups parallel to surface and so as not to interfere with other trades such as duct work or electrical wiring.
- B. Space pipe supports, arrange reducers, and pitch piping to allow air to be vented at system high points and to allow the system to be drained at the low points as required.

- C. Plug all ends of piping and equipment, except when work is being performed, to minimize entrance of dirt and debris.
- D. Pipe shall not be supported by adjoining equipment. Piping shall not exert strain on or cause misalignment of equipment.
- E. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- F. Remove scale, slag, dirt and debris for both inside and outside of piping and fitting before assembly.
- G. Install piping so as not to interfere with equipment.
- H. Install piping free of sags or bends.

3.03 JOINTS

- A. HDPE to Metal Pipe: Make joints between HDPE and metal pipe with flanges in accordance with Section 02605.
- B. Screwed Joints: Do not mar or damage threaded surfaces of pipe and fittings. Apply thread sealant or teflon tape suitable for the service to male threads only.

3.04 PIPE FITTINGS

- A. Make all changes in size and direction of steel piping with standard fittings.
- B. Tees shall be used where branch piping is the same size as the main piping.
- C. Use eccentric reducing couplings where required to bring tops or bottoms of pipe in line to prevent water or air pockets.
- D. Thoroughly purge existing pipe of all hazardous material prior to cutting.

3.05 CONNECTIONS

- A. Install unions in piping 2-inch and smaller at the final connection to each piece of equipment and plumbing fixture, and as shown on the Construction Drawings.
- B. Install flanges in piping 2-1/2-inch and larger, at the final connection to each piece of equipment and plumbing fixture, and as shown on the Construction Drawings.

- C. Provide flanges or unions to equipment and control valves to facilitate dismantling. Arrange connections so that the equipment being served may be removed without disconnecting other piping.
- D. Install all piping at design line size with any change in size being made at the equipment being serviced.

3.06 PIPE SUPPORT HANGERS, SUPPORTS, ANCHORS, AND GUIDES

- A. Use generally accepted stock or production parts wherever possible. Support vertical risers by riser clamps preferably installed below pipe hubs or by resting clamps on the floor slabs or pipe sleeve.
- B. Piping located within 2 feet of the floor shall be supported on stands, piers or standard pipe supports in accordance with Construction Drawings.
- C. Pipe supports shall be installed at valves and flow meters in accordance with Construction Drawings. Horizontal support spacing for continuous pipe shall be a maximum of 8 feet.

3.07 CLEANING AND TESTING

- A. Flushing and Cleaning:
 - 1. Prior to operations, all piping systems shall be flushed cleaned.
- B. Pressure Testing for Piping:
 - 1. Notify Construction Manager of date and time at least 48 hours prior to pipe pressure testing.
 - 2. Perform tests in the presence of the CQC Consultant and in accordance with the detailed test procedure submitted by the Contractor in accordance with this Section.
 - 3. Pressure tests shall be applied to piping only before connection of fixtures, equipment and appurtenances. In no case shall any piping, fixtures, equipment or appurtenances be subjected to pressures exceeding their rating.
 - 4. Blank off or remove diaphragm valves, relief valves, pumps, traps, instruments and automatic valves, which may be damaged by test pressure. Open, but do not back-seat all valves.
 - 5. All defective work shall be repaired or replaced, and the tests shall be repeated.
 - 6. Pressure test pipe at 60 psi internal pressure. Test pipes in accordance with approved test procedure conforming to the requirements of ASME B 31.9.
 - 7. The use of caulking or other temporary fixers, etc., to stop leaks is not permitted.

3.08 FIELD QUALITY CONTROL

- A. Pipe welds shall be made in accordance to and inspected per ASME B 31.3. For the purpose of inspection, this piping is designated as Category D per ASME B 31.3.
- B. A minimum of 20 percent of all welds per location will be evaluated by ASME B 31.3 by an inspector qualified and certified or otherwise approved by the Construction Manager. This level of inspection will include fit up, root pass, cover pass, and when available, pipe I.D. root visual. This level is not mandatory on all welds but demonstrates the various stages of welding that shall be examined and documented.
- C. Verify valves and appurtenances that are directional/flow sensitive are installed correctly.
- D. For the purpose of hydrostatic testing, the HDPE piping shall be isolated from the carbon steel piping being tested. Verify hydrostatic pressure test on carbon steel pipe maintains 60 psi for a period of 3 hours. The test gauge shall be calibrated to N.I.S.T. Standards within 6 months of the test date.

3.09 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will be present during pressure testing of process piping and appurtenances specified in this Section to evaluate compliance with this Section.

[END OF SECTION]

SECTION 15080**VALVES****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes specific materials and equipment necessary for the installation of lockable valves for Valve Houses 7 and 8, and the Control Valve House.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02605 - High Density Polyethylene (HDPE) Pipe and Fittings.
- B. Section 15060 – Process Piping and Appurtenances
- C. Section 16900 – Controls, Instrumentation, and Flow Meters
- D. Part 6 - Statement of Work
- E. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Materials shall conform to applicable requirements listed below and in the Construction Drawings. In the case of a conflict between this Section and the listed documents, the requirements of this section shall prevail.
- B. Latest version of American National Standards Institute (ANSI) standard:
 - 1. ANSI A13.1 Standard Specifications for Piping and Piping Systems
- C. Latest version of American Society of Mechanical Engineers (ASME) standards:
 - 1. ASME B2.1 Standard Specification for Pipe Threads
 - 2. ASME B31.9 Standard Specification for Building Services piping.

1.04 SUBMITTALS

- A. Submit shop drawings with type of construction materials, manufacturer and catalog or model number, characteristics, sizes, ratings, mounting requirements, clearances, components interfacing, connection instructions, etc. for products in this Section to the Construction Manager for review at least 30 calendar days from Notice to Proceed.
- B. Submit the manufacturers' published product literature including certificates of compliance, test reports, maintenance recommendations, and replacement parts procurement information to the Construction Manager.
- C. After completion of the work, furnish and deliver to the Construction Manager 4 copies of complete operating instructions, installation and maintenance instructions, and spare parts bulletins.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All valves shall be lockable valves, capable of receiving the hasp of a lock without any external device. The following valve items are required for each valve house:

LCS	LDS	RLCS	LTS
(1) 6" Knife Valve (3) 3" Ball Valves (4) 3/4" Ball Valve (1) 3" Check Valve	6" Knife Valve (3) 3" Ball Valves (4) 3/4" Ball Valve (1) 3" Check Valve	(1) 6" Knife Valve (2) 3/4" Ball Valves	(1) 6" Knife Valve (1) 3" Ball Valve (1) 3" Auxiliary Connection

2.02 VALVE HOUSE VALVES

- A. Furnish Leachate Collection System (LCS) and Leak Detection System (LDS) 6-inch knife gate valves from Red Valve Company, Inc., Flexgate® Slurry Knife Gate Valve or approved equal, consisting of replaceable elastomer slurry sleeve cartridge and replaceable EPDM Seats. The knife gate valve shall have a full port valve low profile, cast iron body, with 316 SS liner and 150-psi maximum working pressure stainless steel gate. The knife gate valve shall provide a bi-directional shutoff and operated with a cast hand wheel mechanism and machined 303 SS stem providing visual reference of the open position. Valve shall have an integrated lockable mechanism.
- B. Furnish LCS and LDS 3 inches and ¾-inch ball valves consisting of heavy duty constructed carbon steel stems and balls with reinforced PTFE seals rated at 150 psi or better. Valve shall have an integrated lockable mechanism.
- C. Furnish LCS sampling and low-point drain valves consisting of ¾-inch PVC ball valves with NPT threaded connections, teflon backed ethylene propylene diene monomer (EPDM) seats and seals, rated at 30 degrees Fahrenheit to 120 degrees Fahrenheit, 150 psi, and mounted on an HDPE service saddle fitting with a noncorroding threaded insert.
- D. Furnish LDS sampling and low-point drain valves consisting of ¾ inch PVC ball valves with NPT threaded connections, teflon backed EPDM seats and seals, rated at 30 degrees Fahrenheit to 120 degrees Fahrenheit, 150 psi, and mounted on an HDPE service saddle fitting with a noncorroding threaded insert.
- E. Furnish LCS and LDS 3-inch check valves from APCO Valve and Primer Corp., Series 903GE1F or approved equal, consisting of 3-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 degrees Fahrenheit to 120 degrees Fahrenheit, 125 psig, and mounted in the carrier pipe with any required spacers for proper valve operation.
- F. Furnish Redundant Leachate Collection System (RLCS) 6-inch knife gate valves from Red Valve Company, Inc., Flexgate® Slurry Knife Gate Valves or approved equal consisting of replaceable elastomer slurry sleeve cartridge and replaceable EPDM Seats. The knife gate valve shall have a full port valve low profile, cast iron body, with 316 SS liner and 150-psi maximum working pressure stainless steel gate. The knife gate valve shall provide a bi-directional shutoff and operated with a cast hand wheel

mechanism and machined 303 SS stem providing visual reference of the open position. Valve shall have an integrated lockable mechanism.

- G. Furnish Leachate Transmission System (LTS) 6-inch knife valves from Red Valve Company, Inc., Flexgate® Slurry Knife Gate Valves or approved equal consisting of replaceable elastomer slurry sleeve cartridge and replaceable EPDM Seats. The knife gate valve shall have a full port valve low profile, cast iron body, with 316 SS liner and 150-psi maximum working pressure stainless steel gate. The knife Gate Valve shall provide a bi-directional shutoff and operated with a cast hand wheel mechanism and machined 303 SS stem providing visual reference of the open position. Valve shall have an integrated lockable mechanism.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Materials shall be carefully handled to prevent them from damage. Store items in an enclosed area free from contact with soil and water.

3.02 INSTALLATION

- A. Install all items included in this Section in strict accordance with the manufacturer's written installation instructions and recommendations.
- B. After installation and connection work has been completed, the Contractor shall check it for correctness, verifying that all connections are free of leaks by pressure testing in accordance with Section 15060. The Contractor shall certify in writing to the Construction Manager that, for each loop or system checked out, all discrepancies have been corrected by the installation personnel. Testing shall be performed within the limits of the knife gate valves and a blank installed at the upstream HDPE/steel interface on the LTS pipe.

3.03 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will be present during installation and testing of valves as specified in this Section.

[END OF SECTION]

SECTION 15190**MECHANICAL IDENTIFICATION****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes valve, equipment, and piping identification and label material requirements.

1.02 RELATED SECTIONS AND PLANS

- A. Part 6 - Statement of Work
- B. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of Federal Standard (Fed. Std.):
 - 1. No. 595a and Change Notices 2, 3, 4, 5, 6, 7, 8 and Errata.
- B. Latest version of the American Society of Mechanical Engineers (ASME) Standard:
 - 1. ASME A 13.1. Scheme for the Identification of Piping Systems.

1.04 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 VALVE AND EQUIPMENT IDENTIFICATION

- A. Each valve and equipment shall be identified with the unique valve number and description, as shown in Tables 15190-1 through 15190-14.
- B. Label size shall be 1 1/2 inch x 3 inch valve tag with 3/8 inch lettering on line 1 and 3/16 inch lettering on subsequent lines.
- C. Labels shall be constructed of nonreflective materials. Black characters on a white background.
- D. 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.
- E. Valve tags on insulated valves shall be located outside the insulation jacketing and be easily accessible for inspection.
- F. Tags shall be secured using heavy-duty chain fasteners, or 0.025-inch stainless steel aircraft cable with locking clasps permanently fixed closed with a crimp.

2.02 PIPING IDENTIFICATION

- A. Identify the flow medium and the flow direction for all piping systems including insulated pipe by labeling on: (i) interior wall where pipe passes through wall; and (ii) on pipe sections within valve and control valve houses. Pipes shall be labeled as indicated on the Construction Drawings and in accordance with ASME A 13.1.
- B. Content, size, material type, line number, and insulation requirements for each pipeline are identified on the drawings as follows:

Example: CE - 6" - A - 1010 - IC

<u>Medium Code</u>	<u>Size</u>	<u>Material Code</u>	<u>Line Number</u>	<u>Insulation</u>
CE	6"	A	1010	IC

- C. Refer to the Construction Drawings for details on Piping and Instrumentation Diagram (P&ID) symbols and legend for the flowing medium, medium code, and material code relationship.

2.03 PRODUCT MARKING

- A. All piping materials shall be marked and identified in accordance with the applicable ASTM specification as indicated on the piping material data sheets.
- B. All bundles, boxes, or kegs in which welding rods and electrodes are delivered shall be legibly marked with the following information:
1. classification;
 2. trade designation;
 3. standard size and length; and
 4. heat number.
- C. All welding rods and electrodes shall be identified with at least one imprint per rod showing an AWS classification number in accordance with AWS A 5.1. In addition, welding rods 1/8-inch diameter and over shall be marked or stamped with positive identification marks at intervals of not more than 18 inches. Such marks shall be clearly distinguishable and shall include the classification number of the welding rod and the trade designation of the manufacturer.

2.04 TANK SAFETY MARKING

- A. Signs shall be pressure sensitive adhesive vinyl and shall be 14 inches x 10 inches. Signs shall meet ANSI Z 535 specifications and shall be supplied by Seton Identification Products or equal as approved by the Construction Manager.

PART 3 EXECUTION

3.01 ITEMS TO BE IDENTIFIED

- A. All piping, valves, and equipment in valve ~~and control valve~~ houses, except that which is installed in inaccessible locations such as partitions, walls and floors, and that which is buried underground, shall be identified with labels hereinafter specified. All labels shall show direction of fluid flow. Labels shall be applied to piping at the following locations:

1. adjacent to each valve;
 2. each branch and riser at take-off;
 3. at each pipe passage through wall or floor;
 4. at not more than 40 feet spacing on straight pipe runs; and
 5. at each change in direction.
- B. Each valve and piece of equipment shall be labeled according to its identification number shown on the P&ID and Tables 15190-1 through 15190-14.

**TABLE 15190-5
VALVE LABEL LIST
VALVE HOUSE 7**

VALVE LABEL LIST

LINE 1 - 3/8" lettering

LINE 2 - 3/16" lettering

LINE 3 - 3/16" lettering

V-711 LDS CONTAINMENT MONITORING PORT	V-721 RLCS CONTAINMENT MONITORING PORT	V-737 LCS SAMPLE PORT
V-712 LDS CARRIER SAMPLE PORT	V-722 RLCS CARRIER SAMPLE PORT	V-738 LCS CHECK VALVE
V-713 LDS FROM CELL	V-723 RLCS FROM CELL	V-739 LCS TO LTS LINE
V-714 LDS TANK BYPASS	V-731 LCS CONTAINMENT MONITORING PORT	V-750 LTS HOSE CONNECT
V-715 LDS TANK INLET	V-732 LCS CARRIER SAMPLE PORT	V-760 LTS HEADER BLOCK
V-716 LDS TANK OUTLET	V-733 LCS FROM CELL	
V-717 LDS SAMPLE PORT	V-734 LCS FROM CELL	
V-718 LDS CHECK VALVE	V-735 LCS TANK INLET	
V-719 LDS TO LTS LINE	V-736 LCS TANK OUTLET	

**TABLE 15190-6
VALVE LABEL LIST
VALVE HOUSE 8**

VALVE LABEL LIST

LINE 1 - 3/8" lettering

LINE 2 - 3/16" lettering

LINE 3 - 3/16" lettering

V-811 LDS CONTAINMENT MONITORING PORT	V-821 RLCS CONTAINMENT MONITORING PORT	V-837 LCS SAMPLE PORT
V-812 LDS CARRIER SAMPLE PORT	V-822 RLCS CARRIER SAMPLE PORT	V-838 LCS CHECK VALVE
V-813 LDS FROM CELL	V-823 RLCS FROM CELL	V-839 LCS TO LTS LINE
V-814 LDS TANK BYPASS	V-831 LCS CONTAINMENT MONITORING PORT	V-850 LTS HOSE CONNECT
V-815 LDS TANK INLET	V-832 LCS CARRIER SAMPLE PORT	V-860 LTS HEADER BLOCK
V-816 LDS TANK OUTLET	V-833 LCS FROM CELL	
V-817 LDS SAMPLE PORT	V-834 LCS FROM CELL	
V-818 LDS CHECK VALVE	V-835 LCS TANK INLET	
V-819 LDS TO LTS LINE	V-836 LCS TANK OUTLET	

**TABLE 15190-12
EQUIPMENT LABEL LIST****VALVE LABEL LIST**

LINE 1 – 3/8" lettering

LINE 2 – 3/16" lettering

LINE 3 – 3/16" lettering

VALVE HOUSE 7

PMP-701 LDS Pump LP 5- 2	T-701 LDS Tank
PMP-502 LCS Pump LP 7- 4	T-702 LCS Tank
UH-7A Heater LP 7- 5, 7	Receptacles LP 7- 12, 14
UH-7B Heater LP	Interior Lights LP 7- 15
EF-7 Exhaust Fan LP 7- 6	Exterior Wall Pack Lights LP 7- 13
F-5 Ceiling Fan LP 7- 8	

**TABLE 15190-13
EQUIPMENT LABEL LIST**

VALVE LABEL LIST

LINE 1 - 3/8" lettering

LINE 2 - 3/16" lettering

LINE 3 - 3/16" lettering

VALVE HOUSE 8

PMP-801 LDS Pump LP 8- 2	T-801 LDS Tank
PMP-802 LCS Pump LP 8- 4	T-802 LCS Tank
UH-8A Heater LP 8- 5, 7	Receptacles LP 8- 12, 14
UH-8B Heater LP 8- 9, 11	Interior Lights LP 8- 15
EF-8 Exhaust Fan LP 8- 6	Exterior Wall Pack Lights LP 8- 13
F-8 Ceiling Fan LP 8- 8	

[END OF SECTION]

SECTION 15250**PIPING INSULATION****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor, materials, equipment, and services necessary to install process pipe insulation.

1.02 RELATED SECTIONS AND PLANS

- A. Section 02605 – High Density Polyethylene (HDPE) Pipes and Fittings
- B. Section 15060 – Process Piping and Appurtenances
- C. Section 15190 – Mechanical Identification
- D. Part 6 - Statement of Work
- E. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version American Society for Testing and Materials (ASTM) Standards:
 - 1. ASTM D 534. Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 2. ASTM D 1056. Standard Specification for Flexible Cellular Materials – Sponges or Expanded Rubber.

1.04 SUBMITTALS

- A. Submit to the Construction Manager for review Manufacturer's published product literature including certificates of compliance, test reports, maintenance recommendations, and installation instructions within 30 calendar days from Notice to Proceed.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Anti-condensation flexible cellular elastomeric insulation: Slit pipe or sheet insulation in accordance with ASTM C 534 Type 1 – Tubular and ASTM D 1056, RE – 41.

2.02 ACCESSORIES

- A. Adhesives: Fire-resistant adhesive shall be compatible with insulation.

PART 3 EXECUTION**3.01 DELIVERY, STORAGE, AND HANDLING**

- A. Insulation materials shall be identified, inspected, controlled, and protected in a manner that will ensure conformance with the referenced codes and standards.
- B. Care shall be taken in the storage and handling of all insulation material so that contamination by grease, moisture, or other foreign matter does not occur. Insulation materials shall be stored off the ground, protected from the weather, and handled so that physical damage to the insulation material does not occur.

3.02 GENERAL

- A. Piping, which includes valves, fittings, and flanges, shall be insulated for all piping containing the suffixes "IC" in the pipe line number shown on the Construction Drawings.
- B. Install materials in accordance with the manufacturer's instructions.
- C. Flanges shall have removable insulation to permit servicing of take-down joints. Removable covers may be fabricated from segments of block insulation or from preformed sectional pipe covering and premolded components.

- D. Fill joints and seams with bedding compound to form smooth surface.
- E. All nonremovable insulation shall be stopped at a sufficient distance from flanges to permit ease of bolt removal. Insulation shall be beveled at a 45-degree angle at this point.
- F. Pipe Insulation:
1. All piping shall be tested in accordance with Section 02605 or Section 15060 before installing insulation.
 2. Piping, fittings, valves, and flanges shall be insulated as follows:

Pipeline Number Suffix	Type	Material	Minimum Thickness (inches)	Jacketing
IC	anti-condensation	Flexible elastomeric	1	none

3. Insulation shall be applied in a single layer with joints tightly butted and shall be secured in place with wire on 12-inch centers.
4. Finish insulation at supports, protrusions, and interruptions. At pipe supports, remove only enough insulation to provide a snug fit.
5. Inserts shall be the same thickness, material, and contour as adjoining piping insulation. For intersection at tees or other equipment, use block or curved segments. Miter cut to fit neatly on the surface, with joints tightly butted.
6. All insulated valves and piping systems shall be labeled in accordance with Section 15190.

[END OF SECTION]

SECTION 15500**HEATING****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor, materials, equipment, and services necessary to construct, install, and test the complete and operable heating system as defined in this Section and as shown on the Construction Drawings. Heating system includes:
1. electric unit heaters; and
 2. controls.

1.02 RELATED SECTIONS AND PLANS

- A. Section 09900 - Painting
- B. Part 6 - Statement of Work
- C. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of National Fire Protection Association (NFPA) Standards:
1. NFPA 70. National Electrical.
 2. NFPA 90A. Standard for Installation of Air Conditioning and Ventilating System (National Fire Code, Vol. 4).
- B. Latest version of Underwriters Laboratories, Inc. (UL) Standards:
1. UL 705. UL Standards for Safety Power Ventilators.

1.04 SUBMITTALS

- A. Submit to Construction Manager for review data on heaters and accessories, and electrical characteristics, and connection requirements within 45 calendar days from Notice to Proceed.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 GENERAL**

- A. The design basis for heating is to maintain a minimum of 40 degrees Fahrenheit winter design in the valve houses at all times.
- B. All equipment operations and testing of materials shall be in compliance with NFPA 70, NFPA 90A, and UL 705.
- C. All internal components shall be labeled with manufacturer's name, serial number, and a power rating information.

2.02 EQUIPMENT

- A. Furnish 2 unit heaters for each valve house and 1 unit heater for the control valve house.
- B. Electric Horizontal Discharge Unit Heaters
1. Electric Unit Heaters Data Sheet:

Tag Number	UH- (*-A, *-B)
Heater capacity, kW	5
Air flow, cfm	350
Fan motor, hp	1/100
Electric power Volts/phase/Hz	240/1/60
Arrangement	Horiz.
Built-in thermostat Heater A should be set to 50°F Heater B should be set to 40°F	yes

Tag Number	UH- (*-A, *-B)
Hand-off-auto switch with heater contactor	yes
Wall mounting bracket	yes

*Indicates Valve House No.

2. Manufacturers:
 - a. Q-Mark MUH05 or approved equal.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be stored in a clean, dry place and protected from weather prior to shipment. Provide protection from weather and from damage during transit.
- B. Loose items shall be tagged and delivered in a standard commercial package. The package shall be protected from the weather; climate conditions including temperature and humidity variations; dirt and dust; and other contaminants that could adversely affect assembly and operation of the fans.
- C. Protect heaters from weather and construction dust or any other physical damage.

3.02 INSTALLATION

- A. Install all equipment as shown on Construction Drawings and in strict accordance with manufacturer's installation instructions.
- B. Unit heaters in each valve house shall be started by one heater having thermostat set at 40 degrees Fahrenheit and the second heater having a thermostat set at 50 degrees Fahrenheit.
- C. Paint unfinished surfaces in accordance with Section 09900.

3.03 FIELD QUALITY CONTROL

- A. Testing

1. After completion of installation of heaters, test each heater to demonstrate proper operation of unit at the performance requirements specified in this Section.
2. Testing shall include verification of 40 or 50 degrees Fahrenheit thermostat set point.

3.04 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will monitor testing of each heater as specified in this Section.

[END OF SECTION]

SECTION 15865**FANS****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor, materials, equipment, and services necessary for the installation of fans for Valve Houses 7 and 8.

1.02 RELATED SECTIONS AND PLANS

- A. Section 15500 - Heating
- B. Part 6 - Statement of Work
- C. Part 8 - Environmental Health & Safety/Training Requirements

1.02 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 GENERAL**

- A. Codes and Standards:
 - 1. Environmental Health & Safety/Training AMCA Compliance: Provide fans that have been tested and rated for air and sound performance in accordance with AMCA standards, and bear AMCA Certified Rating Seal.
 - 2. Underwriter's Laboratories, Inc. (UL) Compliance: Provide fans that are designed, manufactured, and tested in accordance with UL.
 - 3. National Electrical Manufacturer's Association NEMA Compliance: Provide motors and electrical accessories complying with NEMA standards.

- B. The product of a particular manufacturer has been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and its architecture, or any other portion of the building that result from the use of any product other than the basis of design equipment shall be coordinated with all other trades. Such coordination shall occur before delivery of products from the manufacturer (before shop drawing submittals) and shall be clearly indicated on the shop drawings. Any related modifications shall be performed at no additional cost.
- C. Manufacturer: Subject to compliance with requirements, provide fans of one of the following:
1. Hartzell Fan Co.
 2. Acme Engineering and Manufacturing Corp.
 3. Loren Cook Co.
 4. Penn Ventilator Co.

2.02 INLINE DUCT FANS

- A. Hartzell, Series 48v, Size 12, direct drive duct axial fan with screened discharge outlet. Aluminum housing and aluminum impeller. Max. sound level 70 dBA. Lubrication fittings extended to outside housing. Unit mounted junction box. 600 cfm at 0.500 inches W. A. static pressure
- B. Air Delivery: 540 CFM AT 0.250" WG Static Pressure
- C. Motor: 1/3 HP, 120 VAC, 1 phase, 60 hz

2.03 CEILING FANS

- A. Ceiling fans shall have 56-inches blade sweep for Valve Houses and 36 inch blade sweep for the Control Valve House, with painted steel blades. Down rod length shall be 18 inches. Motor shall be thermally protected PSC type variable speed motor with permanently lubricated bearings. Motor shall be capable of down draft only.
- B. Fan voltage shall be 120 VAC.

PART 3 EXECUTION**3.01 INSPECTION**

- A. General: Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to insure that fans serve their intended function.

3.03 TESTING

- A. After installation of fans has been completed, test each fan to demonstrate proper operation of unit at performance requirements specified including proper balance and rotation. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units that cannot be satisfactorily corrected.

3.04 ADJUSTING AND CLEANING

- A. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

[END OF SECTION]

SECTION 16050**BASIC ELECTRICAL MATERIALS AND METHODS****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor, materials and appliances, including those items that are a part of the electrical system and necessary to its proper operation, but not specifically mentioned in related Sections or shown on the Construction Drawings.
- B. The work shall include, but not be limited to:
 - 1. overhead service including connection to building services in accordance with Section 16160 and 16400;
 - 2. building power distribution in accordance with Sections 16110, 16120, 16130, 16140, and 16450;
 - 3. controls and instrumentation in accordance with Section 16900;
 - 4. testing and start-up of all electrical equipment included in Specifications;
 - 5. lighting and in accordance with Section 16500; and
 - 6. leaving the electrical system fully operational.

1.02 RELATED SECTIONS AND PLANS

- A. Section 09900 - Painting
- B. Section 16110 - Raceways
- C. Section 16120 - Conductors and Terminations
- D. Section 16130 - Outlets, Junctions, and Pull Boxes
- E. Section 16140 - Switches and Receptacles
- F. Section 16160 - Manual Disconnect Switches and Electrical Panels
- G. Section 16400 - Overhead Service
- H. Section 16450 - Grounding

- I. Section 16500 - Lighting
- J. Section 16900 - Controls, Instrumentation, and Flow Meters
- K. Part 6 - Statement of Work
- L. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Furnish all materials and equipment under this and related Sections and comply with the latest versions of applicable standards of the entities listed below:
 1. American National Standards Institute - ANSI;
 2. American Society for Testing Materials - ASTM;
 3. American Standard Association - ASA;
 4. Institute of Electrical and Electronic Engineers - IEEE;
 5. Insulated Cable Engineers Assoc. - ICEA;
 6. National Electrical Code - NEC;
 7. National Electrical Manufacturers' Association - NEMA;
 8. Occupational Safety & Health Act - OSHA;
 9. Underwriters' Laboratories, Inc. - UL;
 10. Factory Mutual - FM;
 11. Electrical Testing Laboratories, Inc. - ETL;
 12. National Electric Safety Code - NESC; and
 13. National Fire Protection Association - NFPA.

1.04 ABBREVIATIONS

- A. When the following abbreviations are used in relation to the work for this and related Sections, they shall have the following meanings:

<u>ITEM</u>	<u>MEANING</u>
Accepted	Reviewed with no exceptions taken to submittal material. See "Submittal" below.
Approved	Inspected and accepted by the CQC Consultant or Construction Manager's Rep.
Boxes	Outlet, Junction, or Pull Boxes.
Code	All codes currently enforced at project location.

<u>ITEM</u>	<u>MEANING</u>
Compression	Compressed using a leverage powered (hydraulic or equivalent) crimping tool.
Connection	All materials and labor required for equipment to be fully operational.
EMT	Electrical Metallic Tubing.
Exterior Location	Outside of or penetrating the outer surfaces of the building weather protective membrane.
Fully Operational	Tested and approved and operating to the satisfaction of the CQC Consultant or Construction Manager, manufacturer, and contract documents.
Furnish	Deliver to the jobsite.
Install	To enter permanently into the project and make fully operational.
GFCI	Ground Fault Circuit Interrupter.
Mfr.	Manufacturer.
NEC	National Electrical Code.
NFPA	National Fire Protection Association. Publication #70 (latest adopted edition with amendments).
NESC	National Electrical Safety Code.
Noted	Shown or specified in the contract documents.
PVC	Polyvinyl Chloride.
Provide	Furnish and install.
RGS	Rigid Galvanized Steel.
Required	As required by code, Construction Manager, or contract documents for the particular installation to be fully operational.
Shop Drawing	Document prepared by Subcontractor, supplier, fabricator, or similar party who fully illustrates and details the equipment and intended installation relative to this specified project.
Shown	As indicated on the Drawings or details.
Submittal	Material for CQC Consultant's or Construction Manager's review which may contain catalog cuts, shop drawings, wiring diagrams, etc., of the actual material being furnished.
Wiring	Raceway, conductors, and connections.

1.05 SUBMITTALS

- A. Submit the following to the Construction Manager for review and approval within 30 calendar days of Notice to Proceed:
 - 1. Listing of the type of material, manufacturer, and catalog or model number for: junction boxes, pull boxes, wireways, raceways, conductors, cables, wiring devices, plates, nameplates, and alarm devices; and
 - 2. Shop drawings of panelboards, electrical panels, and cabinets.
- B. Include dimensions, weight, ratings, mounting requirements, clearances, components interface, wiring diagrams, and other information required for proper evaluation and complete installation on shop drawings.
- C. Approval of systems, equipment and shop drawings is a conditional approval subject to the Construction Drawings, these Specifications and verification of all measurements at the job site. Approval does not relieve the Contractor from the responsibility of shop drawing errors. Carefully check and correct all shop drawings prior to submission for approval.
- D. Submit record drawing copies of all shop drawings to the Construction Manager before final inspection and acceptance.
- E. Order no material or start shop work until the Construction Manager's review of shop drawings has been completed.

1.06 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

1.07 SHOP DRAWINGS

- A. Construction Drawings are generally diagrammatic and show the arrangement and location of fixtures, equipment, and conduit. Carefully investigate the structural and finish conditions affecting the work and arrange the work accordingly.
- B. Equipment indicated on Construction Drawings may be relocated up to 10 feet prior to rough-in without increase in contract cost.

- C. Make all connections to equipment in accordance with approved shop drawings.

1.08 RECORD DRAWINGS

- A. Provide and maintain at the site a set of progress prints on which the actual installation of all work under this section shall be accurately shown, indicating any variation from contract drawings. Changes in circuitry shall be clearly and completely indicated as the work progresses.
- B. These progress prints shall be available for review by the Construction Manager and shall be used to determine the progress of electrical work.
- C. At the completion of the work, prepare a new set of record drawings of the work shown on the progress prints including the dimensioned location of all underground conduit.
- D. Furnish record drawings to the Construction Manager for approval and transmission.

1.09 SUBSTITUTIONS

- A. Where equipment is identified by manufacturer and catalog number, the equipment shall be considered the basis of requirements for quality and performance. Where manufacturers for equipment are identified by name, the Contractor may submit for approval, similar equipment of other manufacturers as substitution. It is the Contractor's responsibility to prove that proposed equipment is equal to that specified. The decision of the Construction Manager as to whether the submitted equipment is acceptable shall be final and binding.
- B. All changes necessary to accommodate the substituted equipment shall be made at the Contractor's expense, and shall be as approved by the Construction Manager. Detailed shop drawings indicating the required changes shall be submitted for approval at the time the substitution is requested.

1.10 SYSTEMS MANUAL

- A. After completion of the work, furnish and deliver 4 copies of a complete electrical equipment systems manual to the Construction Manager's Representative. Include in each manual 1 copy of all approved shop drawings, catalog pages, instruction sheets,

operating instructions, installation and maintenance instructions, spare parts bulletin, and a wiring diagram for each system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. All materials and equipment necessary for the proper installation and operation of the work included under this Section shall be purchased, procured, installed, and wired and tested as required by this and related Sections. Materials and equipment shall include, but not necessarily be limited to 13.2 kv overhead service distribution and 120/240VAC, 1 phase, 3-wire system wiring to electrical equipment such as service panel, control devices, and all other components required for a complete electrical system. The wiring shall include raceways, cables, junction and pull boxes, wireways, and all other required components for a complete installation.
- B. Materials and equipment installed, including lighting fixtures, shall have been tested and listed by Underwriters Laboratories or other approved testing organization and shall be so labeled.
- C. All materials and equipment shall be new and shall meet or exceed the applicable standards listed above. All materials and equipment shall have a product with a date of manufacture of less than 1 year.
- D. All materials and equipment shall be from manufacturers whose products have been in service for at least 3 years.
- E. Include brackets, attachments, mounting, hardware, and other accessories needed for complete installation.

2.02 NAMEPLATES

- A. Provide permanently attached nameplates constructed of three-layer plastic laminated material engraved through white surface material to black sublayer. Lettering shall be 5/16 inch bold style. Nameplates shall indicate the equipment, maximum voltage, number of phases, and the name of the piece of equipment that provides the source of power as shown on the Construction Drawings.

PART 3 EXECUTION**3.01 CUTTING CONSTRUCTION**

- A. Construction materials damaged or cut shall be repaired or replaced with materials of like kind and quality as original materials.

3.02 PAINTING

- A. All exterior and interior steel surfaces shall be properly cleaned and finished with gray ASA-61 paint over a rust-inhibiting phosphatized coating. The finish paint shall be suitable for field painting. Paint unfinished surfaces in accordance with Section 0900. Items furnished under this and related Sections that are scratched or marred in shipment or installation shall be refinished.

3.03 EQUIPMENT CONNECTION

- A. Electrical connections necessary to serve equipment of this and related Sections shall be provided complete. Provide required control connections to all equipment so that the equipment is fully operational upon completion of the project. Whenever the Construction Drawings show an equipment connection, the code-required disconnect switch shall be provided.
- B. All materials and equipment shall be installed in conformance with the manufacturer's installation instructions and UL requirements.

3.04 WIRE NUMBERING

- A. All field wiring, external to pre-manufactured panels and equipment, shall be numbered in manner to be uniquely identified with the associated field equipment. The numbering shall be sequential beginning with 1 and continuing to 99. If a panel requires more than 99 wire numbers start again at 1 preceded by an alpha character starting with A.
- B. A finished wire number schedule shall be submitted complete with conduit numbers and a functional description of the wires.
- C. Wire markers shall be installed in accordance with Section 16120.

3.05 EQUIPMENT SUPPORTS

- A. Installation of structural steel framing, reinforced concrete, etc., shall be complete before installing supporting devices.
- B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structures in accordance with manufacturer's recommendations.
- C. Use expansion anchors for support on concrete surfaces.
- D. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- E. Do not drill structural steel members or concrete protective liner for installing support devices.
- F. 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.
- G. Install surface mounted cabinets and enclosures with 4 anchors (minimum). Provide steel channel supports to stand cabinets and enclosures 1 inch from the wall.

3.06 TESTING DURING INSTALLATION

- A. All wires shall be tested for continuity. Wire insulation shall be megger tested between each conductor and ground. A 1,000-volt megger shall be used for insulation rated 600 volts. Minimum resistance shall be 100 megohms.
- B. Resistance reading between shield and ground shall be measured and recorded for shielded cables in accordance with manufacturer's recommendations shall be transferred to the record drawings.
- C. Provide all test results to CQC Engineer.

3.07 GUARANTEE

- A. Correct all defects in material, equipment, or workmanship disclosed within a period of 1 year from date of project acceptance by the Construction Manager.

[END OF SECTION]

SECTION 16110**RACEWAYS****PART 1 GENERAL****1.01 SCOPE**

- A. This section includes all labor and materials necessary for installation of raceway systems which shall be completed in conformance with National Electrical Code (NEC) and National Electrical Safety Code (NESC).

1.02 RELATED SECTIONS AND PLANS

- A. Part 6 - Statement of Work
B. Part 8 - Environmental Health & Safety/Training Requirements

1.03 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 CONDUIT, FITTINGS AND WIREWAYS**

- A. Acceptable types of conduits and raceways are as follows:
1. Non-metallic (i.e., PVC) conduit.
 2. Liquid-tight flexible metal conduit.
 3. Rigid heavy wall galvanized steel (i.e., RGS) conduit.
 4. Conduits shall be provided as follows:
 - a. Metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) shall be provided for each service indicated. Where types and grades are not indicated, select to comply with specifications and applicable portions of NEC. Minimum size shall be 3/4-inch diameter. All conduit types shall be UL labeled.
 - b. RGS conduit shall be provided and shall be zinc-coated, threaded type, hot-dip galvanized inside and outside and after cutting. RGS shall be used on all interior and outdoor exposed conduit runs.

- c. Liquid-tight flexible metal conduit shall be constructed of single strip, continuous, interlocked and double wrapped steel; hot dipped galvanized; coated with liquid-tight jacket. This conduit shall be used for connections to pumps, valves, outdoors, or heating and ventilator equipment.
 - d. RGS conduits shall be Allied, Republic Steel, Triangle-PWC, or Wheatland. Liquid-tight conduit shall be Anaconda type UA sealtight or Electri-Flex type LA.
- B. Provide metal conduit fittings in accordance with the following:
- 1. Rigid metal conduit fittings shall be cast malleable iron, galvanized, or cadmium plated.
 - 2. RGS fittings shall be of the threaded type. Bushings shall be of the insulated type. Use Myer's hub connectors on all outdoor or damp locations.
 - 3. Conduit fittings and bodies shall be Appleton, O.Z., Steel City, Raco, Crouse-Hinds, Efcor, or Thomas and Betts and conforming to ANSI C 801.
 - 4. Liquid-tight flexible metal conduit fittings shall be insulated throat cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings 3/4 inch minimum conforming to UL 360.
- C. Provide nonmetallic conduit in accordance with the following:
- 1. Provide nonmetallic conduit, ducts and fittings of types, sizes, and weights for each service indicated on the Construction Drawings.
 - 2. Electrical plastic heavy wall conduit shall be Schedule 40, 90° C, constructed of PVC, for direct burial, or concrete encasement, 1 inch minimum size.
- D. Provide nonmetallic conduit fittings and accessories in accordance with the following:
- 1. PVC conduit and tubing fittings shall be manufactured to mate and match to conduit or tubing type and materials as required.
 - 2. PVC conduit shall be Carlon or Triangle-PWC.
 - 3. PVC conduits shall not be supported using metallic encirclements; break encirclements using nylon nuts and bolts.
- E. Provide galvanized cast-metal conduit bodies of types, shapes, and sizes as required to fulfill job requirements. Conduit bodies shall be constructed with threaded-conduit-entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws.
- F. Provide electrical wireways for each type of service indicated on the Construction Drawing. Provide and assemble couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other components and accessories as required for a complete system.

PART 3 EXECUTION**3.01 INSTALLATION OF CONDUITS**

- A. Fasten metal conduits, enclosures, and raceways together to provide effective electrical continuity and rigid mechanical assembly. A ground wire should be installed with all circuits to ensure electrical continuity.
- B. Avoid use of dissimilar metals throughout system to eliminate electrolysis; where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
- C. Provide all empty conduits with 1 No. 10 AWG galvanized wire or nylon equivalent in sufficient length and properly bent at each end to prevent the wire from slipping into the conduit or duct. Conduits to be left empty shall be tested with a ball mandrel. Labels shall be provided to pull cord at each end of the empty conduit identifying the cation at the other end.
- D. Schedule 40 PVC conduit may be installed underground or below slabs on grade only. The use of Schedule 40 PVC elbows or conduit stub-ups shall not be permitted with the exception of grounding system conduit runs.
- E. Make all conduit runs straight and true. Offsets and bends shall be uniform and symmetrical. Bends shall be of the long sweep type. Install all conduit stub-ups plumb and flush to mounting surface.
- F. Clean all conduits immediately after installation with a wire brush that is 1/2 inch larger than the bore of the conduits. All conduits shall be capped with "steel pennies" or plastic "push penny" plugs immediately after installation and cleaning. Duct tape is not an acceptable method of capping conduits. If obstructions are found, the conduits shall be replaced.
- G. Metallic conduits routed below grade shall either be wrapped or have a bitumastic coating.
- H. All outdoor conduits shall be RGS or PVC conduit.
- I. The use of running threads is prohibited.
- J. Secure all RGS conduits entering sheet metal boxes (i.e., junction boxes, pull boxes, electrical panels, etc.) in place with 1 galvanized steel bonding type locknut and 1 insulated grounding type metallic bushing or 2 galvanized steel bushing type locknuts and 1 plastic bushing. Use insulated ~~thread~~ type Myer's Hub in outdoor or damp locations where box does not provide a threaded fitting.

- K. All conduits shall be securely fastened within 36 inches of each outlet box, junction box, cabinet, or fitting. One support shall be provided not over 12 inches from each change in direction.
- L. Flexible raceway connections shall not exceed 6 feet in length.
- M. Fittings shall be suitable for providing conduit terminations with a liquid-tight seal.
- N. Assemble metal enclosures, and raceways and connect to electrical boxes, fittings and cabinets to provide effective electrical continuity and rigid mechanical assembly.

3.02 UNDERGROUND RACEWAYS

- A. Underground raceways shall be RGS or PVC.
- B. Arrange and slope raceways entering valve and control valve houses to drain away from the same.
- C. Provide marker tape over all underground raceways. Marker tape shall read "Caution - Electric Line Buried Below" as manufactured by Terra Tape or approved equal. Marker tape shall be installed 12 inches below grade.
- D. Install underground raceways a minimum of 24 inches below final grade unless otherwise noted on the Construction Drawings or as directed by the Construction Manager. Abrasions on the raceways shall be repaired with PVC-base paint.

3.03 RACEWAYS THAT STUB UP THROUGH CONCRETE SLAB

- A. Install at such depth that the exposed raceway is vertical and no curved section of the elbow is visible.

3.04 SEALING OF RACEWAY PENETRATIONS

- A. Provide a watertight seal around all raceways on concrete slab surfaces above grade in a method that is acceptable to Construction Manager.

3.05 SEALING OF RACEWAYS

- A. Provide a watertight seal in the interior of all raceways that pass through weatherproof panel walls. Seal on the end inside building, using raceway sealing fittings manufactured for this purpose. Seal poured-type fittings with a non-hardening compound manufactured for such service.

3.06 PULL CORDS

- A. Provide a nylon pull cord in spare raceways.

3.07 RACEWAY SIZE

- A. Raceways not sized on the Construction Drawings shall be sized per NEC Table C8. Size 3/4-inch minimum.

3.08 EXPANSION FITTINGS

- A. Provide raceways crossing expansion joints with an expansion fitting with bonding jumper.

3.09 CONDUIT MARKERS

- A. Conduits shall have stainless steel indented marker plates, Panduit Corporation, Catalog No. MMP350-C or approved equal, held in place with stainless steel ties, Catalog No. MLT4S-CP or approved equal. Characters shall be 3/16-inch high minimum, indented with indenter marker press, Catalog No. IMP187, or approved equal.

3.10 CONDUIT CLEANING

- A. Thoroughly swab conduits to remove foreign material before pulling cables.

[END OF SECTION]

SECTION 16120**CONDUCTORS AND TERMINATIONS****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor and materials necessary for installation of conductors, splices, and terminations, which shall be supplied complete and in conformance with National Electrical Code (NEC) and National Electrical Safety Code (NESC).

1.02 RELATED SECTIONS AND PLANS

- A. Section 16050 - Basic Electrical Materials and Methods
- B. Section 16110 - Raceways
- C. Part 6 - Statement of Work
- D. Part 8 - Environmental Health & Safety/Training Requirements

1.03 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 CONDUCTORS**

- A. All conductors shall be soft drawn annealed copper as manufactured by Cable, ITT Royal Electric, Southwire, Carol, or American Insulated Wire Corp. No. 12 and 14 American Wire Gauge (AWG) conductors may be a solid conductor material. No. 10 AWG and larger conductors shall be a stranded conductor material. All wire shall be 90°C rated, with 98 percent conductivity. Secondary conductors shall be, quadruplex (three insulated conductors and one bare neutral cable) and triplex (two insulated

conductors and one bare neutral cable) as indicated on Construction Drawings, with 600 volt cross-linked polyethylene insulation for phase conductors conforming to National Electrical Manufacturer's Association Standard NEMA WC7.

- B. Insulation shall be 600 volt of the following type:
1. Branch Circuits - THWN
 2. Panel/Main Feeders - XHHW-2
 3. Signal/Control Systems - THHN/THWN
 4. Grounding - THWN
- C. Color-coded conductors as follows:
1. Color coding for 240/120-volt, single phase systems:
 - a. Grounded neutral white
 - b. Grounding conductor green or bare
 - c. Ungrounded conductor black
 - d. Ungrounded conductor red
 2. Color Coding for 480/277-Volt, three phase systems:
 - a. Grounded neutral gray
 - b. Grounding conductor green or bare
 - c. Underground conductor brown
 - d. Underground conductor orange
 - e. Underground conductor yellow
- D. Remove and replace all conductors and cables not properly color-coded.
- E. Conductors up to No. 8 AWG shall have continuous color-coded outer jacket. Conductors larger than No. 8 AWG shall be identified at all outlet boxes, junction and pull boxes by means of colored plastic tape applied to the wire. Tape shall be quarter lapped and two inches in length.
- F. Use no conductor smaller than No. 12 AWG for power and no conductor smaller than No. 14 AWG shall be used for control.
- G. Use no conductor smaller than No. 10 AWG for receptacle branch circuit runs exceeding 100 feet for 120 volts.

2.02 SPLICES

- A. Splices shall be solderless type only. Preinsulated "twist-on" type shall be limited to No. 10 AWG and smaller. Bolt or compression-set type with application of preformed insulated cover, heat shrinkable tubing, or plastic insulated tape acceptable for all sizes.

2.03 TERMINATIONS AND CONNECTIONS

- A. Use terminations that are compression-set, bolted, screw type lug, direct bolted, or screw type terminal.
- B. Utilize conductors No. 12 and smaller with eye or forked tongue type compression-set terminator when termination is to a bolt or screw set type terminal block or terminal cabinet.
- C. Furnish terminations suitable for cable size and type employed.
- D. Furnish wire and cable connectors for No. 8 AWG and larger of the bolted pressure type as manufactured by O.Z. Gedney Company. Insulate connections with vinyl mastic pads Scotch Series 2100, or insulating compound, then tape with 3 wraps of Scotch 33 vinyl plastic tape.
- E. Fasten No. 1/0 AWG cable and larger with using multi-crimp (3 crimps minimum) long barrel two (2) hold compression type lugs, then insulate and protect as noted above. Do not use single indent compression lugs.

2.04 CABLE TIES

- A. Cable ties shall be nylon or equivalent, locking type.

2.05 WIRE MARKERS

- A. Wire markers shall be imprinted tubular plastic type.

PART 3 INSTALLATION

3.01 GENERAL

- A. Install all conductors in raceways unless otherwise shown on Construction Drawings or specifically authorized by the Construction Manager. Install all splices and terminations in enclosures as required by this Section.
- B. Use continuous conductors from outlet to outlet. No splices shall be permitted.
- C. Identify wires at each end using wire markers impervious to oil, water and dust as manufactured by Brady, and Thomas & Betts.
- D. Install conductors in a manner that will not damage their insulation. The bending radius for jacketed cables shall not be less than seven times the outside diameter of the cable. Raceways runs shall be thoroughly swabbed and complete before any conductors are installed. Use recommended pulling compound as required.
- E. Neatly group and tie together all feeder, branch circuit, or control wiring passing through pull boxes, and/or being made up in panels, and terminal cabinets using "Ty-Raps" manufactured by Thomas & Betts (T & B) at approximately 6 inch intervals, provide "Ty-Raps" at 36 inch intervals along cable tray runs.

3.02 CONDUCTOR SIZE

- A. Furnish No. 12 AWG minimum conductors for power and lighting circuits.

3.03 RACEWAY SIZES

- A. Raceways (when shown) are sized for copper, type THWN, unless shown otherwise. Size all raceways per code unless specifically shown to be larger on Construction Drawings. See Section 16110 of these Specifications.

3.04 TAPING

- A. Taping, if used, shall be half-lapped synthetic tape.

3.05 CONDUCTORS IN PANELS AND SWITCHBOARDS

- A. Neatly group and form conductors in panels and terminal cabinets in a manner to “fan” into terminals with regular spacing.

3.06 WIRE NUMBERING

- A. Provide wire numbering in accordance with Section 16050 of these Specifications.
- B. Attach wire markers at each termination point within 2 inches of wire termination. Marker nomenclature shall be visible without moving the marker.

3.07 CABLE LUBRICANTS

- A. Use cable lubricants that are specifically recommended by the cable manufacturer for assisting in pulling cables. Cable lubricants shall be soapstone, graphite, or talc. Lubricant shall not be deleterious to the cable.

3.08 CABLE PULLING

- A. Do not exceed the maximum pulling tension recommended by the cable manufacturer.

3.09 TERMINATIONS

- A. Provide terminations with materials and methods as recommended by the manufacturer of the terminations.

[END OF SECTION]

SECTION 16130**OUTLETS, JUNCTIONS, AND PULL BOXES****PART 1 GENERAL****1.01 SCOPE**

- A. Provide all labor and material necessary for installation of outlets, junctions, and pull boxes as required to enclose devices, to facilitate pulling of conductors, and for wire splices and branches.

1.02 RELATED SECTIONS AND PLANS

- A. Section 16050 - Basic Electrical Materials and Methods
- B. Part 6 - Statement of Work
- C. Part 8 - Environmental Health & Safety/Training Requirements

1.03 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Outlet and junction boxes shall be cast or malleable iron or shall be cast of corrosion resistant alloy, complete with conduit hubs, compatible with raceways to which they are connected.
- B. Fabricate pull boxes of heavy gauge steel and hot dipped galvanized complete with malleable iron hubs.
- C. Label all boxes for damp or wet locations as applicable.

PART 3 INSTALLATION**3.01 ANCHORING**

- A. Firmly anchor directly to building structural members. Boxes must be attached such that they will not “rock” or “shift” when devices are operated.

3.02 ELECTRICAL OUTLET BOXES

- A. Device Height: Measure from the finished slab or ground surface to the center line, unless otherwise shown on the Construction Drawings.

3.03 CONNECTION TO EQUIPMENT

- A. For equipment furnished under other Sections, provide outlet boxes of sizes and at locations necessary to serve such equipment and provide final connections to all equipment.
- B. Outlet boxes are required if equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring, or requires a wire with insulation rating different from circuit wiring used. Study equipment details to assure proper coordination.

3.04 BLANK COVERS

- A. Provide blank covers or plates over all boxes that do not contain devices or are not covered by equipment.

3.05 JUNCTION AND PULL BOXES

- A. Install pull and junction boxes as shown, or as necessary to facilitate pulling of wire and to limit the number of bends within code requirements. Boxes shall be permanently accessible and shall be placed only at locations shown on the Construction Drawings or approved by the Construction Manager.

[END OF SECTION]

SECTION 16140**SWITCHES AND RECEPTACLES****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor and materials necessary for installation of all switches, receptacles, and plates complete and fully operational as shown on Construction Drawings or approved by Construction Manager.

1.02 RELATED SECTIONS AND PLANS

- A. Section 16050 - Basic Electrical Materials and Methods
- B. Section 16130 - Outlets, Junctions, and Pull Boxes
- C. Part 6 – Statement of Work
- D. Part 8 – Environmental Health & Safety/Training Requirements

1.03 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. The Contractor shall provide switches, receptacles, and plates of nationally recognized manufacturer regularly engaged in manufacturing such products.

2.02 COLOR

- A. The Contractor shall provide all switch handles and plate faces which are of an ivory, brown, or gray color.

2.03 SWITCHES

- A. The Contractor shall provide switches that are "Specification Grade", heavy-duty type, back and side wired, rated 120 volt, 20 amp. Pass & Seymour 20AC1, Bryant 4901, Hubbell 1221, Leviton 1221, or Slater 720-AG.

2.04 RECEPTACLES

- A. The Contractor shall provide "Industrial Grade" and buck and sidewired, duplex or single NEMA 5-15R configuration (20 amp, 120V) as shown on the Construction Drawings. Receptacle shall be: Hubbell HB65262I or HB65261 as required.

2.05 PLATES

- A. Plates shall be cast aluminum sized to fit box.
- B. Exterior plates shall be Bell #RCH1-DR or perfect Line WGF100-C (horizontal mounting) for 20 amp for receptacles.

PART 3 EXECUTION**3.01 MOUNTING**

- A. Mounting shall be as follows: rigidly fasten (without play) outlet boxes and devices at proper position with wall top and bring receptacle flush with plate or switch handle the proper distance through plate.
- B. Switches, receptacles, and plates shall be aligned and plumb.
- C. Mounting of outlet boxes shall be in accordance with Section 16130.

3.02 ORIENTATION

- A. Switches shall be set with handle operating vertically, up position "ON."
- B. Set receptacles vertically unless shown otherwise or construction requires horizontal mounting.

3.03 PLATES

- A. Plates shall be provided for all switches and receptacles. Plate shall cover cutout for outlet box.

[END OF SECTION]

SECTION 16160**MANUAL DISCONNECT
SWITCHES AND ELECTRICAL PANELS****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor and materials for manual disconnect switches and electrical panels.

1.02 RELATED SECTIONS AND PLANS

- A. Section 09900 - Painting
- B. Section 16050 - Basic Electrical Materials and Methods
- C. Part 6 - Statement of Work
- D. Part 8 - Environmental Health & Safety/Training Requirements

1.03 SUBMITTALS

- A. Submit to Construction Manager for review detailed information on proposed manual disconnect switches and electrical panels within 45 calendar days from Notice to Proceed.

1.04 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 GENERAL

- A. Manual disconnect switches and electrical panels shall conform to National Electrical Manufacturers Association (NEMA) standards for each specific purpose and be Underwriters Laboratory (UL) listed.

2.02 ELECTRICAL PANELS

- A. Electrical panels shall be 600V class construction for 1 phase, 3-wire use.
- B. Breaker Panels shall be the dead-front safety type, equipped with thermal-magnetic molded case circuit breakers with trip rating shown on schedules.
- C. Breaker panels shall be manufactured by General Electric, Square D, Westinghouse, or Siemens.
- D. All interiors shall be completely factory assembled with circuit breakers, wire connectors, and accessories. All wire connectors shall be of the pressure type and all shall be suitable for copper wires.
- E. Interiors shall be so designed that circuit breaker devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
- F. Branch circuits shall be arranged using double row construction. Branch circuits shall be numbered by the manufacturer. The manufacturer shall provide permanent circuit numbers on the deadfront trim with odd numbers on the left side and even on the right. Branch circuit breakers shall be lockable.
- G. Buses shall be tin plated copper. Bussing shall be full height without reduction.
- H. Main bus shall be distribution sequence type configuration to allow installation of two-pole circuit breakers at any location.
- I. Neutral bussing shall be 100 percent rated, insulation from grounded parts and shall have suitable lugs and terminals to make all neutral connections.
- J. Separate ground terminal blocks, 100 percent rated, shall be provided in panels.

- K. Electrical panel shall be rated for NEMA 3R environment, made from galvanized code gauge steel having multiple knockouts. Boxes shall be of sufficient size to provide a minimum gutter space of 4 inches on all sides. Where feeder cables supplying the mains of a panel area carried through its box to supply other electrical equipment, the box shall be so sized as to include this wiring space. This wiring space shall be in addition to the minimum gutter space specified above and the limiting width may be increased accordingly.
- L. Provide hinged lockable doors to cover all switching device handles.

2.03 MANUAL DISCONNECT SWITCHES

- A. Disconnect Switches shall be 600V class construction for 1 phase, 3-wire use.
- B. Disconnect Switches shall be the dead-front safety type, equipped with 100 A Class R fuses.
- C. Disconnect Switches shall be manufactured by General Electric, Square D, Westinghouse, or Siemens.
- D. All interiors shall be completely factory assembled with fuses, wire connectors, and accessories. All wire connectors shall be of the pressure type and all shall be suitable for copper wires.
- E. Interiors shall be so designed that fuses can be replaced without disturbing adjacent units.
- F. Neutral shall be 100 percent rated, insulation from grounded parts and shall have suitable lugs and terminals to make all neutral connections.
- G. Separate ground terminal blocks, 100 percent rated, shall be provided in panels.
- H. Disconnect Switches shall be rated for NEMA 3R environment, made from galvanized code gauge steel having multiple knockouts.
- I. Hinged lockable doors shall be provided. Lock shall be capable of locking disconnect switch in deenergized position.

- J. All exterior and interior steel surfaces of the electrical panels shall be properly cleaned and finished with gray ASA-61 paint over a rust-inhibiting phosphatized coating. The finish paint shall be suitable for field painting. Paint unfinished surfaces in accordance with Section 09900.

PART 3 EXECUTION

3.01 MOUNTING

- A. Securely mount to pre-engineered metal building structural steel members. Attachment to sheeting will not be permitted. Manual disconnect switches and electrical panels supported only by raceways are not acceptable.
- B. Electrical panels shall be installed as shown on the Construction Drawings, in accordance with manufacturer's instructions and shall be installed at maximum 6 feet – 6 inches above catwalk floor to top of electrical panel.
- C. The Contractor shall provide nameplate with panel identification (PID). The Contractor shall provide typewritten circuit directories odd numbers on left and even on right side that accurately list information as shown on Construction Drawings. At the top of the directory, type the electrical PID and voltage.

3.02 FIELD QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the latest version of the National Fire Protection Association Standard (NFPA) 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with the latest version of NEMA PB 1.
- C. Comply with NFPA 70.
- D. Submit test results to Construction Manager upon completion of testing.

[END OF SECTION]

SECTION 16400
OVERHEAD SERVICE

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes all labor and materials necessary to comply with the general requirements for overhead electrical distribution service in accordance with National Electrical Safety Code (NESC).

1.02 RELATED SECTIONS AND PLANS

- A. Section 16120 - Conductors and Terminations
B. Section 16450 - Grounding
C. Part 6 - Statement of Work
D. Part 8 - Environmental Health & Safety/Training Requirements

1.03 REFERENCES

- A. Latest version of American National Standards Institute (ANSI) Standards:
1. ANSI C 29.5. Wet-Process Porcelain Insulators – Low and Medium Voltage Type.
2. ANSI C 57.12. Overhead type transformer 500 KVA and smaller.
3. ANSI C 2. National Electrical Safety Code.
4. ANSI 5.1. Specifications and Dimensions for Wood Poles.
- B. Latest version of American Wood Preservers' Association (AWPA) Standard:
1. AWPA C 7. Western Red Cedar, Northern White Cedar and Alaska's Yellow Cedar Poles – Preservation Treatment of Incised Pole Butts by the thermal process.
- C. Latest version of International Electrical Testing Association (NETA) Standard:
1. NEA ATS-95. Acceptance Testing Specifications of Electrical Power Distribution Equipment and Systems.

1.04 SUBMITTALS

- A. Product Data: Provide dimensional data for all equipment specified in this Section. Provide detailed electrical characteristics of transformers, surge arrestors, and cutouts.
- B. Test Data: Provide no-load loss, winding resistance, and dielectric fluid test results.
- C. Manufacturers Data: Provide manufacturers literature with maintenance schedules, spare parts lists, and operational procedures.

1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 WOOD POLES**

- A. Furnish poles of Southern Pine cut from live stock and conforming to ANSI 5.1. All poles shall be air seasoned and butt treated in accordance with AWPA Standard C7. Each pole shall be branded or marked as described in ANSI 5.1 as follows:
 - 1. The brand or mark shall be placed squarely on the face of the pole and at 10 feet from the butt. The face brand shall designate the supplier's code or trademark; plant location and year of treatment; species and preservative code; and class and length of pole.
 - 2. The pole roof and gain shall be brush coated with pentachlorophenol-petroleum solution conforming to AWPA C7 p8 and p9.
- B. Poles shall be class 2.
- C. The minimum setting depth for poles shall be 6 feet, 6 inches for 55 foot poles; 8 feet, benches for 60 foot poles; and 8 feet, 6 inches for 80 foot poles.

2.02 POLE LINE HARDWARE

- A. All pole line hardware shall be heavy galvanized steel.

2.03 OPEN FUSE CUTOUTS, POLE MOUNTED

- A. Unit shall be rated 15 kV, shall be positive latch type, for hook-stick operation rated 10,000 AIC. Provide with fuses. Sizes as shown on Construction Drawings.

2.04 SPAN OR DOWN GUYS

- A. Span or down guys shall employ high strength stranded galvanized steel guy wire. An eye bolt shall be used on the pole (angle eye bolt for down guy) and a three bolt clamp. Use 8-foot-long plastic half-round guy guard at lower end of down guy.

2.05 ANCHORS

- A. Anchors shall be helix screw type as shown on Construction Drawings set in line with the angle of the down guy and with the eye at top projecting not more than 5 inches above finished grade. Anchor shall be rated for 23,000 pounds tension in medium dense soil conditions.

2.06 INSULATORS, POLE MOUNTED

- A. Pin type insulators shall be in accordance with ANSI C29.5 Class 55-4. Insulators shall be wet process born porcelain.

2.07 POLE MOUNTED TRANSFORMERS

- A. Single phase distribution type per ANSI C57.12. Oil filled, non-PCB type. Four taps, (2) 2-1/2 percent above, (2) 2-1/2 percent below 25 kVA as shown on the Construction Drawings. Top-mounted primary bushings and side-mounted secondary bushings. Provided with lifting lugs and mounting brackets. Transformers shall be delivered to site for testing at least 2 weeks prior to installation. Transformer primary voltages shall be 20.4 kV/13.2 kV. Secondary voltages shall provide 240 V/120 V center tapped for single phase connections.

2.08 SURGE ARRESTERS

- A. Distribution class designed for outdoor pole mounting. Shall be valve type rated for 15 kV. External air gap type not permitted. Provide with mounting bracket.

2.09 SERVICE DROP

- A. Cable shall be rated for 600 volts, suitable for outdoor aerial installation. Conductors shall be wound symmetrically around messenger cable.

PART 3 INSTALLATION**3.01 GENERAL**

- A. Installation shall be per ANSI C2.
- B. Plumb all poles to true vertical.

3.02 TRANSFORMER INSTALLATION

- A. The Contractor shall install transformers in accordance with manufacturer's instructions and Construction Drawings.

3.03 QUALITY CONTROL

- A. Electrical inspection and testing 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 by the Construction Manager 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.
- B. Testing shall be witnessed by Consultant and CQC and manufacturer's service representatives(s), if required.
- C. Submit test results and calibration data on approved forms to Construction Manager for review.

- D. Visual inspections shall be performed for phasing and connections.
- E. Repair or replacement of components where test results are unacceptable, including those damaged during testing process, is required.

[END OF SECTION]

SECTION 16450**GROUNDING****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes all labor and materials necessary for installing grounding systems for service neutral power ground and for equipment grounds and bonding as required by the National Electric Code (NEC) and National Electrical Safety Code (NESC) and specified in Section 16050.

1.02 RELATED SECTIONS AND PLANS

- A. Section 16050 - Basic Electrical Materials and Methods
- B. Part 6 - Statement of Work
- C. Part 8 - Environmental Health & Safety/Training Requirements

1.03 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 GROUNDING CONDUCTORS AND CONNECTORS**

- A. Grounding conductors shall be copper only, sized per code. Bare or green insulated in sizes No. 10 American Wire Gauge (AWG) or larger. Green insulated for size No. 12 AWG.
- B. Overhead distribution poles, pole ground wire shall be copper, sized per code. Bare size No. 4 AWG or larger.

2.02 GROUND RODS

- A. Furnish 3/4-inch-diameter by 10-foot-long copper clad steel ground rods.

PART 3 EXECUTION**3.01 GROUNDING**

- A. Ground electrical systems and equipment as required by NEC and NESC and as shown on Construction Drawings.

3.02 GROUND RODS

- A. Provide ground rods as shown and/or required and the grounding conductor shall be connected to each rod.

3.03 PROTECTION OF GROUNDING CONDUCTOR

- A. Where exposed to physical damage, ground wire shall be protected with rigid non-ferrous conduit as permitted by applicable NESC.

3.04 GROUNDING CONDUCTOR

- A. Provide grounding conductor in all conduit run except for control circuits 24 V and less.

3.05 CONNECTION TO POWER GROUND BUS

- A. Furnish and install connections in accordance with codes, including but not limited to:
1. raceway system;
 2. panelboards;
 3. service neutral;
 4. "separately derived service" (transformer or emergency power supply);
 5. electrically operated equipment and devices; and
 6. surge arrestors.

- B. No device or equipment shall be connected for electrical service which has a neutral conductor connected to a grounding conductor or to the frame within the device or equipment.

3.06 METHOD OF CONNECTIONS

- A. Ground connections and ground cable splices shall be made by thermal welding or copper compression-set type connectors Underwriters Laboratory (UL) listed for grounding purposes. Grounding lugs, where provided as standard manufacturer's items on equipment furnished, may be used.

3.07 EXPANSION FITTINGS

- A. In conduit runs requiring an expansion fitting, a bonding jumper shall be installed around the fitting to maintain continuous ground continuity.

3.08 TESTING

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation as specified in Part 6 of the Contract Documents and manufacturer's instructions. Accurately record as-built locations of grounding electrodes where different from Construction Drawings, and submit to the Construction Manager. Test instrumentation shall conform to NETA ATS. Provide certification for instrumentation.
- B. 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 of equal size shall be installed a minimum of 6 feet from the original and connected with a No. 2 AWG wire minimum. Test new ground rod and record results. Notify Construction Manager if second ground rod test result are above 25 OHMs.
- C. Measure the system's resistance to 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 to Construction Manager upon completion of testing.

3.09 CONSTRUCTION QUALITY REQUIREMENTS

- A. CQC Consultant will monitor grounding installation and testing as specified in this Section.

[END OF SECTION]

SECTION 16500**LIGHTING****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes labor and materials necessary for installation of the lighting system, which shall be installed complete and fully operational and shall conform to National Electrical Code (NEC) and Underwriters' Laboratories, Inc. (UL) listing requirements.

1.02 RELATED SECTIONS AND PLANS

- A. Section 16050 - Basic Electrical Materials and Methods
- B. Part 6 - Statement of Work
- C. Part 8 - Environmental Health & Safety/Training Requirements

1.03 SUBMITTALS

- A. Original manufacturer's product descriptions, neatly and clearly marked, shall be submitted to indicate that fixtures and ballasts fully comply with this Section and Construction Drawings.

1.04 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS**2.01 FIXTURE VOLTAGE**

- A. Match fixture voltage and voltage of circuit serving the fixture. Fixture voltage shall be 120 VAC.

2.02 LIGHT TRANSMITTING COMPONENTS

- A. Light transmitting components shall be such as do not yellow with age.

2.03 SPECIAL PARTS

- A. Provide adapters, plates, brackets, and anchors where required to suitably mount lighting fixtures.

2.04 FLUORESCENT FIXTURES

- A. Provide 2 lamp, 4-foot apertured industrial grade fluorescent fixtures, 120 volt AC, with T8 energy-efficient electronic ballasts.
1. Fluorescent lamps shall be 4-foot, 32 watt, rapid start, energy-efficient, reduced mercury type, T8 diameter, and 2650 mean lumens.

2.05 OUTDOOR LIGHTING FIXTURE

- A. Provide dusk-to-dawn packaged outdoor lighting fixture, die cast aluminum, 120 Volt AC, 70 watt high pressure sodium lamp and ballast with photoelectric control packaged complete with fixture, lamp, hook up wire, photo control, and mounting hardware.

2.06 EXIT SIGN/EGREES LIGHTING FIXTURE

- A. Provide red LED exit sign with 2, 12v Egress Lights. Unit shall operate on 120 VAC, have 1.5 hrs of battery life and be package to mount on utility box and be hard wired to Bldg.

PART 3 EXECUTION**3.01 LIGHT FIXTURES**

- A. Light fixtures shall be installed in accordance with manufacturer's instructions and as shown on the Construction Drawings.
- B. Fixtures inside buildings shall be set with bottom of fixture set above finished floor or attached as shown on the Construction Drawings.

[END OF SECTION]

SECTION 16900**CONTROLS, INSTRUMENTATION, AND FLOW METERS****PART 1 GENERAL****1.01 SCOPE**

- A. This section includes all labor and materials necessary to install the control system, which shall be installed complete and fully operational and shall conform to National Electrical Code (NEC) and Underwriters' Laboratories, Inc. (UL) listing requirements. Instrument Data Sheets are included in this Section.

1.02 RELATED SECTIONS AND PLANS

- A. Part 6 - Statement of Work
- B. Part 8 - Environmental Health & Safety/Training Requirements and Safety

1.03 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be as specified in Part 8 of the Contract Documents.

1.04 SUBMITTALS

- A. Submit the manufacturer's published product literature and completed instrument data sheets to the Construction Manager for review prior to installation.
- B. Submit shop drawings which include assembly and wiring diagrams to the Construction Manager for review prior to installation.
- C. Submit installation instructions, including recommended calibration procedures and installation details to the Construction Manager for review prior to installation.
 - 1. Include frequency of calibration required at the time after system installation and regular intervals thereafter.
 - 2. Certification of test equipment (calibration records) used to complete the work as described in this Section.

- D. Provide inspection and test procedures to the Construction Manager for review prior to testing.
- E. Submit test reports that shall be typewritten, listing equipment used, person or persons performing the tests, date tested, device or circuit tested, and results of test, to the Construction Manager for review prior to installation.
- F. Submit calibration reports to the Construction Manager for review prior to installation.
- G. Submit operation and maintenance (O&M) manuals to the Construction Manager prior to installation including suggested spare parts inventory for each type of equipment to be installed.

PART 2 PRODUCTS

2.01 GENERAL

- A. Match control unit voltage and voltage of circuit serving the instrument.

2.02 INSTRUMENTATION

- A. Flow Meter:
 - 1. Furnish Metron Farnier Model Spectrum 260 flow meter with 3-inch flange connection at leachate collection system (LCS) and leak detection system (LDS) locations within valve houses. Furnish Metron Farnier Model Spectrum 440 flow meter with 6-inch flange at control valve house location.
- B. Flow Transmitter:
 - 1. Furnish Contrec Rate Totalizer Model 202D-14, loop powered with 4 to 20 mA output at all flow meter locations.
- C. Level Recorder:
 - 1. Furnish In-Situ Troll Model 4000, alkaline battery, 15 psi pressure range with RS2323 communications kit. Provide RS232, teflon, quick connect cable with integral vent and service grip, 6 feet long.

- D. Level Transmitter:
1. Use Great Lakes Industries Model 4500L Concentric Shield Level sensor with Model 690L Level analyzer and 2-wire, loop powered level transmitter. The one-piece unit shall be provided with $\frac{3}{4}$ -inch NPT threads for mounting, rated IP65, NEMA 4, and cable/conduit knockouts. The sensor shall be capable of measurements to 40 inches. The transmitter shall include built-in temperature compensation; maximum power consumption at 24 VDC shall be 1 watt. The signal output range shall be 4 to 20 mA, the span shall be selectably proportional or inversely proportional, the accuracy shall be at least 0.5 percent of full range in air, and the resolution shall be at least $\frac{1}{4}$ inch.
- E. Level Indicators for control panel as specified on Drawings.
- F. Level Switch
1. Furnish Kobold Type NSM-5101 polypropylene float with SPDT microswitch, 0.6 g/ml float density with Neoprene cable cladding.

2.03 CONTROL PANEL

- A. Furnish and install control panel as shown on the Construction Drawings.
- B. Functional description of control panel operation. Flow meters shall be provided with local readout flow transmitters that can be toggled between total flow and flow rate. Flow transmitters shall be connected to panel mounted readouts for the LCS and LDS calibrated to display total flow. Level transmitters shall be provided with panel-mounted readouts calibrated that display percent full of the leachate storage tanks for the LCS and LDS. Level recorders shall be configured to record tank level in feet and temperature in degrees Fahrenheit. Readings shall be spaced 15 minutes apart. Each level recorder shall be programmed with a unique identification number corresponding to the process and instrumentation diagram. Level switch shall be installed with normally open contact. Contact closure shall activate a panel mounted sump indicator light. The sump indicator lights shall be resettable using a momentary contact push button on the panel face.

PART 3 INSTALLATION

3.01 FLOW METERS

- A. Install flow meters horizontal with meter face in upright position. Attach pulse pickup to meter face. Mount rate totalizer to side of meter. Set k-factor to read

gallons corresponding to meter face. Time base should display gallons per minute. Connect rate totalizer to readout device.

3.02 LEVEL TRANSMITTERS

- A. Install level transmitters into bulkhead fitting or top of tank. Ensure unit is level and that no obstructions or equipment are installed in the sensor path.

3.03 LEVEL RECORDER

- A. Insert Troll into tank with tip of sensor at the bottom of the tank using service grip. Secure service grip to bulkhead fitting.

3.04 LEVEL SWITCH

- A. Install level switch in sump to activate at level 1 inch below top of sump. Do not drill or install anchors into sump liner. Secure loop of float switch to bottom of sump using weight on cable approximately 6 inches from float.

3.05 SCOPE

- A. Install air flow switch and associated duct, per switch manufacturer's installation instructions, on supply fan discharge.
 - 1. Air Flow Switch: McMaster-Carr catalog #1783k13, paddle-style air flow switch.

3.06 ATTACHMENT

- A. Instrument Data Sheets

3.07 QUALITY ASSURANCE

- A. **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).
- B. **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.

INSTRUMENT DATA SHEETS

5062

REQUISITION NO.			VENDOR					
1	Tag Nos.		LT-701 & LT-801		LR-702 & LR-802		FT-703 & FT-803	
2	Item No.							
3	Model No.		690L		Troll 4000		202D-14	
4	Service		LDS Tank		LDS Tank		LDS Pipe	
5	Vessel or Equipment No.		T-*02		T-*02		CE-3"-A-1014-1C	
6	P&ID No.		LT-*01		LR-*02		FE-*03	
7	Type		Capacitance		Press Transmitter		Pulse	
SERVICE CONDITIONS								
8	Upper Fluid		Leachate		Leachate		Leachate	
9	Lower Fluid							
10	SG Upper	SG Lower	1		1		1	
11	Press Max	Normal	ATM		ATM		ATM	
12	Temp Max	Normal	90° F	60° F	90° F	60° F	90° F	60° F
13								
14								
BODY								
15	Material		316SS		316 SS		Painted Steel	
16	Size & Type Connections		3/4" NPT		1.5" Dia.		Clamp On	
17	Top Connection Location		Atmosphere		Atmosphere		NA	
18	Bot Connection Location		LDS Tank		LDS Tank		LDS Flow Motor	
19	Case Mounting		Integral		Integral		Integral	
20	Flange Orientation		Vertical		Vertical			
21	Rotatable Head							
22								
ELEMENT								
23	Diameter or Length In.		3/4"		1.5" x 20"		3"	
24	Extension In.		40"		N/A			
25	Material		Teflon		316 SS			
26	Torque Tube Material		NA		NA			
27	Air Fin		NA		NA			
28								
TRANSMITTER								
29	Type		Electronic		Electronic		Electronic	
30	Output		4-20 mA DC		RS 232		4-20 mA DC	
31								
CONTROL								
32	Type		NA		NA		NA	
33	Proportional %	Reset						
34	Output							
35	On Level Increase Output							
36								
ACCESSORIES								
37	Filter & Regulator							
38	Gauge Glass Connections							
39	Gauge Glass							
40	Purge Connection							
41	Electric Switch							
42								
43								

000201

INSTRUMENT DATA SHEETS

5062

REQUISITION NO.		VENDOR					
1	Tag Nos.	LT-704 & LT-804		LR-705 & LR-805		FT-706 & FT-806	
2	Item No.						
3	Model No.	690L		Troll 4000		202D-14	
4	Service	LDS Tank		LDS Tank		LCS Pipe	
5	Vessel or Equipment No.	T-*01		T-*01		CE-3"-A-1014-1C	
6	P&ID No.	LT-*04		LR-*04		FE-*06	
7	Type	Capacitance		Press Transmitter		Pulse	
SERVICE CONDITIONS							
8	Upper Fluid	Leachate		Leachate		Leachate	
9	Lower Fluid						
10	SG Upper	SG Lower	1		1		1
11	Press Max	Normal	ATM		ATM		ATM
12	Temp Max	Normal	90° F	60° F	90° F	60° F	90° F 60° F
13							
14							
BODY							
15	Material	316SS		316 SS		Painted Steel	
16	Size & Type Connections	3/4" NPT		1.5" Dia.		Clamp On	
17	Top Connection Location	Atmosphere		Atmosphere		NA	
18	Bot Connection Location	LCS Tank		LCS Tank		LCS Flow Meter	
19	Case Mounting	Integral		Integral		Integral	
20	Flange Orientation	Vertical		Vertical			
21	Rotatable Head						
22							
ELEMENT							
23	Diameter or Length In.	3/4"		1.5" x 20"		3"	
24	Extension In.	40"		N/A			
25	Material	Teflon		316 SS			
26	Torque Tube Material	NA		NA			
27	Air Fin	NA		NA			
28							
TRANSMITTER							
29	Type	Electronic		Electronic		Electronic	
30	Output	4-20 mA DC		RS 232		4-20 mA	
31							
CONTROL							
32	Type	NA		NA		NA	
33	Proportional %	Reset					
34	Output						
35	On Level Increase Output						
36							
ACCESSORIES							
37	Filter & Regulator						
38	Gauge Glass Connections						
39	Gauge Glass						
40	Purge Connection						
41	Electric Switch						
42							
43							

000202

INSTRUMENT DATA SHEETS

5:062

REQUISITION NO.			VENDOR			
1	Tag Nos.	LS-707 & LS-807		FT-1002		
2	Item No.					
3	Model No.	NSM-5101				
4	Service	Sump				
5	Vessel or Equipment No.					
6	P&ID No.	LS-*07				
7	Type	Float				
SERVICE CONDITIONS						
8	Upper Fluid	Leachate				
9	Lower Fluid					
10	SG Upper	SG Lower	1			
11	Press Max	Normal	ATM			
12	Temp Max	Normal	90° F	60° F		
13						
14						
BODY						
15	Material	Polypropylene				
16	Size & Type Connections					
17	Top Connection Location					
18	Bot Connection Location					
19	Case Mounting					
20	Flange Orientation					
21	Rotatable Head					
22						
ELEMENT						
23	Diameter or Length In.	1.18" x 4"				
24	Extension In.					
25	Material	PP				
26	Torque Tube Material					
27	Air Fin					
28						
TRANSMITTER						
29	Type	SPDT				
30	Output					
31						
CONTROL						
32	Type					
33	Proportional %	Reset				
34	Output					
35	On Level Increase Output					
36						
ACCESSORIES						
37	Filter & Regulator					
38	Gauge Glass Connections					
39	Gauge Glass					
40	Purge Connection					
41	Electric Switch					
42						
43						

[END OF SECTION]

000203

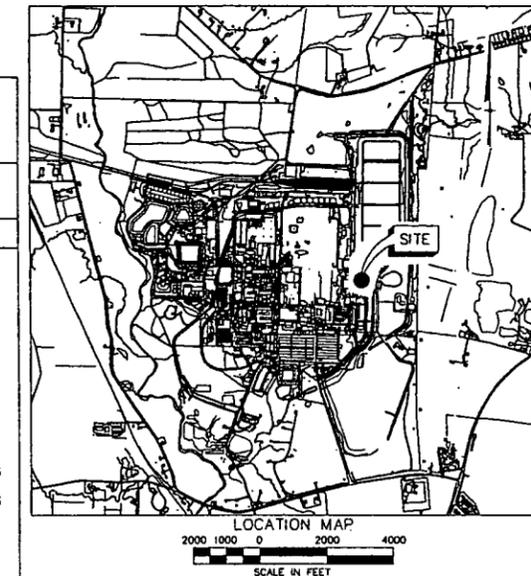
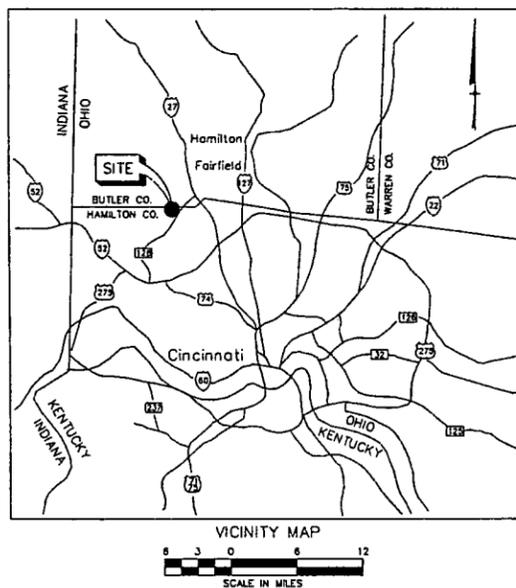


UNITED STATES DEPARTMENT OF ENERGY FERNALD ENVIRONMENTAL MANAGEMENT PROJECT ON-SITE DISPOSAL FACILITY ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM VALVE HOUSE 7 & 8

5062



HAMILTON COUNTY AND BUTLER COUNTY, OHIO
FLUOR FERNALD, INC. PROJECT NUMBER 20112
CONSTRUCTION CONTRACT NO. FSC-693



SHEET NO.	REVISION NO.	FEMP DRAWING NO.	TITLE	SHEET NO.	REVISION NO.	FEMP DRAWING NO.	TITLE
GENERAL				REFERENCE			
X-1	0	90X-5500-X-00660	TITLE SHEET	G-14A	0	90X-6000-G-00222	IMPACTED MATERIAL HAUL ROAD GRADING PLAN
X-2	0	90X-5500-X-00661	LEGEND AND SYMBOLS	G-30B	2	90X-6000-G-00220	STORM-WATER MANAGEMENT SYSTEM DETAILS
				G-40B	0	90X-6000-G-00223	HORIZONTAL MONITORING WELL AND MISCELLANEOUS DETAILS
CIVIL					23	22C-5500-P-00660	UNDERGROUND UTILITIES - GRID 1
G-1	0	90X-5500-G-00662	SITE DEVELOPMENT PLAN		24	22C-5500-P-00661	UNDERGROUND UTILITIES - GRID 2
G-2	0	90X-5500-G-00663	LTS PIPE PLAN AND PROFILE STATIONS 23+00 TO 29+00		31	22C-5500-P-00662	UNDERGROUND UTILITIES - GRID 3
G-3	0	90X-5500-G-00664	VALVE HOUSE ELEVATIONS AND DETAILS		25	22F-5500-P-00663	UNDERGROUND UTILITIES - GRID 4
ELECTRICAL					23	22A-5500-P-00664	UNDERGROUND UTILITIES - GRID 5
E-1	0	90X-5500-E-00665	OVERHEAD POWER TRANSMISSION SYSTEM PLAN		21	22H-5500-P-00666	UNDERGROUND UTILITIES - GRID 7
E-2	0	90X-5500-E-00666	OVERHEAD POWER TRANSMISSION SYSTEM DETAILS I	G0029	10	93X-5900-G-00302	CIVIL - EXISTING SITE AND UTILITY PLAN - GRID 29
E-3	0	90X-5500-E-00667	OVERHEAD POWER TRANSMISSION SYSTEM DETAILS II	G0037	11	93X-5900-G-00310	CIVIL - EXISTING SITE AND UTILITY PLAN - GRID 37
E-4	0	90X-5500-E-00668	VALVE HOUSE ELECTRICAL DETAILS	G0045	10	93X-5900-G-00318	CIVIL - EXISTING SITE AND UTILITY PLAN - GRID 45
E-5	0	90X-5500-E-00669	CONTROL VALVE HOUSE ELECTRICAL DETAILS	G0053	4	93X-5900-G-00326	CIVIL - EXISTING SITE AND UTILITY PLAN - GRID 53
E-6	0	90X-5500-E-00670	ELEC. POWER FOR VALVE HOUSE SUMP ALARMS		2	93X-5500-E-00504	LEACHATE CONVEYANCE SYSTEM 480V FEED TO OSDF TRAILERS AND PERMANENT LIFT STATION
P&ID					2	93X-5500-E-00505	LEACHATE CONVEYANCE SYSTEM 480V FEED TO OSDF TRAILERS AND PERMANENT LIFT STATION
N-1	0	90X-5500-N-00671	PIPING AND INSTRUMENTATION DIAGRAM		1	90X-5500-E-00570	PERMANENT LIFT STATION LEVEL CONTROL PANEL
MECHANICAL				G-8	1	90X-6000-G-00286	LTS PIPE PLAN AND PROFILE STATIONS 29+00 TO 34+24.34
M-1	0	90X-5500-M-00672	VALVE HOUSE 7 MECHANICAL DETAILS I				
M-2	0	90X-5500-M-00673	VALVE HOUSE 7 MECHANICAL DETAILS II				
M-3	0	90X-5500-M-00674	VALVE HOUSE 8 MECHANICAL DETAILS III				
M-4	0	90X-5500-M-00675	VALVE HOUSE 8 MECHANICAL DETAILS IV				
M-5	0	90X-5500-M-00676	VALVE HOUSE MECHANICAL DETAILS V				
M-6	0	90X-5500-M-00677	VALVE HOUSE MECHANICAL DETAILS VI				
STRUCTURAL							
S-1	0	90X-5500-S-00678	VALVE HOUSE 7 STRUCTURAL DETAILS I				
S-2	0	90X-5500-S-00679	VALVE HOUSE 7 STRUCTURAL DETAILS II				
S-3	0	90X-5500-S-00680	VALVE HOUSE 8 STRUCTURAL DETAILS III				
S-4	0	90X-5500-S-00681	VALVE HOUSE 8 STRUCTURAL DETAILS IV				
S-5	0	90X-5500-S-00682	VALVE HOUSE 7 STAIR AND CATWALK STRUCTURAL DETAILS				
S-6	0	90X-5500-S-00683	VALVE HOUSE 8 STAIR AND CATWALK STRUCTURAL DETAILS				

FLUOR FERNALD, INC.
FLUOR FERNALD, INC.
P.O. BOX 398704
CINCINNATI, OHIO 45239

000204

D	ISSUED CFC	9-22-03	GES	JKS
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.

**UNITED STATES
DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT**

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8

DRAWING TITLE
TITLE SHEET

APPROVALS		DATE	BY	FOR
COGNIZANT ENG.	<i>[Signature]</i>	9/22/03	GES	JKS
CIVIL & STR.	<i>[Signature]</i>			
ELECTRICAL	<i>[Signature]</i>			
ENGINEER	<i>[Signature]</i>			
INSTRUMENT	<i>[Signature]</i>			
MECHANICAL	<i>[Signature]</i>			
CHECKED	<i>[Signature]</i>			
APPROVED	<i>[Signature]</i>			
DRAWN BY	G.E. SCHWARZMAN	PROJECT NO.	20112	SHEET NO.
DES PROJECT NO.	FERNALD	DRAWING REVISION NO.	90X-5500-X-00660	REV. NO.
REV 4453	F00-0060.DWG			X-1

SYMBOLS LEGEND	
EXISTING	NEW
	BATTERY LIMIT
	FEMP PROPERTY LINE
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FENCE
	SECURITY FENCE
	RADIOLOGICAL CONTROL FENCE
	FENCE GATE
	PAVED ROAD, SIDEWALK, OR PARKING LOT
	UNPAVED ROAD, SIDEWALK, OR PARKING LOT
	CENTERLINE
	SLOPE CREST OR TOE
	DECIDUOUS TREE
	CONIFEROUS TREE
	TREE LINE
	CELL DESIGNATION
	SITE FEATURE
	DRAINAGE FLOW DIRECTION
	SLOPE INDICATOR
	CONSTRUCTION CONTROL POINT
	POST
	BENCHMARK
	LEACHATE TRANSMISSION SYSTEM PERMANENT LIFT STATION
	DRAINAGE CHANNEL GRAVITY INLET STRUCTURE
	CULVERT
	GUY ANCHOR AND GUY WIRE(S) ASSEMBLY
	GEOTEXTILE SEPARATOR
	HEATER
	PUMP
	WATER SURFACE
	REINFORCED CONCRETE PIPE
	DEMOLITION LIMIT
	BERM CREST
	GROUT
	RIPRAP
	TRENCH BACKFILL
	PIPE EMBEDMENT FILL
	BASE AGGREGATE
	SEDIMENT
	SUBGRADE/COMPACTED FILL
	EXISTING GRADE
	CONCRETE
	ACCESS CORRIDOR
	RE-ESTABLISH EXISTING GRADES

DETAIL AND SECTION IDENTIFICATION LEGEND	
	SEQUENTIAL DETAIL NUMBER
	SHEET ON WHICH ABOVE DETAIL IS PRESENTED
	SEQUENTIAL DETAIL NUMBER
	SHEET ON WHICH ABOVE DETAIL IS REFERENCED
	DETAIL
	LINER SYSTEM ON CELL BASE
	SCALE: 1" = 2'
	EXAMPLE: DETAIL NUMBER 31, WHICH IS PRESENTED ON SHEET G-15, WAS REFERENCED ON SHEET G-22.
	SECTION LETTER
	SHEET ON WHICH ABOVE SECTION IS PRESENTED
	SECTION LETTER
	SHEET ON WHICH ABOVE SECTION IS REFERENCED
	SECTION
	CELL PERIMETER
	SCALE: 1" = 2'
	EXAMPLE: SECTION LETTER "C", WHICH IS PRESENTED ON SHEET G-15, WAS REFERENCED ON SHEET G-5.

ABBREVIATIONS	
AFF	ABOVE FINISHED FLOOR
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
BM	BENCH MARK
BOP	BOTTOM OF PIPE
CFC	CERTIFIED-FOR-CONSTRUCTION
CG&E	CHICAGO GAS AND ELECTRIC
C	CENTERLINE
CLR	CLEARANCE
CMP	CORRUGATED METAL PIPE
CQC	CONSTRUCTION QUALITY CONTROL
CVH	CONTROL VALVE HOUSE
D	DEPTH
DIA	DIAMETER
DOE	DEPARTMENT OF ENERGY
DOT	DEPARTMENT OF TRANSPORTATION
DW	DRINKING WATER
E	EASTING
EL	ELEVATION
EPA	ENVIRONMENTAL PROTECTION AGENCY
EPDM	ETHYLENE PROPYLENE DIENE MONOMER
EP/TS	ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
FEMP	FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FF	FLUOR FERNALD
FG	FUEL GAS
FT	FILTRATE
HDPE	HIGH DENSITY POLYETHYLENE
GS	DRAINAGE CHANNEL GRAVITY INLET STRUCTURE
H:V	HORIZONTAL TO VERTICAL LENGTH RATIO FOR A SLOPE
ICAT	INTEGRATED CONSTRUCTION ACCEPTANCE TEST
ID	INSIDE DIAMETER
ILTS	INTERIM LEACHATE TRANSMISSION SYSTEM
INC.	INCORPORATED
IP	IRON PIN
LCS	LEACHATE COLLECTION SYSTEM
LCS-M*	EXISTING LEACHATE COLLECTION SYSTEM MANHOLE DESIGNATION
LDS	LEAK DETECTION SYSTEM
LDS-M*	EXISTING LEAK DETECTION SYSTEM MANHOLE DESIGNATION
LF	LINEAR FOOT
LTS	LEACHATE TRANSMISSION SYSTEM
(MAX)	MAXIMUM
(MIN)	MINIMUM
N	NORTHING
N/A	NOT APPLICABLE
NAD	NORTH AMERICAN DATUM
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NO.	NUMBER
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OMTA	OSDF MATERIAL TRANSFER AREA
OSDF	ON-SITE DISPOSAL FACILITY
PI	POINT OF INTERSECTION
PLS	PERMANENT LIFT STATION
PVC	POLYVINYL CHLORIDE
PM	POINT OF VERTICAL INTERSECTION
RCP	REINFORCED CONCRETE PIPE
REV.	REVISION
RGS	RIGID GALVANIZED STEEL CONDUIT
RLCS	REDUNDANT LEACHATE COLLECTION SYSTEM
SCH	SCHEDULE
SDR	STANDARD DIMENSION RATIO
SN	SANITARY
SOT	SYSTEM OPERABILITY TEST
SS	STAINLESS STEEL
SSR	STANDARD START-UP REVIEW
ST	STORM SEWER
STA	STATION
(TYP)	TYPICAL
W	WIDTH
WAC	WASTE ACCEPTANCE CRITERIA
W.E.	WATER ELEVATION
W/F	WELDED WIRE FABRIC
VH--	VALVE HOUSE
&	AND

CONTOUR LEGEND	
EXISTING	NEW
	EXISTING GROUND ELEVATION (FEET)
	SUBGRADE ELEVATION (FEET)

UTILITY LEGEND	
EXISTING	NEW
	OVERHEAD ELECTRIC
	BURIED CONDUIT
	13.2KV OVERHEAD PRIMARY LINE
	ILTS PIPE
	LTS PIPE
	OVERHEAD POWER POLE

GENERAL NOTES

NOTES:

- TOPOGRAPHY BASED ON 8 JULY 2003 FLYOVER.
- ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
- GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
- DETAILS ARE SHOWN TO SCALE AS NOTED, EXCEPT WHERE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY.
- SURVEY COORDINATES AND DIMENSIONS SHOWN SHALL BE USED FOR CONSTRUCTION. DRAWINGS SHALL NOT BE SCALED TO OBTAIN LOCATIONS AND DIMENSIONS.
- THIS IS A STANDARDIZED DRAWING. ALL SYMBOLS AND ABBREVIATIONS ON THIS DRAWING ARE NOT NECESSARILY REFERENCED IN WORK UNDER THIS PROJECT.

MECHANICAL LEGEND	
SYMBOLS	
	OPEN KNIFE GATE VALVE
	CLOSED KNIFE GATE VALVE
	OPEN BALL VALVE
	CLOSED BALL VALVE
	BLIND FLANGE
	CHECK VALVE
	ELECTRICAL CONTROL PANEL
	ELECTRICAL SIGNAL
	FLOW DIRECTION
	LOCAL MOUNTED INSTRUMENT
	PANEL MOUNTED INSTRUMENT
	MATERIAL CODE BREAK
	MOTOR OPERATOR
	OPEN PIPE END
	PIPE SIZE BREAK
	QUICK CONNECT
	MONITORING PORT (WITH VALVE)
	SAMPLING PORT (WITH VALVE)
	LOW POINT DRAIN AND SAMPLING PORT (WITH VALVE)
	SUBMERSIBLE PUMP
	TRANSFER PUMP
	VENT WITH SCREEN
	PRESSURE INDICATOR
	FLOW METER

PIPING CODES

MC - PS - MT - LN - MD

MC = FLOW MEDIUM CODE
 PS = NOMINAL PIPE SIZE (CARRIER/CONTAINMENT) NON-CENTRALIZED
 (PS) = NOMINAL PIPE SIZE (CARRIER/CONTAINMENT) CENTRALIZED
 MT = PIPE MATERIAL STANDARD ABBREVIATION
 LN = PIPELINE NUMBER
 MD = MODIFIER (IF REQUIRED)

EXAMPLE: CE-8"10"-B4-0006-IC
 CE = CONTAMINATED SEWER
 8"10" = 8"10" NOMINAL PIPE SIZE - NON-CENTRALIZED (CARRIER/CONTAINMENT)
 B4 = HDPE
 0006 = PIPELINE NUMBER 0006
 IC = CONDENSATION INSULATION

STANDARD ABBREVIATIONS	
A	ASS. GRADE A SEAMLESS STEEL PIPE
B4	HIGH DENSITY POLYETHYLENE (HDPE)
CE	CONTAMINATED SEWER
FH	FLEXIBLE-METAL HOSE ASSEMBLY-TYPE 304 STAINLESS STEEL WIRE BRAID AND TYPE 316 STAINLESS STEEL FITTINGS
FPT	FEMALE PIPE THREAD
IC	CONDENSATION INSULATION
IPS	IRON PIPE SIZE
WW	WASTEWATER

EQUIPMENT ABBREVIATIONS	
FE	FLOW ELEMENT
FM	FORCEMAIN
FO	FLOW TOTALIZER/INDICATOR
FT	FLOW TRANSMITTER
LA	ALARM LIGHT
LI	LEVEL INDICATOR
LIC	PROGRAMMABLE LEVEL INDICATOR/CONTROLLER
LL	LEVEL LIGHT
LR	LEVEL RECORDER
LS	LEVEL SWITCH
LSHH	LEVEL SWITCH HIGH HIGH
LT	LEVEL TRANSMITTER
P	CONTROL PANEL
PC	PRIMARY CONTAINMENT VESSEL
PI	PRESSURE INDICATOR
PMP	PUMP
QC	QUICK CONNECT
T	TANK
V	VALVE

INSTRUMENT CODES

AAA - BCC

AAA = EQUIPMENT ABBREVIATION
 B = CELL NUMBER
 CC = INSTRUMENT NUMBER

EXAMPLE: V-704
 V = VALVE
 7 = CELL 7
 04 = INSTRUMENT NUMBER 04

SYMBOLS	
	DELTA
	WYE

ELECTRICAL LEGEND	
ABBREVIATIONS	
A	AMPERE
ACSR	ALUMINUM CLAD STEEL REINFORCED
ALUM.	ALUMINUM
AMPS	AMPERES
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
AWG	AMERICAN WIRE GAUGE
AWPA	AMERICAN WOOD PRODUCTS ASSOCIATION
BL	BASIC IMPULSE LEVEL
C	CONDUIT
CAT.	CATALOG
CBL	CABLE
CKT.	CIRCUIT
CRL	CONTROL RELAY
DOA	DISSOLVED OXYGEN AUGMENTATION
DPDT	DOUBLE POLE DOUBLE THROW
DWG.	DRAWING
E	FUSE SIZE
FC	FUSED OUTOUT
FCL	FUSED OUTOUT WITH LIGHTNING ARRESTOR
FEEDER	FEEDER
FO	FLOW TOTALIZER/INDICATOR
FT	FLOW TRANSMITTER
FU	FUSE
G	GROUND
GFO	GROUND FAULT CIRCUIT INTERRUPTOR
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
JC	JOINT INDUSTRIAL COUNCIL
KA	THOUSAND AMPS
KCMIL	THOUSAND CIRCULAR MILS
KV	KILOVOLTS
KVA	KILOVOLT AMPS
LA	LIGHTNING ARRESTOR
LBS	POUNDS
LBS/FT	POUNDS PER LINEAR FOOT
LBS/FT ³	POUNDS PER CUBIC FOOT
LI	LEVEL INDICATOR
LL	LEVEL LIGHT
LP	LIGHTNING PANEL
LR	LEVEL RECORDER
LS	LEVEL SWITCH
LT	LEVEL TRANSMITTER
MA	MILLIAMPERE
MCB	MAIN CIRCUIT BREAKER
MCP	MOTOR CONTROL PANEL
MSC	MANUFACTURER SUPPLIED CABLE
N.O.	NORMALLY OPEN
NO.	NUMBER
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
PH	PHASE
PLS	PERMANENT LIFT STATION
PMP	PUMP
REC.	RECEPTABLE
RGS	RIGID GALVANIZED STEEL CONDUIT
SD	SERVICE DISCONNECT
SHLD	SHIELD
S.N.	SOLID NEUTRAL
SPAR.	SPARROW
T	TRANSFORMER
T-	TRAILER NUMBER
UH	UNIT HEATER
UV	ULTRAVIOLET
V	VOLTS
V-	VALVE
VAC	VOLT ALTERNATING CURRENT
VDC	VOLT DIRECT CURRENT
W	WIRE
WPX	WALL PACK
XFMR	TRANSFORMER
Z	IMPEDANCE

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPV.
D	ISSUED CFC	9-22-03	GES	MSB
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

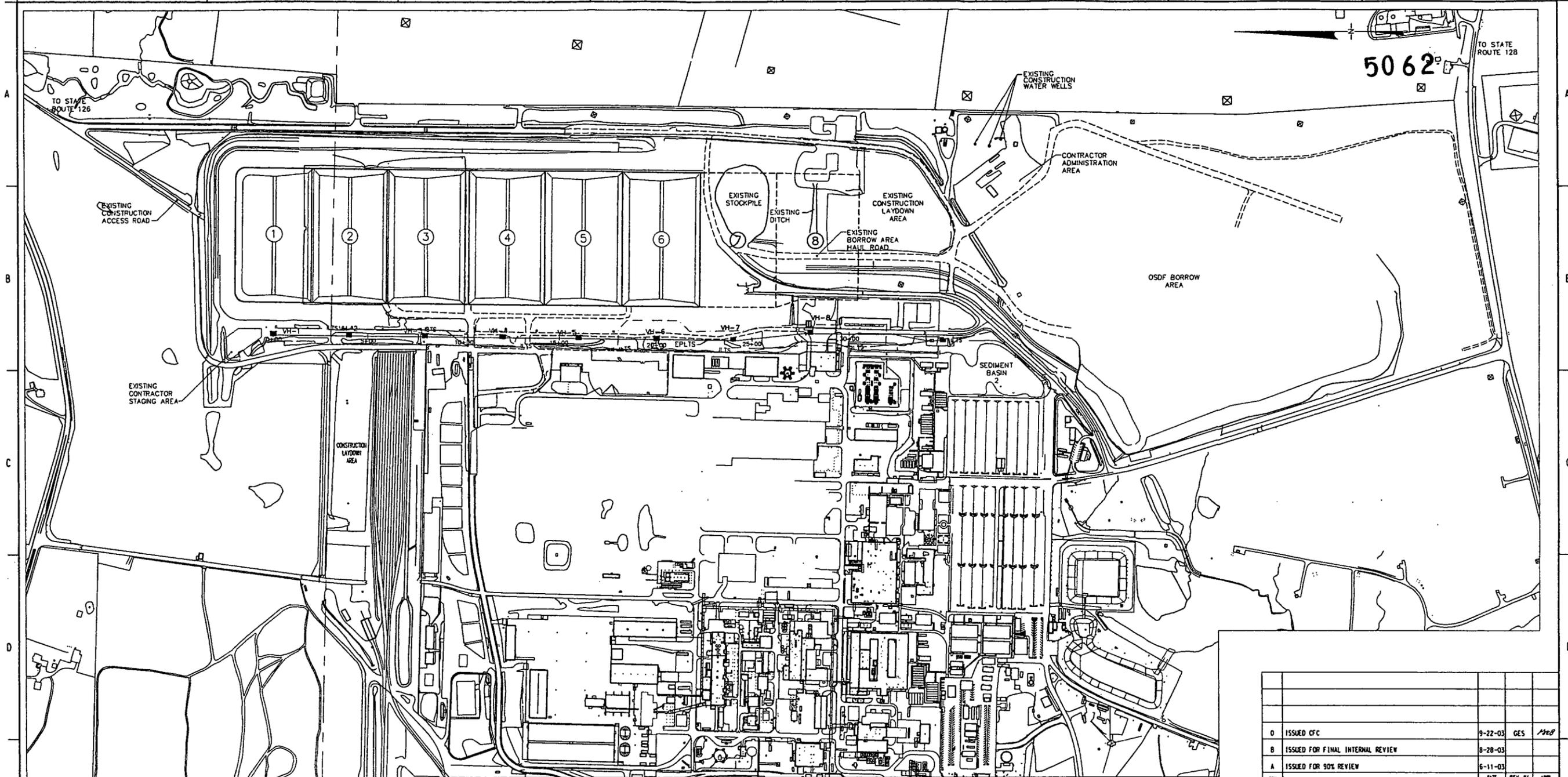
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
 DRAWING TITLE
VALVE HOUSE 7 & 8

LEGENDS AND SYMBOLS

APPROVALS	
COGNIZANT ENG.	SAFETY ENG.
CIVIL & STR.	MAINTENANCE
ELECTRICAL	FIRE PROTECT.
ENGINEER	WASTE MNGT.
INSTRUMENT	SECURITY
MECHANICAL	CONSTRUCTION
CHECKED	
APPROVED	

DRAWN BY: J.S. WININGER
 PROJECT NO.: 20112
 THIS PROJECT NO. FILENAME: 100-55001.DWG
 SHEET NO.: X-2
 REV. NO.: 0
 DRAWING NO. CODE NO.: 90X-5500-X-00661

000205



A
B
C
D
E
F

5062 TO STATE ROUTE 128

EXISTING CONSTRUCTION ACCESS ROAD

EXISTING CONTRACTOR STAGING AREA

1

2

3

4

5

6

EXISTING STOCKPILE

EXISTING DITCH

7

8

EXISTING CONSTRUCTION LAYDOWN AREA

EXISTING BORROW AREA HAUL ROAD

EXISTING CONSTRUCTION WATER WELLS

CONTRACTOR ADMINISTRATION AREA

OSDF BORROW AREA

SEDIMENT BASIN

CONSTRUCTION LAYDOWN AREA

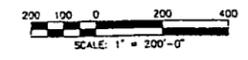
VH-1, VH-2, VH-3, VH-4, VH-5, VH-6, VH-7, EPLTS, 25+00, 10+00

LEGEND

- BUTLER COUNTY/HAMILTON COUNTY LINE
- FEMP PROPERTY LINE
- BATTERY LIMIT
- ILTS
- LTS PIPE
- 10+00
- OSDF-4
- (1)
- BENCHMARK
- ON-SITE DISPOSAL FACILITY (OSDF) CELL DESIGNATION

NOTES:

1. THE PURPOSE OF THIS DRAWING IS TO CONCEPTUALLY ILLUSTRATE THE DEVELOPMENT AND LOCATION OF THE ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM (EPLTS) WITH SUPPORT FACILITIES INCLUDING, BUT NOT LIMITED TO, HAUL ROADS, CONTRACTOR STAGING AREA, CONTRACTOR ADMINISTRATION AND LAYDOWN AREAS, AND BORROW AREA. THE SIZE AND LOCATION OF THE SUPPORT FACILITIES MAY VARY FROM THOSE SHOWN.
2. CONTRACTOR SHALL CONTAIN AND CONTROL CONSTRUCTION WATERS GENERATED DURING CONSTRUCTION.
3. CONTRACTOR SHALL USE SOIL STOCKPILES IN BORROW AREA AS APPROVED BY CONSTRUCTION MANAGER.
4. CONTRACTOR SHALL AVOID DAMAGING EXISTING LTS PIPE.
5. CONTRACTOR SHALL PERFORM SURFACE-WATER MANAGEMENT AND EROSION CONTROL IN ACCORDANCE WITH SPECIFICATION SECTION 02270.



000206

D	ISSUED CFC	9-22-03	GES MEB
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03	
A	ISSUED FOR 90% REVIEW	6-11-03	
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY
			APPR. DETAILS AND DATE

UNITED STATES DEPARTMENT OF ENERGY FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM VALVE HOUSE 7 & 8

DRAWING TITLE
SITE DEVELOPMENT PLAN

APPROVALS

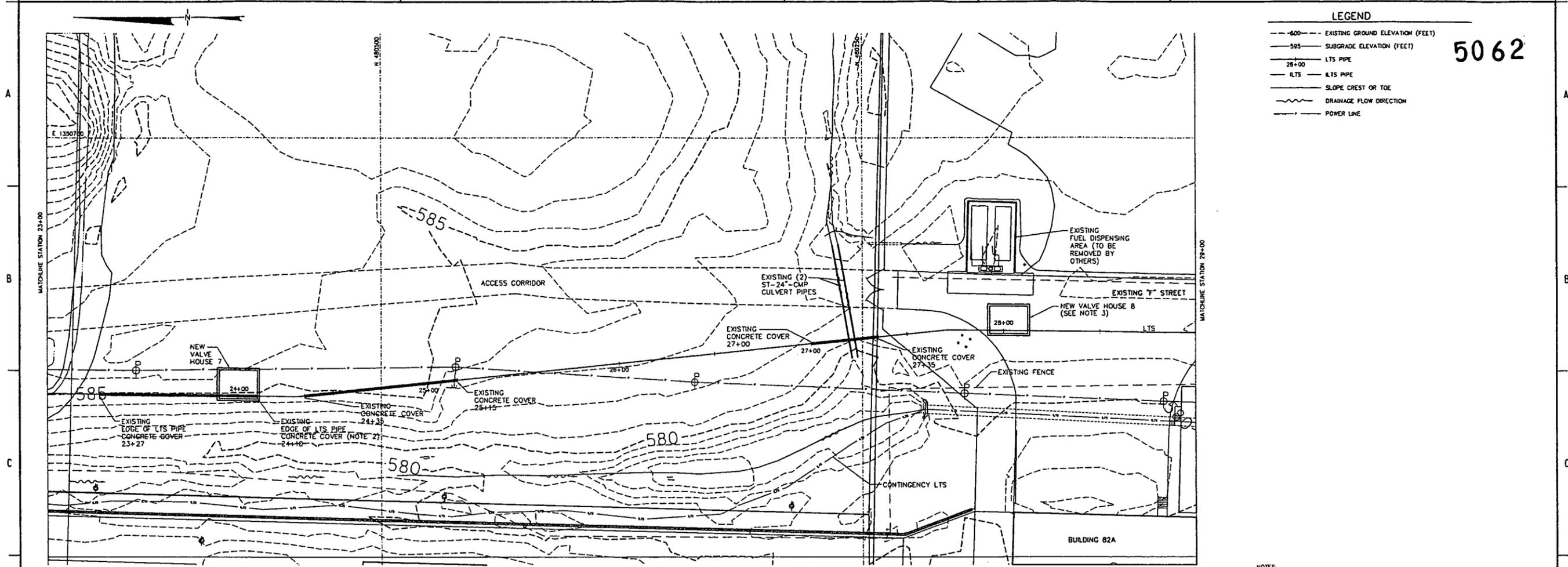
COGNIZANT ENG.	<i>[Signature]</i>	9/2/03	SAFETY ENG.	
CIVIL & STR.	<i>[Signature]</i>	9/2/03	MAINTENANCE	
ELECTRICAL	<i>[Signature]</i>	9/2/03	FIRE PROTECT.	
ENGINEER	<i>[Signature]</i>	9/2/03	WASTE MANAGE.	
INSTRUMENT	<i>[Signature]</i>	9/2/03	SECURITY	
MECHANICAL	<i>[Signature]</i>	9/2/03	CONSTRUCTION	
CHECKED	<i>[Signature]</i>	9/2/03		
APPROVED	<i>[Signature]</i>	9/2/03		

DRAWN BY G.E. SCHWARZMAN	PROJECT NO. 20112	DRAWING INDEX CODE NO. 90X-5500-G-00662	SHEET NO. G-1	REV. NO. 0
RES PROJECT NO. RES 4493	FILENAME F00-0335.DGN			

LEGEND

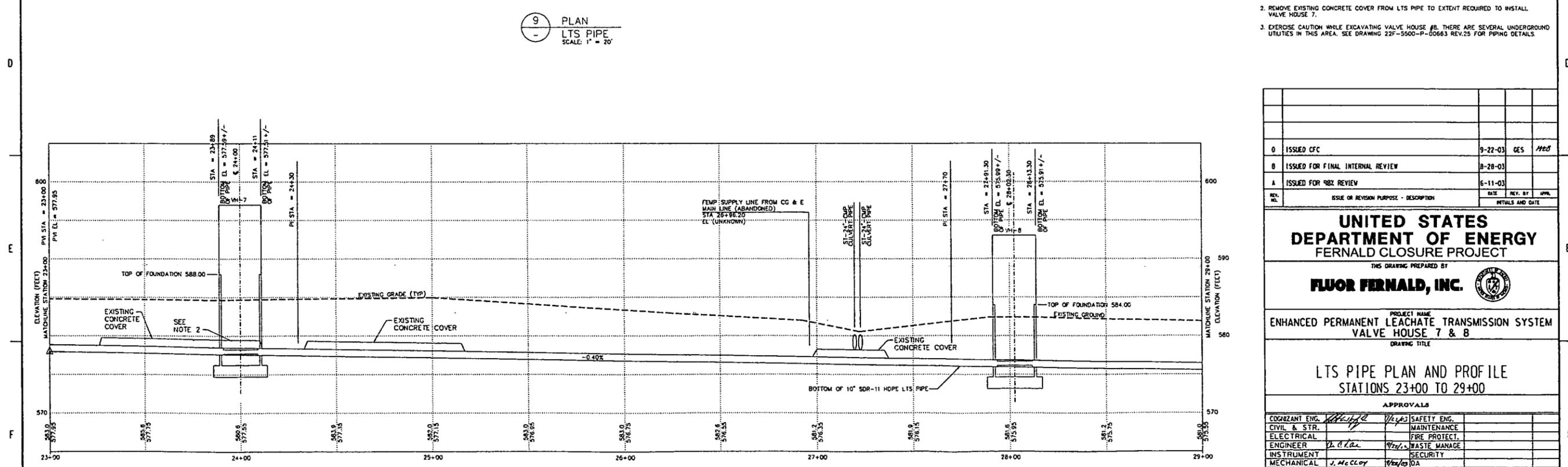
- 600--- EXISTING GROUND ELEVATION (FEET)
- 595--- SUBGRADE ELEVATION (FEET)
- 28+00--- LTS PIPE
- ILTS--- ILTS PIPE
- SLOPE CREST OR TOE
- DRAINAGE FLOW DIRECTION
- POWER LINE

5062



9 PLAN
LTS PIPE
SCALE: 1" = 20'

- NOTES:
- FIELD VERIFY LTS PIPE BOTTOM ELEVATIONS PRIOR TO CONSTRUCTION OF VALVE HOUSE.
 - REMOVE EXISTING CONCRETE COVER FROM LTS PIPE TO EXTENT REQUIRED TO INSTALL VALVE HOUSE 7.
 - EXERCISE CAUTION WHILE EXCAVATING VALVE HOUSE #8. THERE ARE SEVERAL UNDERGROUND UTILITIES IN THIS AREA. SEE DRAWING 22F-5500-P-00663 REV.25 FOR PIPING DETAILS.



10 PROFILE
LTS PIPE
SCALE: 1" = 20' HORIZONTAL
SCALE: 1" = 5' VERTICAL

000207

0	ISSUED CFC	9-22-03	GES	MS
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
			INITIALS AND DATE	

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
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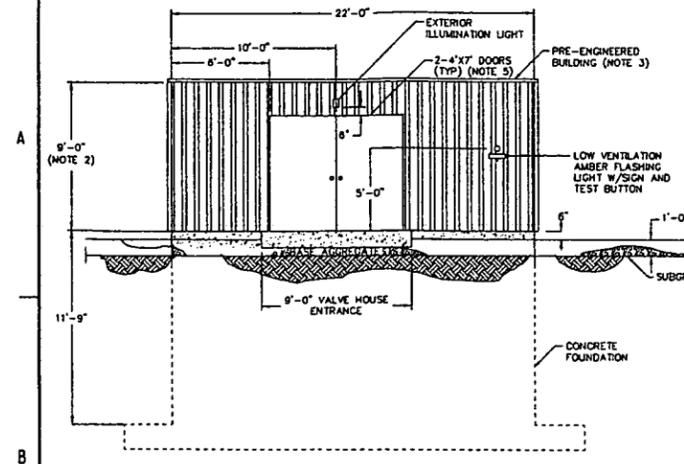
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8
DRAWING TITLE

LTS PIPE PLAN AND PROFILE
STATIONS 23+00 TO 29+00

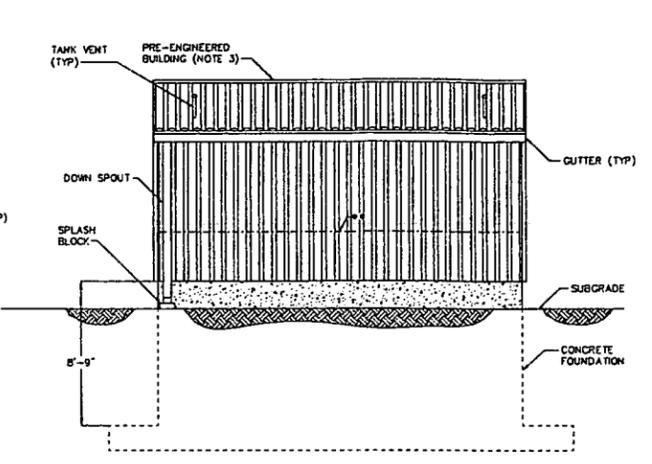
APPROVALS

COORZANT ENG.	<i>[Signature]</i>	SAFETY ENG.	<i>[Signature]</i>
CIVIL & STR.	<i>[Signature]</i>	MAINTENANCE	<i>[Signature]</i>
ELECTRICAL	<i>[Signature]</i>	FIRE PROTECT.	<i>[Signature]</i>
ENGINEER	<i>[Signature]</i>	WASTE MANAGE.	<i>[Signature]</i>
INSTRUMENT	<i>[Signature]</i>	SECURITY	<i>[Signature]</i>
MECHANICAL	<i>[Signature]</i>	CONSTRUCTION	<i>[Signature]</i>

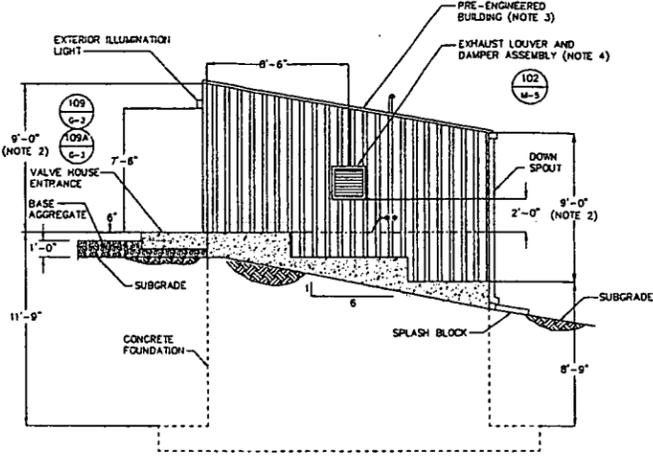
CHECKED	<i>[Signature]</i>	PROJECT NO.	20112	DRAWING NUMBER	90X-5500-G-00663	SHEET NO.	G-2	REV. NO.	0
APPROVED	<i>[Signature]</i>	DESIGNER	J.S. WININGER	FILENAME	100-0323.DGN				
		RES PROJECT NO.	RES 4453						



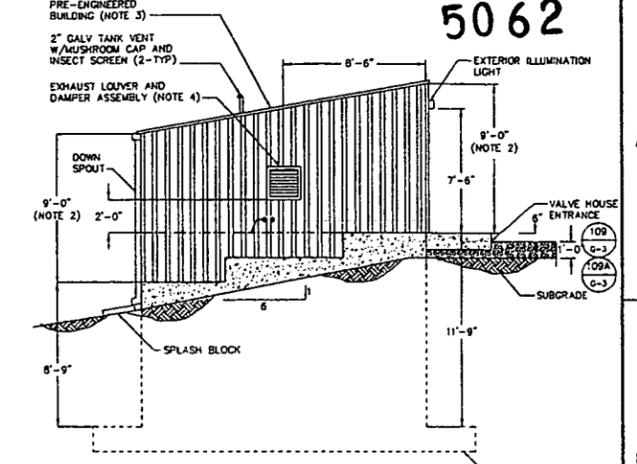
VALVE HOUSE 7 EAST ELEVATION
SCALE: 1" = 4'



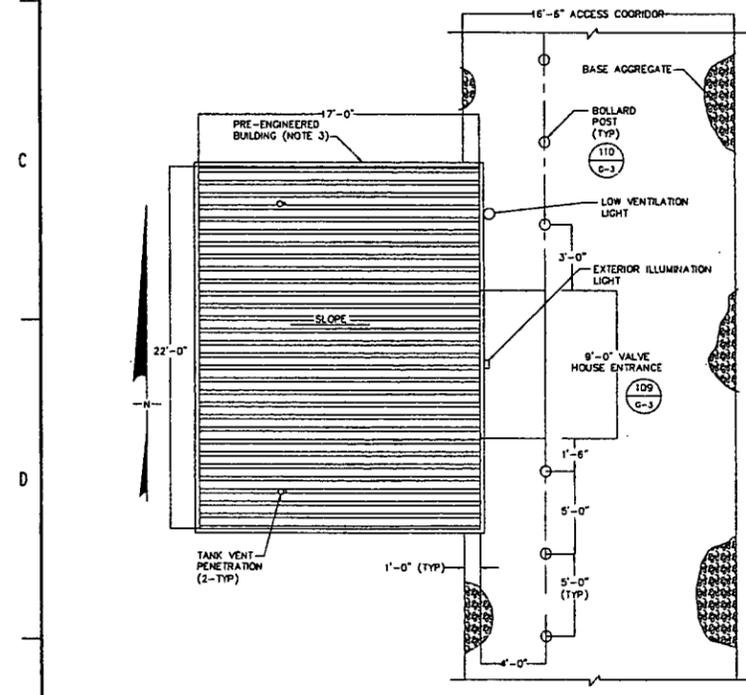
VALVE HOUSE 7 WEST ELEVATION
SCALE: 1" = 4'
***VALVE HOUSE 8 IDENTICAL EXCEPT FOUNDATION IS NOT STEPPED.



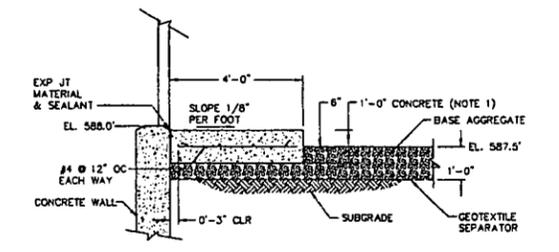
VALVE HOUSE 7 NORTH ELEVATION
SCALE: 1" = 4'
***VALVE HOUSE 8 IDENTICAL EXCEPT FOUNDATION IS NOT STEPPED.



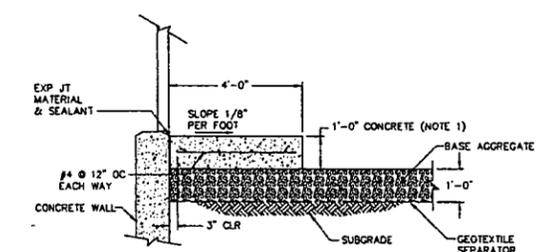
VALVE HOUSE 7 SOUTH ELEVATION
SCALE: 1" = 4'
***VALVE HOUSE 8 IDENTICAL EXCEPT FOUNDATION IS NOT STEPPED.



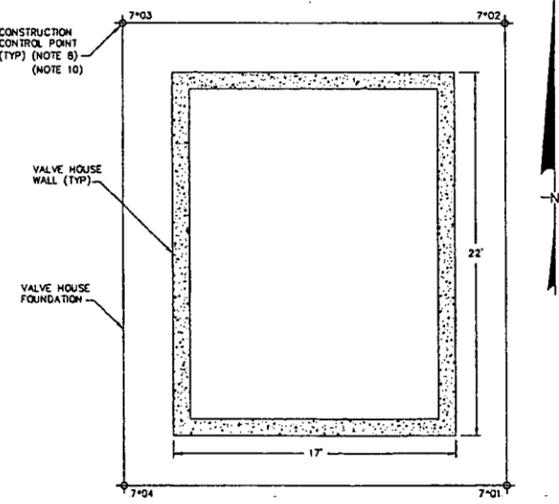
PLAN-VALVE HOUSE AND APPURTENANCES
SCALE: 1" = 4'



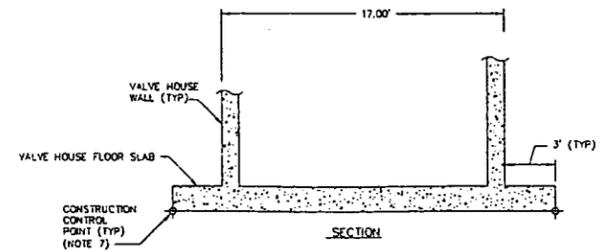
109 DETAIL
G-3 VALVE HOUSE 7 ENTRANCE
SCALE: 1" = 2'



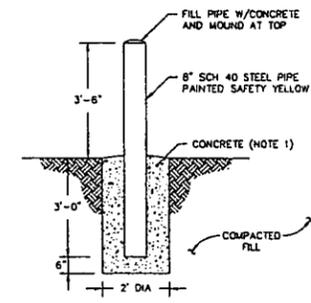
109A DETAIL
G-3 VALVE HOUSE 8 ENTRANCE
SCALE: 1" = 2'



PLAN



VALVE HOUSE CONSTRUCTION CONTROL POINTS
SCALE: 1" = 4'



110 DETAIL
G-3 BOLLARD
SCALE: 1" = 2'

VALVE HOUSE FOUNDATION CONSTRUCTION CONTROL POINTS			
VALVE HOUSE 7			
POINT NO.	NORTHING	EASTING	ELEVATION
7701	480561.32	1350632.07	SEE NOTE 7.
7702	480569.31	1350631.52	SEE NOTE 7.
7703	480568.86	1350608.52	SEE NOTE 7.
7704	480560.87	1350608.07	SEE NOTE 7.
VALVE HOUSE 8			
POINT NO.	NORTHING	EASTING	ELEVATION
7801	480162.53	1350666.19	SEE NOTE 7.
7802	480190.53	1350666.29	SEE NOTE 7.
7803	480190.35	1350643.30	SEE NOTE 7.
7804	480162.35	1350643.20	SEE NOTE 7.

VALVE HOUSE SITE-WIDE BUILDING IDENTIFICATION NUMBERS	
STRUCTURE	IDENTIFICATION NUMBER
VH-7	9007
VH-8	9008

- NOTES:
- CONCRETE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03100.
 - DIMENSION SHOWN REPRESENTS BOTTOM OF ROOF JOIST SYSTEM. THICKNESS OF ROOF IS NOT SHOWN TO SCALE.
 - PRE-ENGINEERED BUILDING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13120.
 - CONTRACTOR SHALL COORDINATE LOCATIONS OF INLET AND EXHAUST LOUVER AND DAMPER ASSEMBLY WITH PRE-ENGINEERED BUILDING REQUIREMENTS AND SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 10211.
 - STANDARD STEEL DOORS AND FRAMES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 08110.
 - ROOF PENETRATIONS FOR TANK VENTS TO BE PER BUILDING MANUFACTURER'S SPECIFICATIONS. PROVIDE BIRDSCREEN AT VENT DISCHARGE.
 - BOTTOM ELEVATION OF BOTTOM OF VALVE HOUSE FLOOR SLAB SHALL BE SET RELATIVE TO ACTUAL LTS PIPE ELEVATIONS AS SHOWN ON SHEET M-3.
 - GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH. SEE SCHEDULE THIS DRAWING.
 - CONTRACTOR SHALL AVOID DAMAGING EXISTING LTS PIPE. CONTRACTOR SHALL SUPPORT EXISTING LTS PIPE IN EXCAVATION DURING CONSTRUCTION OF VALVE HOUSE.
 - THE "X" SYMBOL REPRESENTS CELL AT WHICH APPROPRIATE VALVE HOUSE IS LOCATED.

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
D	ISSUED OFC	9-22-03	GES	MES
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

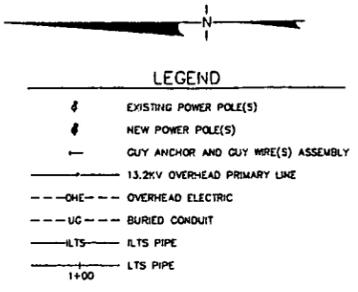
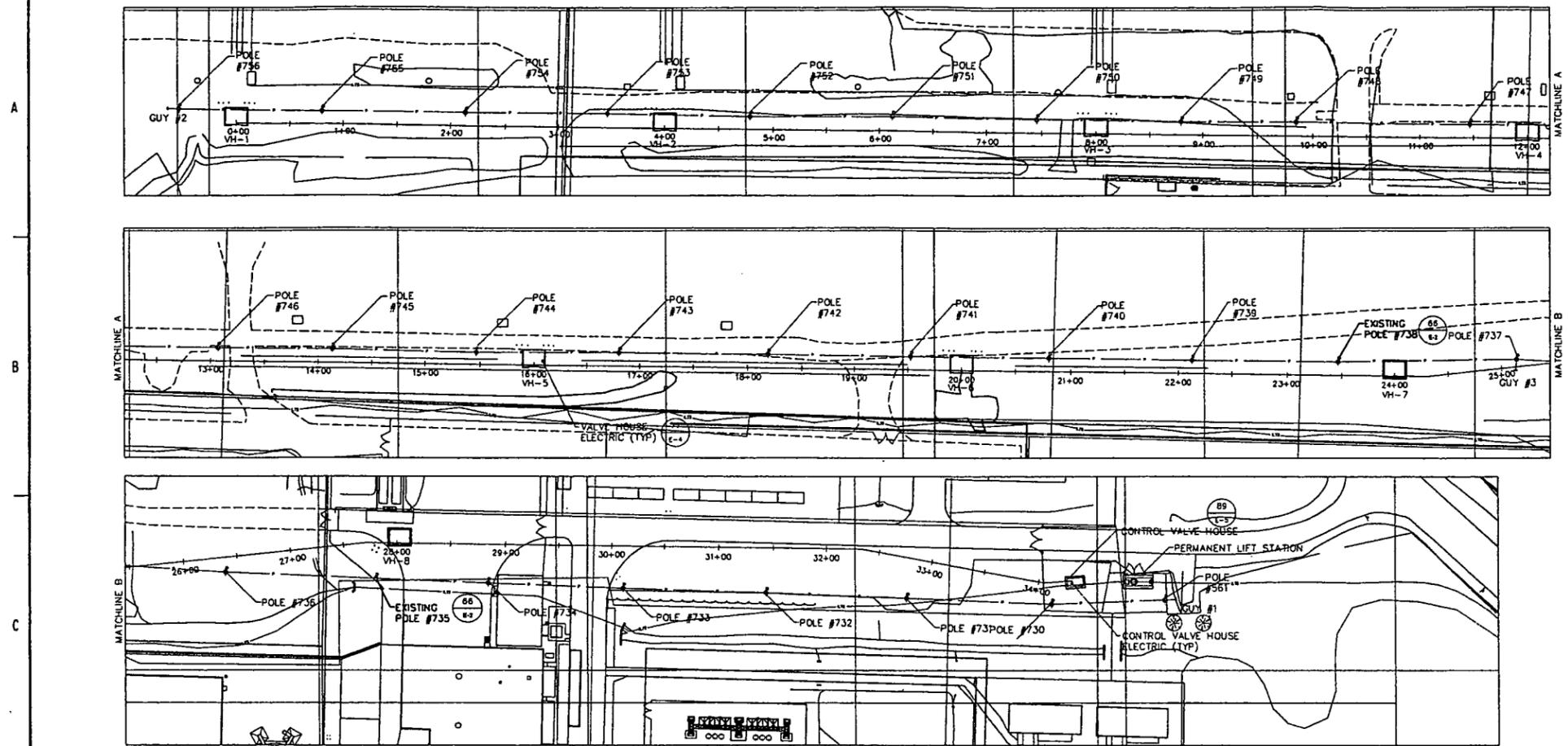
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8
DRAWING TITLE

VALVE HOUSE ELEVATIONS AND DETAILS

APPROVALS			
COGNIZANT ENG.	DATE	SAFETY ENG.	
CIVIL & STR.	9/22/03	MAINTENANCE	
ELECTRICAL		FIRE PROTECT.	
ENGINEER		WASTE MANAGE	
INSTRUMENT		SECURITY	
MECHANICAL		CONSTRUCTION	

CHECKED	APPROVED	DRAWN BY	PROJECT NO.	DRAWING NO. / CODE NO.	SHEET NO.	REV. NO.
		G.E. SCHWARZMAN	2011Z	90X-5500-G-00664	G-3	0
		RES 4453	FILENAME	1700-0128.DWG		

000208



62 PLAN SITE ELECTRICAL PLAN SCALE: 1" = 50'

NOTE: SEE DWG 96X-5500-E-02003 FOR CURRENT POLE INFORMATION

POLE NO.	POLE LENGTH	POLE STATUS	AS-BUILT COORDINATES		POLE ELEVATION(S)		GUY ASSEMBLY NUMBERS	SERVICES ON POLE	NOTES
			NORTHING	EASTING	DWG. NO.	DETAIL NO.			
561	60'	EXISTING	479,463.35	1,350,598.25	64	1	4		USE SAME ANCHORS
730	55'	EXISTING	479,588.20	1,350,592.37	66				
731	55'	EXISTING	479,701.88	1,350,597.87	75				
732	55'	EXISTING	479,834.04	1,350,603.09	75				
733	55'	EXISTING	479,966.62	1,350,607.32	65				
734	55'	EXISTING	480,093.51	1,350,612.13	65				
735	55'	EXISTING	480,196.72	1,350,616.33	66				SERVICE FOR VH-B
736	55'	EXISTING	480,336.72	1,350,622.19	65				
737	55'	EXISTING	480,461.39	1,350,630.13	67	3			
738	55'	EXISTING	480,628.38	1,350,626.28	66				SERVICE FOR VH-7
739	55'	EXISTING	480,761.76	1,350,629.43	65				
740	55'	EXISTING	480,894.69	1,350,631.43	65				
741	55'	EXISTING	481,022.35	1,350,632.56	66				
742	55'	EXISTING	481,156.13	1,350,634.72	65				
743	55'	EXISTING	481,294.47	1,350,636.20	65				
744	55'	EXISTING	481,428.48	1,350,636.67	66				
745	55'	EXISTING	481,561.58	1,350,639.68	65				
746	55'	EXISTING	481,697.83	1,350,646.75	65				
747	55'	EXISTING	481,828.18	1,350,642.78	66				
748	55'	EXISTING	481,969.71	1,350,645.37	67	4			
749	55'	EXISTING	482,095.85	1,350,645.84	65				
750	55'	EXISTING	482,229.21	1,350,647.72	66				
751	55'	EXISTING	482,362.53	1,350,650.12	66				
752	55'	EXISTING	482,496.17	1,350,650.37	65				
753	55'	EXISTING	482,628.63	1,350,653.17	66				
754	55'	EXISTING	482,761.67	1,350,654.14	65				
755	55'	EXISTING	482,894.72	1,350,655.28	65				
756	55'	EXISTING	483,027.99	1,350,657.56	76	2	5		USE SAME ANCHORS

POLE NO.	POLE LENGTH	13.2 KV SERVICE ON POLE		ELECTRICAL EQUIPMENT ON POLE						
		FOR SA	FOR SC	LIGHTING ARRESTER(S)	FUSED OUTLET(S)	FUSE SIZE(S)	LOAD BREAK(S)	TRANSFORMER(S)	#-KVA SIZE	NOTES
561	60'	/	/	561B-2C-LA	561B-2C-FGL	3-10E		561-2C-T	3-37.5	
730	55'	/	/	730-2C-LA	730-2C-FGL	3-10E				
731	55'	/	/							
732	55'	/	/							
733	55'	/	/							
734	55'	/	/							
735	55'	/	/	735-2C-LA	735-2C-FGL	2-5E		735-2C-T	1-25	SERVICE FOR VH-B
736	55'	/	/							
737	55'	/	/	737-2C-LA	737-2C-FGL	3-5E		737-2C-T	3-25	
738	55'	/	/	738-2C-LA	738-2C-FGL	2-5E		738-2C-T	1-25	SERVICE FOR VH-7
739	55'	/	/							
740	55'	/	/							
741	55'	/	/	741-2C-LA	741-2C-FGL	2-5E		741-2C-T	1-25	
742	55'	/	/							
743	55'	/	/							
744	55'	/	/	744-2C-LA	744-2C-FGL	2-5E		744-2C-T	1-25	
745	55'	/	/							
746	55'	/	/							
747	55'	/	/	747-2C-LA	747-2C-FGL	2-5E		747-2C-T	1-25	
748	55'	/	/	748-2C-LA	748-2C-FGL	3-15E		748-2C-T	3-100	
749	55'	/	/							
750	55'	/	/	750-2C-LA	750-2C-FGL	2-5E		750-2C-T	1-25	
751	55'	/	/							
752	55'	/	/							
753	55'	/	/	753-2C-LA	753-2C-FGL	2-5E		753-2C-T	1-25	
754	55'	/	/							
755	55'	/	/							
756	55'	/	/	756-2C-LA	756-2C-FGL	2-5E		756-2C-T	1-25	
757	55'	/	/							
758	55'	/	/	758-2C-LA	758-2C-FGL	2-5E		758-2C-T	1-25	
759	55'	/	/							
760	55'	/	/	760-2C-LA	760-2C-FGL	2-5E		760-2C-T	1-25	

FROM POLE	TO POLE	LENGTH	30' F SAC		50' F SAC		70' F SAC		90' F SAC	
			SPAR IN.	STATIC IN.						
561	730	133.33'	29	24	33	26	36	28	39	30
730	731	133.33'	29	24	33	26	36	28	39	30
731	732	133.33'	29	24	33	26	36	28	39	30
732	733	133.33'	29	24	33	26	36	28	39	30
733	734	126.00'	26	22	30	24	33	26	36	28
734	735	119.00'	24	20	27	22	30	24	33	25
735	736	125.00'	26	22	29	23	33	25	36	27
736	737	123.00'	26	22	29	23	33	25	36	27
737	738	168.00'	33	24	48	38	53	41	67	43
738	739	133.33'	29	24	33	26	36	28	39	30
739	740	133.33'	29	24	33	26	36	28	39	30
740	741	133.33'	29	24	33	26	36	28	39	30
741	742	133.33'	29	24	33	26	36	28	39	30
742	743	133.33'	29	24	33	26	36	28	39	30

GUY NO.	FROM POLE	TO POLE	ANCHOR COORDINATES		LENGTH	NOTES
			NORTHING	EASTING		
1	561	30'	479430	1350589	42'-6"	
2	756	30'	483059	1350657	50'-0"	NOTE 5
3	737	30'	480461	1350836	33'-9"	NOTE 5
4	561	SEE ABOVE			120V SIGNAL WIRE WITHIN 9"	
5	756	SEE ABOVE			120V SIGNAL WIRE WITHIN 9"	

NOTES:
1. ALL OVERHEAD POWER AND POLES ARE EXISTING. PROVIDE NEW ELECTRICAL EQUIPMENT AND SERVICE TO VH-7 AND VH-B PER SCHEDULE.

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPV.
0	ISSUED OFC	9-22-03	GES	ABE
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT
 THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM VALVE HOUSE 7 & 8
 DRAWING TITLE

OVERHEAD POWER TRANSMISSION SYSTEM PLAN

APPROVALS

COOZMANT ENG. <i>[Signature]</i>	SAFETY ENG. <i>[Signature]</i>
CIVIL & STR. <i>[Signature]</i>	MAINTENANCE <i>[Signature]</i>
ELECTRICAL ENGINEER <i>[Signature]</i>	FIRE PROTECT. <i>[Signature]</i>
INS TRUMENT MECHANICAL <i>[Signature]</i>	WASTE MANAGE. <i>[Signature]</i>
	SECURITY <i>[Signature]</i>
	CONSTRUCTION <i>[Signature]</i>

CHECKED *[Signature]*
 APPROVED *[Signature]*

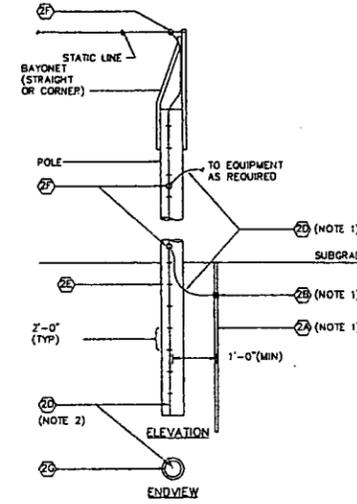
DESIGN BY: J.S. WILKINER
 RES PROJECT NO: RES 4453
 PROJECT NO: 20112
 DRAWING NO: 90X-5500-E-00665
 SHEET NO: E-1
 REV. NO: 0

000209

MATERIAL LIST (ALL ITEMS NOT USED FOR EVERY POLE)

- ITEM TAG POLE MATERIAL ITEMS**
- (1A) WOODEN POLE - ANSI 05.1, CLASS 2, SOUTHERN PINE, PENTACHLOROPHENOL TREATED TO 12 LBS/FT. WPA CA. SEE "POLE SCHEDULE" FOR REQUIRED LENGTH.
 - (1B) WOODEN CROSSARM - 3 1/2" X 4 1/2" X 8'-0". SOUTHERN PINE, PENTACHLOROPHENOL TREATED TO 8 LBS/FT.
 - (1C) WOODEN CROSSARM - 3 1/2" X 4 1/2" X 8'-0". SOUTHERN PINE, PENTACHLOROPHENOL TREATED TO 8 LBS/FT.
 - (1D) WOODEN CROSSARM - 3 3/4" X 4 3/4" X 10'-0". SOUTHERN PINE, PENTACHLOROPHENOL TREATED TO 8 LBS/FT.
 - (1E) CROSSARM ANGLE BRACE - 63" LONG X 18" DROP, HOT DIP GALVANIZED ASTM A675 (2 PIECE BRACES ARE ACCEPTABLE).
- ITEM TAG HARDWARE ITEMS**
- (2A) DOUBLE ARMING 5/8" BOLT - FULL THREAD, HOT DIP GALVANIZED, LENGTH AS REQUIRED.
 - (2B) 5/8" MACHINE BOLT - ANSI C135.1, LENGTH AS REQUIRED, HOT DIP GALVANIZED.
 - (2C) SQUARE WASHER - FOR 5/8" BOLT, HOT DIP GALVANIZED.
 - (2D) ROUND WASHER - FOR 5/8" BOLT, HOT DIP GALVANIZED.
 - (2E) SPRING LOCK WASHER - FOR 5/8" BOLT, HOT DIP GALVANIZED.
 - (2F) SQUARE NUT - FOR 5/8" BOLT, HOT DIP GALVANIZED.
 - (2G) EYENUT - ANSI C135.1, FOR 5/8" BOLT, HOT DIP GALVANIZED.
 - (2H) THIMBLE EYENUT - FOR 5/8" BOLT, HOT DIP GALVANIZED.
 - (2I) ASSEMBLY, EXTENSION LINK 20", WITH END CLEVIS, ANCHOR SHACKLE AND EYENUT, ALL HOT DIP GALVANIZED, PLUS CLEWS FOR DOUBLE ARMING BOLT ATTACHMENT.
 - (2J) CROSSARM GAIN - 3" X 4", TEETH ON BOTH SIDES, HOT DIP GALVANIZED.
- ITEM TAG GROUNDING ITEMS**
- (3A) GROUND ROD - 3/4" DIAMETER X 10' LONG, COPPERWELD.
 - (3B) GROUND ROD CLAMP (FOR GROUND WIRE CONNECTION) - 3/4" DIA, BRONZE OR BRASS.
 - (3C) GROUND CONDUCTOR - #2 AWG, BARE SOLID COPPER, SOFT DRAWN.
 - (3D) GROUND CONDUCTOR - #4 AWG, BARE SOLID COPPER, SOFT DRAWN.
 - (3E) GROUND STAPLE - COPPERCLAD, 1 1/2" LONG.
 - (3F) GROUNDING CLAMP - WIRE TO WIRE.
 - (3G) POLE BOTTOM GROUND PLATE - COPPER (OR COIL GROUND WIRE ON POLE BOTTOM).
- ITEM TAG GUYING ITEMS**
- (4A) GUY ANCHOR SYSTEM - HELIX SCREW TYPE, GALVANIZED STEEL, ASTM A36/306 WITH MINIMUM PULLOUT CAPACITY OF 23,000 LBS FOR SOIL WITH BLOW COUNT OF 13. MID-STRENGTH INSTALLATION TORQUE SERIES, EYENUT TO ACCOMMODATE UP TO THREE GUY WIRES.
 - (4B) GUY WIRE - 1/2" DIA STRAND, CLASS A OR B GALVANIZED, ASTM A475 1 X 7 EXTRA HIGH STRENGTH CONSTRUCTION, MINIMUM TENSILE STRENGTH OF 26,000 LBS.
 - (4C) DEADEND GRIP - PREFORMED TWISTED LOOP, CLASS A OR B GALVANIZED, SIZED FOR GUY WIRE.
 - (4D) GUY STRAIN INSULATOR - 5/8" SIZE, ANSI C29.4 CLASS 54-1.
 - (4E) FIBERGLASS GUY STRAIN INSULATOR - 16,000 LBS RATING, HOT-DIPPED GALVANIZED CLEWS-THIMBLE-EYE FITTINGS, LENGTH AS REQUIRED.
 - (4F) 3/4" THIMBLE-EYE ANGLE BOLT (LENGTH AS REQUIRED), WASHER, SPRING LOCK WASHER, NUT, HOT DIP GALVANIZED, MINIMUM TENSILE STRENGTH OF 18,000 LBS.
 - (4G) GUY WIRE MARKER - HALF ROUND UV RESISTANT YELLOW PLASTIC, 2" WIDE X 96" LONG, WITH MOUNTING HARDWARE.
 - (4H) GUY STATIC ATTACHMENT - THIMBLEYES (2) WITH ROD SIZED FOR BAYONET HOLE, HOT DIP GALVANIZED.
- ITEM TAG ELECTRICAL SWITCH ITEMS**
- (5A) CUTOFF SWITCH/ARRESTER COMBINATION UNIT, FOR CROSSARM MOUNTING, CUTOFFS, ANSI C37.42, LOAD BREAK, UNLESS EXISTING, DROPOUT TYPE, 110 KV BIL, SEE SINGLE LINE FOR RATINGS, SEE ITEM TAG 4E BELOW FOR ARRESTER REQUIREMENTS.
 - (5B) FUSED CUTOFF SWITCH/ARRESTER COMBINATION UNIT, FOR CROSSARM MOUNTING, CUTOFFS, ANSI C37.42, LOAD BREAK, UNLESS EXISTING, DROPOUT TYPE, 110 KV BIL, FUSES, TYPE K, SEE SINGLE LINE FOR RATINGS, SEE ITEM TAG 4E BELOW FOR ARRESTER TYPE AND RATING.
 - (5C) LOAD BREAK SWITCH, FOR CROSSARM MOUNTING, ANSI C37.30, 110 KV BIL, FUSES, WHERE REQUIRED, TYPE K, SEE SINGLE LINE FOR RATINGS.
 - (5D) LOAD BREAK SWITCH, FOR CROSSARM MOUNTING, HORIZONTAL, S & C CAT. # 147432-D-52, ANSI C37.30, 110 KV BIL, FUSES, WHERE REQUIRED, TYPE K, SEE SINGLE LINE FOR RATINGS.
 - (5E) ARRESTER, DIRECT CONNECTED, 9 KV, IEEE C62.1, RISER POLE TYPE, METAL OXIDE VALVE W/CROSSARM MOUNTING HARDWARE.
 - (5F) SWITCH NAMEPLATE - 1/4" BAKELITE SIGN MATERIAL SIZED FOR NUMBER OF CHARACTERS, BLACK LETTERS ON WHITE BACKGROUND WITH MOUNTING HOLES SIZED FOR 1/4" BOLTS SET AT BOTH ENDS. MOUNT THE NAMEPLATE AT EYE LEVEL NEAR OPERATING HANDLE.

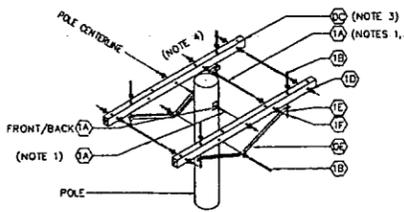
- ITEM TAG TRANSFORMER ITEMS**
- (6A) TRANSFORMER POLE MOUNTED, SEE SINGLE LINE FOR RATINGS AND QUANTITIES - ANSI C57.12, 20, 1 PHASE, OIL FILLED, 125 KV BIL, 45°C OVER 30°C RISE, EXTERNALLY OPERATED CHANGER FOR TWO EACH 2 1/2 % ABOVE AND BELOW NORMAL VOLTAGE TAPS.
 - (6B) POLE MOUNTED EQUIPMENT BRACKET FOR SINGLE TRANSFORMER - DOUBLE-BANDED, HEAVY DUTY CLUSTER MOUNT, HIGH-STRENGTH STEEL GALVANIZED OR ALUMINUM, WITH GROUNDING LUG, SIZED FOR ITEM 5A ABOVE.
 - (6C) POLE MOUNTED EQUIPMENT BRACKET FOR THREE TRANSFORMERS - DOUBLE-BANDED, HEAVY DUTY CLUSTER MOUNT, HIGH-STRENGTH STEEL GALVANIZED OR ALUMINUM, WITH GROUNDING LUG, SIZED FOR ITEM 5A ABOVE.
- ITEM TAG STATIC LINE, CABLE(S) AND INSULATOR ITEMS**
- (7A) STATIC LINE - 3/8" DIA STRAND, CLASS A OR B GALVANIZED, 1 X 7 HIGH STRENGTH CONSTRUCTION, MINIMUM TENSILE STRENGTH OF 10,000 LBS.
 - (7B) STATIC LINE BAYONET - STRAIGHT, 66" LENGTH, HOT DIP GALVANIZED.
 - (7C) STATIC LINE BAYONET - CORNER, 66" LENGTH, HOT DIP GALVANIZED.
 - (7D) STATIC LINE CLAMP - HOT DIP GALVANIZED J-BOLT DESIGNED TO FIT INTO TWO HOLES AT TOP OF BAYONET.
 - (7E) 13.2KV AERIAL CABLE - 336.4KCMIL ACSR "MERLIN", ASTM B232.
 - (7F) 13.2KV AERIAL CABLE - #2 AWG ACSR "SPARROW", ASTM B232.
 - (7G) DEADEND CLAMP - ALUMINUM, STRAIGHT-LINE, SIZED FOR AERIAL CABLE.
 - (7H) CABLE TO CABLE CONNECTOR USED FOR XFMR PRIMARY CONNECTION TO OVERHEAD - COMPRESSION STRIP (ALUM., SIZED FOR STRIP AND TAP CABLE). USE SILICON-BRONZE BOLTING MATERIALS.
 - (7I) CABLE TO CABLE CONNECTOR USED FOR MAIN LINE TAPS TO BRANCH CIRCUITS - ALUMINUM MECHANICAL NON-CRIMP REMOVABLE CONNECTOR, SIZED FOR CABLES. USE SILICON-BRONZE BOLTING MATERIALS.
 - (7J) CABLE TO CABLE CONNECTOR USED FOR MAIN LINE CONNECTIONS - ALUMINUM COMPRESSION CONNECTOR, SIZED FOR CABLES. USE SILICON-BRONZE BOLTING MATERIALS.
 - (7K) SUSPENSION INSULATOR - CLEVIS TYPE, STEEL HARDWARE, ANSI C29.2, CLASS 52-9, 2 REQUIRED FOR 13.2KV SERVICE. OTHER INSULATOR ARRANGEMENTS SUITABLE FOR 13KV SERVICE MAY BE SUBMITTED FOR APPROVAL.
 - (7L) STRAIGHT PIN/INSULATOR/ASSEMBLY, FOR WOOD CROSSARM, DEAD END INSULATOR REQUIRED FOR MPT56 - FLAT BASE LONG SHANK TYPE, MOUNTING HARDWARE, HOT DIP GALVANIZED; PIN INSULATOR - 14.4KV, GLAZED PORCELAIN, ANSI C29.5, CLASS 55-5, 7" NECK; ARMOR ROD - SIZED AND LENGTH AS REQUIRED BY AERIAL CABLE SIZE/SUPPORT(S); THE WIRE - TYPE (COPPER OR ALUMINUM), SIZED AND LENGTH AS REQUIRED BY AERIAL CABLE SIZE/SUPPORT(S); SEAL WITH SILICON PUTTY WHEN NOT MOUNTED UPRIGHT.
 - (7M) CORNER ANGLE PIN/INSULATOR/PREFORMED ARMOR ROD/TIE WIRE ASSEMBLY, CORNER ANGLE PIN FOR WOOD CROSSARM - MOUNTING HARDWARE, HOT DIP GALVANIZED; PIN INSULATOR - 14.4KV, GLAZED PORCELAIN, ANSI C29.5, CLASS 55-5, 7" NECK; ARMOR ROD - SIZED AND LENGTH AS REQUIRED BY AERIAL CABLE SIZE/SUPPORT(S); THE WIRE - TYPE (COPPER OR ALUMINUM), SIZED AND LENGTH AS REQUIRED BY AERIAL CABLE SIZE/SUPPORT(S); SEAL WITH SILICON PUTTY WHEN NOT MOUNTED UPRIGHT.
 - (7N) POLE TOP PIN/INSULATOR/ASSEMBLY, POLE TOP PIN - C135.22, 15" LENGTH, MOUNTING HARDWARE FOR WOOD POLE, HOT DIP GALVANIZED; PIN INSULATOR - 14.4KV, GLAZED PORCELAIN, ANSI C29.5, CLASS 55-5, 7" NECK; ARMOR ROD - SIZED AND LENGTH AS REQUIRED BY AERIAL CABLE SIZE/SUPPORT(S); THE WIRE - TYPE (COPPER OR ALUMINUM), SIZED AND LENGTH AS REQUIRED BY AERIAL CABLE SIZE/SUPPORT(S); SEAL WITH SILICON PUTTY WHEN NOT MOUNTED UPRIGHT.
 - (7O) CABLE TERMINATION - SIZED FOR INSULATED CABLE WITH CROSSARM MOUNTING HARDWARE.
 - (7P) SECONDARY SERVICE CABLE - 600V CROSS-LINKED POLYETHYLENE INSULATION, 3 WIRE OR 4 WIRE SERVICE CABLE, 2 OR 3 CONDUCTOR INSULATED ALUMINUM WITH BARE ALUMINUM NEUTRAL MESSENGER. SEE SINGLE LINE DIAGRAM FOR WIRE SIZE.
- ITEM TAG ELECTRICAL SWITCH ITEMS**
- (7Q) THIMBLE, FOR STATIC WIRE OR MESSENGER WIRE DEAD-END.
 - (7R) EYE BOLT, OVAL EYE TYPE, FOR DEAD-END, 5/8" DIA, WITH ONE SQUARE NUT, ADDITIONAL NUTS, WASHERS, AND LENGTH AS REQUIRED.
 - (7S) GUY GRIP, FOR STATIC WIRE, PREFORMED WIRE TYPE.



POLE GROUNDING NOTES:

- INSTALL ITEMS 2A, 2B AND 2D WHEN INSTALLING TRANSFORMERS ON POLE.
- LOCATE ITEM 2D FOR MAXIMUM CLEARANCE TO NEAREST 13.2KV BARE AERIAL CONDUCTOR(S). ALWAYS LOCATE ON OPPOSITE SIDE OF POLE FROM OFF-CENTER MIDDLE PHASE FEATURES.

73 DETAIL
E-2 POLE GROUNDING SYSTEM
SCALE: NTS



CROSSARM AND MOUNTING NOTES:

- PROVIDE ADEQUATE LENGTH OF THREAD TO FACILITATE ADDITION OF FUTURE CUTOFF AND EYENUTS ON END OF BOLT.
- PROVIDE ITEM 1A WITH REQUIRED HARDWARE WHEN "OFFSET" IS NEEDED.
- REPLACES WHERE NOTED. USE 4 CROSSARMS (ADJUST LENGTH OF WHERE NOTED).
- USE STANDARD CROSSARM DRILL HOLE SPACINGS.

71 DETAIL
- CROSSARMS AND MOUNTING ITEMS
SCALE: NTS

0	ISSUED OFC	9-22-03	GES	MS
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP. INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

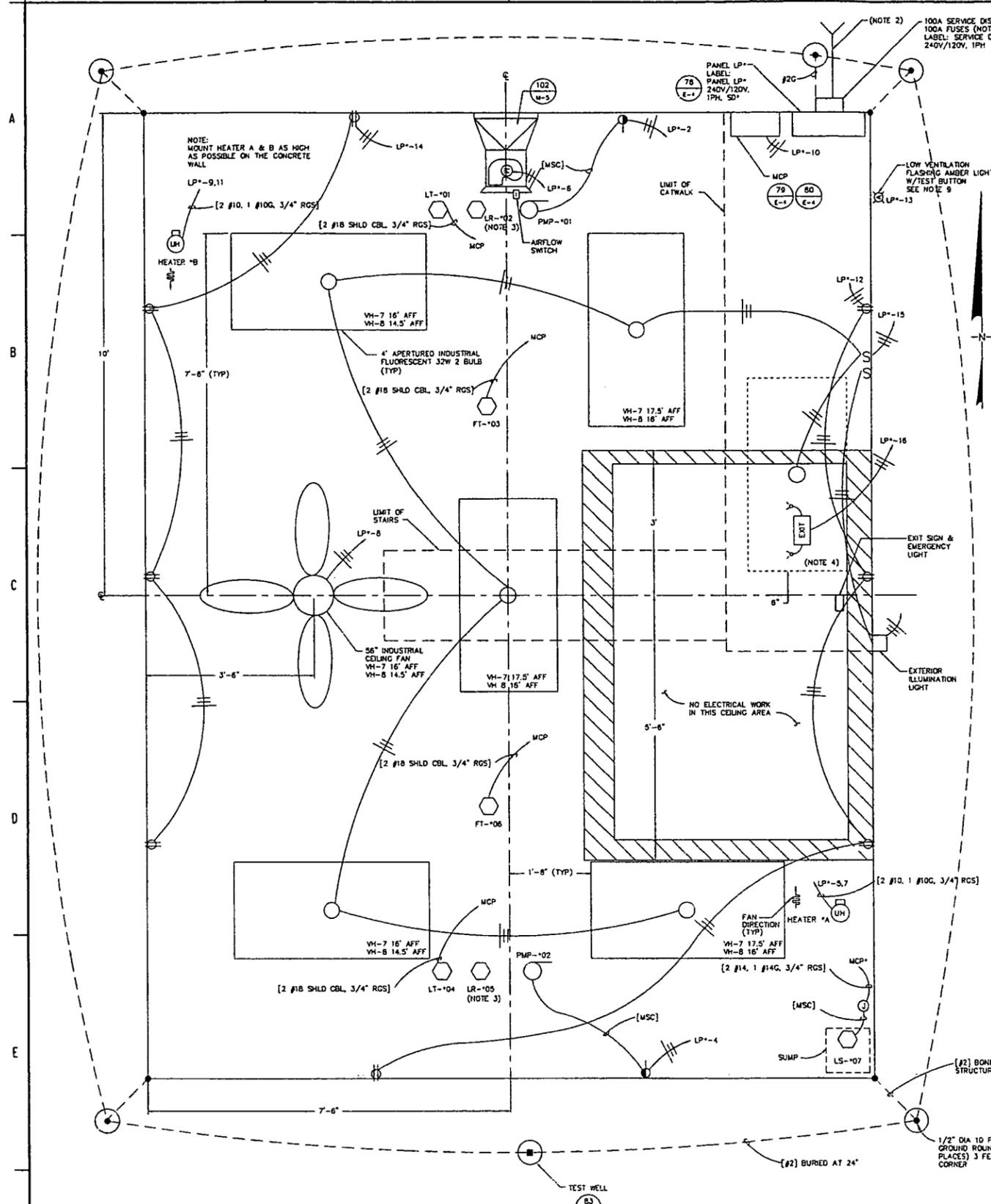
THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM VALVE HOUSE 7 & 8

DRAWING TITLE
OVERHEAD POWER TRANSMISSION SYSTEM DETAILS II

COGNIZANT ENG.	SAFETY ENG.		
CIVIL & STR.	MAINTENANCE		
ELECTRICAL	FIRE PROTECT.		
ENGINEER	WASTE MANAGE.		
INSTRUMENT	SECURITY		
MECHANICAL	CONSTRUCTION		
CHECKED			
APPROVED			
DRAWN BY	PROJECT NO.	DRAWING REVISION CODE NO.	SHEET NO.
G. E. SCHWARZMAN	20112		E-3
RES. PROJECT NO.	FILENAME	90X-5500-E-00667	0
RES. 4453	100-0296.DWG		

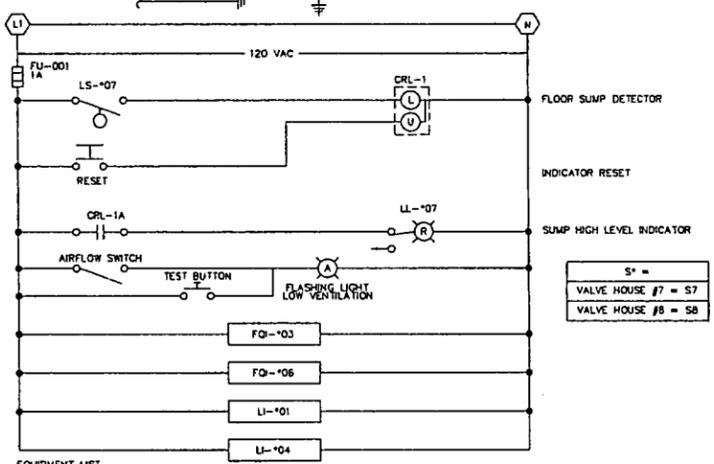
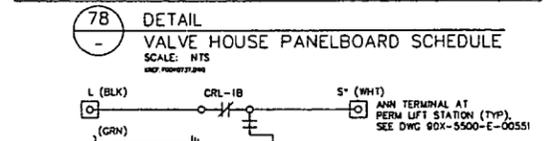
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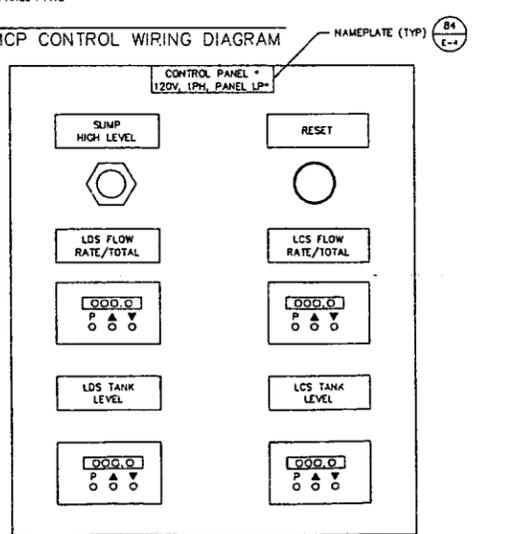
PANEL LP* (SEE NOTE 5) 240V/120V, 1PH, 3W S.N. 225A MAINS

CKT. NO.	USE	KVA	BREAKER	WIRE SIZE	L1	L2	WIRE SIZE	BREAKER	KVA	USE	CKT. NO.
1	MAIN		100	1			12	20	1.2	PMP1 REC.	2
3							12	20	1.2	PMP2 REC.	4
5	HEATER 'A'	2.5	30	10			12	15	0.7	SUPPLY FAN	6
7	HEATER 'B'	2.5	30	10			12	15	0.2	CEILING FAN	8
9							12	15	0.1	MCP*	10
11							12	20	0.9	RECEPTACLES	12
13	EXTERIOR WALL PACK	1.0	20	12			12	20	0.9	RECEPTACLES	14
15	INTERIOR LIGHTS	0.4	20	12			20			EXIT/EGRESS FIXTURE	16
17	SPACE						20			SPARE	18
19	SPACE						20			SPARE	20
21	SPACE						20			SPARE	22
23	SPACE						20			SPARE	24
25	SPACE						20			SPARE	26
27	SPACE						20			SPARE	28
29	SPACE						20			SPARE	30

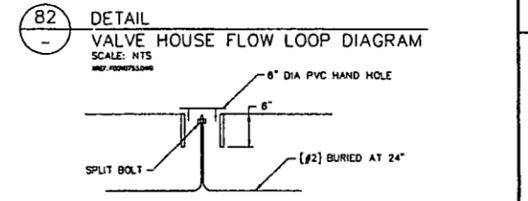
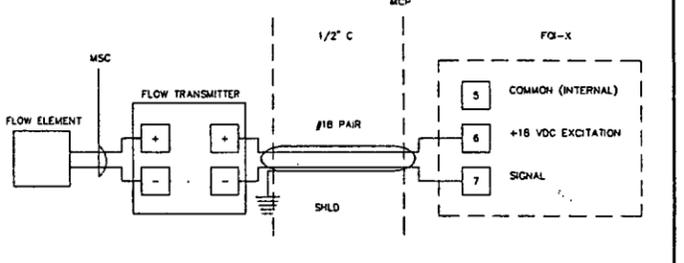
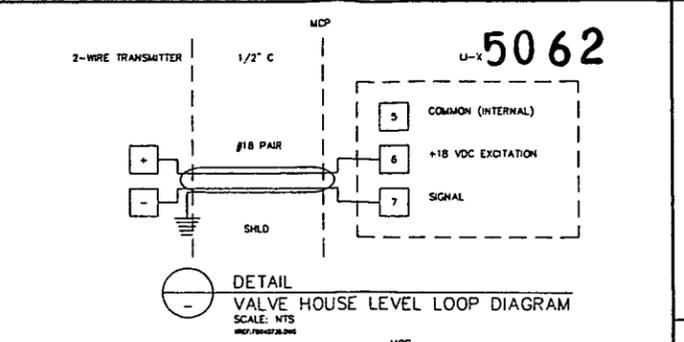
TOTAL CONNECTED LOAD = 16.6 KVA, 69 AMPS
 SQUARE D H00030L225CU OR EQUAL
 * GFCI BREAKER



- EQUIPMENT LIST
- PUSH-TO-TEST PILOT LIGHT, 120V, EXTERIOR FRAME TYPE, RED LENS
 - PUSH BUTTON, BLACK HEAD, 1 H.O. CONTACT
 - LATCHING RELAY, DPDT WITH SOCKETS
 - ULTRASONIC LEVEL SENSORS
 - FLOAT SWITCH
 - APOLLO INTELLIGENT METERS FOR PROCESS INPUTS WITH 18 VDC EXCITATION, MODEL NO. IMP20162.
 - APOLLO INTELLIGENT METERS FOR PROCESS INPUTS WITH 18 VDC EXCITATION, AND TOTALIZER MODEL NO. IMP23160, OR APPROVED EQUAL.
- ENCLOSURE, NEMA 12, JC, 14 X 12 X 8
 WEGMANN B141208 CH WITH PANEL P1412



- LEGEND
- EEEE = EQUIPMENT ID
 - VVVV = MAXIMUM VOLTAGE
 - X = NUMBER OF PHASES
 - PPPP = POWER FEED LOCATION



- NOTES:
- BREAKER FOR MCP LOAD IS LOCATED IN PANEL LP*. CIRCUIT NO. 10.
 - PROVIDE DISCONNECT SWITCH FOR SERVICE AND MOUNT ON EXTERIOR WALL.
 - COIL AND SECURE DATA LOGGER CABLE TO TANK.
 - MOUNT LIGHT FIXTURE TO BOTTOM OF CATWALK FLOOR STEEL.
 - * = VALVE HOUSE NUMBER.
 - ALL CONVENIENCE RECEPTACLES SHALL BE MOUNTED AT LEAST 5 FEET 2 INCHES ABOVE FINISHED FLOOR.
 - SEE SINGLE LINE DIAGRAM FOR SERVICE ENTRANCE WIRE SCHEDULE.
 - INSTALL FLASHING AMBER LIGHT (APPROX. 4" DIA.) ON VALVE HOUSE EXTERIOR WALL NEXT TO ENTRY DOOR, 5' HEIGHT. INSTALL LIGHT TWO PUSHBUTTON AND INFORMATION SIGN BELOW THE LIGHT, LOW VENTILATION CONTACT INDUSTRIAL HYGENE PRIOR TO ENTRY INTO BUILDING.

77 PLAN VALVE HOUSE ELECTRIC
 (NOTE 5)
 SCALE: 1/15
 REF: 90X-5500-E-0055

84 DETAIL NAMEPLATE
 SCALE: 1/15
 REF: 90X-5500-E-0055

0	ISSUED CFC	9-22-03	GES	MJB
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.

UNITED STATES DEPARTMENT OF ENERGY
 FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
 ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
 VALVE HOUSE 7 & 8

DRAWING TITLE
VALVE HOUSE ELECTRICAL DETAILS

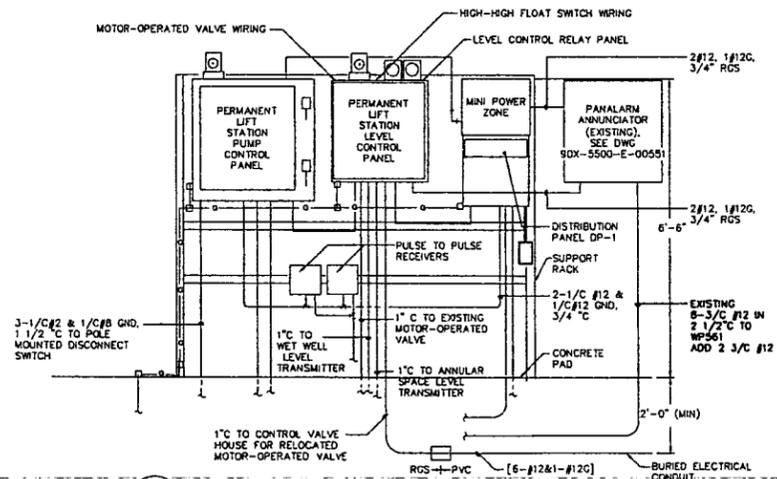
APPROVALS

COORDINANT ENGR.	SAFETY ENGR.
CIVIL & STR.	MAINTENANCE
ELECTRICAL	FIRE PROTECT.
ENGINEER	WASTE MANAGE.
INSTRUMENT	SECURITY
MECHANICAL	QA
	CONSTRUCTION

CHECKED: MJB
 APPROVED: MJB

DRAWN BY: G.E. SCHWARZMAN
 RES. PROJECT NO.: 90X-5500-E-00668
 FILENAME: 1700-0258.DWG

PROJECT NO.: 20112
 SHEET NO.: E-4
 REV. NO.: 0



89
E-1
DETAIL
PERMANENT LIFT STATION EQUIPMENT RACK
SCALE: NTS
NOTE-EQUIPMENT RACK IS EXISTING-
INSTALL ALARM WIRING FROM VH-7 AND VH-8.
REF: CONTROL INTERFACE IFC DRAWINGS

0	ISSUED CFC	9-22-03	GES	MES
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
			INITIALS AND DATE	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

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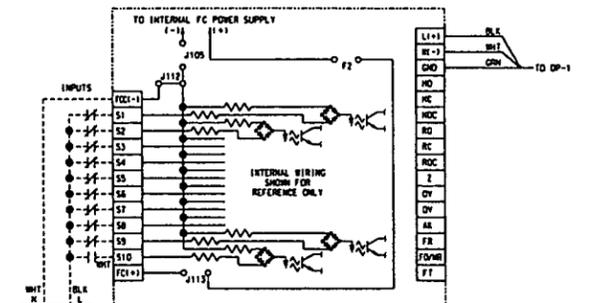
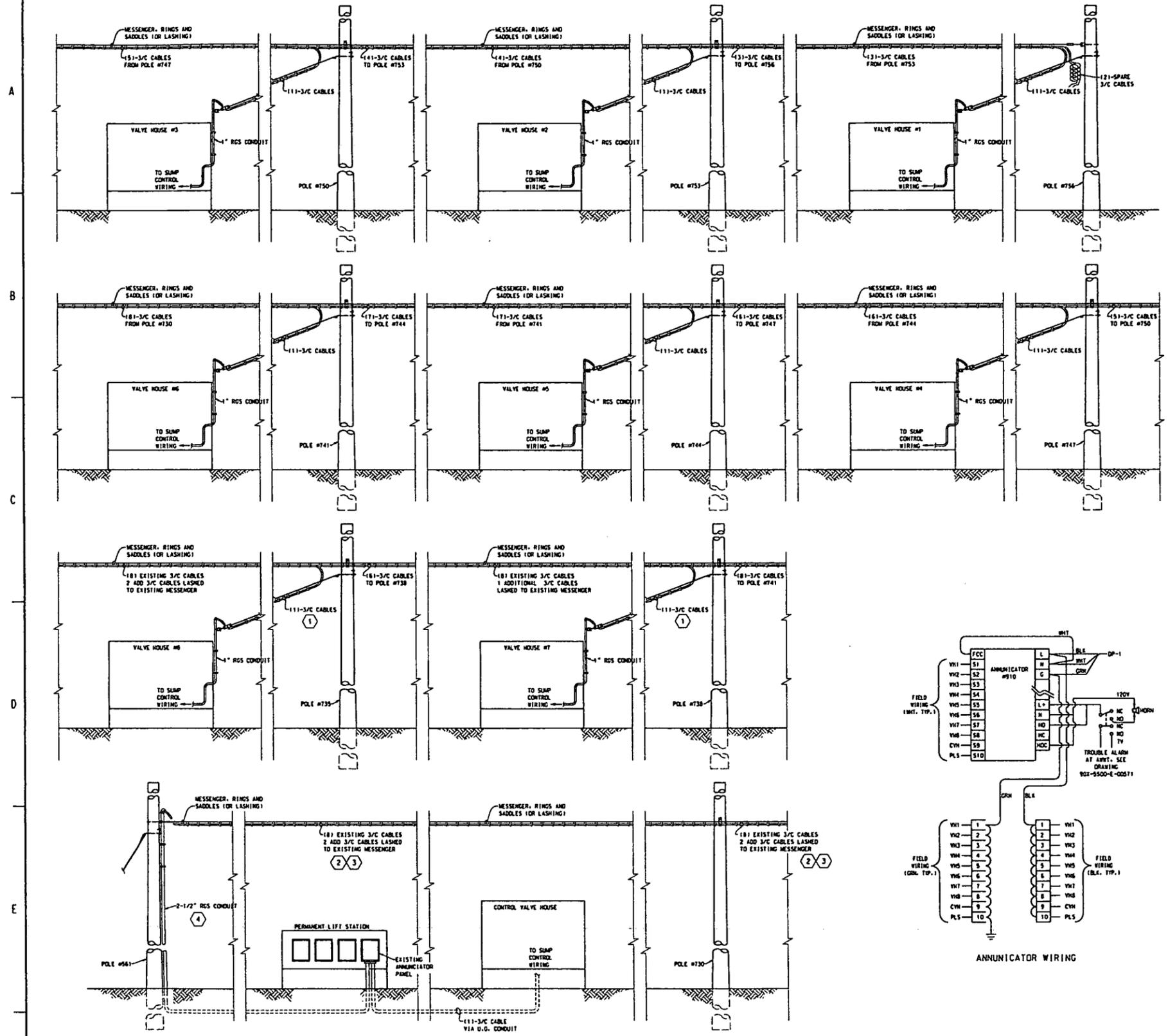
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8
DRAWING TITLE

CONTROL VALVE HOUSE ELECTRICAL DETAILS

APPROVALS			
COGNIZANT ENG. CIVIL & STR. ENGINEER	<i>[Signature]</i>	SAFETY ENG. MAINTENANCE	
ELECTRICAL ENGINEER		FIRE PROTECT. WASTE MANAGE	
INSTRUMENT MECHANICAL	<i>J. McCloy</i>	SECURITY CONSTRUCTION	
CHECKED	<i>[Signature]</i>		
APPROVED	<i>[Signature]</i>		
DRAWN BY	PROJECT NO.	DRAWING REVISION CODE NO.	SHEET NO.
J.S. WEININGER	20112	90X-5500-E-00669	E-5
REV PROJECT NO. RES 4153	FILENAME 100-0307.DWG		0

000213

- CONNECT THE CONTROL HOUSE AND (8)- VALVE HOUSES' SUMP WIRING BY AERIAL WIRING TO THE ANNUNCIATOR.
- THE AERIAL CONTROL WIRING HAS A 120VAC SIGNAL AND IS INSULATED WITH 600V INSULATION. SO THIS WIRING SHALL BE INSTALLED IN THE 120/480V SECTION OF POLE WIRING, NOT THE COMMUNICATION ZONE.
- ALL THE CONTROL WIRING SHALL BE SUSPENDED FROM MESSENGER WIRE. SEE DRAWINGS 16A-5500-E-00105 AND 00106 FOR DETAILS ON POLE HARDWARE FOR AERIAL WIRING. NOTE: THESE DRAWINGS REFERENCE TO THE SUSPENDED CABLE AS ALARM CABLE. THIS IS THE HARDWARE REQUIRED FOR THE CONTROL WIRING.
- ALL WIRING TO BE COPPER #12 AWG WITH 600V INSULATION UNLESS OTHERWISE NOTED.
- ALL POLES AND AERIAL WIRING FOR VALVE HOUSES 1 THRU 6 ARE EXISTING. PROVIDE 3/C CABLES FOR VALVE HOUSE 7 & 8.

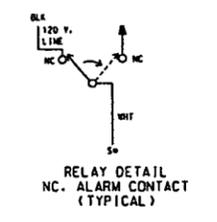
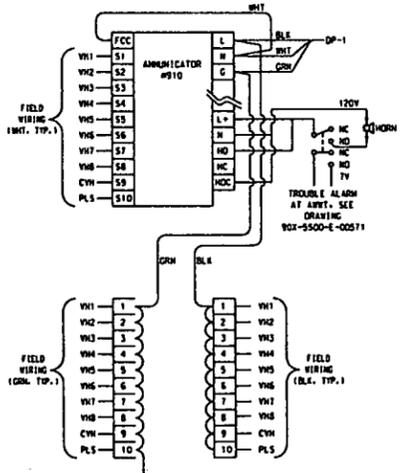


GENERAL NOTES: (FOR WIRING DIAGRAM ABOVE)

- "B" VERSION CARD WILL DE-ENERGIZE AT A HIGHER VOLTAGE THAN STANDARD "AC" UNIT TO COMPENSATE FOR THE UNDESIRABLE EFFECT OF RESIDUAL VOLTAGE CAUSED BY DISTRIBUTED CAPACITANCE ALONG FIELD CONTACT WIRING (APPROXIMATELY 90 VAC AND 180 VAC FOR 120 AND 240 VAC UNITS RESPECTIVELY).
- JUMPERS J105 AND J113 ARE NOT USED (INPUT BOARD).
- NOTE: DO NOT CONNECT "YCC1-1" TO "ON".

TYPE "K12", "K24", "K48", "K120", "K120", "K120", "K120", "K120" (OPTICALLY COUPLED) WIRING DIAGRAM WITH CUSTOMER SUPPLIED 7C VOLTAGE, 12VAC/DC, 24VAC/DC, 48VAC/DC, 120VAC, 125VAC, 240VAC, 250VDC

CUSTOMER WIRING DIAGRAM
"AC", "K" & "KR" INPUTS (OPTICALLY COUPLED) FOR MODEL 910 ANNUNCIATOR
VENDOR "PANALOR" INC. 310450-E-1, REVISION 6



1	VALVE HOUSE #1 SUMP ALARM
2	VALVE HOUSE #2 SUMP ALARM
3	VALVE HOUSE #3 SUMP ALARM
4	VALVE HOUSE #4 SUMP ALARM
5	VALVE HOUSE #5 SUMP ALARM
6	VALVE HOUSE #6 SUMP ALARM
7	VALVE HOUSE #7 SUMP ALARM
8	VALVE HOUSE #8 SUMP ALARM
9	CONTROL VALVE HOUSE SUMP ALARM
10	PERMANENT LIFT STATION ALARM

ELEVATION
NOT TO SCALE
WIRING LAYOUT FOR VALVE HOUSE SUMP ALARMS TO BE ANNUNCIATED TO ARMY

D	ISSUED CFC	9-22-03	GES	MUS
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-12-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
			INITIALS AND DATE	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

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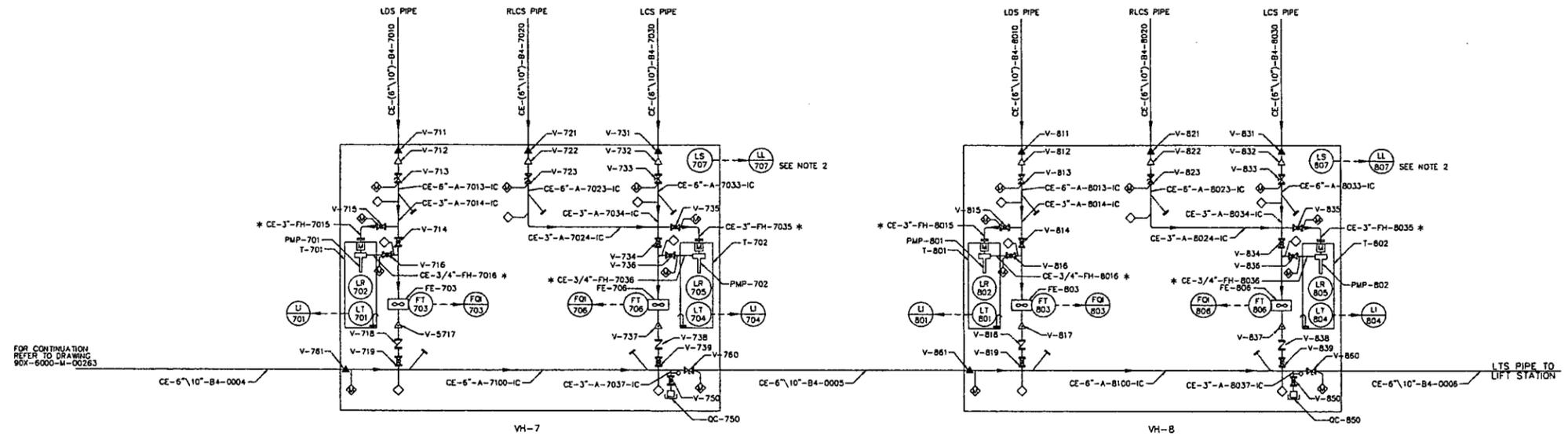
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8

DRAWING TITLE
ELEC. POWER FOR VALVE HOUSE SUMP ALARMS
NO SCALE

COGNIZANT ENG.	<i>[Signature]</i>	9/16/03	SAFETY ENG.	
CIVIL & STR.			MAINTENANCE	
ELECTRICAL			FIRE PROTECT.	
ENGINEER			WASTE MANAGE.	
INSTRUMENT			SECURITY	
MECHANICAL	J. Mc Cloy	9/16/03	CONSTRUCTION	
CHECKED	<i>[Signature]</i>			
APPROVED	<i>[Signature]</i>	9/16/03		

000214

DRAWN BY	PROJECT NO.	DRAWING REVISION CODE NO.	SHEET NO.	REV. NO.
G.E. SCHWARZMAN	20112		E-6	0
RES PROJECT NO.	FILENAME	PROJECT CODE NO.		
RES 4453	10210610.DGN	90X-5500-E-00670		



PIPING CODES

MC - PS - MT - LN - MD
 MC = FLOW MEDIUM CODE
 PS = NOMINAL PIPE SIZE (CARRIER/CONTAINMENT) NON-CENTRALIZED
 (PS) = NOMINAL PIPE SIZE (CARRIER/CONTAINMENT) CENTRALIZED
 MT = PIPE MATERIAL STANDARD ABBREVIATION
 LN = PIPELINE NUMBER
 MD = MODIFIER (IF REQUIRED)

EXAMPLE: CE-6"10"-B4-0006-IC
 CE = CONTAMINATED SEWER
 6"10" = 6"10" NOMINAL PIPE SIZE - NON-CENTRALIZED (CARRIER/CONTAINMENT)
 B4 = HDPE
 0006 = PIPELINE NUMBER 0006
 IC = CONDENSATION INSULATION

STANDARD ABBREVIATIONS

A - A53, GRADE A SEAMLESS STEEL PIPE
 B4 - HIGH DENSITY POLYETHYLENE (HDPE)
 CE - CONTAMINATED SEWER
 FH - FLEXIBLE-METAL HOSE ASSEMBLY-TYPE 304 STAINLESS STEEL WIRE BRAID AND TYPE 316 STAINLESS STEEL FITTINGS
 IC - CONDENSATION INSULATION
 WW - WASTEWATER

EQUIPMENT ABBREVIATIONS

FE - FLOW ELEMENT
 FM - FORCEMAIN
 FT - FLOW TOTALIZER/INDICATOR
 FT - FLOW TRANSMITTER
 LA - ALARM LIGHT
 LI - LEVEL INDICATOR
 LIC - PROGRAMMABLE LEVEL INDICATOR/CONTROLLER
 LL - LEVEL LIGHT
 LR - LEVEL RECORDER
 LS - LEVEL SWITCH
 LSH - LEVEL SWITCH HIGH HIGH
 LT - LEVEL TRANSMITTER
 P - CONTROL PANEL
 PC - PRIMARY CONTAINMENT VESSEL
 PI - PRESSURE INDICATOR
 PMP - PUMP
 QC - QUICK CONNECT
 T - TANK
 V - VALVE

INSTRUMENT CODES

AAA - BCC
 AAA = EQUIPMENT ABBREVIATION
 B = CELL NUMBER
 CC = INSTRUMENT NUMBER

EXAMPLE: V-704
 V = VALVE
 7 = CELL 7
 04 = INSTRUMENT NUMBER 04

SYMBOLS

OPEN KNIFE GATE VALVE
 CLOSED KNIFE GATE VALVE
 OPEN BALL VALVE
 CLOSED BALL VALVE
 BLIND FLANGE
 CHECK VALVE
 ELECTRICAL CONTROL PANEL
 ELECTRICAL SIGNAL
 FLOW DIRECTION
 LOCAL MOUNTED INSTRUMENT
 PANEL MOUNTED INSTRUMENT
 MATERIAL CODE BREAK
 MOTOR OPERATOR
 OPEN PIPE END
 PIPE SIZE BREAK
 QUICK CONNECT
 MONITORING PORT (WITH VALVE)
 SAMPLING PORT (WITH VALVE)
 LOW POINT DRAIN AND SAMPLING PORT (WITH VALVE)
 SUBMERSIBLE PUMP
 TRANSFER PUMP
 VENT WITH SCREEN
 PRESSURE INDICATOR
 FLOW METER
 * SEE SPECIFICATIONS

NOTES:

1. MONITORING PORT IS LOCATED ON 10-INCH SECONDARY CONTAINMENT PIPE. SAMPLING PORT IS LOCATED ON 6-INCH CARRIER PIPE.
 2. LIMIT OF CONTRACTOR WORK IS AS SHOWN ON DRAWING. CONTRACTOR WORK INCLUDES ELECTRICAL TIE-INS AT THE PERMANENT LIFT STATION CONTROL PANEL.

D	ISSUED CFC	9-22-03	GES	MSB
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 98% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
			DETAILS AND DATE	

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM VALVE HOUSE 7 & 8

DRAWING TITLE
PIPING AND INSTRUMENTATION DIAGRAM

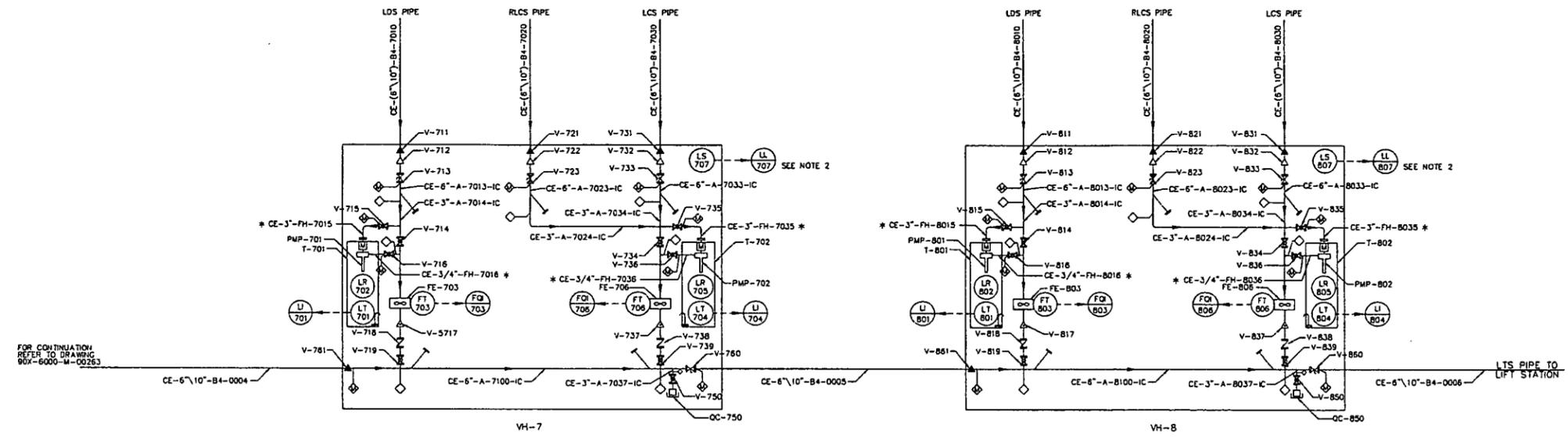
APPROVALS

COGNIZANT ENG.	<i>[Signature]</i>	SAFETY ENG.	
CIVIL & STR. ENGINEER	<i>[Signature]</i>	MAINTENANCE	
ELECTRICAL ENGINEER		FIRE PROTECT.	
INSTRUMENT MECHANICAL	<i>[Signature]</i>	WASTE MANAGE	
		SECURITY	
		CONSTRUCTION	

CHECKED: *[Signature]*
 APPROVED: *[Signature]*

DRAWN BY	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
C. F. SCHWARZMAN	20112	90X-5500-N-00671	N-1	0
RES PROJECT NO.	FILENAME			
RES 4453	F00-0210.DWG			

000215



FOR CONTINUATION
REFER TO DRAWING
90X-6000-M-00263

PIPING CODES

MC - PS - MT - LN - MD
 MC = FLOW MEDIUM CODE
 PS = NOMINAL PIPE SIZE (CARRIER/CONTAINMENT) NON-CENTRALIZED
 (PS) = NOMINAL PIPE SIZE (CARRIER/CONTAINMENT) CENTRALIZED
 MT = PIPE MATERIAL STANDARD ABBREVIATION
 LN = PIPELINE NUMBER
 MD = MODIFIER (IF REQUIRED)

EXAMPLE: CE-6"10'-B4-0006-IC
 CE = CONTAMINATED SEWER
 6"10' = 6"10" NOMINAL PIPE SIZE - NON-CENTRALIZED (CARRIER/CONTAINMENT)
 B4 = HDPE
 0006 = PIPELINE NUMBER 0006
 IC = CONDENSATION INSULATION

STANDARD ABBREVIATIONS

A A33, GRADE A SEAMLESS STEEL PIPE
 B4 HIGH DENSITY POLYETHYLENE (HDPE)
 CE CONTAMINATED SEWER
 FH FLEXIBLE-METAL HOSE ASSEMBLY-TYPE 304 STAINLESS STEEL WIRE BRAID AND TYPE 316 STAINLESS STEEL FITTINGS
 IC CONDENSATION INSULATION
 WW WASTEWATER

EQUIPMENT ABBREVIATIONS

FE FLOW ELEMENT
 FM FORCEMAIN
 FQI FLOW TOTALIZER/INDICATOR
 FT FLOW TRANSMITTER
 LA ALARM LIGHT
 LI LEVEL INDICATOR
 LIC PROGRAMMABLE LEVEL INDICATOR/CONTROLLER
 LL LEVEL LIGHT
 LR LEVEL RECORDER
 LS LEVEL SWITCH
 LSH LEVEL SWITCH HIGH HIGH
 LT LEVEL TRANSMITTER
 P CONTROL PANEL
 PC PRIMARY CONTAINMENT VESSEL
 PI PRESSURE INDICATOR
 PMP PUMP
 QC QUICK CONNECT
 T TANK
 V VALVE

INSTRUMENT CODES

AAA - BCC
 AAA = EQUIPMENT ABBREVIATION
 B = CELL NUMBER
 CC = INSTRUMENT NUMBER

EXAMPLE: V-704
 V = VALVE
 7 = CELL 7
 04 = INSTRUMENT NUMBER 04

SYMBOLS

OPEN KNIFE GATE VALVE
 CLOSED KNIFE GATE VALVE
 OPEN BALL VALVE
 CLOSED BALL VALVE
 BLIND FLANGE
 CHECK VALVE
 ELECTRICAL CONTROL PANEL
 ELECTRICAL SIGNAL
 FLOW DIRECTION
 LOCAL MOUNTED INSTRUMENT
 PANEL MOUNTED INSTRUMENT
 MATERIAL CODE BREAK
 MOTOR OPERATOR
 OPEN PIPE END
 PIPE SIZE BREAK
 QUICK CONNECT
 MONITORING PORT (WITH VALVE)
 SAMPLING PORT (WITH VALVE)
 LOW POINT DRAIN AND SAMPLING PORT (WITH VALVE)
 SUBMERSIBLE PUMP
 TRANSFER PUMP
 VENT WITH SCREEN
 PRESSURE INDICATOR
 FLOW METER
 * SEE SPECIFICATIONS

NOTES:

1. MONITORING PORT IS LOCATED ON 10-INCH SECONDARY CONTAINMENT PIPE. SAMPLING PORT IS LOCATED ON 8-INCH CARRIER PIPE.
 2. LIMIT OF CONTRACTOR WORK IS AS SHOWN ON DRAWING. CONTRACTOR WORK INCLUDES ELECTRICAL TIE-INS AT THE PERMANENT LIFT STATION CONTROL PANEL.

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP. BY
0	ISSUED CFC	9-22-03	DES	MSB
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 98% REVIEW	6-11-03		

**UNITED STATES
DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT**

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
**ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8**

DRAWING TITLE
PIPING AND INSTRUMENTATION DIAGRAM

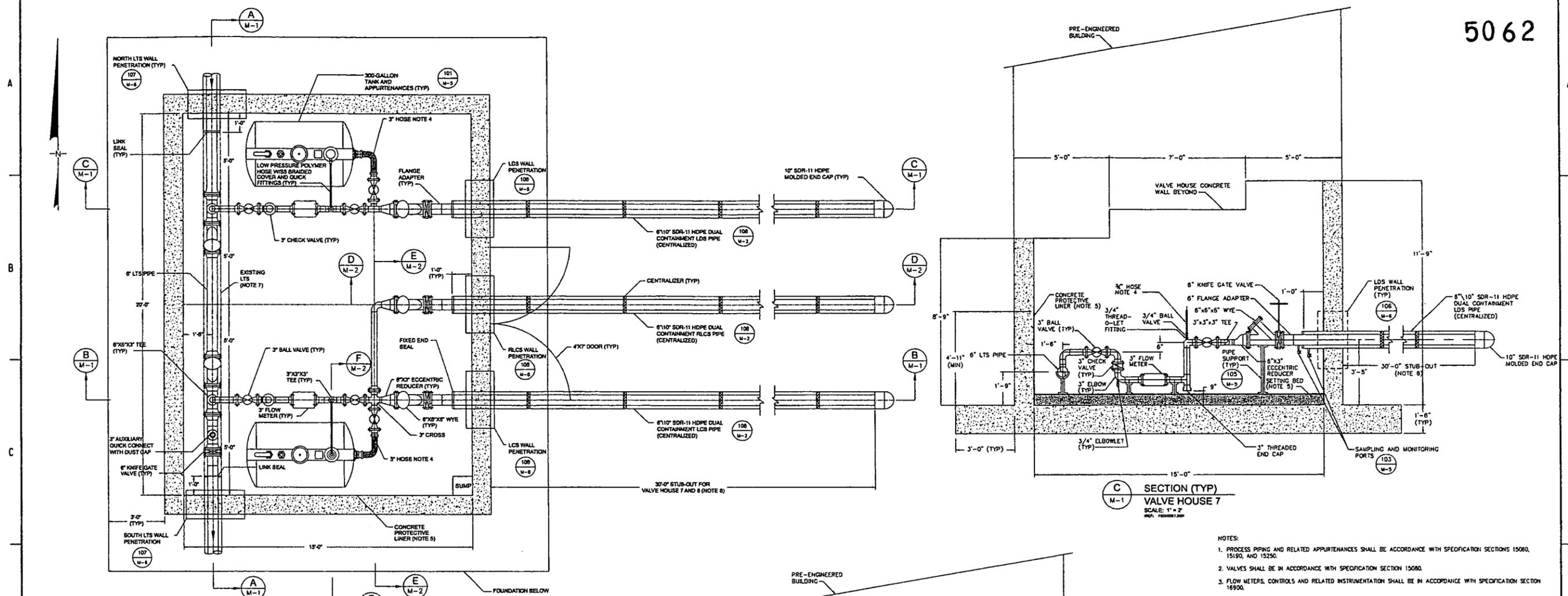
APPROVALS

COGNIZANT ENG. <i>[Signature]</i>	SAFETY ENG.
CIVIL & STR. <i>[Signature]</i>	MAINTENANCE
ELECTRICAL	FIRE PROTECT.
ENGINEER	WASTE MANAGE.
INSTRUMENT	SECURITY
MECHANICAL <i>[Signature]</i>	CONSTRUCTION

CHECKED *[Signature]*
 APPROVED *[Signature]*

DRAWN BY G.E. SCHWARZMAN	PROJECT NO. 20112	DRAWING INDEX CODE NO. 90X-5500-N-00671	SHEET NO. N-1	REV. NO. 0
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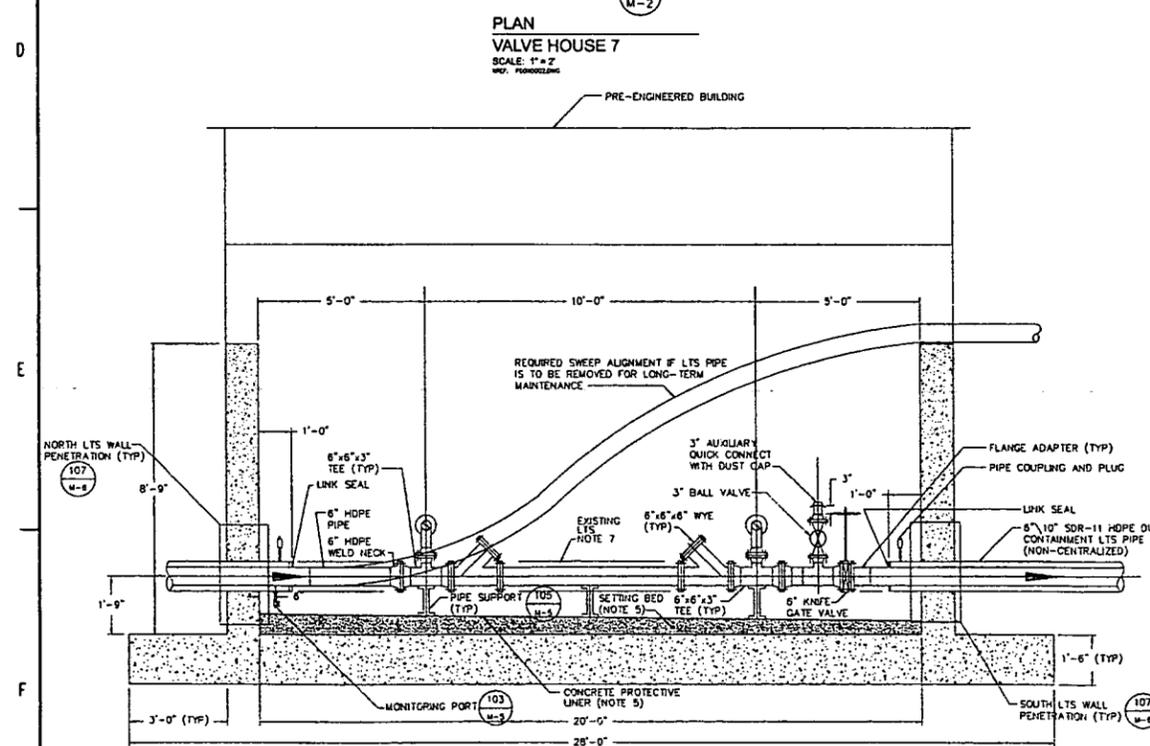
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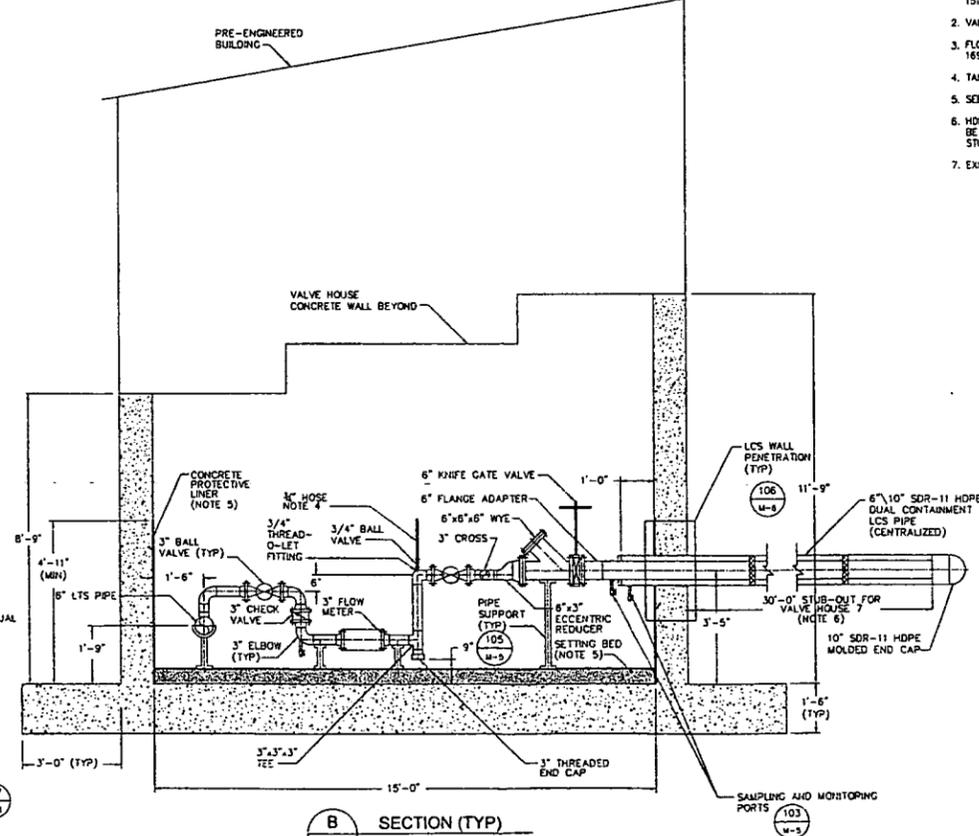
PLAN
VALVE HOUSE 7
SCALE: 1" = 2'

SECTION (TYP)
VALVE HOUSE 7
SCALE: 1" = 2'

- NOTES:
1. PROCESS PIPING AND RELATED APPURTENANCES SHALL BE ACCORDANCE WITH SPECIFICATION SECTIONS 15060, 15190, AND 15250.
 2. VALVES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 15080.
 3. FLOW METERS, CONTROLS AND RELATED INSTRUMENTATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 16900.
 4. TANKS, FLEXIBLE HOSE, AND TANK TRANSFER PUMPS SHALL BE IN ACCORDANCE WITH SECTION 15070.
 5. SEE DRAWINGS 5-2 FOR CONCRETE PROTECTIVE LINER AND SETTING BED INSTALLATION DETAILS.
 6. HDPE STUB-OUT PIPES AND MOLDED END CAPS SHALL BE INSTALLED AT VALVE HOUSE. STUB-OUT PIPES SHALL BE CONSTRUCTED FROM A SINGLE LENGTH WITHOUT BUTT-FUSION WELDS EXCEPT FOR JOINT AT MOLDED END CAP. STUB-OUT PIPES ARE NOT REQUIRED TO BE HYDROSTATIC TESTED.
 7. EXISTING 8" LTS PIPE TO BE REMOVED. SEE SPECIFICATION SECTION 02050 FOR REQUIREMENTS.



SECTION (TYP)
VALVE HOUSE 7
SCALE: 1" = 2'



SECTION (TYP)
VALVE HOUSE 7
SCALE: 1" = 2'

000217

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
D	ISSUED CFC	9-22-03	GES	WES
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		

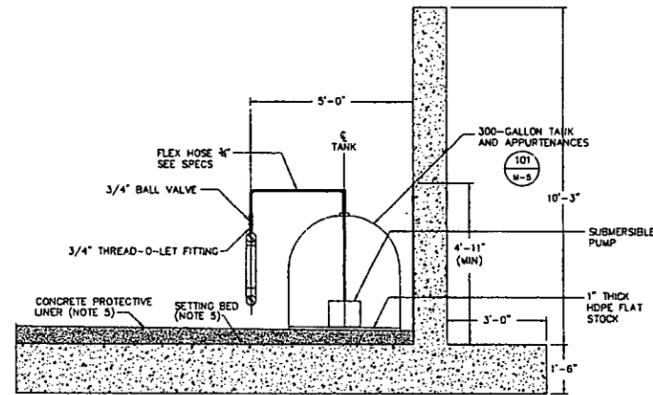
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

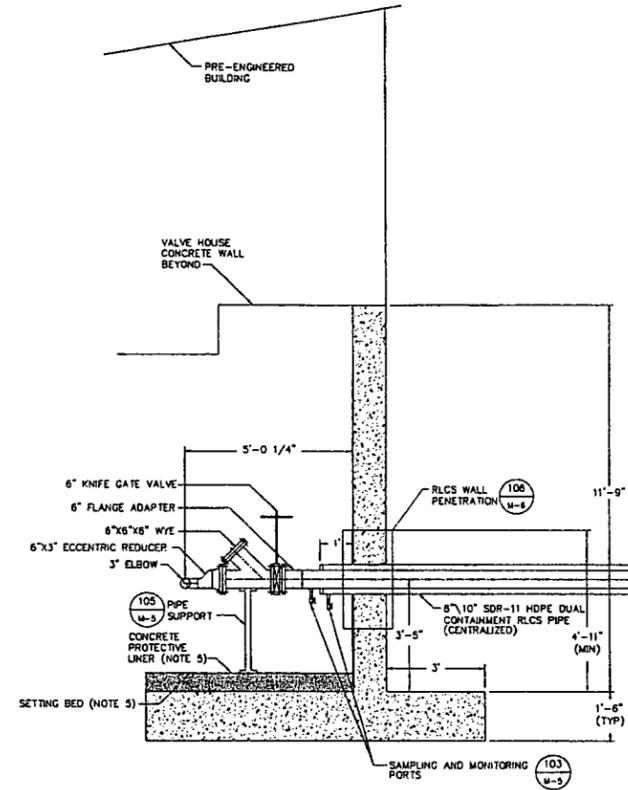
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8

DRAWING TITLE
VALVE HOUSE 7 MECHANICAL DETAILS I

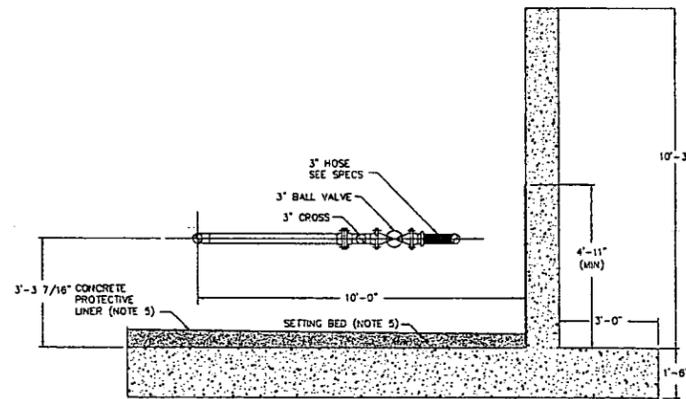
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COORDINANT ENG. <i>[Signature]</i>	SAFETY ENG. <i>[Signature]</i>
CIVIL & STR. <i>[Signature]</i>	MAINTENANCE <i>[Signature]</i>
ELECTRICAL <i>[Signature]</i>	FIRE PROTECT. <i>[Signature]</i>
ENGINEER <i>[Signature]</i>	WASTE MANAGE. <i>[Signature]</i>
INSTRUMENT <i>[Signature]</i>	SECURITY <i>[Signature]</i>
MECHANICAL <i>[Signature]</i>	QA <i>[Signature]</i>
	CONSTRUCTION <i>[Signature]</i>
CHECKED <i>[Signature]</i>	
APPROVED <i>[Signature]</i>	
DRAWN BY J.S. WINGER	PROJECT NO. 20112
REV PROJECT NO. RES 4453	FILENAME F00-0271.DGN
DRAWING INDEX CODE NO. 90X-5500-M-00672	SHEET NO. M-1
	REV. NO. 0



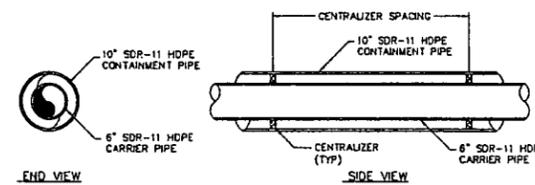
F SECTION (TYP)
M-1 VALVE HOUSE 7
SCALE: 1" = 2'
REF: F00-0213.DGN



D SECTION (TYP)
M-1 VALVE HOUSE 7
SCALE: 1" = 2'
REF: F00-0213.DGN



E SECTION (TYP)
M-1 VALVE HOUSE 7
SCALE: 1" = 2'
REF: F00-0213.DGN



108 DETAIL
M-1/1-1 CENTRALIZED LRS, RLCS AND LCS PIPES
(NOTE 1)
SCALE: 1" = 1'
REF: F00-0213.DGN

- NOTES:
1. PROCESS PIPING AND RELATED APPURTENANCES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTIONS 15060, 15190, AND 15250.
 2. VALVES SHALL BE ACCORDANCE WITH SPECIFICATION SECTION 15080.
 3. FLOW METERS, CONTROLS AND RELATED INSTRUMENTATION SHALL BE ACCORDANCE WITH SPECIFICATION SECTION 16900.
 4. TANKS, FLEXIBLE HOSE, AND TANK TRANSFER PUMPS SHALL BE ACCORDANCE WITH SECTION 15070.
 5. SEE DRAWINGS S-2 AND S-3 FOR CONCRETE PROTECTIVE LINER AND SETTING BED INSTALLATION DETAILS.

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPV.
D	ISSUED OFC	9-22-03	GES	mes
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM VALVE HOUSE 7 & 8

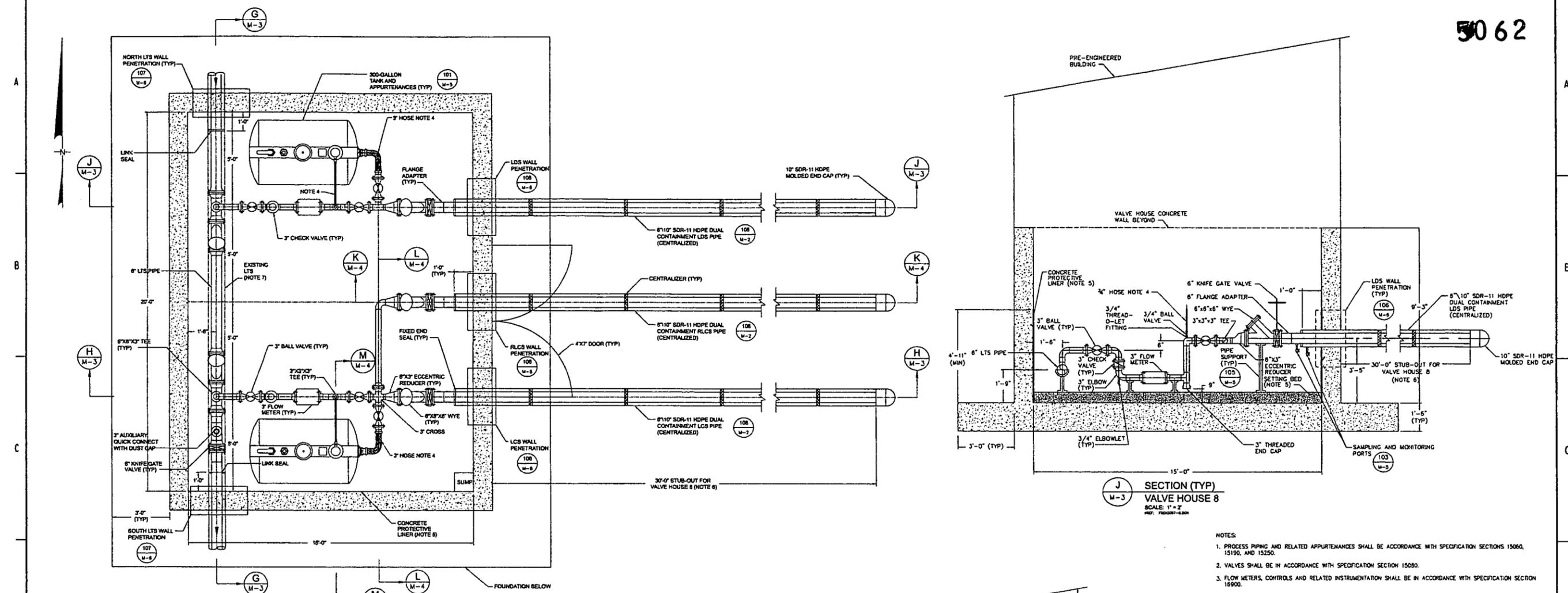
DRAWING TITLE
VALVE HOUSE 7 MECHANICAL DETAILS II

APPROVALS

DESIGNED BY	CHECKED BY	APPROVED BY	SAFETY ENG. MAINTENANCE	FIRE PROTECT.	WASTE MANAGE.	SECURITY	CONSTRUCTION
<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>					

DESIGNED BY G. E. SCHWARZMAN	PROJECT NO. 20112	DRAWING REVISION CODE NO. 90X-5500-M-00673	SHEET NO. M-2	REV. NO. 0
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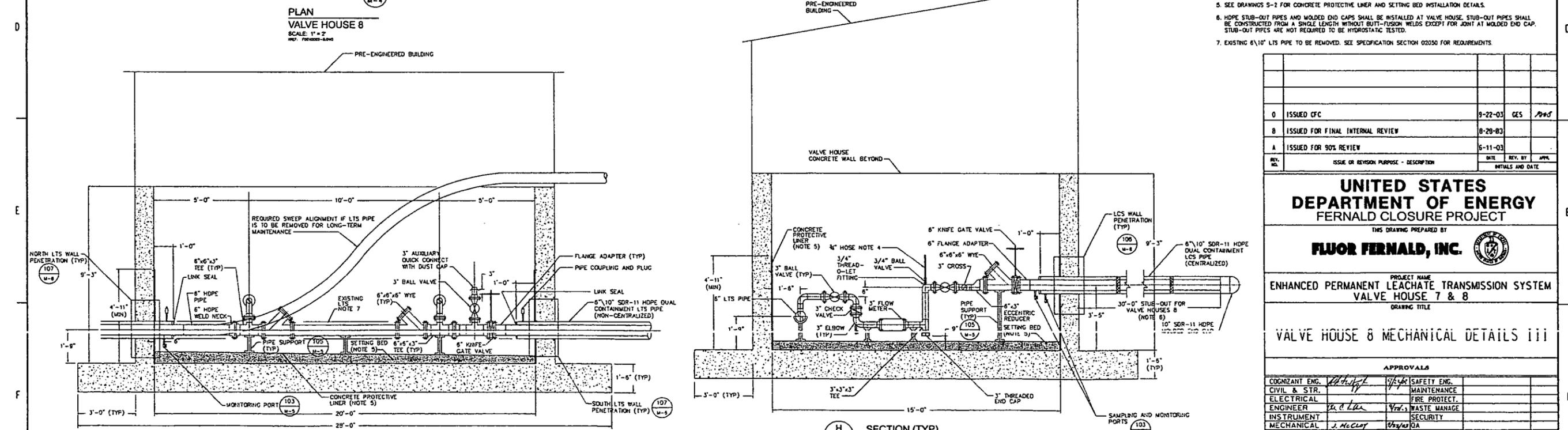
000218



PLAN
VALVE HOUSE 8
SCALE: 1" = 2'
REF: F200201-1000

SECTION (TYP)
VALVE HOUSE 8
SCALE: 1" = 2'
REF: F200201-1000

- NOTES:
1. PROCESS PIPING AND RELATED APPURTENANCES SHALL BE ACCORDANCE WITH SPECIFICATION SECTIONS 15060, 15190, AND 15250.
 2. VALVES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 15080.
 3. FLOW METERS, CONTROLS AND RELATED INSTRUMENTATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 18900.
 4. TANKS, FLEXIBLE HOSE, AND TANK TRANSFER PUMPS SHALL BE IN ACCORDANCE WITH SECTION 15070.
 5. SEE DRAWINGS 5-2 FOR CONCRETE PROTECTIVE LINER AND SETTING BED INSTALLATION DETAILS.
 6. HOPE STUB-OUT PIPES AND MOLDED END CAPS SHALL BE INSTALLED AT VALVE HOUSE. STUB-OUT PIPES SHALL BE CONSTRUCTED FROM A SINGLE LENGTH WITHOUT BUTT-FUSION WELDS EXCEPT FOR JOINT AT MOLDED END CAP. STUB-OUT PIPES ARE NOT REQUIRED TO BE HYDROSTATIC TESTED.
 7. EXISTING 6\"/>



SECTION (TYP)
VALVE HOUSE 8
SCALE: 1" = 2'
REF: F200201-1000

SECTION (TYP)
VALVE HOUSE 8
SCALE: 1" = 2'
REF: F200201-1000

0	ISSUED CFC	9-22-03	GES	JWS
8	ISSUED FOR FINAL INTERNAL REVIEW	8-29-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP. INITIALS AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

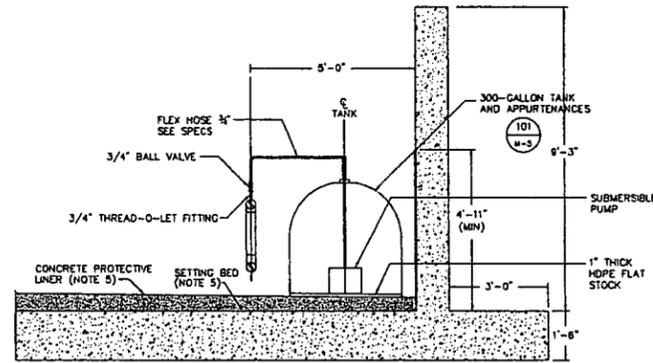
THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8

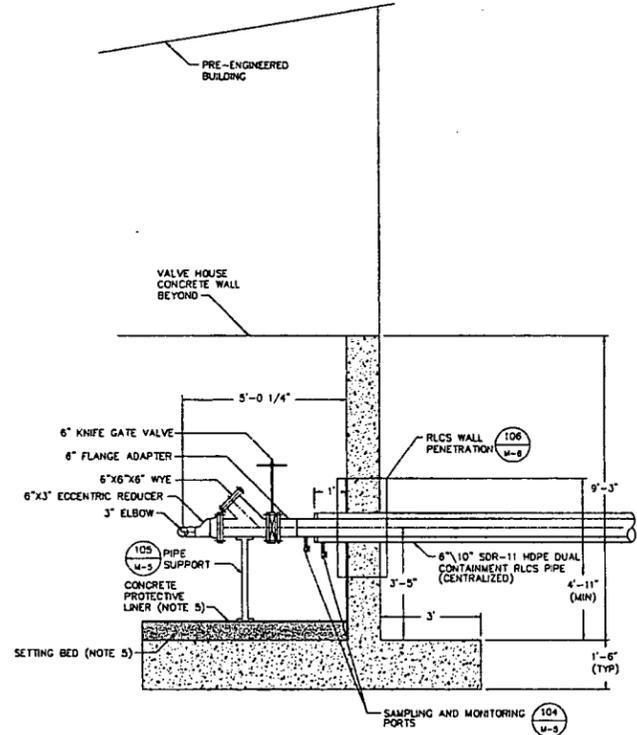
DRAWING TITLE
VALVE HOUSE 8 MECHANICAL DETAILS III

APPROVALS	
CONTRACTOR ENG. <i>[Signature]</i>	SAFETY ENG. <i>[Signature]</i>
CIVIL & STR. <i>[Signature]</i>	MAINTENANCE <i>[Signature]</i>
ELECTRICAL <i>[Signature]</i>	FIRE PROTECT. <i>[Signature]</i>
ENGINEER <i>[Signature]</i>	WASTE MANAGE. <i>[Signature]</i>
INSTRUMENT <i>[Signature]</i>	SECURITY <i>[Signature]</i>
MECHANICAL <i>[Signature]</i>	CONSTRUCTION <i>[Signature]</i>

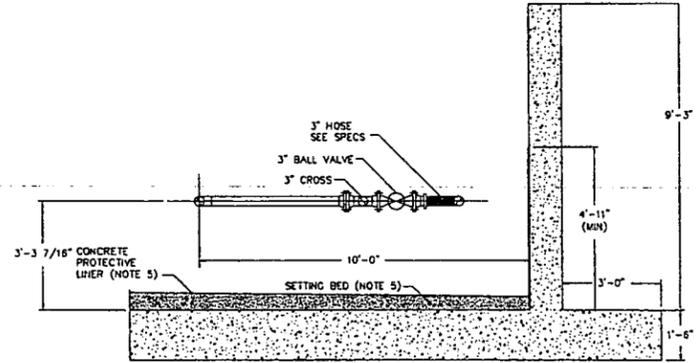
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M SECTION (TYP)
M-3 VALVE HOUSE 8
SCALE: 1" = 2'
REV: PER0007-1204



K SECTION (TYP)
M-3 VALVE HOUSE 8
SCALE: 1" = 2'
REV: PER0007-1204



L SECTION (TYP)
M-3 VALVE HOUSE 8
SCALE: 1" = 2'
REV: PER0007-1204

- NOTES:
1. PROCESS PIPING AND RELATED APPURTENANCES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTIONS 15060, 15190, AND 15250.
 2. VALVES SHALL BE ACCORDANCE WITH SPECIFICATION SECTION 15080.
 3. FLOW METERS, CONTROLS AND RELATED INSTRUMENTATION SHALL BE ACCORDANCE WITH SPECIFICATION SECTION 16900.
 4. TANKS, FLEXIBLE HOSE, AND TANK TRANSFER PUMPS SHALL BE ACCORDANCE WITH SECTION 15070.
 5. SEE DRAWINGS S-2 AND S-4 FOR CONCRETE PROTECTIVE LINER AND SETTING BED INSTALLATION DETAILS.

0	ISSUED CFC	9-22-03	GES	JHS
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR SOI REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
				DETAILS AND DATE

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8

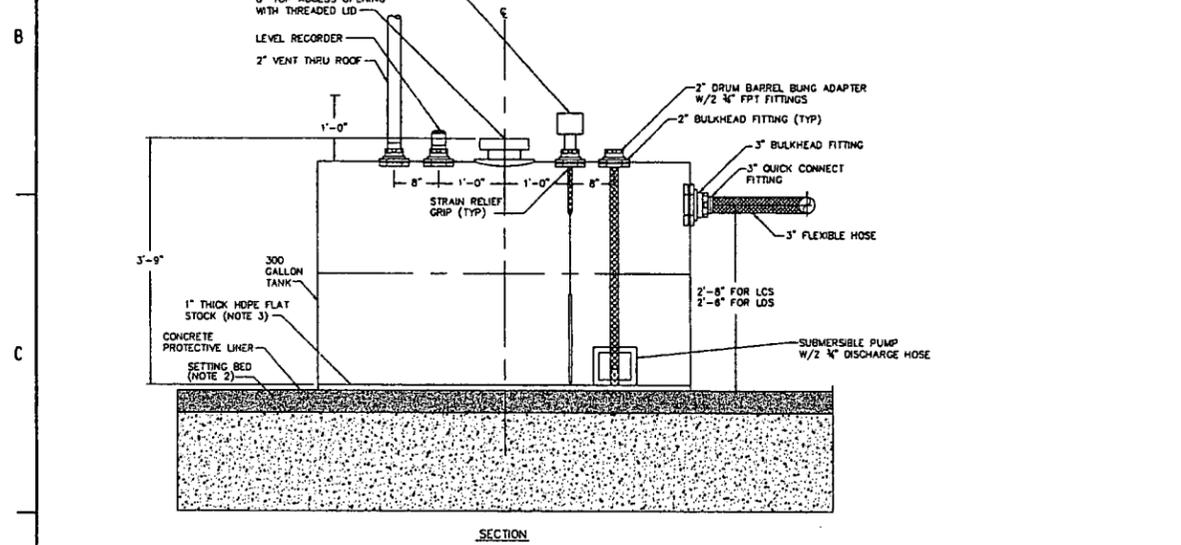
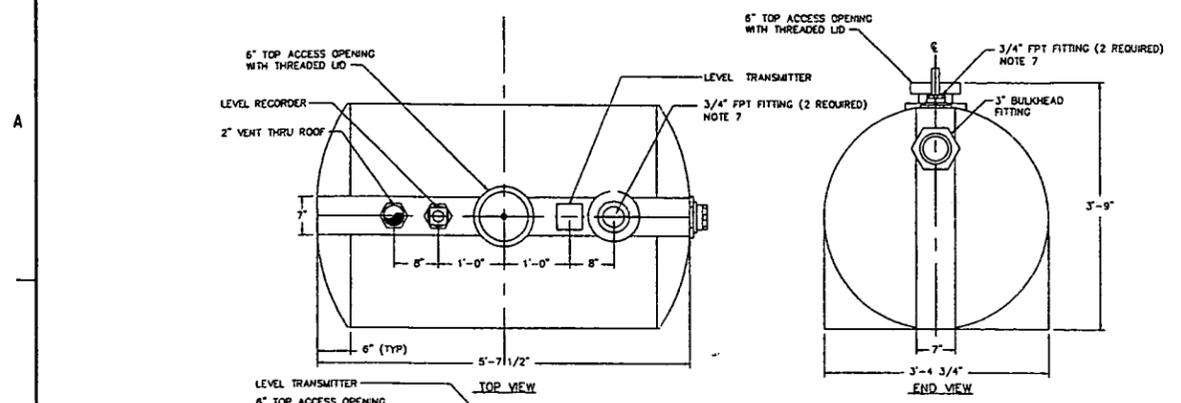
DRAWING TITLE
VALVE HOUSE 8 MECHANICAL DETAILS IV

APPROVALS

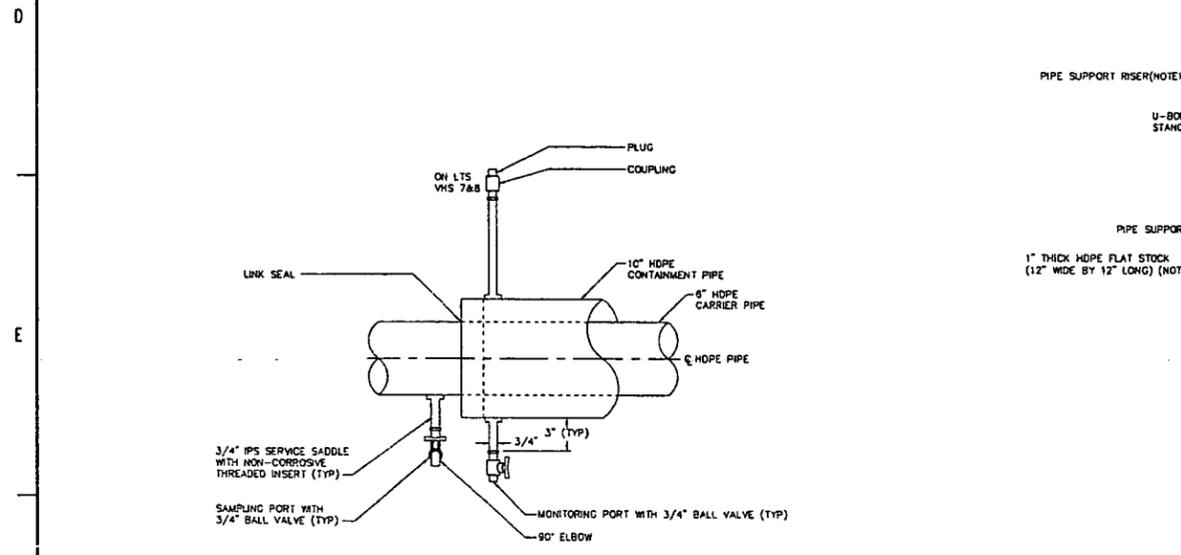
COGNIZANT ENG. CIVIL & STR.	<i>[Signature]</i>	7/2/03	SAFETY ENG. MAINTENANCE	
ELECTRICAL ENGINEER	<i>[Signature]</i>	7/2/03	FIRE PROTECT. WASTE MANAGE.	
INSTRUMENT MECHANICAL	<i>[Signature]</i>	7/2/03	SECURITY	
CHECKED	<i>[Signature]</i>	7/2/03	CONSTRUCTION	
APPROVED	<i>[Signature]</i>	7/2/03		

000220

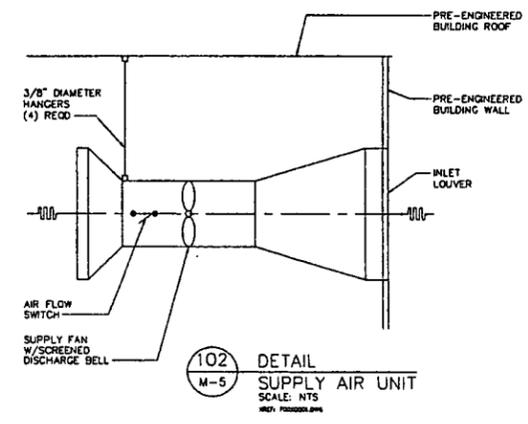
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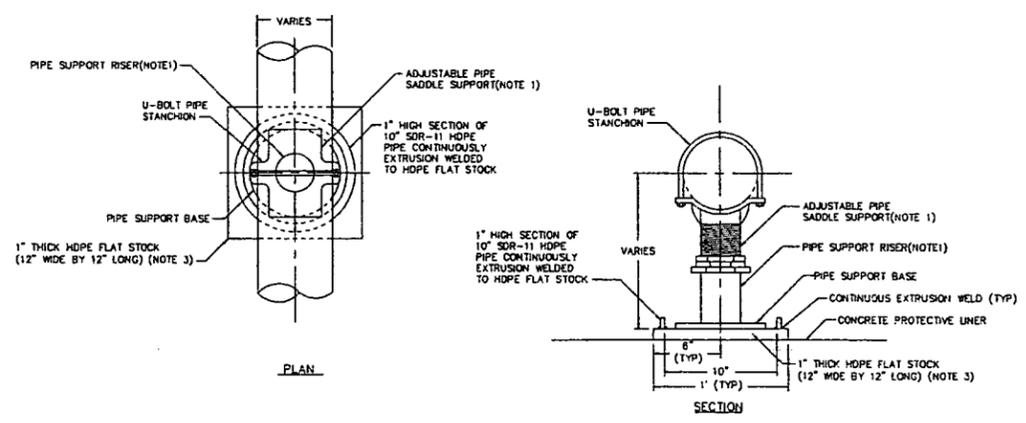
101 DETAIL
M-1/M-1
300-GALLON TANK AND APPURTENANCES
SCALE: 1" = 1'



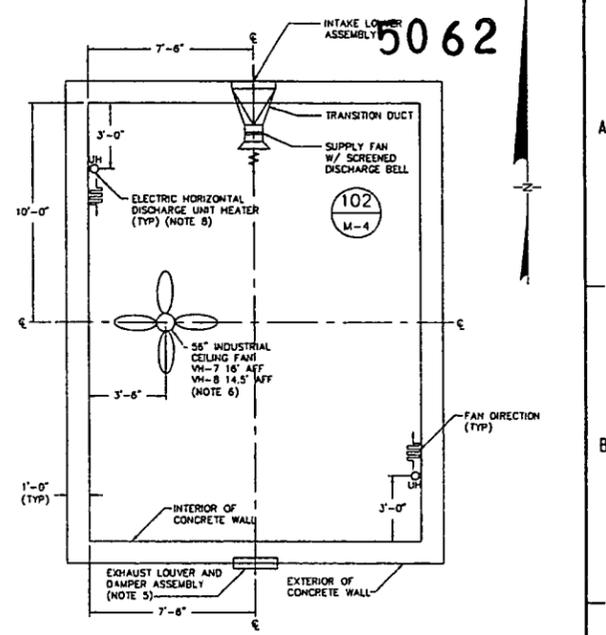
103 DETAIL
M-1/M-1
SAMPLING AND MONITORING PORTS
SCALE: 1" = 6"



102 DETAIL
M-5
SUPPLY AIR UNIT
SCALE: NTS



105 DETAIL
M-1/M-1
PIPE SUPPORT
SCALE: NTS



PLAN
VALVE HOUSE HEATING AND VENTILATION EQUIPMENT
SCALE: NTS

- NOTES:
- ADJUSTABLE PIPE SADDLE SUPPORT WITH U-BOLT SHALL BE GRANNEL FIGURE 259 MODIFIED WITH GRANNEL FIGURE 264. CONTRACTOR SHALL VERIFY DIMENSIONAL SUPPORT REQUIREMENTS AND ORDER FROM DISTRIBUTOR ACCORDINGLY.
 - SETTING BED THICKNESS VARIES DEPENDING ON LOCATION WITHIN VALVE HOUSE.
 - CONTRACTOR SHALL PROVIDE 1-INCH THICK HDPE FLAT STOCK IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
 - FANS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 15865.
 - EXHAUST AND INTAKE LOUVER AND DAMPER ASSEMBLY SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 10211.
 - ELECTRIC HORIZONTAL DISCHARGE UNIT HEATER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 15500.
 - FABRICATE BARREL BUNG ADAPTER W/2- 3/4" FITTINGS FOR 3/4" HOSE ATTACHMENT AND SUMP PUMP ELECTRICAL CORD.

0	ISSUED CFC	9-22-03	GES	Red
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP. BY
				INITIALS AND DATE

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8
DRAWING TITLE

VALVE HOUSE MECHANICAL
DETAILS V

APPROVALS

COGNIZANT ENG. CIVIL & STR.	<i>[Signature]</i>	SAFETY ENG. MAINTENANCE	<i>[Signature]</i>
ELECTRICAL ENGINEER	<i>[Signature]</i>	FIRE PROTECT. WASTE MANAGE.	<i>[Signature]</i>
INSTRUMENT MECHANICAL	<i>[Signature]</i>	SECURITY	<i>[Signature]</i>
CHECKED	<i>[Signature]</i>	CONSTRUCTION	<i>[Signature]</i>
APPROVED	<i>[Signature]</i>		

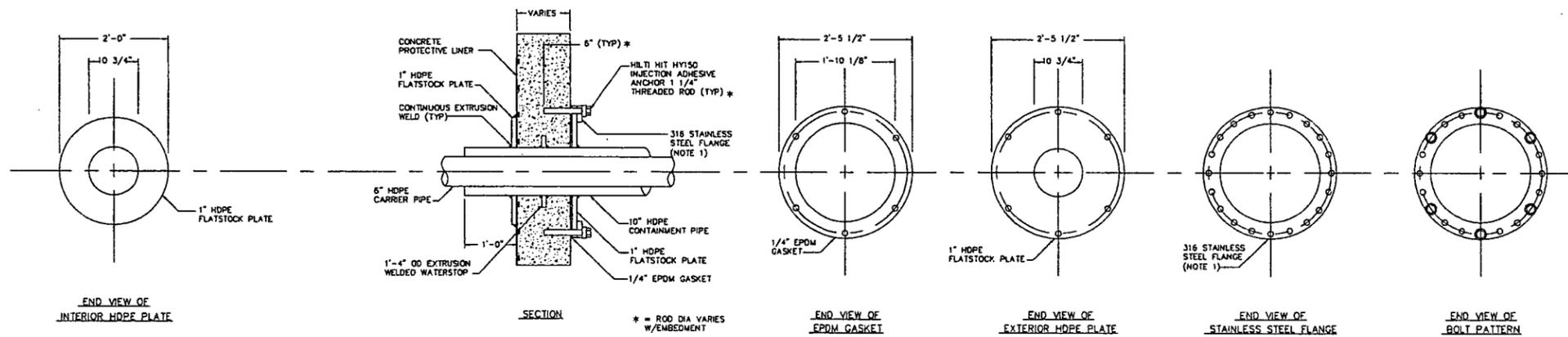
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000221

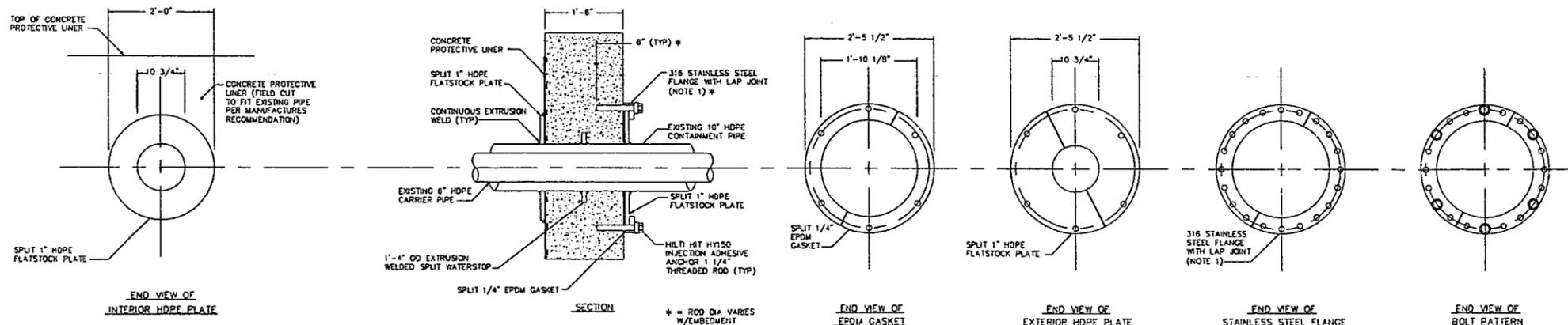
STRUCTURE	LCS PIPE		RLCS PIPE		LDS PIPE		NORTH LTS PIPE		SOUTH LTS PIPE		NORTH LTS PIPE		SOUTH LTS PIPE	
	MECHANICAL	STRUCTURAL	MECHANICAL	STRUCTURAL	MECHANICAL	STRUCTURAL	MECHANICAL	STRUCTURAL	MECHANICAL	STRUCTURAL	MECHANICAL	STRUCTURAL	MECHANICAL	STRUCTURAL
VALVE HOUSE 7	TYPE II	CAST-IN-PLACE	TYPE II	CAST-IN-PLACE	TYPE II	CAST-IN-PLACE	TYPE III	CAST-IN-PLACE	TYPE III	CAST-IN-PLACE	N/A	N/A	N/A	N/A
VALVE HOUSE 8	TYPE II	CAST-IN-PLACE	TYPE II	CAST-IN-PLACE	TYPE II	CAST-IN-PLACE	TYPE III	CAST-IN-PLACE	TYPE III	CAST-IN-PLACE	N/A	N/A	N/A	N/A

--- SCHEDULE
--- WALL PENETRATION DETAIL
SCALE: 1" = 1'

TYPE I NOT USED



106 DETAIL
--- TYPE II WALL PENETRATION
(NOTE 2)
SCALE: 1" = 1'



107 DETAIL
--- TYPE III WALL PENETRATION
(NOTE 2)
SCALE: 1" = 1'

- NOTES:
1. STAINLESS STEEL RING FLANGE SIZE IS BASED ON A NOMINAL PIPE SIZE DIMENSION OF 22 INCHES.
 2. WALL PENETRATIONS SHALL BE ASSEMBLED WITH ORIENTATION AS SHOWN ON DRAWING.
 3. WALL PENETRATION SCHEDULE IS APPLICABLE TO ALL WALL PENETRATIONS SHOWN ON MECHANICAL AND STRUCTURAL DRAWINGS.

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
0	ISSUED CFC	9-22-03	GES	Mtd
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8
DRAWING TITLE

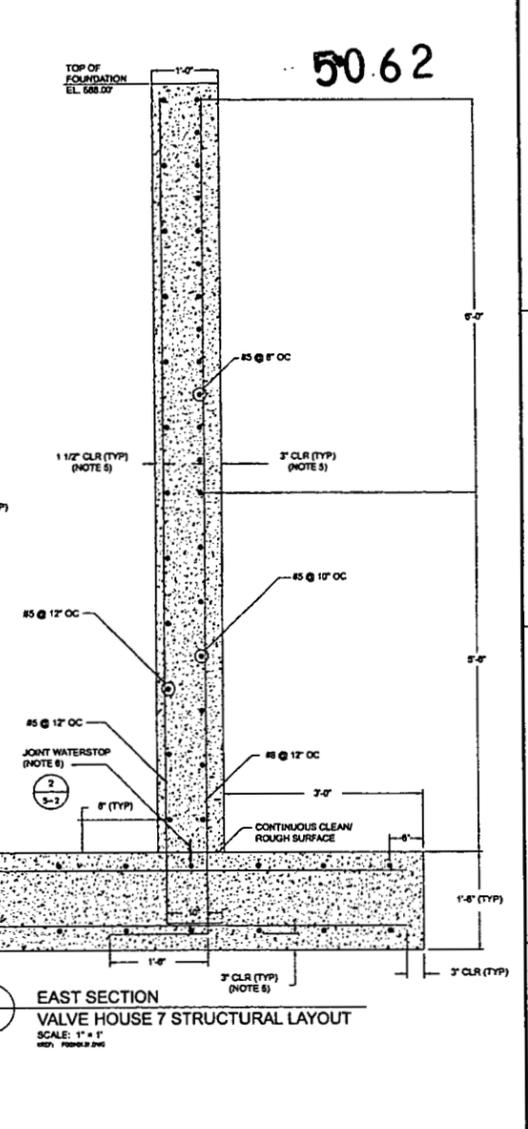
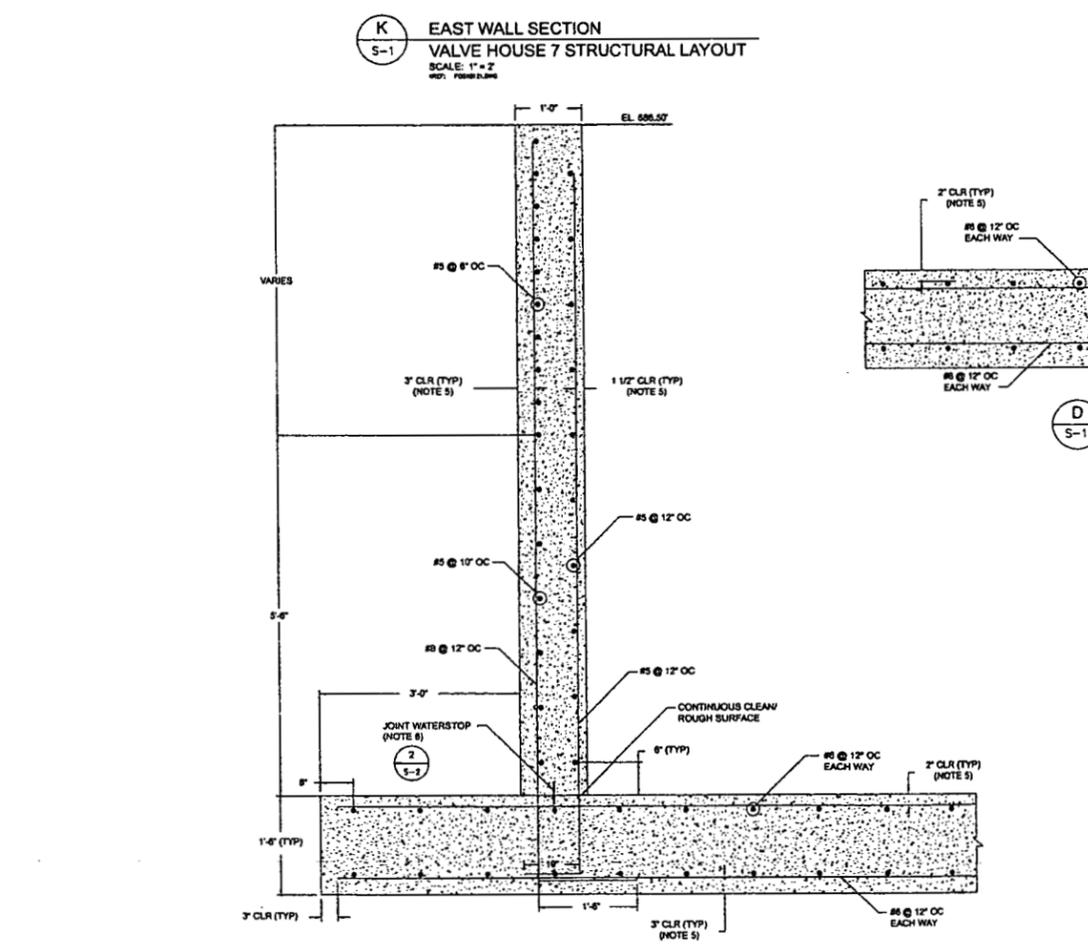
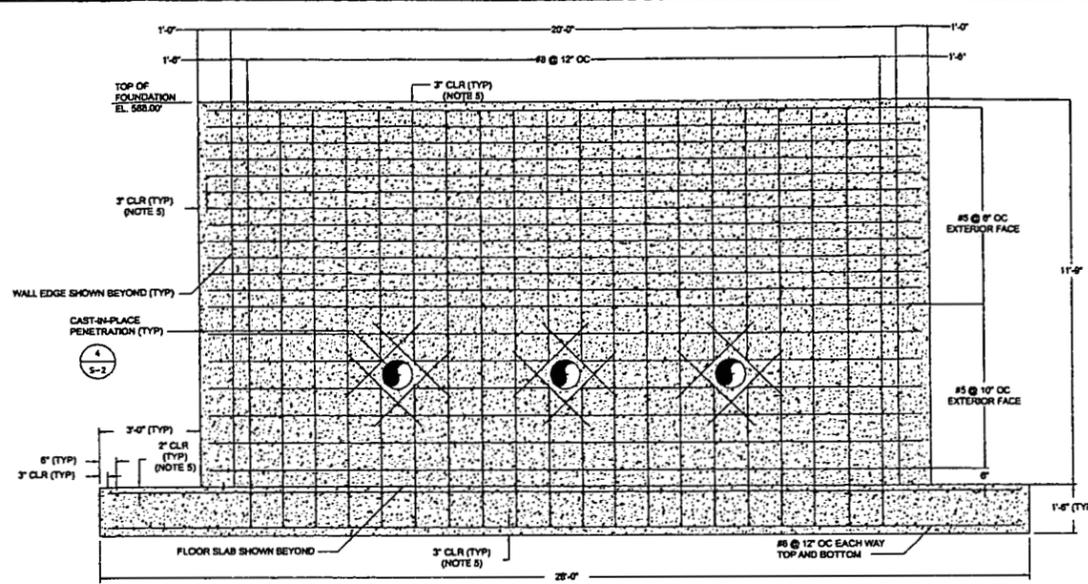
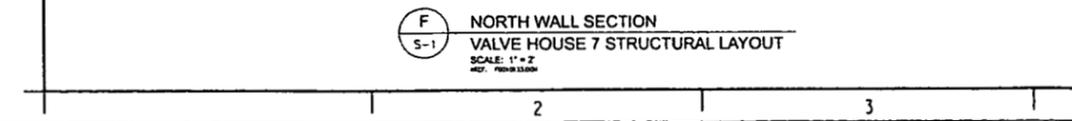
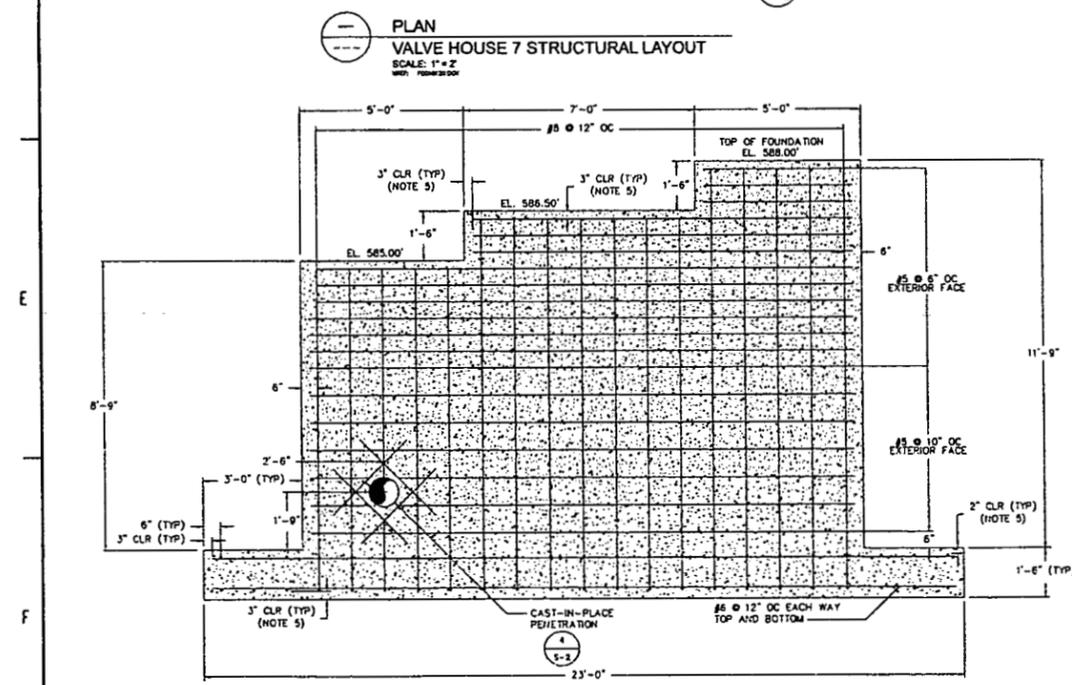
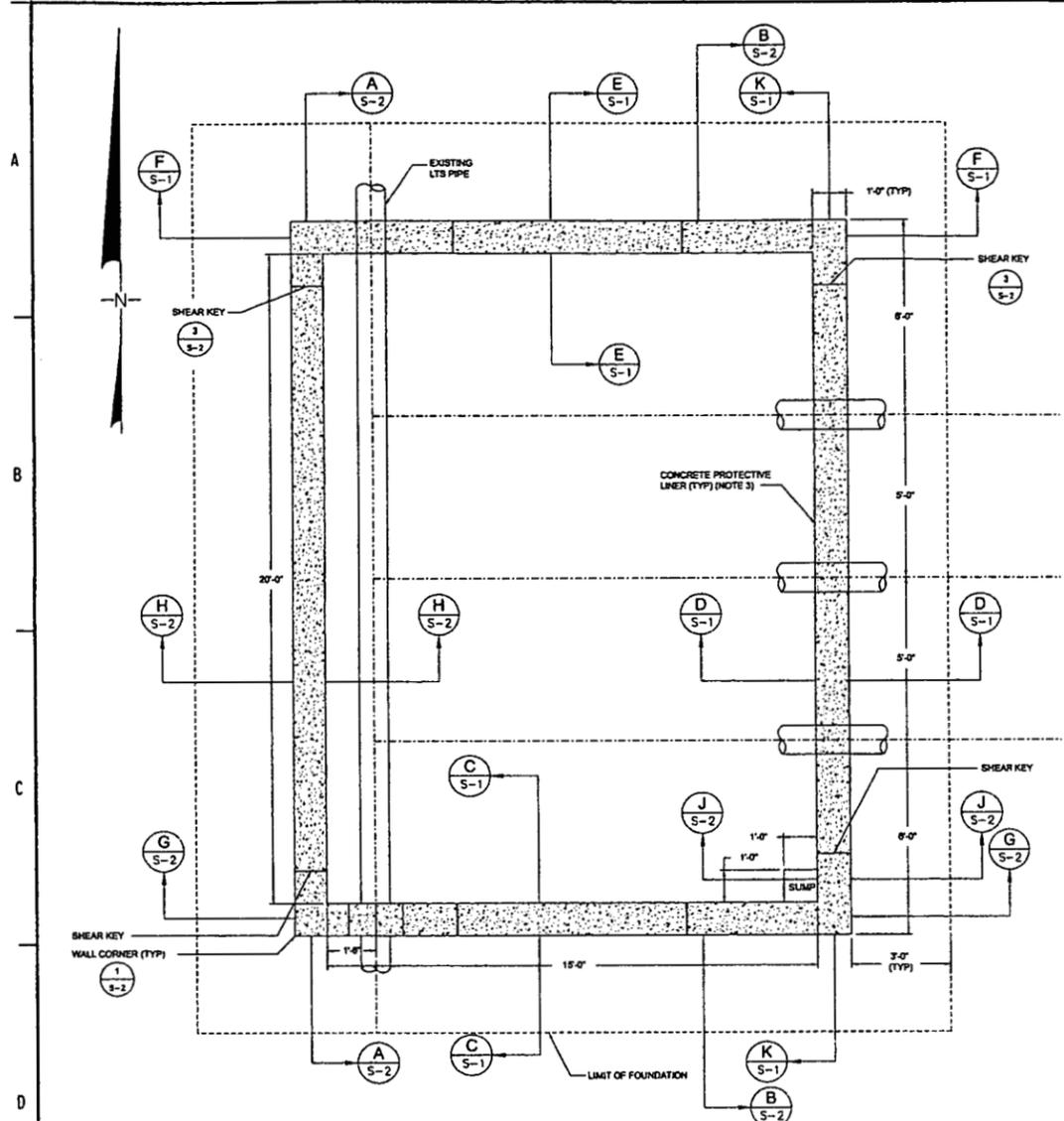
VALVE HOUSE MECHANICAL DETAILS VI

APPROVALS

COGNIZANT ENG.	<i>[Signature]</i>	SAFETY ENG.	
CIVIL & STR.		MAINTENANCE	
ELECTRICAL		FIRE PROTECT.	
ENGINEER		WASTE MANAGE	
INSTRUMENT		SECURITY	
MECHANICAL	<i>J. McCloy</i>	CONSTRUCTION	

CHECKED	<i>[Signature]</i>	PROJECT NO.	20112	DRAWING INDEX CODE NO.	90X-5500-M-00677	SHEET NO.	M-6	REV. NO.	0
APPROVED	<i>[Signature]</i>	FILENAME	FOO-0252.DWG						

000222



0	ISSUED CFC	9-22-03	GES	1/2/03
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
			INITIALS	AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

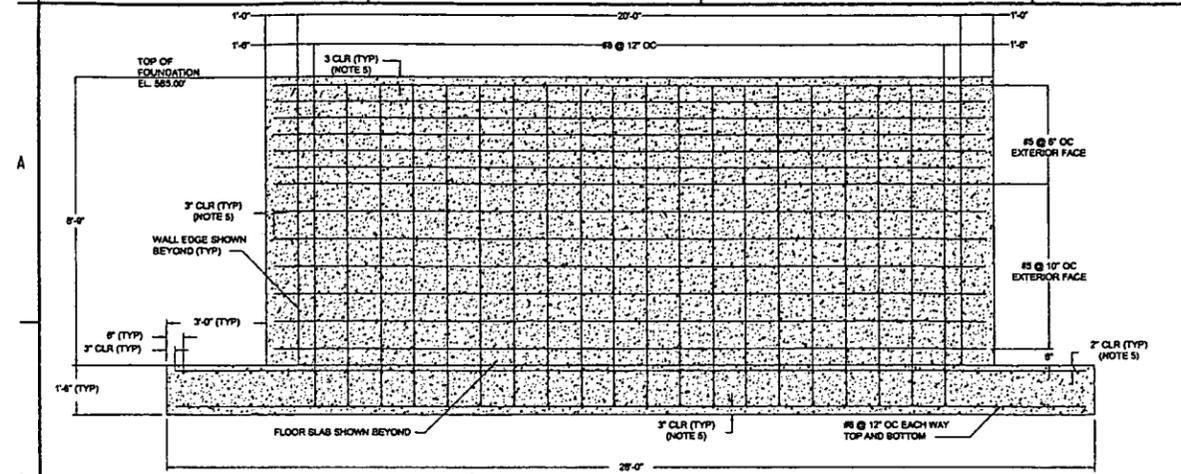
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8
DRAWING TITLE

VALVE HOUSE 7 STRUCTURAL
DETAILS I

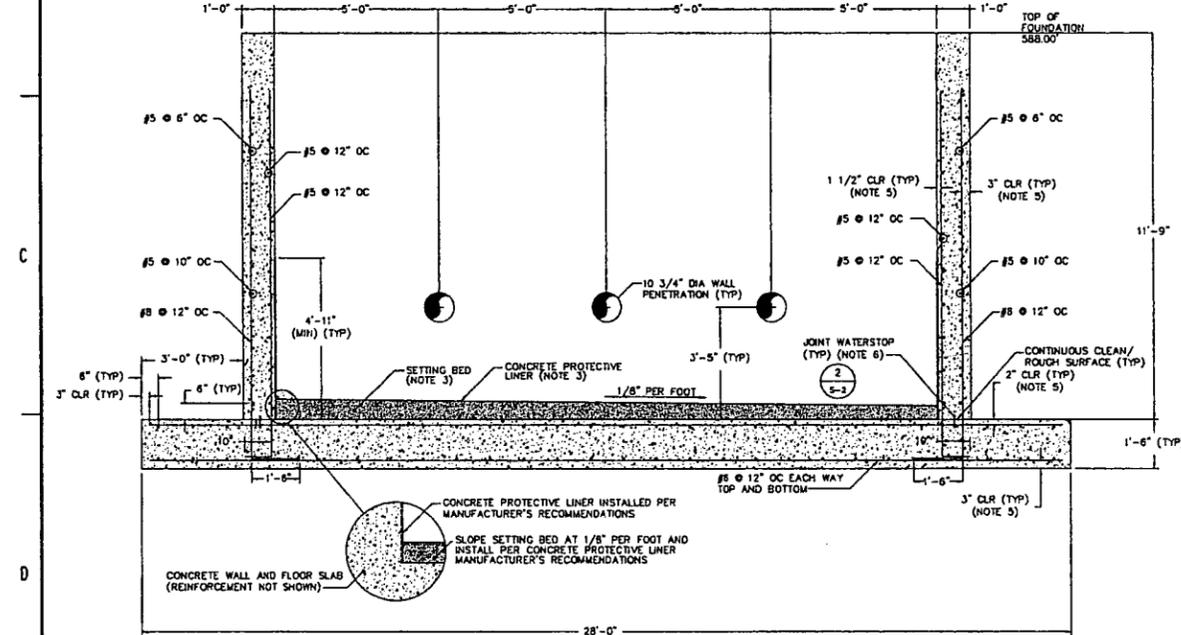
APPROVALS

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CIVIL & STR.	<i>[Signature]</i>	MAINTENANCE	
ELECTRICAL		FIRE PROTECT.	
ENGINEER	<i>[Signature]</i>	WASTE MANAGE.	
INSTRUMENT		SECURITY	
MECHANICAL	<i>[Signature]</i>	QA	
		CONSTRUCTION	

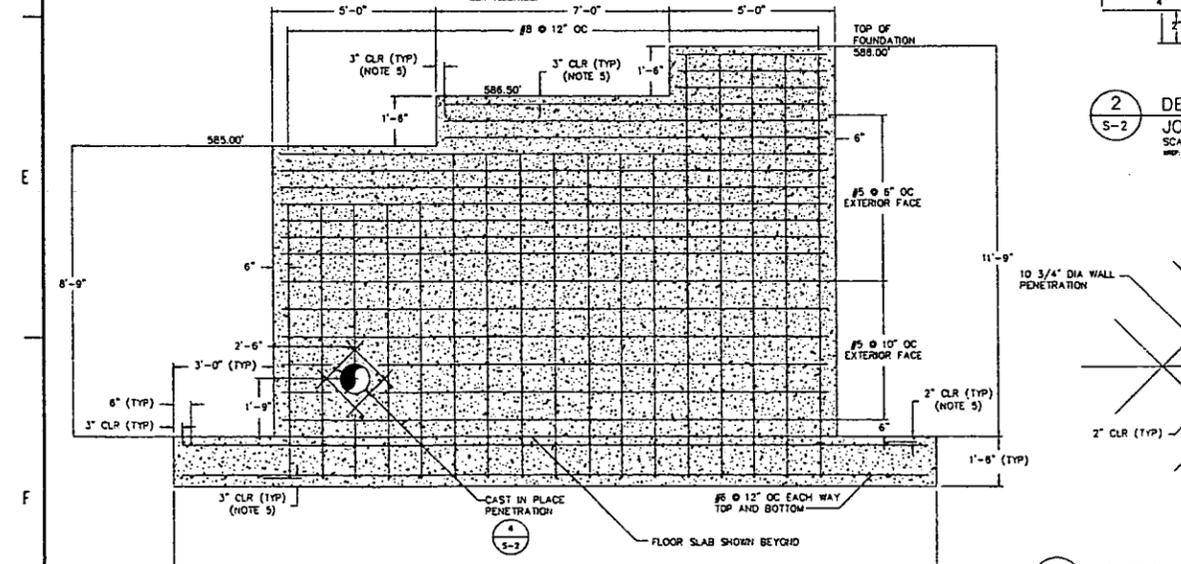
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REV. PROJECT NO.	RES 4453	FILE NO.	100-0311.DGN						



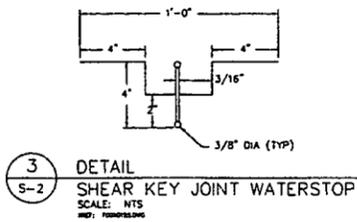
A WEST WALL SECTION
VALVE HOUSE 7 STRUCTURAL LAYOUT
SCALE: 1" = 2'
REV: FEBRUARY 2012



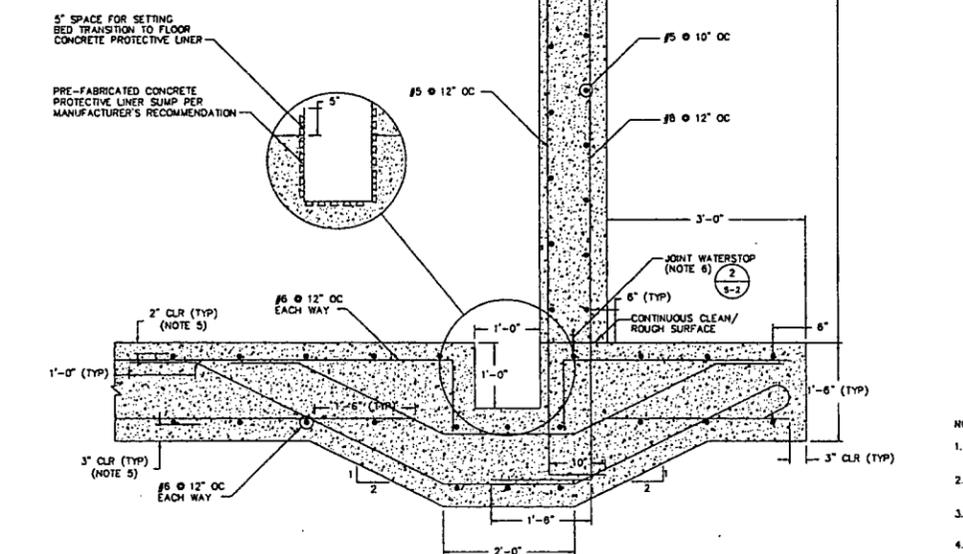
B EAST WALL LINER SECTION
VALVE HOUSE 7 STRUCTURAL LAYOUT
SCALE: 1" = 2'
REV: FEBRUARY 2012



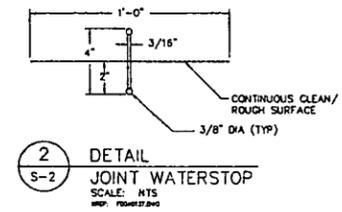
G SOUTH WALL SECTION
VALVE HOUSE 7 STRUCTURAL LAYOUT
SCALE: 1" = 2'
REV: FEBRUARY 2012



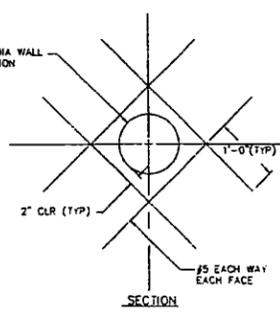
3 S-2
DETAIL
SHEAR KEY JOINT WATERSTOP
SCALE: NTS
REV: FEBRUARY 2012



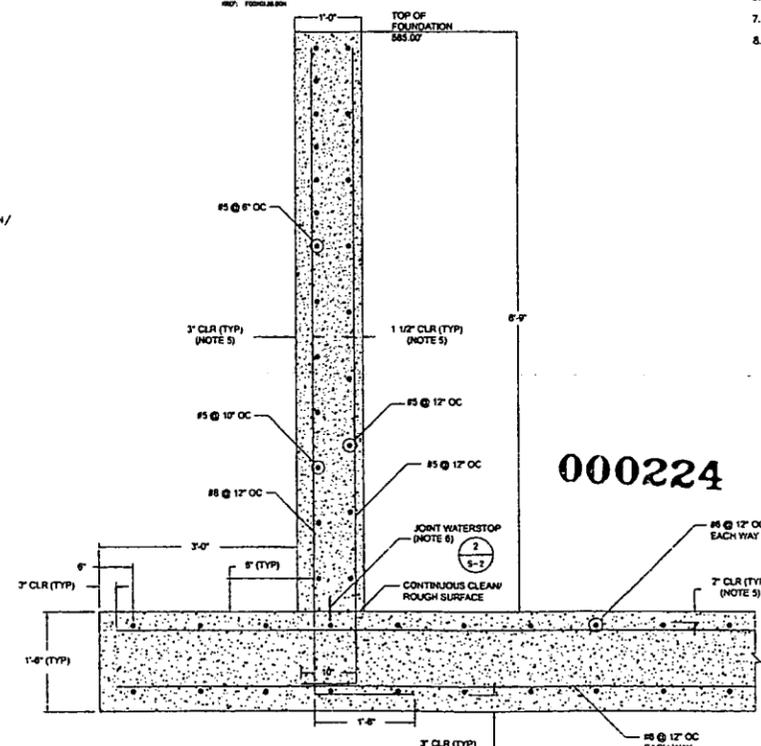
J S-1
SOUTH EAST SECTION
VALVE HOUSE 7 SUMP
SCALE: 1" = 1'
REV: FEBRUARY 2012



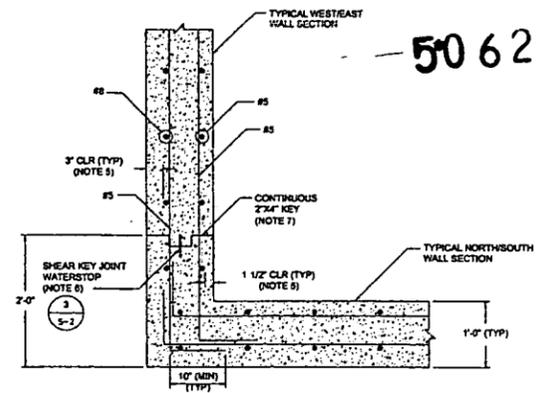
2 S-2
DETAIL
JOINT WATERSTOP
SCALE: NTS
REV: FEBRUARY 2012



4 S-1
DETAIL
CAST-IN-PLACE PENETRATION
SCALE: 1" = 1'
REV: FEBRUARY 2012



H S-1
WEST SECTION (TYP)
VALVE HOUSE 7 STRUCTURAL LAYOUT
SCALE: 1" = 1'
REV: FEBRUARY 2012



1 S-1
DETAIL
VALVE HOUSE 7 WALL CORNER
SCALE: 1" = 1'
REV: FEBRUARY 2012

- NOTES:
- VAPOR BARRIER SHALL BE INSTALLED UNDER FLOOR SLAB PRIOR TO CONSTRUCTION. VAPOR BARRIER SHALL BE 6-MIL THICK POLYETHYLENE SHEET.
 - SEALANT SHALL BE APPLIED TO EXPOSED SURFACE OF CONCRETE PRIOR TO PLACEMENT OF TRENCH BACKFILL MATERIAL.
 - SETTING BED AND CONCRETE PROTECTIVE LINER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03110.
 - CONCRETE, REINFORCING STEEL BARS AND FORMWORK SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03100.
 - STEEL REINFORCEMENT SHALL HAVE A MINIMUM CONCRETE COVER OF 3 INCHES, 2 INCHES OR 1.5 INCHES AS SHOWN.
 - WATERSTOPS SHALL BE CONTINUOUS AND SHALL HAVE A MINIMUM CONCRETE COVER OF 3 INCHES.
 - CONTINUOUS SHEAR KEY SHALL TERMINATE 8 INCHES FROM TOP OF WALL SECTION.
 - VERIFY REBAR & BOLT RING TEMPLATE ALIGNMENT PRIOR TO ERECTING WALL FORMS.

0	ISSUED CFC	9-22-03	GES	4/25
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPV.

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM VALVE HOUSE 7 & 8

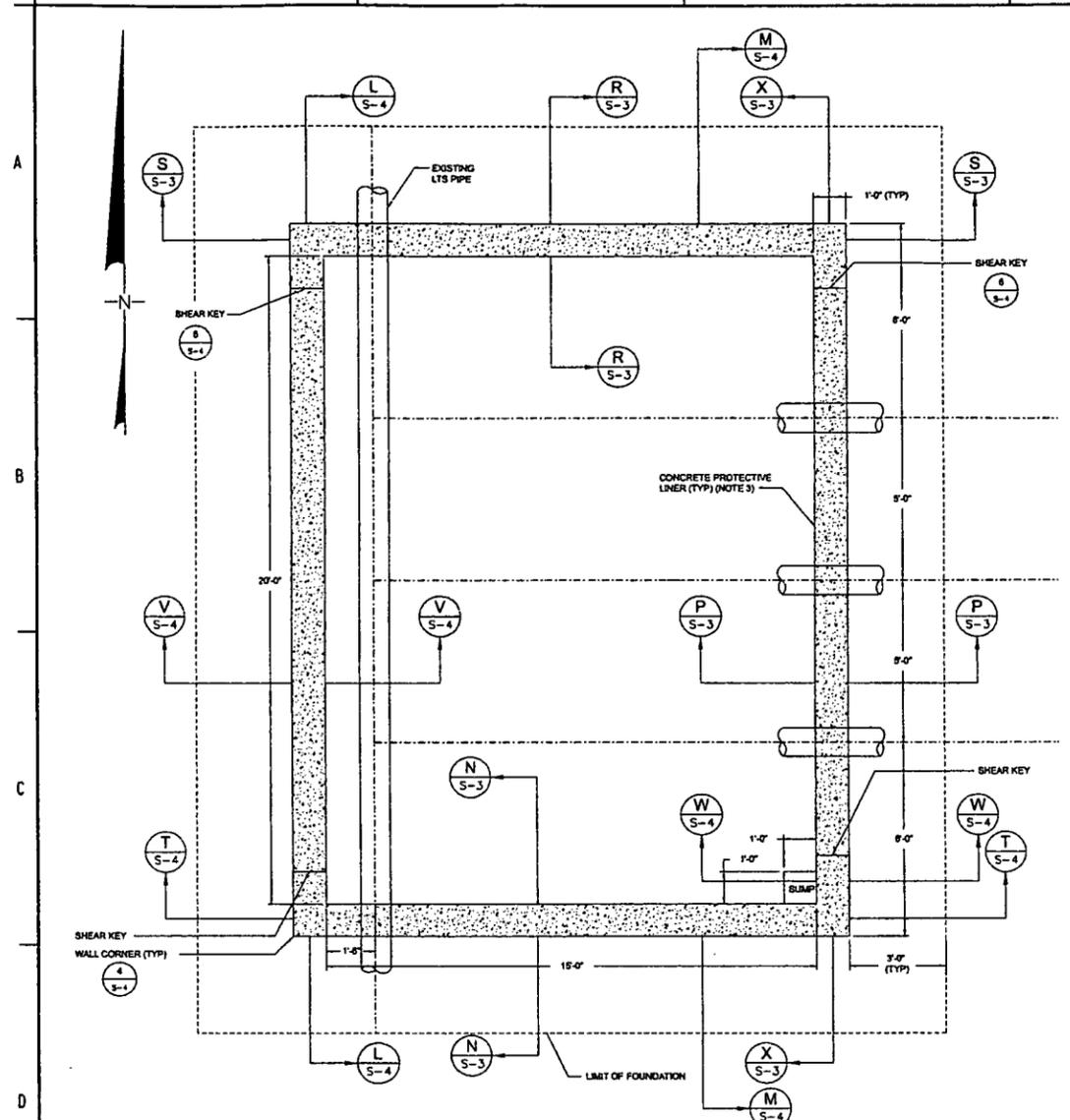
DRAWING TITLE
VALVE HOUSE 7 STRUCTURAL DETAILS II

APPROVALS

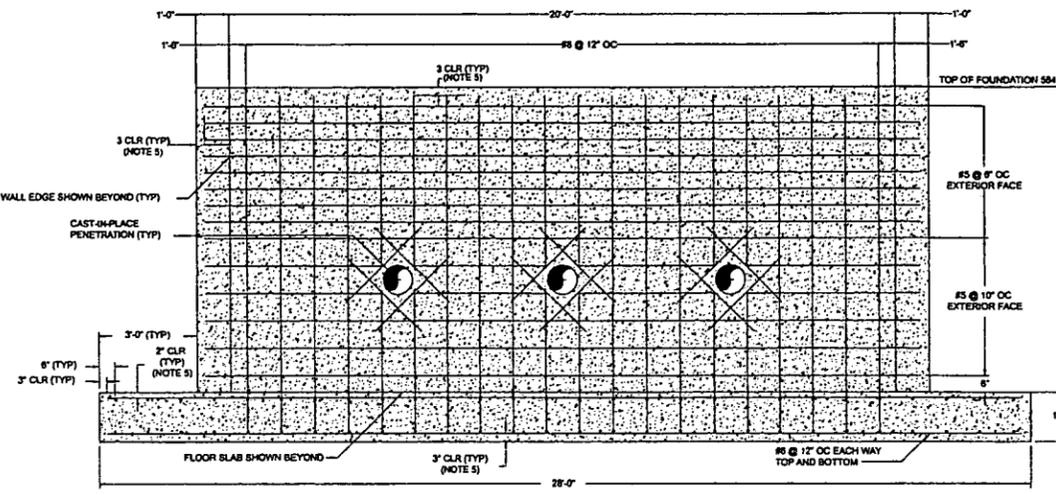
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CIVIL & STR.	<i>[Signature]</i>	MAINTENANCE	
ELECTRICAL	<i>[Signature]</i>	FIRE PROTECT.	
ENGINEER	<i>[Signature]</i>	WASTE MANAGE.	
INSTRUMENT	<i>[Signature]</i>	SECURITY	
MECHANICAL	<i>[Signature]</i>	CONSTRUCTION	

CHECKED *[Signature]*
APPROVED *[Signature]*

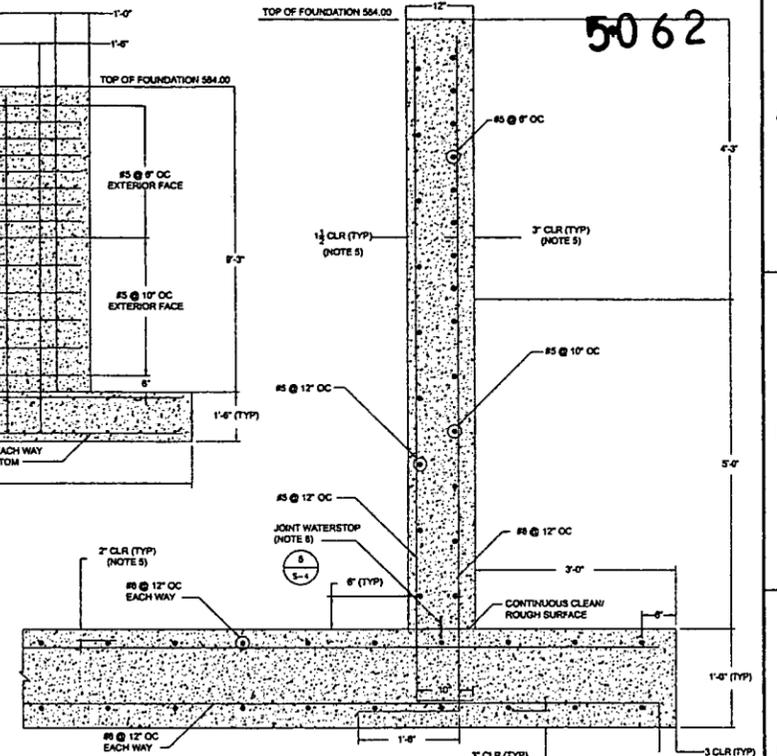
DRAWN BY J.S. WININGER PROJECT NO. 20112 DRAWING NO. CODE NO. SHEET NO. REV. NO.
REV. PROJECT NO. RES 4453 FILENAME F00-0312-DCH 90X-5500-S-00679 S-2 0



PLAN
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 2'
REF: 100010-0100

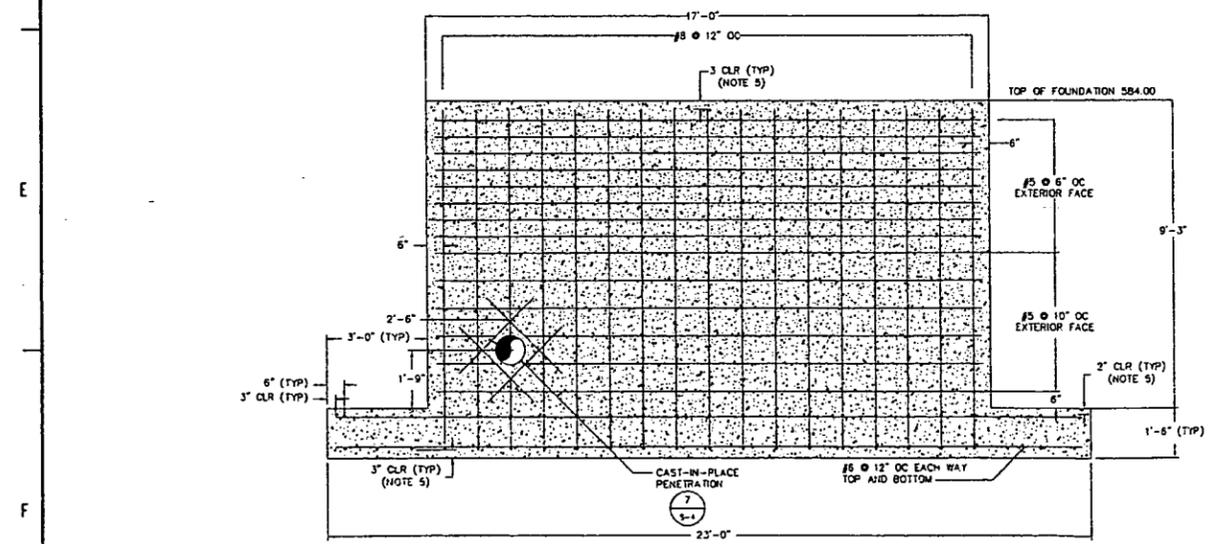


X
EAST WALL SECTION
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 2'
REF: 100010-0100

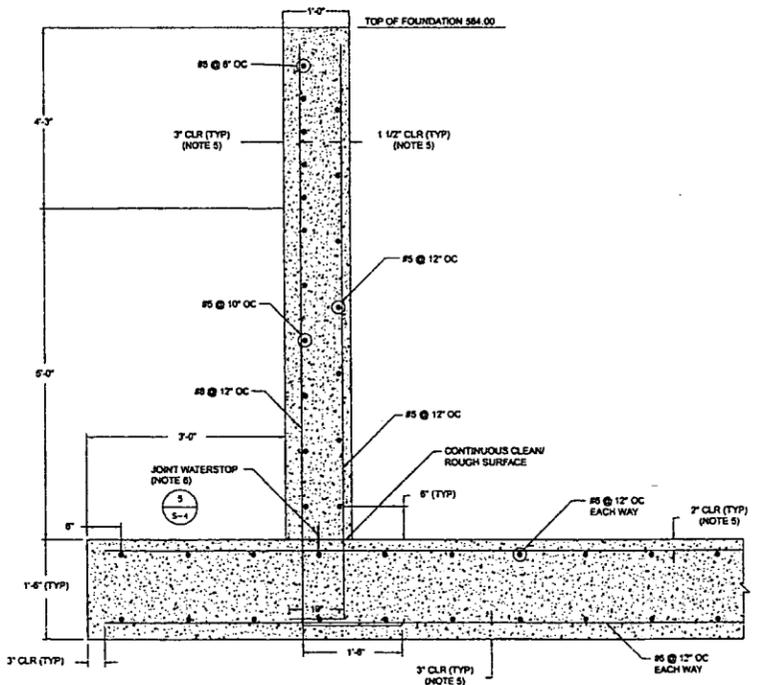


P
EAST SECTION
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 1'
REF: 100010-0100

- NOTES:
- VAPOR BARRIER SHALL BE INSTALLED UNDER FLOOR SLAB PRIOR TO CONSTRUCTION. VAPOR BARRIER SHALL BE 8-MIL THICK POLYETHYLENE SHEET.
 - SEALANT SHALL BE APPLIED TO EXPOSED SURFACE OF CONCRETE PRIOR TO PLACEMENT OF TRENCH BACKFILL MATERIAL.
 - CONCRETE PROTECTIVE LINER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03110.
 - CONCRETE REINFORCING STEEL BARS AND FORMWORK SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03100.
 - STEEL REINFORCEMENT SHALL HAVE A MINIMUM CONCRETE COVER OF 3 INCHES, 2 INCHES OR 1.5 INCHES AS SHOWN.
 - WATERSTOPS SHALL BE CONTINUOUS AND SHALL HAVE A MINIMUM CONCRETE COVER OF 3 INCHES.
 - VERIFY REBAR & BOLT RING TEMPLATE ALIGNMENT PRIOR TO ERECTING WALL FORMS.
 - NORTH/SOUTH CAST-IN-PLACE PENETRATIONS ARE TYPE II, EAST CAST-IN-PLACE PENETRATIONS ARE TYPE II.



S
NORTH WALL SECTION
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 2'
REF: 100010-0100



R N
NORTH AND SOUTH SECTION
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 1'
REF: 100010-0100

000225

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPV.
D	ISSUED CFC	9-22-03	GES	Med
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
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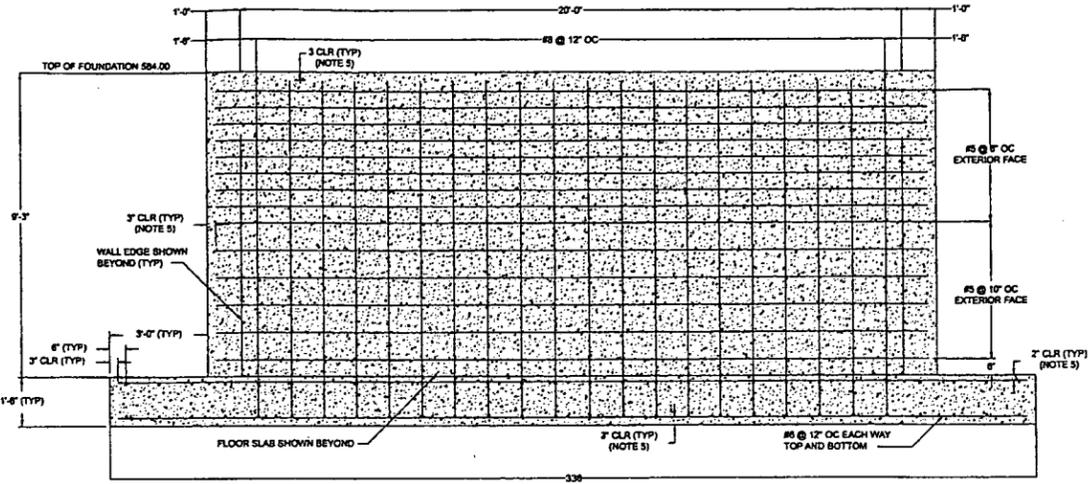
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8

DRAWING TITLE
VALVE HOUSE 8 STRUCTURAL
DETAILS III

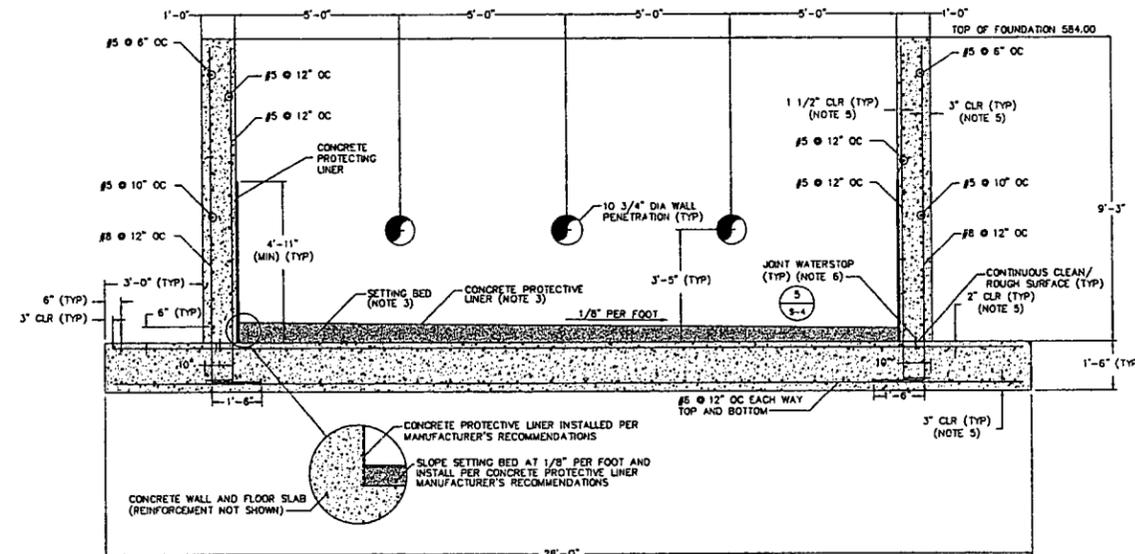
APPROVALS

COGNIZANT ENG.	CIVIL & STR.	ELECTRICAL	ENGINEER	INSTRUMENT MECHANICAL	SAFETY ENG.	MAINTENANCE	FIRE PROTECT.	WASTE MANAGE.	SECURITY	CONSTRUCTION

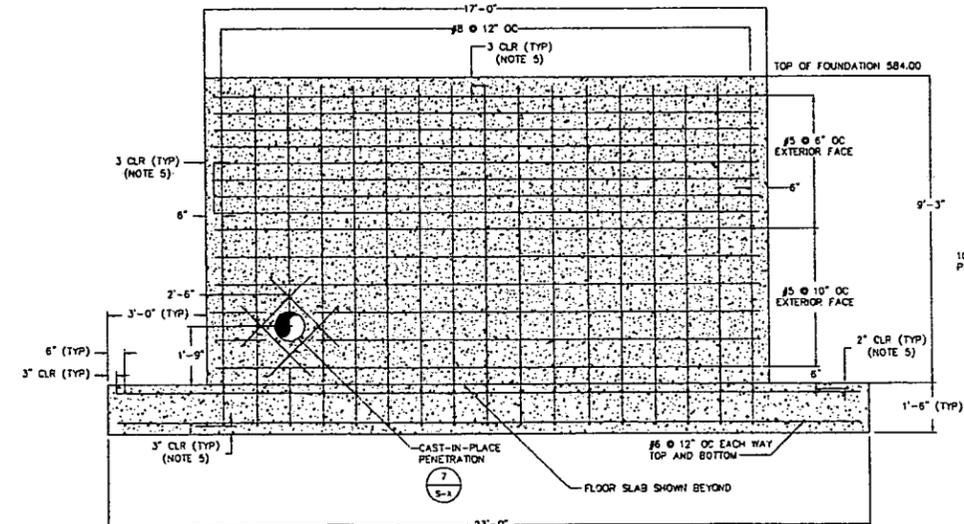
DRAWN BY	PROJECT NO.	DRAWING NO. CODE NO.	SHEET NO.	TOTAL SHEETS
J.S. KUNINGER	20112	90X-5500-S-00680	S-3	0



L WEST WALL SECTION
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 2"
REF: F0020-8-200



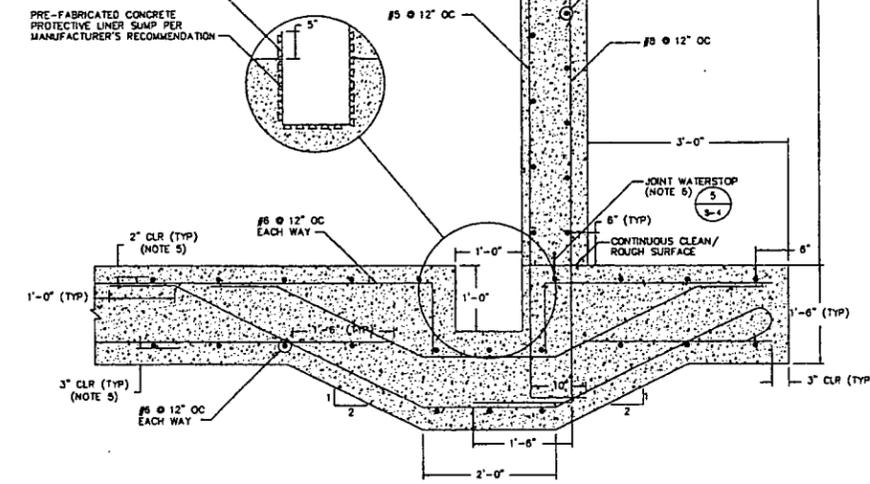
M EAST WALL LINER SECTION
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 2"
REF: F0020-8-200



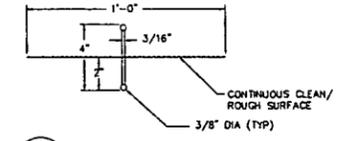
T SOUTH WALL SECTION
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 2"
REF: F0020-8-200



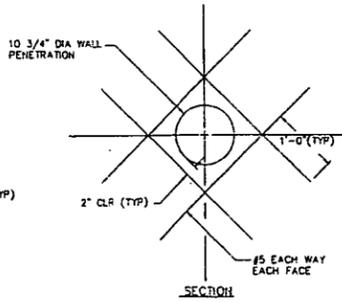
6 DETAIL
SHEAR KEY JOINT WATERSTOP
SCALE: NTS
REF: F0020-8-200



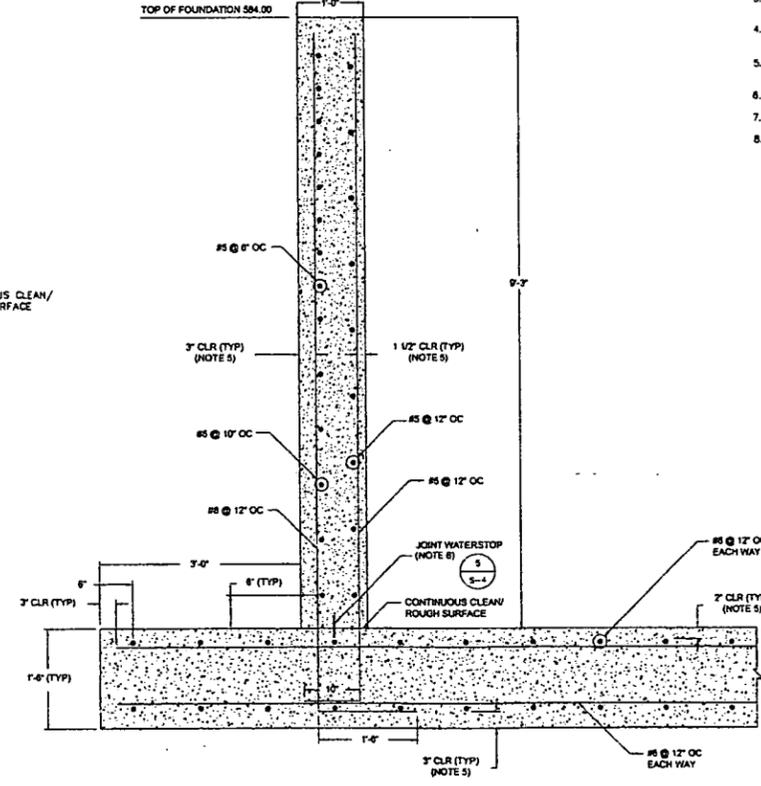
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VALVE HOUSE 8 SUMP
SCALE: 1" = 1"
REF: F0020-8-200



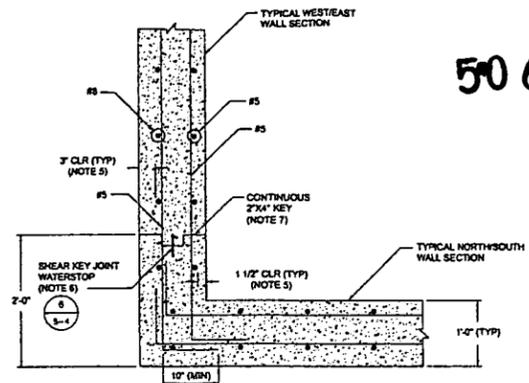
5 DETAIL
JOINT WATERSTOP
SCALE: NTS
REF: F0020-8-200



7 DETAIL
CAST-IN-PLACE PENETRATION
SCALE: 1" = 1"
REF: F0020-8-200



V WEST SECTION (TYP)
VALVE HOUSE 8 STRUCTURAL LAYOUT
SCALE: 1" = 1"
REF: F0020-8-200



4 DETAIL
VALVE HOUSE 8 WALL CORNER
SCALE: 1" = 1"
REF: F0020-8-200

- NOTES:
- VAPOR BARRIER SHALL BE INSTALLED UNDER FLOOR SLAB PRIOR TO CONSTRUCTION. VAPOR BARRIER SHALL BE 6-MIL THICK POLYETHYLENE SHEET.
 - SEALANT SHALL BE APPLIED TO EXPOSED SURFACE OF CONCRETE PRIOR TO PLACEMENT OF TRENCH BACKFILL MATERIAL.
 - SETTING BED AND CONCRETE PROTECTIVE LINER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03110.
 - CONCRETE, REINFORCING STEEL BARS AND FORMWORK SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03100.
 - STEEL REINFORCEMENT SHALL HAVE A MINIMUM CONCRETE COVER OF 3 INCHES, 2 INCHES OR 1.5 INCHES AS SHOWN.
 - WATERSTOPS SHALL BE CONTINUOUS AND SHALL HAVE A MINIMUM CONCRETE COVER OF 3 INCHES.
 - CONTINUOUS SHEAR KEY SHALL TERMINATE 6 INCHES FROM TOP OF WALL SECTION.
 - VERIFY REBAR & U-5 BOLT RING TEMPLATE ALIGNMENT PRIOR TO ERECTING WALL FORMS.

0	ISSUED CFC	9-22-03	GES	1/05
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		
REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APPR.
			INITIALS	AND DATE

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

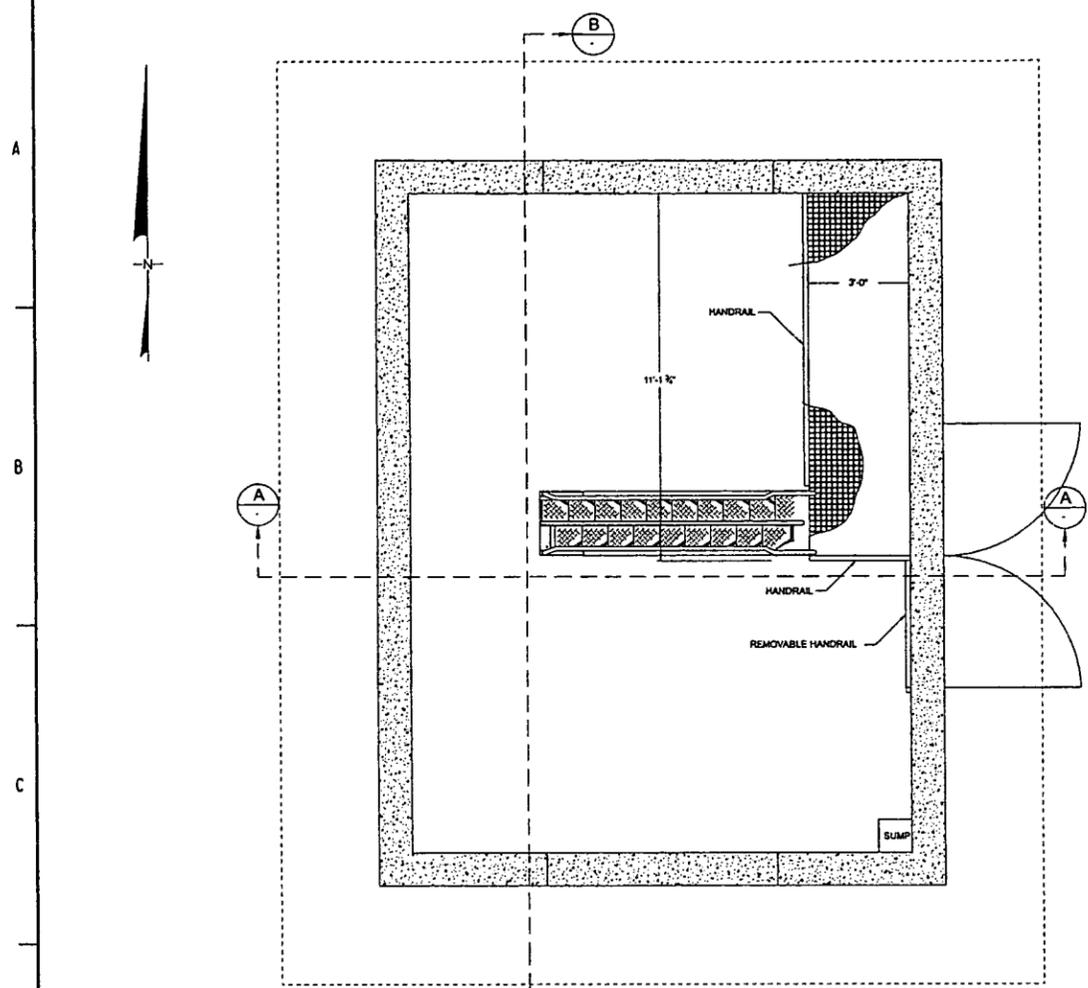
PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM VALVE HOUSE 7 & 8

DRAWING TITLE
VALVE HOUSE 8 STRUCTURAL DETAILS IV

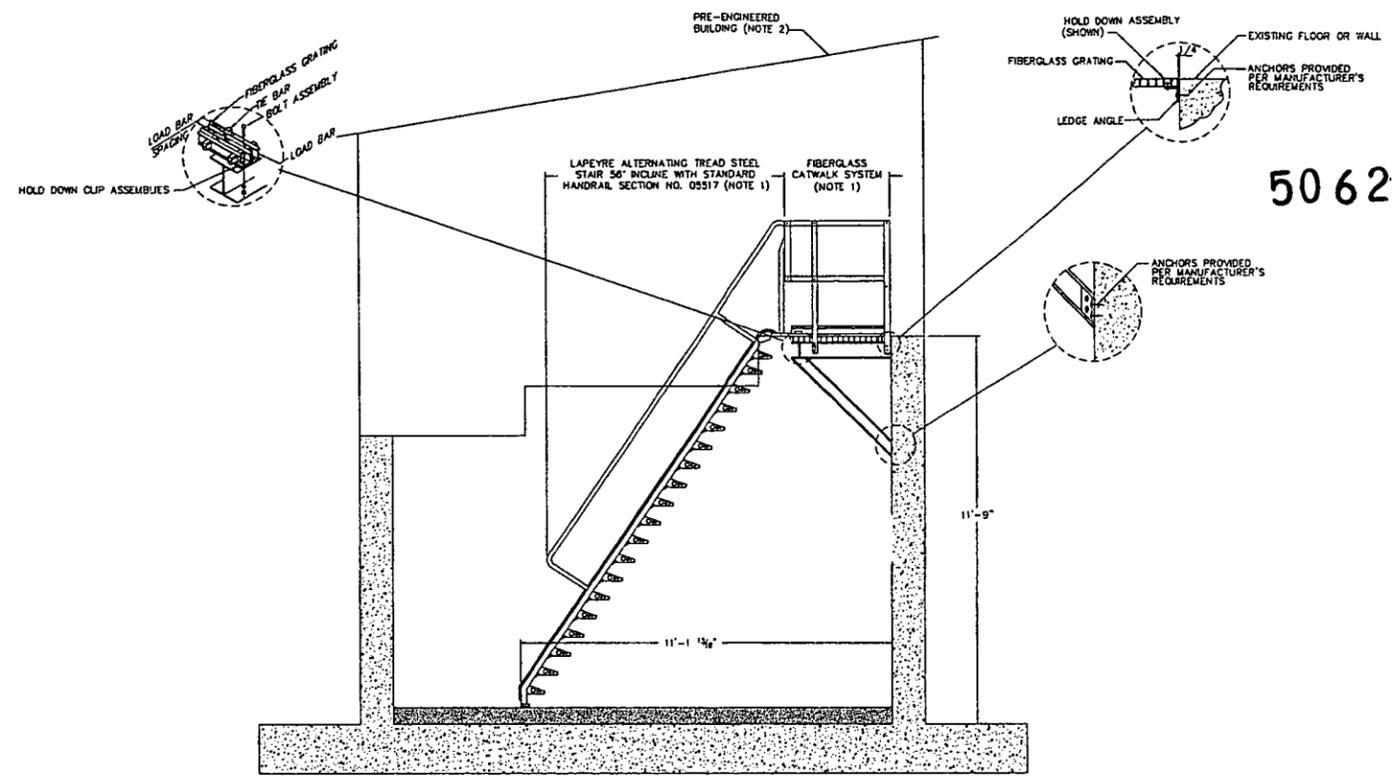
APPROVALS

COGNIZANT ENG.	<i>[Signature]</i>	12/16/03	SAFETY ENG.	
CIVIL & STR.			MAINTENANCE	
ELECTRICAL			FIRE PROTECT.	
ENGINEER	<i>[Signature]</i>	1/16/04	WASTE MANAGE	
INSTRUMENT			SECURITY	
MECHANICAL	<i>[Signature]</i>	1/16/04	QA	
			CONSTRUCTION	

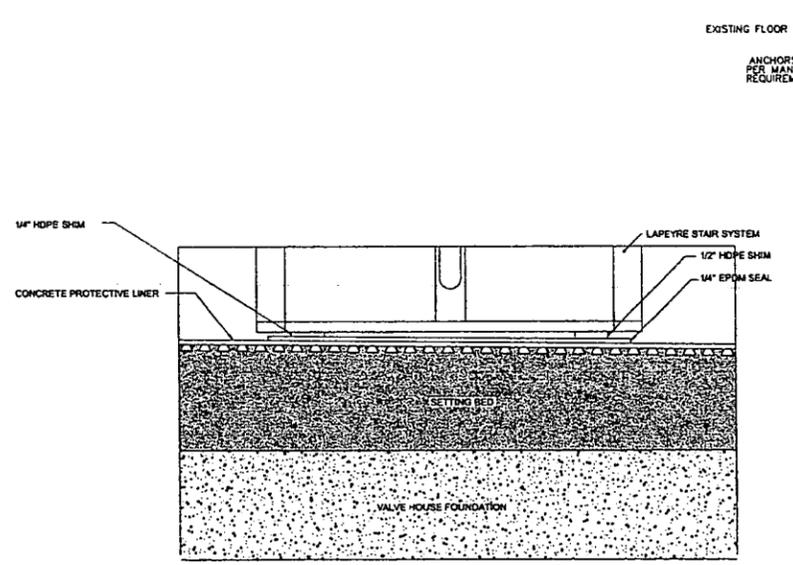
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APPROVED	<i>[Signature]</i>			
DESIGN BY	<i>[Signature]</i>			
J.S. WININGER	PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
RES 4453	20112	90X-5500-S-00681	S-4	0



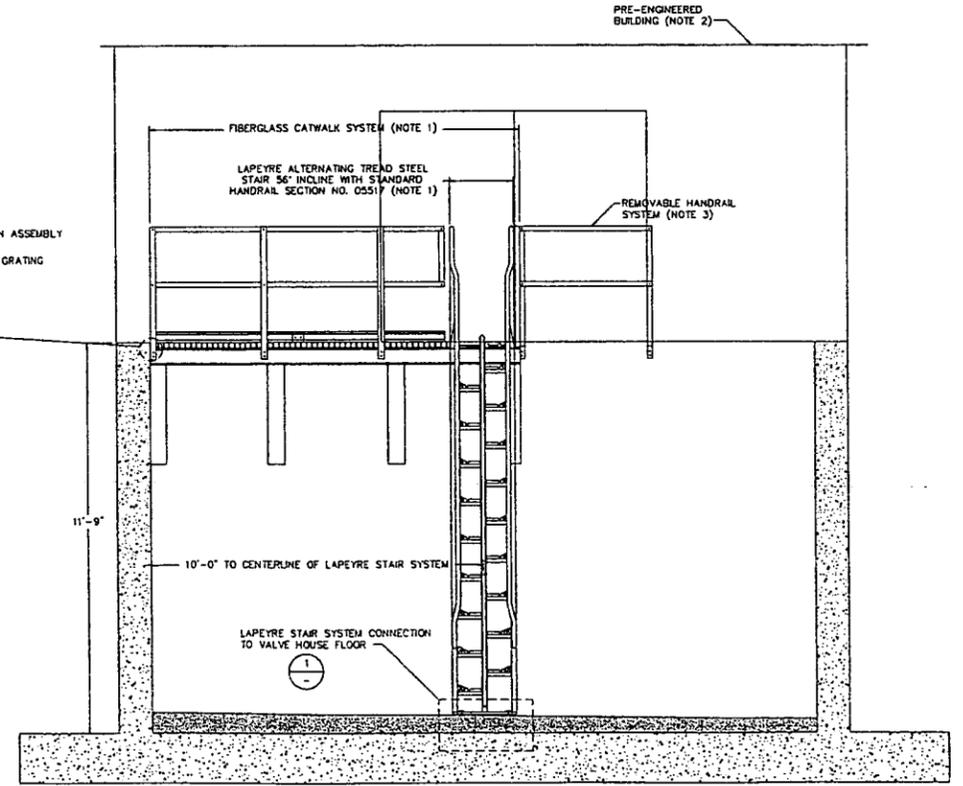
PLAN
LAPEYRE STAIR SYSTEM AND CATWALK SYSTEM
VALVE HOUSE 7
SCALE: 1" = 2'
REF: F00-0295.DGN



A
SECTIONAL ELEVATION
LAPEYRE STAIR SYSTEM AND CATWALK SYSTEM
VALVE HOUSE 7
SCALE: 1" = 2'
REF: F00-0295.DGN



1
DETAIL
LAPEYRE STAIR SYSTEM CONNECTION
TO VALVE HOUSE FLOOR
SCALE: 1" = 4'
REF: F00-0295.DGN



B
SECTIONAL ELEVATION
LAPEYRE STAIR SYSTEM AND CATWALK SYSTEM
VALVE HOUSE 7
SCALE: 1" = 2'
REF: F00-0295.DGN

- NOTES:**
- LAPEYRE STEEL STAIRS, MOLDED GRATING, HANDRAIL ASSEMBLIES AND STRUCTURAL SUPPORT MEMBERS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13130.
 - PRE-ENGINEERED BUILDING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13120.
 - REMOVABLE HANDRAIL SYSTEM SHALL BE CONNECTED TO FOUNDATION WALL WITH A PINNED-SLIP CONNECTION.

NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	DATE	REV. BY	APP.
D	ISSUED CFC	9-22-03	GES	MSB
B	ISSUED FOR FINAL INTERNAL REVIEW	8-28-03		
A	ISSUED FOR 90% REVIEW	6-11-03		

**UNITED STATES
DEPARTMENT OF ENERGY**
FERNALD CLOSURE PROJECT

THIS DRAWING PREPARED BY
FLUOR FERNALD, INC.

PROJECT NAME
ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
VALVE HOUSE 7 & 8

DRAWING TITLE
VALVE HOUSE 7
STAIR AND CATWALK STRUCTURAL
DETAILS

APPROVALS

COGNIZANT ENG.	DATE	SIGNATURE	SAFETY ENG.	DATE	SIGNATURE
CIVIL & STR.			MAINTENANCE		
ELECTRICAL			FIRE PROTECT.		
ENGINEER			WASTE MANAGE.		
INSTRUMENT			SECURITY		
MECHANICAL			CONSTRUCTION		

DRAWN BY	PROJECT NO.	DRAWING MODEL CODE NO.	SHEET NO.	REV. NO.
C.E. SCHWARZBAUM	20112		5-5	0
RES PROJECT NO.	FILENAME	PROJECT MODEL CODE NO.		
RES 4453	F00-0295.DGN	90X-5500-S-00682		

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